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Preface

Both novice users and those familiar with the SunOS operating system can use online man pages to obtain information about the system and its features. A man page is intended to answer concisely the question "What does it do?" The man pages in general comprise a reference manual. They are not intended to be a tutorial.

Overview

The following contains a brief description of each man page section and the information it references:

- Section 1 describes, in alphabetical order, commands available with the operating system.
- Section 1M describes, in alphabetical order, commands that are used chiefly for system maintenance and administration purposes.
- Section 2 describes all of the system calls. Most of these calls have one or more error returns. An error condition is indicated by an otherwise impossible returned value.
- Section 3 describes functions found in various libraries, other than those functions that directly invoke UNIX system primitives, which are described in Section 2.
- Section 4 outlines the formats of various files. The C structure declarations for the file formats are given where applicable.
- Section 5 contains miscellaneous documentation such as character-set tables.
- Section 6 contains available games and demos.
- Section 7 describes various special files that refer to specific hardware peripherals and device drivers. STREAMS software drivers, modules and the STREAMS-generic set of system calls are also described.
- Section 9 provides reference information needed to write device drivers in the kernel environment. It describes two device driver interface specifications: the Device Driver Interface (DDI) and the Driver/Kernel Interface (DKI).
- Section 9E describes the DDI/DKI, DDI-only, and DKI-only entry-point routines a developer can include in a device driver.
- Section 9F describes the kernel functions available for use by device drivers.
- Section 9S describes the data structures used by drivers to share information between the driver and the kernel.
Below is a generic format for man pages. The man pages of each manual section generally follow this order, but include only needed headings. For example, if there are no bugs to report, there is no BUGS section. See the intro pages for more information and detail about each section, and man(1) for more information about man pages in general.

NAME
This section gives the names of the commands or functions documented, followed by a brief description of what they do.

SYNOPSIS
This section shows the syntax of commands or functions. When a command or file does not exist in the standard path, its full path name is shown. Options and arguments are alphabetized, with single letter arguments first, and options with arguments next, unless a different argument order is required.

The following special characters are used in this section:

[ ] Brackets. The option or argument enclosed in these brackets is optional. If the brackets are omitted, the argument must be specified.

... Ellipses. Several values can be provided for the previous argument, or the previous argument can be specified multiple times, for example, "filename...".

| Separator. Only one of the arguments separated by this character can be specified at a time.

{} Braces. The options and/or arguments enclosed within braces are interdependent, such that everything enclosed must be treated as a unit.

PROTOCOL
This section occurs only in subsection 3R to indicate the protocol description file.

DESCRIPTION
This section defines the functionality and behavior of the service. Thus it describes concisely what the command does. It does not discuss OPTIONS or cite EXAMPLES. Interactive commands, subcommands, requests, macros, and functions are described under USAGE.

IOCTL
This section appears on pages in Section 7 only. Only the device class that supplies appropriate parameters to the ioctl(2) system call is called ioctl and generates its own
heading. `ioctl` calls for a specific device are listed alphabetically (on the man page for that specific device). `ioctl` calls are used for a particular class of devices all of which have an `io` ending, such as `mtio(7I)`.

**OPTIONS**  
This section lists the command options with a concise summary of what each option does. The options are listed literally and in the order they appear in the SYNOPSIS section. Possible arguments to options are discussed under the option, and where appropriate, default values are supplied.

**OPERANDS**  
This section lists the command operands and describes how they affect the actions of the command.

**OUTPUT**  
This section describes the output – standard output, standard error, or output files – generated by the command.

**RETURN VALUES**  
If the man page documents functions that return values, this section lists these values and describes the conditions under which they are returned. If a function can return only constant values, such as 0 or –1, these values are listed in tagged paragraphs. Otherwise, a single paragraph describes the return values of each function. Functions declared `void` do not return values, so they are not discussed in RETURN VALUES.

**ERRORS**  
On failure, most functions place an error code in the global variable `errno` indicating why they failed. This section lists alphabetically all error codes a function can generate and describes the conditions that cause each error. When more than one condition can cause the same error, each condition is described in a separate paragraph under the error code.

**USAGE**  
This section lists special rules, features, and commands that require in-depth explanations. The subsections listed here are used to explain built-in functionality:

- Commands
- Modifiers
- Variables
- Expressions
- Input Grammar
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXAMPLES</td>
<td>This section provides examples of usage or of how to use a command or function. Wherever possible a complete example including command-line entry and machine response is shown. Whenever an example is given, the prompt is shown as example%, or if the user must be superuser, example#. Examples are followed by explanations, variable substitution rules, or returned values. Most examples illustrate concepts from the SYNOPSIS, DESCRIPTION, OPTIONS, and USAGE sections.</td>
</tr>
<tr>
<td>ENVIRONMENT VARIABLES</td>
<td>This section lists any environment variables that the command or function affects, followed by a brief description of the effect.</td>
</tr>
<tr>
<td>EXIT STATUS</td>
<td>This section lists the values the command returns to the calling program or shell and the conditions that cause these values to be returned. Usually, zero is returned for successful completion, and values other than zero for various error conditions.</td>
</tr>
<tr>
<td>FILES</td>
<td>This section lists all file names referred to by the man page, files of interest, and files created or required by commands. Each is followed by a descriptive summary or explanation.</td>
</tr>
<tr>
<td>ATTRIBUTES</td>
<td>This section lists characteristics of commands, utilities, and device drivers by defining the attribute type and its corresponding value. See attributes(5) for more information.</td>
</tr>
<tr>
<td>SEE ALSO</td>
<td>This section lists references to other man pages, in-house documentation, and outside publications.</td>
</tr>
<tr>
<td>DIAGNOSTICS</td>
<td>This section lists diagnostic messages with a brief explanation of the condition causing the error.</td>
</tr>
<tr>
<td>WARNINGS</td>
<td>This section lists warnings about special conditions which could seriously affect your working conditions. This is not a list of diagnostics.</td>
</tr>
<tr>
<td>NOTES</td>
<td>This section lists additional information that does not belong anywhere else on the page. It takes the form of an aside to the user, covering points of special interest. Critical information is never covered here.</td>
</tr>
<tr>
<td>BUGS</td>
<td>This section describes known bugs and, wherever possible, suggests workarounds.</td>
</tr>
</tbody>
</table>
Multimedia Library Functions - Part 1
# mlib_free

## Name
mlib_free – free a block of bytes

## Synopsis
```c
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

void mlib_free(void *ptr);
```

## Description
The `mlib_free()` function frees a block of bytes previously allocated by `mlib_malloc()` or `mlib_realloc()`.

This function is a wrapper of the standard C function `free()`.

## Parameters
The function takes the following arguments:

- `ptr` Pointer to a previously allocated block.

## Return Values
None.

## Attributes
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_malloc(3MLIB), mlib_realloc(3MLIB), malloc(3C), attributes(5)
mlib_GraphicsBoundaryFill_8, mlib_GraphicsBoundaryFill_32 – boundary fill

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsBoundaryFill_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsBoundaryFill_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 c2);

Description  
Each of these functions performs boundary fill.

Parameters  
Each of the functions takes the following arguments:

- **buffer**: Pointer to the image into which the function is drawing.
- **x**: X coordinate of the starting point.
- **y**: Y coordinate of the starting point.
- **c**: Color used in the drawing.
- **c2**: Color that defines the filling boundary.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
attributes(5)
Each of the `mlib_GraphicsDrawArc_8()` functions draws an arc with the center at \((x, y)\), radius \(r\), start angle \(t1\), and end angle \(t2\).

Each of the `mlib_GraphicsDrawArc_X_8()` functions draws an arc in Xor mode as follows:

\[
data[x,y] ^= c^2
\]

Each of the `mlib_GraphicsDrawArc_A_8()` functions draws an arc with antialiasing.
Each of the `mlib_GraphicsDrawArc_B_*()` functions draws an arc with alpha blending as follows:

\[
data[x,y] = (data[x,y] \cdot (255 - a) + c \cdot a) / 255
\]

Each of the `mlib_GraphicsDrawArc_AB_*()` functions draws an arc with antialiasing and alpha blending.

**Parameters** Each of the functions takes some of the following arguments:
- `buffer` Pointer to the image into which the function is drawing.
- `x` X coordinate of the center.
- `y` Y coordinate of the center.
- `r` Radius of the arc.
- `t1` Start angle of the arc in radians.
- `t2` End angle of the arc in radians.
- `c` Color used in the drawing.
- `c2` Alternation color.
- `a` Alpha value for blending. \( 0 \leq a \leq 255 \).

**Return Values** Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes** See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** `mlib_GraphicsDrawCircle(3MLIB)`,
Each of the mlib_GraphicsDrawCircle_*( ) functions draws a circle with the center at \((x, y)\) and radius \(r\).

Each of the mlib_GraphicsDrawCircle_X_*( ) functions draws a circle in Xor mode as follows:

\[
data[x,y] \oplus c \oplus c2
\]

Each of the mlib_GraphicsDrawCircle_A_*( ) functions draws a circle with antialiasing.

Each of the mlib_GraphicsDrawCircle_B_*( ) functions draws a circle with alpha blending as follows:

\[
data[x,y] = (data[x,y] \times (255 - a) + c \times a) / 255
\]
Each of the `mlib_GraphicsDrawCircle_AB_*()` functions draws a circle with antialiasing and alpha blending.

**Parameters**  
Each of the functions takes some of the following arguments:

- `buffer`  
  Pointer to the image into which the function is drawing.
- `x`  
  X coordinate of the center.
- `y`  
  Y coordinate of the center.
- `r`  
  Radius of the arc.
- `c`  
  Color used in the drawing.
- `c2`  
  Alternation color.
- `a`  
  Alpha value for blending. 0 ≤ a ≤ 255.

**Return Values**  
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

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<thead>
<tr>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
`mlib_GraphicsDrawArc(3MLIB), mlib_GraphicsDrawEllipse(3MLIB), attributes(5)`
mlib_GraphicsDrawEllipse_X_8, mlib_GraphicsDrawEllipse_X_32,
mlib_GraphicsDrawEllipse_A_8, mlib_GraphicsDrawEllipse_A_32,
mlib_GraphicsDrawEllipse_B_8, mlib_GraphicsDrawEllipse_B_32,

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawEllipse_8(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsDrawEllipse_32(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsDrawEllipse_X_8(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsDrawEllipse_X_32(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsDrawEllipse_A_8(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsDrawEllipse_A_32(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsDrawEllipse_B_8(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);
mlib_status mlib_GraphicsDrawEllipse_B_32(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);
mlib_status mlib_GraphicsDrawEllipse_AB_8(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);
mlib_status mlib_GraphicsDrawEllipse_AB_32(mlib_image *buffer, mlib_s16 x,
  mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);

Each of the mlib_GraphicsDrawEllipse_() functions draws an ellipse with the center at (x, y), major semiaxis a, and minor semiaxis b. The angle of the major semiaxis is t counterclockwise from the X axis.

Each of the mlib_GraphicsDrawEllipse_X_() functions draws an ellipse in Xor mode as follows:
  data[x,y] ^= c ^ c2
Each of the `mlib_GraphicsDrawEllipse_A_*()` functions draws an ellipse with antialiasing.

Each of the `mlib_GraphicsDrawEllipse_B_*()` functions draws an ellipse with alpha blending as follows:

\[
data[x,y] = \frac{data[x,y] \times (255 - \alpha) + c \times \alpha}{255}
\]

Each of the `mlib_GraphicsDrawEllipse_A_*()` functions draws an ellipse with antialiasing and alpha blending.

**Parameters**

Each of the functions takes some of the following arguments:

- **buffer** Pointer to the image into which the function is drawing.
- **x** X coordinate of the center.
- **y** Y coordinate of the center.
- **a** Major semiaxis of the ellipse.
- **b** Minor semiaxis of the ellipse.
- **t** Angle of major semiaxis in radians.
- **c** Color used in the drawing.
- **c2** Alternation color.
- **alpha** Alpha value for blending. \(0 \leq \alpha \leq 255\).

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

`mlib_GraphicsDrawArc(3MLIB), mlib_GraphicsDrawCircle(3MLIB), attributes(5)`
**Name**
mlib_GraphicsDrawLine_X_8, mlib_GraphicsDrawLine_X_32,
mlib_GraphicsDrawLine_A_8, mlib_GraphicsDrawLine_A_32,
mlib_GraphicsDrawLine_B_8, mlib_GraphicsDrawLine_B_32,
mlib_GraphicsDrawLine_G_8, mlib_GraphicsDrawLine_G_32,
mlib_GraphicsDrawLine_Z_8, mlib_GraphicsDrawLine_Z_32,
mlib_GraphicsDrawLine_AB_8, mlib_GraphicsDrawLine_AB_32,
mlib_GraphicsDrawLine_ABG_8, mlib_GraphicsDrawLine_ABG_32,
mlib_GraphicsDrawLine_ABGZ_8, mlib_GraphicsDrawLine_ABGZ_32,
mlib_GraphicsDrawLine_ABZ_8, mlib_GraphicsDrawLine_ABZ_32,
mlib_GraphicsDrawLine_AG_8, mlib_GraphicsDrawLine_AG_32,
mlib_GraphicsDrawLine_AGZ_8, mlib_GraphicsDrawLine_AGZ_32,
mlib_GraphicsDrawLine_AZ_8, mlib_GraphicsDrawLine_AZ_32,
mlib_GraphicsDrawLine_BG_8, mlib_GraphicsDrawLine_BG_32,
mlib_GraphicsDrawLine_BGZ_8, mlib_GraphicsDrawLine_BGZ_32,
mlib_GraphicsDrawLine_BZ_8, mlib_GraphicsDrawLine_BZ_32,
mlib_GraphicsDrawLine_GZ_8, mlib_GraphicsDrawLine_GZ_32

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawLine_8(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c);
mlib_status mlib_GraphicsDrawLine_32(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c);
mlib_status mlib_GraphicsDrawLine_X_8(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsDrawLine_X_32(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsDrawLine_A_8(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c);
mlib_status mlib_GraphicsDrawLine_A_32(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c);
mlib_status mlib_GraphicsDrawLine_B_8(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawLine_B_32(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawLine_G_8(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 cl);
mlib_status mlib_GraphicsDrawLine_G_32(mlib_image *buffer, mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 cl);
mlib_status mlib_GraphicsDrawLine_Z_8(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c);

mlib_status mlib_GraphicsDrawLine_Z_32(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c);

mlib_status mlib_GraphicsDrawLine_AB_8(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_AB_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_ABG_8(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_ABG_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_AG_8(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLine_AG_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLine_AGZ_8(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c1, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLine_AGZ_32(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s32 c1, mlib_s32 c2);
mlib_status mlib_GraphicsDrawLine_AGZ_32(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, 
    mlib_s32 c1, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLine_AZ_8(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, 
    mlib_s32 c);

mlib_status mlib_GraphicsDrawLine_AZ_32(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, 
    mlib_s32 c);

mlib_status mlib_GraphicsDrawLine_BG_8(mlib_image *buffer, mlib_s16 x1, 
    mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2, 
    mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_BG_32(mlib_image *buffer, mlib_s16 x1, 
    mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2, 
    mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_BGZ_8(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, 
    mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_BGZ_32(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, 
    mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_BZ_8(mlib_image *buffer, mlib_s16 x1, 
    mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, 
    mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_BZ_32(mlib_image *buffer, mlib_s16 x1, 
    mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s32 c, 
    mlib_s32 a);

mlib_status mlib_GraphicsDrawLine_GZ_8(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s32 c1, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLine_GZ_32(mlib_image *buffer, 
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, 
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, 
    mlib_s32 c1, mlib_s32 c2);
Each of the \texttt{mlib\_GraphicsDrawLine\_*()} functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\).

Each of the \texttt{mlib\_GraphicsDrawLine\_X\_*()} functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\) in Xor mode as follows:

\[
data[x,y] ^= c ^ c 2
\]

Each of the \texttt{mlib\_GraphicsDrawLine\_A\_*()} functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\) with antialiasing.

Each of the \texttt{mlib\_GraphicsDrawLine\_B\_*()} functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\) with alpha blending as follows:

\[
data[x,y] = (data[x,y] * (255 - a) + c * a) / 255
\]

Each of the \texttt{mlib\_GraphicsDrawLine\_G\_*()} functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\) with Gouraud shading.

Each of the \texttt{mlib\_GraphicsDrawLine\_Z\_*()} functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\) with Z buffering.

Each of the other functions draws a line between \((x_1, y_1)\) and \((x_2, y_2)\) with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

### Parameters

Each of the functions takes some of the following arguments:

- **buffer**: Pointer to the image into which the function is drawing.
- **zbuffer**: Pointer to the image that holds the Z buffer.
- **x1**: X coordinate of the first point.
- **y1**: Y coordinate of the first point.
- **z1**: Z coordinate of the first point.
- **x2**: X coordinate of the second point.
- **y2**: Y coordinate of the second point.
- **z2**: Z coordinate of the second point.
- **c**: Color used in the drawing.
- **c1**: Color of the first point.
- **c2**: Color of the second point, or the alternation color in the Xor mode.
- **a**: Alpha value for blending. \(0 \leq a \leq 255\).
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_GraphicsDrawLineSet(3MLIB), mlib_GraphicsDrawLineFanSet(3MLIB), mlib_GraphicsDrawLineStripSet(3MLIB), attributes(5)
mlib_GraphicsDrawLineFanSet, mlib_GraphicsDrawLineFanSet_8,
mlib_GraphicsDrawLineFanSet_32, mlib_GraphicsDrawLineFanSet_X_8,
mlib_GraphicsDrawLineFanSet_X_32, mlib_GraphicsDrawLineFanSet_A_8,
mlib_GraphicsDrawLineFanSet_A_32, mlib_GraphicsDrawLineFanSet_B_8,
mlib_GraphicsDrawLineFanSet_B_32, mlib_GraphicsDrawLineFanSet_G_8,
mlib_GraphicsDrawLineFanSet_G_32, mlib_GraphicsDrawLineFanSet_Z_8,
mlib_GraphicsDrawLineFanSet_Z_32, mlib_GraphicsDrawLineFanSet_AB_8,
mlib_GraphicsDrawLineFanSet_AB_32, mlib_GraphicsDrawLineFanSet_ABG_8,
mlib_GraphicsDrawLineFanSet_ABG_32, mlib_GraphicsDrawLineFanSet_ABGZ_8,
mlib_GraphicsDrawLineFanSet_ABGZ_32, mlib_GraphicsDrawLineFanSet_ABZ_8,
mlib_GraphicsDrawLineFanSet_ABZ_32, mlib_GraphicsDrawLineFanSet_AG_8,
mlib_GraphicsDrawLineFanSet_AG_32, mlib_GraphicsDrawLineFanSet_AGZ_8,
mlib_GraphicsDrawLineFanSet_AGZ_32, mlib_GraphicsDrawLineFanSet_AZ_8,
mlib_GraphicsDrawLineFanSet_AZ_32, mlib_GraphicsDrawLineFanSet_BG_8,
mlib_GraphicsDrawLineFanSet_BG_32, mlib_GraphicsDrawLineFanSet_BGZ_8,
mlib_GraphicsDrawLineFanSet_BGZ_32, mlib_GraphicsDrawLineFanSet_BZ_8,
mlib_GraphicsDrawLineFanSet_BZ_32, mlib_GraphicsDrawLineFanSet_GZ_8,
mlib_GraphicsDrawLineFanSet_GZ_32 – draw line set where all members of the set have one
common end point

Synopsis  
c c [ flag... ] file... -lmlib [ library... ]
#include "mlib.h"

mlib_status mlib_GraphicsDrawLineFanSet_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawLineFanSet_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawLineFanSet_X_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawLineFanSet_X_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawLineFanSet_A_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawLineFanSet_A_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawLineFanSet_B_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
mlib_s32 a);
mlib_status mlib_GraphicsDrawLineFanSet_B_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
mlib_s32 a);
mlib_status mlib_GraphicsDrawLineFanSet_G_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineFanSet_G_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineFanSet_Z_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineFanSet_Z_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineFanSet_AB_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_AB_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_ABG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_ABG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_ABGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c,
    mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_ABGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c,
    mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_ABZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_ABZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_AG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineFanSet_AG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);
mlib_status mlib_GraphicsDrawLineFanSet_AGZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineFanSet_AGZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineFanSet_AZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineFanSet_AZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineFanSet_BG_8(mlib_image *buffer, 
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_BG_32(mlib_image *buffer, 
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_BGZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_BGZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_BZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_BZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineFanSet_GZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineFanSet_GZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

Description Each of the mlib_GraphicsDrawLineFanSet_*(a) functions draws a set of lines connecting (x1,y1) with (x2,y2), (x1,y1) with (x3,y3), ..., and (x1,y1) with (x_n,y_n). Each of the mlib_GraphicsDrawLineFanSet_X_*(a) functions draws a set of lines in Xor mode as follows:
Each of the \texttt{mlib\_Graphics\_Draw\_Line\_Fan\_Set\_A\_\_\_\_()} functions draws a set of lines with antialiasing.

Each of the \texttt{mlib\_Graphics\_Draw\_Line\_Fan\_Set\_B\_\_\_()} functions draws a set of lines with alpha blending as follows:

\[
data[x,y] = (data[x,y] \times (255 - a) + c \times a) / 255
\]

Each of the \texttt{mlib\_Graphics\_Draw\_Line\_Fan\_Set\_G\_\_\_()} functions draws a set of lines with Gouraud shading.

Each of the \texttt{mlib\_Graphics\_Draw\_Line\_Fan\_Set\_Z\_\_\_()} functions draws a set of lines with Z buffering.

Each of the other functions draws a set of lines with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

\textbf{Parameters} Each of the functions takes some of the following arguments:

- \textit{buffer} Pointer to the image into which the function is drawing.
- \textit{zbuffer} Pointer to the image that holds the Z buffer.
- \textit{x} Pointer to array of X coordinates of the points.
- \textit{y} Pointer to array of Y coordinates of the points.
- \textit{z} Pointer to array of Z coordinates of the points.
- \textit{npoints} Number of points in the arrays.
- \textit{c} Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- \textit{c2} Alternation color.
- \textit{a} Alpha value for blending. \(0 \leq a \leq 255\).

\textbf{Return Values} Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

\textbf{Attributes} See \texttt{attributes(5)} for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  mlib_GraphicsDrawLine(3MLIB), mlib_GraphicsDrawLineSet(3MLIB), mlib_GraphicsDrawLineStripSet(3MLIB), attributes(5)
**Name**

mlib_GraphicsDrawLineSet, mlib_GraphicsDrawLineSet_8, mlib_GraphicsDrawLineSet_32,
mlib_GraphicsDrawLineSet_X_8, mlib_GraphicsDrawLineSet_X_32,
mlib_GraphicsDrawLineSet_A_8, mlib_GraphicsDrawLineSet_A_32,
mlib_GraphicsDrawLineSet_B_8, mlib_GraphicsDrawLineSet_B_32,
mlib_GraphicsDrawLineSet_G_8, mlib_GraphicsDrawLineSet_G_32,
mlib_GraphicsDrawLineSet_Z_8, mlib_GraphicsDrawLineSet_Z_32,
mlib_GraphicsDrawLineSet_AB_8, mlib_GraphicsDrawLineSet_AB_32,
mlib_GraphicsDrawLineSet_ABG_8, mlib_GraphicsDrawLineSet_ABG_32,
mlib_GraphicsDrawLineSet_ABGZ_8, mlib_GraphicsDrawLineSet_ABGZ_32,
mlib_GraphicsDrawLineSet_ABZ_8, mlib_GraphicsDrawLineSet_ABZ_32,
mlib_GraphicsDrawLineSet_AG_8, mlib_GraphicsDrawLineSet_AG_32,
mlib_GraphicsDrawLineSet_AGZ_8, mlib_GraphicsDrawLineSet_AGZ_32,
mlib_GraphicsDrawLineSet_AZ_8, mlib_GraphicsDrawLineSet_AZ_32,
mlib_GraphicsDrawLineSet_BG_8, mlib_GraphicsDrawLineSet_BG_32,
mlib_GraphicsDrawLineSet_BGZ_8, mlib_GraphicsDrawLineSet_BGZ_32,
mlib_GraphicsDrawLineSet_BZ_8, mlib_GraphicsDrawLineSet_BZ_32,
mlib_GraphicsDrawLineSet_GZ_8, mlib_GraphicsDrawLineSet_GZ_32

**Synopsis**

cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>  

mlib_status mlib_GraphicsDrawLineSet_8(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_32(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_X_8(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
                                        mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLineSet_X_32(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
                                        mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLineSet_A_8(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_A_32(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_A_8(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_A_32(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_B_8(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
                                        mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_B_32(mlib_image *buffer,
                                        const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
                                        mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawLineSet_G_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineSet_G_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineSet_Z_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_Z_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_AB_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_AB_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_ABG_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_ABG_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_ABGZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_ABGZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_ABZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_ABZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_AG_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c);
mlib_status mlib_GraphicsDrawLineSet_AG_32(mlib_image *buffer, 
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineSet_AGZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineSet_AGZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineSet_AZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_AZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_BG_8(mlib_image *buffer, 
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_BG_32(mlib_image *buffer, 
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_BGZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_BGZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_BZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_BZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineSet_GZ_8(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineSet_GZ_32(mlib_image *buffer, 
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
Each of the mlib_GraphicsDrawLineSet_*() functions draws a set of lines connecting 
(x1,y1) with (x2,y2), (x3,y3) with (x4,y4),..., and (xn-1,yn-1) with (xn,yn).

Each of the mlib_GraphicsDrawLineSet_X_*() functions draws a set of lines in Xor mode as 
follows:

\[ \text{data}[x,y] \leftarrow c \oplus c^2 \]

Each of the mlib_GraphicsDrawLineSet_A_*() functions draws a set of lines with 
antialiasing.

Each of the mlib_GraphicsDrawLineSet_B_*() functions draws a set of lines with alpha 
blending as follows:

\[ \text{data}[x,y] = (\text{data}[x,y] \cdot (255 - a) + c \cdot a) / 255 \]

Each of the mlib_GraphicsDrawLineSet_G_*() functions draws a set of lines with Gouraud 
shading.

Each of the mlib_GraphicsDrawLineSet_Z_*() functions draws a set of lines with Z 
buffering.

Each of the other functions draws a set of lines with a combination of two or more features like 
antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

**Parameters**

Each of the functions takes some of the following arguments:

- **buffer** Pointer to the image into which the function is drawing.
- **zbuffer** Pointer to the image that holds the Z buffer.
- **x** Pointer to array of X coordinates of the points.
- **y** Pointer to array of Y coordinates of the points.
- **z** Pointer to array of Z coordinates of the points.
- **npoints** Number of points in the arrays. npoints must be a multiple of 2.
- **c** Color used in the drawing, or pointer to array of colors of the points in the case of 
  Gouraud shading.
- **c2** Alternation color.
- **a** Alpha value for blending. \(0 \leq a \leq 255\).

**Return Values**

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:
mlib_GraphicsDrawLineSet(3MLIB)

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
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</table>

See Also  
mlib_GraphicsDrawLine(3MLIB), mlib_GraphicsDrawLineFanSet(3MLIB),  
mlib_GraphicsDrawLineStripSet(3MLIB), attributes(5)
Name  
mlib_GraphicsDrawLineStripSet, mlib_GraphicsDrawLineStripSet_8,  
mlib_GraphicsDrawLineStripSet_32, mlib_GraphicsDrawLineStripSet_X_8,  
mlib_GraphicsDrawLineStripSet_X_32, mlib_GraphicsDrawLineStripSet_A_8,  
mlib_GraphicsDrawLineStripSet_A_32, mlib_GraphicsDrawLineStripSet_B_8,  
mlib_GraphicsDrawLineStripSet_B_32, mlib_GraphicsDrawLineStripSet_G_8,  
mlib_GraphicsDrawLineStripSet_G_32, mlib_GraphicsDrawLineStripSet_Z_8,  
mlib_GraphicsDrawLineStripSet_Z_32, mlib_GraphicsDrawLineStripSet_AB_8,  
mlib_GraphicsDrawLineStripSet_AB_32, mlib_GraphicsDrawLineStripSet_ABG_8,  
mlib_GraphicsDrawLineStripSet_ABG_32, mlib_GraphicsDrawLineStripSet_ABGZ_8,  
mlib_GraphicsDrawLineStripSet_ABGZ_32, mlib_GraphicsDrawLineStripSet_ABZ_8,  
mlib_GraphicsDrawLineStripSet_ABZ_32, mlib_GraphicsDrawLineStripSet_AG_8,  
mlib_GraphicsDrawLineStripSet_AG_32, mlib_GraphicsDrawLineStripSet_AGZ_8,  
mlib_GraphicsDrawLineStripSet_AGZ_32, mlib_GraphicsDrawLineStripSet_AZ_8,  
mlib_GraphicsDrawLineStripSet_AZ_32, mlib_GraphicsDrawLineStripSet_BG_8,  
mlib_GraphicsDrawLineStripSet_BG_32, mlib_GraphicsDrawLineStripSet_BGZ_8,  
mlib_GraphicsDrawLineStripSet_BGZ_32, mlib_GraphicsDrawLineStripSet_BZ_8,  
mlib_GraphicsDrawLineStripSet_BZ_32, mlib_GraphicsDrawLineStripSet_GZ_8,  
mlib_GraphicsDrawLineStripSet_GZ_32 – draw line set where each member of the set starts at the point where the previous member ended

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_GraphicsDrawLineStripSet_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_X_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLineStripSet_X_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawLineStripSet_A_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_A_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_B_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_B_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawLineStripSet_G_8(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineStripSet_G_32(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineStripSet_Z_8(mlib_image *buffer, 
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_Z_32(mlib_image *buffer, 
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
    const mlib_s16 *z, 
    mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_AB_8(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_AB_32(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_ABG_8(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_ABG_32(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_ABGZ_8(mlib_image *buffer, 
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_ABGZ_32(mlib_image *buffer, 
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_ABZ_8(mlib_image *buffer, 
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_ABZ_32(mlib_image *buffer, 
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, 
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_AG_8(mlib_image *buffer, 
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, 
    const mlib_s32 *c);
mlib_status mlib_GraphicsDrawLineStripSet_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineStripSet_AGZ_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineStripSet_AGZ_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineStripSet_AZ_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_AZ_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawLineStripSet_BG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_BG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_BGZ_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_BGZ_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_BZ_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_BZ_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawLineStripSet_GZ_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawLineStripSet_GZ_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s32 npoints, const mlib_s32 *c);
Each of the `mlib_GraphicsDrawLineStripSet_*()` functions draws a set of lines connecting $(x1,y1)$ with $(x2,y2), (x2,y2)$ with $(x3,y3), \ldots$, and $(xn-1,yn-1)$ with $(xn,yn)$.

Each of the `mlib_GraphicsDrawLineStripSet_X_*()` functions draws a set of lines in Xor mode as follows:

$$data[x,y] \leftarrow c \oplus c2$$

Each of the `mlib_GraphicsDrawLineStripSet_A_*()` functions draws a set of lines with antialiasing.

Each of the `mlib_GraphicsDrawLineStripSet_B_*()` functions draws a set of lines with alpha blending as follows:

$$data[x,y] = (data[x,y] \cdot (255 - a) + c \cdot a) / 255$$

Each of the `mlib_GraphicsDrawLineStripSet_G_*()` functions draws a set of lines with Gouraud shading.

Each of the `mlib_GraphicsDrawLineStripSet_Z_*()` functions draws a set of lines with Z buffering.

Each of the other functions draws a set of lines with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Note that the `mlib_GraphicsDrawPolyline_*()` functions are aliases of the `mlib_GraphicsDrawLineStripSet_*()` functions.

### Parameters
Each of the functions takes some of the following arguments:

- **buffer**: Pointer to the image into which the function is drawing.
- **zbuffer**: Pointer to the image that holds the Z buffer.
- **x**: Pointer to array of X coordinates of the points.
- **y**: Pointer to array of Y coordinates of the points.
- **z**: Pointer to array of Z coordinates of the points.
- **npoints**: Number of points in the arrays.
- **c**: Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- **c2**: Alternation color.
- **a**: Alpha value for blending. $0 \leq a \leq 255$.

### Return Values
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Description

Parameters

Return Values
Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
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<tbody>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_GraphicsDrawLine(3MLIB), mlib_GraphicsDrawLineSet(3MLIB), mlib_GraphicsDrawLineFanSet(3MLIB), mlib_GraphicsDrawPolyline(3MLIB), attributes(5)
mlib_GraphicsDrawPoint(3MLIB)


Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawPoint_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c);
mlib_status mlib_GraphicsDrawPoint_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c);
mlib_status mlib_GraphicsDrawPoint_X_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsDrawPoint_X_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsDrawPoint_B_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawPoint_B_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 a);

Description Each of the mlib_GraphicsDrawPoint_*( ) functions draws a point at (x, y) in color c.

Each of the mlib_GraphicsDrawPoint_X_*( ) functions draws a point at (x, y) in Xor mode as follows:

\[
data[x,y] ^= c ^ c2
\]

Each of the mlib_GraphicsDrawPoint_B_*( ) functions draws a point at (x, y) with alpha blending as follows:

\[
data[x,y] = (data[x,y] * (255 - a) + c * a) / 255
\]

Parameters Each of the functions takes some of the following arguments:

- **buffer** Pointer to the image into which the function is drawing.
- **x** X coordinate of the point.
- **y** Y coordinate of the point.
- **c** Color used in the drawing.
- **c2** Alternation color.
- **a** Alpha value for blending, 0 ≤ a ≤ 255.
Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also  mlib_GraphicsDrawPointSet(3MLIB), attributes(5)
**Name**
mlib_GraphicsDrawPointSet, mlib_GraphicsDrawPointSet_8,
mlib_GraphicsDrawPointSet_32, mlib_GraphicsDrawPointSet_X_8,
mlib_GraphicsDrawPointSet_X_32, mlib_GraphicsDrawPointSet_B_8,
mlib_GraphicsDrawPointSet_B_32, mlib_GraphicsDrawPolyPoint_8,
mlib_GraphicsDrawPolyPoint_32, mlib_GraphicsDrawPolyPoint_X_8,
mlib_GraphicsDrawPolyPoint_X_32, mlib_GraphicsDrawPolyPoint_B_8,
mlib_GraphicsDrawPolyPoint_B_32 – draw a set of points

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawPointSet_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPointSet_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPointSet_X_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawPointSet_X_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawPointSet_B_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawPointSet_B_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawPolyPoint_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyPoint_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyPoint_X_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawPolyPoint_X_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawPolyPoint_B_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
mlib_s32 c2);

mlib_status mlib_GraphicsDrawPolyPoint_B_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
mlib_s32 c2);
Each of the `mlib_GraphicsDrawPointSet_*()` and `mlib_GraphicsDrawPolypoint_*()` functions draws a set of points at \((x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\).

Each of the `mlib_GraphicsDrawPointSet_X_*()` and `mlib_GraphicsDrawPolypoint_X_*()` functions draws a set of points at \((x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\) in Xor mode as follows:

\[
data[x, y] \text{ XOR } c^2
\]

Each of the `mlib_GraphicsDrawPointSet_B_*()` and `mlib_GraphicsDrawPolypoint_B_*()` functions draws a set of points at \((x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\) with alpha blending as follows:

\[
data[x, y] = (data[x, y] \times (255 - a) + c \times a) / 255
\]

The `mlib_GraphicsDrawPolypoint_*()` functions are aliases of the `mlib_GraphicsDrawPointSet_*()` functions.

Each of the functions takes some of the following arguments:

- **buffer**: Pointer to the image into which the function is drawing.
- **x**: Pointer to array of X coordinates of the points.
- **y**: Pointer to array of Y coordinates of the points.
- **npoints**: Number of points in the arrays.
- **c**: Color used in the drawing.
- **c2**: Alternation color.
- **a**: Alpha value for blending. \(0 \leq a \leq 255\).

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_GraphicsDrawPoint(3MLIB), attributes(5)`
**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawPolygon_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_X_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 c2);

mlib_status mlib_GraphicsDrawPolygon_X_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 c2);

mlib_status mlib_GraphicsDrawPolygon_A_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_A_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_B_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_B_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);
```

---

**Name**

mlib_GraphicsDrawPolygon, mlib_GraphicsDrawPolygon_8,
mlib_GraphicsDrawPolygon_32, mlib_GraphicsDrawPolygon_X_8,
mlib_GraphicsDrawPolygon_X_32, mlib_GraphicsDrawPolygon_A_8,
mlib_GraphicsDrawPolygon_A_32, mlib_GraphicsDrawPolygon_B_8,
mlib_GraphicsDrawPolygon_B_32, mlib_GraphicsDrawPolygon_G_8,
mlib_GraphicsDrawPolygon_G_32, mlib_GraphicsDrawPolygon_Z_8,
mlib_GraphicsDrawPolygon_Z_32, mlib_GraphicsDrawPolygon_AB_8,
mlib_GraphicsDrawPolygon_AB_32, mlib_GraphicsDrawPolygon_ABG_8,
mlib_GraphicsDrawPolygon_ABG_32, mlib_GraphicsDrawPolygon_ABGZ_8,
mlib_GraphicsDrawPolygon_ABGZ_32, mlib_GraphicsDrawPolygon_ABZ_8,
mlib_GraphicsDrawPolygon_ABZ_32, mlib_GraphicsDrawPolygon_AG_8,
mlib_GraphicsDrawPolygon_AG_32, mlib_GraphicsDrawPolygon_AGZ_8,
mlib_GraphicsDrawPolygon_AGZ_32, mlib_GraphicsDrawPolygon_AZ_8,
mlib_GraphicsDrawPolygon_AZ_32, mlib_GraphicsDrawPolygon_BG_8,
mlib_GraphicsDrawPolygon_BG_32, mlib_GraphicsDrawPolygon_BGZ_8,
mlib_GraphicsDrawPolygon_BGZ_32, mlib_GraphicsDrawPolygon_BZ_8,
mlib_GraphicsDrawPolygon_BZ_32, mlib_GraphicsDrawPolygon_GZ_8,
mlib_status mlib_GraphicsDrawPolygon_G_8(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,  
    const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolygon_G_32(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y,  
    mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolygon_Z_8(mlib_image *buffer,  
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_Z_32(mlib_image *buffer,  
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_AB_8(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y,  
    mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_AB_32(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y,  
    mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_ABG_8(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_ABG_32(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_ABGZ_8(mlib_image *buffer,  
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_ABGZ_32(mlib_image *buffer,  
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_ABZ_8(mlib_image *buffer,  
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_ABZ_32(mlib_image *buffer,  
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_AG_8(mlib_image *buffer,  
    const mlib_s16 *x, const mlib_s16 *y,  
    const mlib_s32 *c);

mlib_GraphicsDrawPolygon(3MLIB)

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mlib_status mlib_GraphicsDrawPolygon_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolygon_AG_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolygon_AGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolygon_AZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_AZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_BG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_BG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_BGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolygon_BGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_BZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_BZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolygon_GZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolygon_GZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints,
    const mlib_s32 *c);

Description

Each of the mlib_GraphicsDrawPolygon_*() functions draws a polygon enclosing \((x_1,y_1),\ (x_2,y_2), \ldots,\) and \((x_n,y_n)\).

Each of the mlib_GraphicsDrawPolygon_X_*() functions draws a polygon in Xor mode as follows:

\[
data[x,y] \oplus= c \oplus c^2
\]

Each of the mlib_GraphicsDrawPolygon_A_*() functions draws a polygon with antialiasing.

Each of the mlib_GraphicsDrawPolygon_B_*() functions draws a polygon with alpha blending as follows:

\[
data[x,y] = (data[x,y] \times (255 - a) + c \times a) / 255
\]

Each of the mlib_GraphicsDrawPolygon_G_*() functions draws a polygon with Gouraud shading.

Each of the mlib_GraphicsDrawPolygon_Z_*() functions draws a polygon with Z buffering.

Each of the other functions draws a polygon with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Parameters

Each of the functions takes some of the following arguments:

- **buffer**  
  Pointer to the image into which the function is drawing.
- **zbuffer**  
  Pointer to the image that holds the Z buffer.
- **x**  
  Pointer to the array of X coordinates of the vertices.
- **y**  
  Pointer to the array of Y coordinates of the vertices.
- **z**  
  Pointer to the array of Z coordinates of the vertices.
- **npoints**  
  Number of vertices in the arrays.
- **c**  
  Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- **c2**  
  Alternation color.
- **a**  
  Alpha value for blending. \(0 \leq a \leq 255\).

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
Attributes  See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  `mlib_GraphicsFillPolygon(3MLIB), attributes(5)`
mlib_GraphicsDrawPolyline(3MLIB)

**Name**  
mlib_GraphicsDrawPolyline, mlib_GraphicsDrawPolyline_8,  
mlib_GraphicsDrawPolyline_32, mlib_GraphicsDrawPolyline_X_8,  
mlib_GraphicsDrawPolyline_X_32, mlib_GraphicsDrawPolyline_A_8,  
mlib_GraphicsDrawPolyline_A_32, mlib_GraphicsDrawPolyline_B_8,  
mlib_GraphicsDrawPolyline_B_32, mlib_GraphicsDrawPolyline_G_8,  
mlib_GraphicsDrawPolyline_G_32, mlib_GraphicsDrawPolyline_Z_8,  
mlib_GraphicsDrawPolyline_Z_32, mlib_GraphicsDrawPolyline_AB_8,  
mlib_GraphicsDrawPolyline_AB_32, mlib_GraphicsDrawPolyline_ABG_8,  
mlib_GraphicsDrawPolyline_ABG_32, mlib_GraphicsDrawPolyline_ABGZ_8,  
mlib_GraphicsDrawPolyline_ABGZ_32, mlib_GraphicsDrawPolyline_ABZ_8,  
mlib_GraphicsDrawPolyline_ABZ_32, mlib_GraphicsDrawPolyline_BG_8,  
mlib_GraphicsDrawPolyline_BG_32, mlib_GraphicsDrawPolyline_BGZ_8,  
mlib_GraphicsDrawPolyline_BGZ_32, mlib_GraphicsDrawPolyline_BZ_8,  
mlib_GraphicsDrawPolyline_BZ_32, mlib_GraphicsDrawPolyline_GZ_8,  
mlib_GraphicsDrawPolyline_GZ_32

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawPolyline_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_X_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_X_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_A_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_A_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_B_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,  
mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_B_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,  
mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_G_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawPolyline_G_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawPolyline_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawPolyline_Z_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawPolyline_AB_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_AB_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_ABG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_ABG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawPolyline_AG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawPolyline_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawPolyline_AGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolyline_AGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolyline_AZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_AZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 c);

mlib_status mlib_GraphicsDrawPolyline_BG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_BG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_BGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_BGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_BZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_BZ_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawPolyline_GZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawPolyline_GZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

Description  Each of the mlib_GraphicsDrawPolyline_() functions draws a polyline connecting
(x1,y1), (x2,y2), ..., and (xn,yn).

Each of the mlib_GraphicsDrawPolyline_X_() functions draws a polyline in Xor mode as follows:
Each of the mlib_GraphicsDrawPolyline_A_*() functions draws a polyline with antialiasing.

Each of the mlib_GraphicsDrawPolyline_B_*() functions draws a polyline with alpha blending as follows:

\[
data[x,y] = \frac{(data[x,y] \times (255 - a) + c \times a)}{255}
\]

Each of the mlib_GraphicsDrawPolyline_G_*() functions draws a polyline with Gouraud shading.

Each of the mlib_GraphicsDrawPolyline_Z_*() functions draws a polyline with Z buffering.

Each of the other functions draws a polyline with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Note that the mlib_GraphicsDrawPolyline_*() functions are aliases of the mlib_GraphicsDrawLineStripSet_*() functions.

**Parameters**

Each of the functions takes some of the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `zbuffer` Pointer to the image that holds the Z buffer.
- `x` Pointer to array of X coordinates of the points.
- `y` Pointer to array of Y coordinates of the points.
- `z` Pointer to array of Z coordinates of the points.
- `npoints` Number of points in the arrays.
- `c` Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- `c2` Alternation color.
- `a` Alpha value for blending, \(0 \leq a \leq 255\).

**Return Values**

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  mlib_GraphicsDrawLine(3MLIB), mlib_GraphicsDrawLineSet(3MLIB),
mlib_GraphicsDrawLineFanSet(3MLIB), mlib_GraphicsDrawLineStripSet(3MLIB),
attributes(5)
Each of the `mlib_GraphicsDrawRectangle_*()` functions draws a rectangle with the upper-left corner at \((x, y)\), width \(w\), and height \(h\).

Each of the `mlib_GraphicsDrawRectangle_X_*()` functions draws a rectangle in Xor mode as follows:

\[
data[x, y] ^= c ^^ c2
\]

Each of the `mlib_GraphicsDrawRectangle_B_*()` functions draws a rectangle with alpha blending as follows:

\[
data[x, y] = (data[x, y] * (255 - a) + c * a) / 255
\]

### Parameters

Each of the functions takes some of the following arguments:

- **buffer**  
  Pointer to the image into which the function is drawing.
- **x**  
  X coordinate of the upper-left corner of the rectangle.
- **y**  
  Y coordinate of the upper-left corner of the rectangle.
- **w**  
  Width of the rectangle.
- **h**  
  Height of the rectangle.
- **c**  
  Color used in the drawing.
Alternation color.

Alpha value for blending. $0 \leq a \leq 255$.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  mlib_GraphicsFillRectangle(3MLIB), attributes(5)
Name  
mlib_GraphicsDrawTriangle, mlib_GraphicsDrawTriangle_8,
mlib_GraphicsDrawTriangle_32, mlib_GraphicsDrawTriangle_X_8,
mlib_GraphicsDrawTriangle_X_32, mlib_GraphicsDrawTriangle_A_8,
mlib_GraphicsDrawTriangle_A_32, mlib_GraphicsDrawTriangle_B_8,
mlib_GraphicsDrawTriangle_B_32, mlib_GraphicsDrawTriangle_G_8,
mlib_GraphicsDrawTriangle_G_32, mlib_GraphicsDrawTriangle_Z_8,
mlib_GraphicsDrawTriangle_Z_32, mlib_GraphicsDrawTriangle_AB_8,
mlib_GraphicsDrawTriangle_AB_32, mlib_GraphicsDrawTriangle_ABG_8,
mlib_GraphicsDrawTriangle_ABG_32, mlib_GraphicsDrawTriangle_ABGZ_8,
mlib_GraphicsDrawTriangle_ABGZ_32, mlib_GraphicsDrawTriangle_ABZ_8,
mlib_GraphicsDrawTriangle_ABZ_32, mlib_GraphicsDrawTriangle_AG_8,
mlib_GraphicsDrawTriangle_AG_32, mlib_GraphicsDrawTriangle_AGZ_8,
mlib_GraphicsDrawTriangle_AGZ_32, mlib_GraphicsDrawTriangle_AZ_8,
mlib_GraphicsDrawTriangle_AZ_32, mlib_GraphicsDrawTriangle_BG_8,
mlib_GraphicsDrawTriangle_BG_32, mlib_GraphicsDrawTriangle_BGZ_8,
mlib_GraphicsDrawTriangle_BGZ_32, mlib_GraphicsDrawTriangle_BZ_8,
mlib_GraphicsDrawTriangle_BZ_32, mlib_GraphicsDrawTriangle_GZ_8,
mlib_GraphicsDrawTriangle_GZ_32 – draw triangle

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawTriangle_8(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_32(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_X_8(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawTriangle_X_32(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsDrawTriangle_A_8(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_A_32(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_B_8(mlib_image *buffer, mlib_s16 x1,
  mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
  mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangle_B_32(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_G_8(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsDrawTriangle_G_32(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsDrawTriangle_GZ_8(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
mlib_s16 x3, mlib_s16 y3, mlib_s16 z1, mlib_s16 z2, mlib_s16 z3, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_GZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
mlib_s16 x3, mlib_s16 y3, mlib_s16 z1, mlib_s16 z2, mlib_s16 z3, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_AB_8(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_AB_32(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_ABG_8(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_ABG_32(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_ABGZ_8(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
mlib_s16 x3, mlib_s16 y3, mlib_s16 z1, mlib_s16 z2, mlib_s16 z3, mlib_s32 c1,
mlib_s32 c2, mlib_s32 c3, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_ABGZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
mlib_s16 x3, mlib_s16 y3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangle_ABZ_8(mlib_image *buffer,
mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c, mlib_s32 a);
mlib_s16 z3, mlib_s32 c, 
milib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_ABZ_32(mlib_image *buffer,
  mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
  mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
  mlib_s16 z3, mlib_s32 c,
  mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_A8(mlib_image *buffer,
  mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
  mlib_s16 y3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsDrawTriangle_AGZ_32(mlib_image *buffer,
  mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
  mlib_s16 x3, mlib_s16 y3, mlib_s16 z1, mlib_s32 c1,
  mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsDrawTriangle_AZ_32(mlib_image *buffer,
  mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
  mlib_s16 x3, mlib_s16 y3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsDrawTriangle_BG_8(mlib_image *buffer,
  mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
  mlib_s16 y3, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_BG_32(mlib_image *buffer,
  mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
  mlib_s16 y3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_BGZ_8(mlib_image *buffer,
  mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2,
  mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s16 z1, mlib_s32 c1,
  mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_BGZ_32(mlib_image *buffer,
  mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2,
  mlib_s16 x3, mlib_s16 y3, mlib_s16 z1, mlib_s32 c1,
  mlib_s32 c2, mlib_s32 c3, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangle_BGZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c1,
mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_BZ_8(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2,
mlib_s16 x3, mlib_s16 y3, mlib_s16 z3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_BZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c,
mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangle_GZ_8(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2,
mlib_s16 x3, mlib_s16 y3, mlib_s32 c1, mlib_s32 c2,
mlib_s32 c3);

mlib_status mlib_GraphicsDrawTriangle_GZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c1,
mlib_s32 c2, mlib_s32 c3);

Description
Each of the mlib_GraphicsDrawTriangle_*( ) functions draws a triangle with the vertices at
(x1,y1), (x2,y2), and (x3,y3).

Each of the mlib_GraphicsDrawTriangle_X_*( ) functions draws a triangle in Xor mode as follows:
\[ \text{data}[x,y] \oplus c \oplus c^2 \]

Each of the mlib_GraphicsDrawTriangle_A_*( ) functions draws a triangle with antialiasing.

Each of the mlib_GraphicsDrawTriangle_B_*( ) functions draws a triangle with alpha
blending as follows:
\[ \text{data}[x,y] = \left( \text{data}[x,y] \times (255 - a) + c \times a \right) / 255 \]

Each of the mlib_GraphicsDrawTriangle_G_*( ) functions draws a triangle with Gouraud
shading.

Each of the mlib_GraphicsDrawTriangle_Z_*( ) functions draws a triangle with Z buffering.

Each of the other functions draws a triangle with a combination of two or more features like
antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).
Each of the functions takes some of the following arguments:

- **buffer**: Pointer to the image into which the function is drawing.
- **zbuffer**: Pointer to the image that holds the Z buffer.
- **x1**: X coordinate of the first vertex.
- **y1**: Y coordinate of the first vertex.
- **z1**: Z coordinate of the first vertex.
- **x2**: X coordinate of the second vertex.
- **y2**: Y coordinate of the second vertex.
- **z2**: Z coordinate of the second vertex.
- **x3**: X coordinate of the third vertex.
- **y3**: Y coordinate of the third vertex.
- **z3**: Z coordinate of the third vertex.
- **c**: Color used in the drawing.
- **c1**: Color of the first vertex.
- **c2**: Color of the second vertex, or the alternation color in Xor Mode.
- **c3**: Color of the third vertex.
- **a**: Alpha value for blending. $0 \leq a \leq 255$.

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

See attributes(5) for descriptions of the following attributes:

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<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
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<td>Committed</td>
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<tr>
<td>MT-Level</td>
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</table>

See Also  [mlib_GraphicsFillTriangle(3MLIB), attributes(5)]
Name  mlib_GraphicsDrawTriangleFanSet, mlib_GraphicsDrawTriangleFanSet_8,
      mlib_GraphicsDrawTriangleFanSet_32, mlib_GraphicsDrawTriangleFanSet_X_8,
      mlib_GraphicsDrawTriangleFanSet_X_32, mlib_GraphicsDrawTriangleFanSet_A_8,
      mlib_GraphicsDrawTriangleFanSet_A_32, mlib_GraphicsDrawTriangleFanSet_B_8,
      mlib_GraphicsDrawTriangleFanSet_B_32, mlib_GraphicsDrawTriangleFanSet_G_8,
      mlib_GraphicsDrawTriangleFanSet_G_32, mlib_GraphicsDrawTriangleFanSet_Z_8,
      mlib_GraphicsDrawTriangleFanSet_Z_32, mlib_GraphicsDrawTriangleFanSet_AB_8,
      mlib_GraphicsDrawTriangleFanSet_AB_32, mlib_GraphicsDrawTriangleFanSet_ABG_8,
      mlib_GraphicsDrawTriangleFanSet_ABG_32,
      mlib_GraphicsDrawTriangleFanSet_ABGZ_8,
      mlib_GraphicsDrawTriangleFanSet_ABGZ_32, mlib_GraphicsDrawTriangleFanSet_ABZ_8,
      mlib_GraphicsDrawTriangleFanSet_ABZ_32, mlib_GraphicsDrawTriangleFanSet_AG_8,
      mlib_GraphicsDrawTriangleFanSet_AG_32, mlib_GraphicsDrawTriangleFanSet_AGZ_8,
      mlib_GraphicsDrawTriangleFanSet_AGZ_32, mlib_GraphicsDrawTriangleFanSet_AZ_8,
      mlib_GraphicsDrawTriangleFanSet_AZ_32, mlib_GraphicsDrawTriangleFanSet_BG_8,
      mlib_GraphicsDrawTriangleFanSet_BG_32, mlib_GraphicsDrawTriangleFanSet_BGZ_8,
      mlib_GraphicsDrawTriangleFanSet_BGZ_32, mlib_GraphicsDrawTriangleFanSet_BZ_8,
      mlib_GraphicsDrawTriangleFanSet_BZ_32, mlib_GraphicsDrawTriangleFanSet_GZ_8,
      mlib_GraphicsDrawTriangleFanSet_GZ_32 – draw triangle set where all members of the set
      have a common vertex

Synopsis  cc [ flag...] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawTriangleFanSet_8(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_32(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_X_8(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
      mlib_s32 c2);

mlib_status mlib_GraphicsDrawTriangleFanSet_X_32(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
      mlib_s32 c2);

mlib_status mlib_GraphicsDrawTriangleFanSet_A_8(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_A_32(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_B_8(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
      mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_B_32(mlib_image *buffer,
      const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
      mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_G_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawTriangleFanSet_G_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawTriangleFanSet_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawTriangleFanSet_Z_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawTriangleFanSet_AB_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_AB_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_ABG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_ABG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleFanSet_AG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsDrawTriangleFanSet_AG_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleFanSet_AGZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleFanSet_AGZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints,
const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleFanSet_AGZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_AGZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_AZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_AZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleFanSet_BG_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_BG_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_BGZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_BGZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_BZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_BZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleFanSet_GZ_8(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleFanSet_GZ_32(mlib_image *buffer,
mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);
Each of the `mlib_GraphicsDrawTriangleFanSet_*()` functions draws a set of triangles with vertices at \{(x_1,y_1), (x_2,y_2), (x_3,y_3)\}, \{(x_1,y_1), (x_3,y_3), (x_4,y_4)\}, ..., and \{(x_1,y_1), (x_{n-1},y_{n-1}), (x_n,y_n)\}.

Each of the `mlib_GraphicsDrawTriangleFanSet_X_*()` functions draws a set of triangles in Xor mode as follows:

\[
data[x,y] \oplus c^c 2
\]

Each of the `mlib_GraphicsDrawTriangleFanSet_A_*()` functions draws a set of triangles with antialiasing.

Each of the `mlib_GraphicsDrawTriangleFanSet_B_*()` functions draws a set of triangles with antialiasing.

Each of the `mlib_GraphicsDrawTriangleFanSet_G_*()` functions draws a set of triangles with Gouraud shading.

Each of the `mlib_GraphicsDrawTriangleFanSet_Z_*()` functions draws a set of triangles with Z buffering.

Each of the other functions draws a set of triangles with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Each of the functions takes some of the following arguments:

- **buffer**: Pointer to the image into which the function is drawing.
- **zbuffer**: Pointer to the image that holds the Z buffer.
- **x**: Pointer to array of X coordinates of the points.
- **y**: Pointer to array of Y coordinates of the points.
- **z**: Pointer to array of Z coordinates of the points.
- **npoints**: Number of points in the arrays.
- **c**: Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- **c2**: Alternation color.
- **a**: Alpha value for blending, \(0 \leq a \leq 255\).

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:
mlib_GraphicsDrawTriangleFanSet(3MLIB)

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<th>ATTRIBUTE TYPE</th>
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<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_GraphicsDrawTriangle(3MLIB), mlib_GraphicsDrawTriangleSet(3MLIB), mlib_GraphicsDrawTriangleStripSet(3MLIB), attributes(5)
mlib_GraphicsDrawTriangleSet(3MLIB)

Name
mlib_GraphicsDrawTriangleSet, mlib_GraphicsDrawTriangleSet_8,
mlib_GraphicsDrawTriangleSet_32, mlib_GraphicsDrawTriangleSet_X_8,
mlib_GraphicsDrawTriangleSet_X_32, mlib_GraphicsDrawTriangleSet_A_8,
mlib_GraphicsDrawTriangleSet_A_32, mlib_GraphicsDrawTriangleSet_B_8,
mlib_GraphicsDrawTriangleSet_B_32, mlib_GraphicsDrawTriangleSet_G_8,
mlib_GraphicsDrawTriangleSet_G_32, mlib_GraphicsDrawTriangleSet_Z_8,
mlib_GraphicsDrawTriangleSet_Z_32, mlib_GraphicsDrawTriangleSet_AB_8,
mlib_GraphicsDrawTriangleSet_AB_32, mlib_GraphicsDrawTriangleSet_ABG_8,
mlib_GraphicsDrawTriangleSet_ABG_32, mlib_GraphicsDrawTriangleSet_ABGZ_8,
mlib_GraphicsDrawTriangleSet_ABGZ_32, mlib_GraphicsDrawTriangleSet_ABZ_8,
mlib_GraphicsDrawTriangleSet_ABZ_32, mlib_GraphicsDrawTriangleSet_AG_8,
mlib_GraphicsDrawTriangleSet_AG_32, mlib_GraphicsDrawTriangleSet_AGZ_8,
mlib_GraphicsDrawTriangleSet_AGZ_32, mlib_GraphicsDrawTriangleSet_AZ_8,
mlib_GraphicsDrawTriangleSet_AZ_32, mlib_GraphicsDrawTriangleSet_BG_8,
mlib_GraphicsDrawTriangleSet_BG_32, mlib_GraphicsDrawTriangleSet_BGZ_8,
mlib_GraphicsDrawTriangleSet_BGZ_32, mlib_GraphicsDrawTriangleSet_BZ_8,
mlib_GraphicsDrawTriangleSet_BZ_32, mlib_GraphicsDrawTriangleSet_GZ_8,
mlib_GraphicsDrawTriangleSet_GZ_32 – draw triangle set where each member can have
different vertices

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsDrawTriangleSet_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_X_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_X_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_A_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_A_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_B_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_B_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);
mlib_status mlib_GraphicsDrawTriangleSet_G_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleSet_G_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleSet_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_Z_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleSet_AB_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_AB_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_ABG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_ABG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleSet_AG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleSet_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
Each of the `mlib_GraphicsDrawTriangleSet_A_*()` functions draws a set of triangles with vertices at \((x_1, y_1), (x_2, y_2), (x_3, y_3),\) \((x_4, y_4), (x_5, y_5), (x_6, y_6)\), ..., and \((x_{n-2}, y_{n-2}), (x_{n-1}, y_{n-1}), (x_n, y_n)\).

Each of the `mlib_GraphicsDrawTriangleSet_B_*()` functions draws a set of triangles in Xor mode as follows:
Each of the \texttt{mlib\_GraphicsDrawTriangleSet\_A\_\*()} functions draws a set of triangles with antialiasing.

Each of the \texttt{mlib\_GraphicsDrawTriangleSet\_B\_\*()} functions draws a set of triangles with alpha blending as follows:

\[
data[x,y] = \frac{(data[x,y] \times (255 - a) + c \times a)}{255}
\]

Each of the \texttt{mlib\_GraphicsDrawTriangleSet\_G\_\*()} functions draws a set of triangles with Gouraud shading.

Each of the \texttt{mlib\_GraphicsDrawTriangleSet\_Z\_\*()} functions draws a set of triangles with Z buffering.

Each of the other functions draws a set of triangles with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

**Parameters**  
Each of the functions takes some of the following arguments:

- \textit{buffer}  
  Pointer to the image into which the function is drawing.

- \textit{zbuffer}  
  Pointer to the image that holds the Z buffer.

- \textit{x}  
  Pointer to array of X coordinates of the points.

- \textit{y}  
  Pointer to array of Y coordinates of the points.

- \textit{z}  
  Pointer to array of Z coordinates of the points.

- \textit{npoints}  
  Number of points in the arrays. \textit{npoints} must be a multiple of 3.

- \textit{c}  
  Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.

- \textit{c2}  
  Alternation color.

- \textit{a}  
  Alpha value for blending. \(0 \leq a \leq 255\).

**Return Values**  
Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

**Attributes**  
See \texttt{attributes(5)} for descriptions of the following attributes:

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</table>
See Also  mlib_GraphicsDrawTriangle(3MLIB), mlib_GraphicsDrawTriangleFanSet(3MLIB),
mlib_GraphicsDrawTriangleStripSet(3MLIB), attributes(5)
mlib_GraphicsDrawTriangleStripSet(3MLIB)

Name  
mlib_GraphicsDrawTriangleStripSet, mlib_GraphicsDrawTriangleStripSet_8,  
mlib_GraphicsDrawTriangleStripSet_32, mlib_GraphicsDrawTriangleStripSet_X_8,  
mlib_GraphicsDrawTriangleStripSet_X_32, mlib_GraphicsDrawTriangleStripSet_A_8,  
mlib_GraphicsDrawTriangleStripSet_A_32, mlib_GraphicsDrawTriangleStripSet_B_8,  
mlib_GraphicsDrawTriangleStripSet_B_32, mlib_GraphicsDrawTriangleStripSet_G_8,  
mlib_GraphicsDrawTriangleStripSet_G_32, mlib_GraphicsDrawTriangleStripSet_Z_8,  
mlib_GraphicsDrawTriangleStripSet_Z_32, mlib_GraphicsDrawTriangleStripSet_AB_8,  
mlib_GraphicsDrawTriangleStripSet_AB_32, mlib_GraphicsDrawTriangleStripSet_ABG_8,  
mlib_GraphicsDrawTriangleStripSet_ABG_32, mlib_GraphicsDrawTriangleStripSet_ABGZ_8,  
mlib_GraphicsDrawTriangleStripSet_ABGZ_32, mlib_GraphicsDrawTriangleStripSet_ABZ_8,  
mlib_GraphicsDrawTriangleStripSet_ABZ_32, mlib_GraphicsDrawTriangleStripSet_AG_8,  
mlib_GraphicsDrawTriangleStripSet_AG_32, mlib_GraphicsDrawTriangleStripSet_AGZ_8,  
mlib_GraphicsDrawTriangleStripSet_AGZ_32, mlib_GraphicsDrawTriangleStripSet_AZ_8,  
mlib_GraphicsDrawTriangleStripSet_AZ_32, mlib_GraphicsDrawTriangleStripSet_BG_8,  
mlib_GraphicsDrawTriangleStripSet_BG_32, mlib_GraphicsDrawTriangleStripSet_BGZ_8,  
mlib_GraphicsDrawTriangleStripSet_BGZ_32, mlib_GraphicsDrawTriangleStripSet_GZ_8,  
mlib_GraphicsDrawTriangleStripSet_GZ_32 – draw triangle set where the first side of each member is common to the second side of the previous member

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_GraphicsDrawTriangleStripSet_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleStripSet_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleStripSet_X_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,  
mlib_s32 c2);

mlib_status mlib_GraphicsDrawTriangleStripSet_X_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,  
mlib_s32 c2);

mlib_status mlib_GraphicsDrawTriangleStripSet_A_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleStripSet_A_32(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleStripSet_B_8(mlib_image *buffer,  
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,  
mlib_s32 a);}
mlib_status mlib_GraphicsDrawTriangleStripSet_B_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_G_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_G_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleStripSet_Z_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsDrawTriangleStripSet_AB_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_AB_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_ABG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_ABG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_AG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsDrawTriangleStripSet_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_AGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_AGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_AGZ_32_AZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_AGZ_32_AZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_BG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_BG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_BGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_BGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_BZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_BZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsDrawTriangleStripSet_GZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsDrawTriangleStripSet_GZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);
Each of the `mlib_GraphicsDrawTriangleStripSet_*()` functions draws a set of triangles with vertices at \{(x_1,y_1), (x_2,y_2), (x_3,y_3)\}, \{(x_2,y_2), (x_3,y_3), (x_4,y_4)\}, ..., and \{(x_{n-2},y_{n-2}), (x_{n-1},y_{n-1}), (x_n,y_n)\}.

Each of the `mlib_GraphicsDrawTriangleStripSet_X_*()` functions draws a set of triangles in Xor mode as follows:

\[
data[x,y] \oplus c \oplus c^2
\]

Each of the `mlib_GraphicsDrawTriangleStripSet_A_*()` functions draws a set of triangles with antialiasing.

Each of the `mlib_GraphicsDrawTriangleStripSet_B_*()` functions draws a set of triangles with alpha blending as follows:

\[
data[x,y] = (data[x,y] \times (255 - a) + c \times a) / 255
\]

Each of the `mlib_GraphicsDrawTriangleStripSet_G_*()` functions draws a set of triangles with Gouraud shading.

Each of the `mlib_GraphicsDrawTriangleStripSet_Z_*()` functions draws a set of triangles with Z buffering.

Each of the other functions draws a set of triangles with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Each of the functions takes some of the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `zbuffer` Pointer to the image that holds the Z buffer.
- `x` Pointer to array of X coordinates of the points.
- `y` Pointer to array of Y coordinates of the points.
- `z` Pointer to array of Z coordinates of the points.
- `npoints` Number of points in the arrays.
- `c` Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- `c2` Alternation color.
- `a` Alpha value for blending, \(0 \leq a \leq 255\).

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:
### mlib_GraphicsDrawTriangleStripSet (3MLIB)

<table>
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**See Also**  
mlib_GraphicsDrawTriangle(3MLIB), mlib_GraphicsDrawTriangleSet(3MLIB),  
mlib_GraphicsDrawTriangleFanSet(3MLIB), attributes(5)
Name  mlib_GraphicsFillArc, mlib_GraphicsFillArc_8, mlib_GraphicsFillArc_32,
       mlib_GraphicsFillArc_X_8, mlib_GraphicsFillArc_X_32, mlib_GraphicsFillArc_A_8,
       mlib_GraphicsFillArc_A_32, mlib_GraphicsFillArc_B_8, mlib_GraphicsFillArc_B_32,
       mlib_GraphicsFillArc_AB_8, mlib_GraphicsFillArc_AB_32 – draw filled arc

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsFillArc_8(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c);
mlib_status mlib_GraphicsFillArc_32(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c);
mlib_status mlib_GraphicsFillArc_X_8(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c,
       mlib_s32 c2);
mlib_status mlib_GraphicsFillArc_X_32(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c,
       mlib_s32 c2);
mlib_status mlib_GraphicsFillArc_A_8(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c);
mlib_status mlib_GraphicsFillArc_A_32(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c);
mlib_status mlib_GraphicsFillArc_B_8(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c,
       mlib_s32 a);
mlib_status mlib_GraphicsFillArc_B_32(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c,
       mlib_s32 a);
mlib_status mlib_GraphicsFillArc_AB_8(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c,
       mlib_s32 a);
mlib_status mlib_GraphicsFillArc_AB_32(mlib_image *buffer, mlib_s16 x,
       mlib_s16 y, mlib_s32 r, mlib_f32 t1, mlib_f32 t2, mlib_s32 c,
       mlib_s32 a);

Description  Each of the mlib_GraphicsFillArc_*( ) functions draws a filled
circle with the center at (x, y), radius r, start angle t1, and end angle t2.

Each of the mlib_GraphicsFillArc_X_*( ) functions draws a filled arc in Xor mode as
follows:
  data[x,y] ^= c ^ c2

Each of the mlib_GraphicsFillArc_A_*( ) functions draws a filled arc with antialiasing.
Each of the `mlib_GraphicsFillArc_B_*(())` functions draws a filled arc with alpha blending as follows:

\[
\text{data}[x,y] = (\text{data}[x,y] \times (255 - a) + c \times a) / 255
\]

Each of the `mlib_GraphicsFillArc_AB_*(())` functions draws a filled arc with antialiasing and alpha blending.

**Parameters**

Each of the functions takes some of the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `x` X coordinate of the center.
- `y` Y coordinate of the center.
- `r` Radius of the arc.
- `t1` Start angle of the arc in radians.
- `t2` End angle of the arc in radians.
- `c` Color used in the drawing.
- `c2` Alternation color.
- `a` Alpha value for blending. \(0 \leq a \leq 255\).

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

`mlib_GraphicsFillCircle(3MLIB),mlib_GraphicsFillEllipse(3MLIB),attributes(5)`
Each of the `mlib_GraphicsFillCircle_*(8)` functions draws a filled circle with the center at \((x, y)\) and radius \(r\).

Each of the `mlib_GraphicsFillCircle_X_*(8)` functions draws a filled circle in Xor mode as follows:

\[
data[x, y] ^= c^2
\]

Each of the `mlib_GraphicsFillCircle_A_*(8)` functions draws a filled circle with antialiasing.

Each of the `mlib_GraphicsFillCircle_B_*(8)` functions draws a filled circle with alpha blending as follows:

\[
data[x, y] = (data[x, y] * (255 - a) + c * a) / 255
\]
Each of the `mlib_GraphicsFillCircle_AB_*( )` functions draws a filled circle with antialiasing and alpha blending.

**Parameters**

Each of the functions takes some of the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `x` X coordinate of the center.
- `y` Y coordinate of the center.
- `r` Radius of the arc.
- `c` Color used in the drawing.
- `c2` Alternation color.
- `a` Alpha value for blending. $0 \leq a \leq 255$.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

`mlib_GraphicsFillArc(3MLIB), mlib_GraphicsFillEllipse(3MLIB), attributes(5)`

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsFillEllipse_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsFillEllipse_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsFillEllipse_X_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsFillEllipse_X_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsFillEllipse_A_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsFillEllipse_A_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c);
mlib_status mlib_GraphicsFillEllipse_B_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);
mlib_status mlib_GraphicsFillEllipse_B_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);
mlib_status mlib_GraphicsFillEllipse_AB_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);
mlib_status mlib_GraphicsFillEllipse_AB_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 a, mlib_s32 b, mlib_f32 t, mlib_s32 c, mlib_s32 alpha);

Each of the mlib_GraphicsFillEllipse() functions draws a filled ellipse with the center at (x, y), major semiaxis a, and minor semiaxis b. The angle of the major semiaxis is t counterclockwise from the X axis.

Each of the mlib_GraphicsFillEllipse_X() functions draws a filled ellipse in Xor mode as follows:

data[x,y] ^= c^ c2
Each of the mlib_GraphicsFillEllipse_A_*( ) functions draws a filled ellipse with antialiasing.

Each of the mlib_GraphicsFillEllipse_B_*( ) functions draws a filled ellipse with alpha blending as follows:
\[
data[x,y] = (data[x,y] \times (255 - \alpha) + c \times \alpha) / 255
\]

Each of the mlib_GraphicsFillEllipse_A_*( ) functions draws a filled ellipse with antialiasing and alpha blending.

**Parameters**
Each of the functions takes some of the following arguments:
- *buffer*: Pointer to the image into which the function is drawing.
- *x*: X coordinate of the center.
- *y*: Y coordinate of the center.
- *a*: Major semiaxis of the ellipse.
- *b*: Minor semiaxis of the ellipse.
- *t*: Angle of major semiaxis in radians.
- *c*: Color used in the drawing.
- *c2*: Alternation color.
- *\alpha*: Alpha value for blending. \(0 \leq \alpha \leq 255\).

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_GraphicsFillArc(3MLIB), mlib_GraphicsFillCircle(3MLIB), attributes(5)
Name

mlib_GraphicsFillPolygon, mlib_GraphicsFillPolygon_8, mlib_GraphicsFillPolygon_32,
mlib_GraphicsFillPolygon_X_8, mlib_GraphicsFillPolygon_X_32,
mlib_GraphicsFillPolygon_A_8, mlib_GraphicsFillPolygon_A_32,
mlib_GraphicsFillPolygon_B_8, mlib_GraphicsFillPolygon_B_32,
mlib_GraphicsFillPolygon_G_8, mlib_GraphicsFillPolygon_G_32,
mlib_GraphicsFillPolygon_Z_8, mlib_GraphicsFillPolygon_Z_32,
mlib_GraphicsFillPolygon_AB_8, mlib_GraphicsFillPolygon_AB_32,
mlib_GraphicsFillPolygon_ABG_8, mlib_GraphicsFillPolygon_ABG_32,
mlib_GraphicsFillPolygon_ABGZ_8, mlib_GraphicsFillPolygon_ABGZ_32,
mlib_GraphicsFillPolygon_ABZ_8, mlib_GraphicsFillPolygon_ABZ_32,
mlib_GraphicsFillPolygon_AG_8, mlib_GraphicsFillPolygon_AG_32,
mlib_GraphicsFillPolygon_AGZ_8, mlib_GraphicsFillPolygon_AGZ_32,
mlib_GraphicsFillPolygon_AZ_8, mlib_GraphicsFillPolygon_AZ_32,
mlib_GraphicsFillPolygon_BG_8, mlib_GraphicsFillPolygon_BG_32,
mlib_GraphicsFillPolygon_BGZ_8, mlib_GraphicsFillPolygon_BGZ_32,
mlib_GraphicsFillPolygon_BZ_8, mlib_GraphicsFillPolygon_BZ_32,
mlib_GraphicsFillPolygon_GZ_8, mlib_GraphicsFillPolygon_GZ_32 – draw filled polygon

Synopsis

cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_GraphicsFillPolygon_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillPolygon_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillPolygon_X_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsFillPolygon_X_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsFillPolygon_A_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillPolygon_A_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillPolygon_B_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_B_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_G_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_G_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_Z_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_Z_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_Z_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AB_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AB_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_ABG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_ABG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_ABGZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_ABGZ_32(mlib_image *buffer,
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    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_ABZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_ABZ_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

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    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AGZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AGZ_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_AZ_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_BG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_BG_32(mlib_image *buffer,
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    mlib_s32 a);

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    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_BZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_BZ_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_GZ_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
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    mlib_s32 a);

mlib_status mlib_GraphicsFillPolygon_Z_32(mlib_image *buffer,
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    const mlib_s32 *c);
mlib_status mlib_GraphicsFillPolygon_G_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);
mlib_status mlib_GraphicsFillPolygon_Z_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints,
    mlib_s32 c);
mlib_status mlib_GraphicsFillPolygon_Z_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints,
    mlib_s32 c);
mlib_status mlib_GraphicsFillPolygon_AB_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c,
    mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_AB_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c,
    mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_ABG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_ABG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_ABGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_ABGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_ABZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_ABZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillPolygon_AG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);
mlib_status mlib/GraphicsFillPolygon_AG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y,
    mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_AGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_AGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_AGZ_8(MLIB_AGZ_8/mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_AGZ_32(MLIB_AGZ_32/mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_AZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_AZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_BG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib/GraphicsFillPolygon_BG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib/GraphicsFillPolygon_BGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_BGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_BZ_8(mlib_image *buffer,
    const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_BZ_32(mlib_image *buffer,
    const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_GZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c);

mlib_status mlib/GraphicsFillPolygon_GZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s32 *c);
const mlib_s16 *z, mlib_s32 *c);

**Description**
Each of the `mlib_GraphicsFillPolygon_(*`) functions draws a filled polygon enclosing 
\((x_1, y_1), (x_2, y_2), \ldots, \text{and } (x_n, y_n)\).

Each of the `mlib_GraphicsFillPolygon_X_(*`) functions draws a filled polygon in Xor mode
as follows:
\[
data[x, y] \quad \text{^=} \quad c \quad ^\text{^} \quad c^2
\]

Each of the `mlib_GraphicsFillPolygon_A_(*`) functions draws a filled polygon with
antialiasing.

Each of the `mlib_GraphicsFillPolygon_B_(*`) functions draws a filled polygon with alpha
blending as follows:
\[
data[x, y] = \left( \frac{\text{data}[x, y] \times (255 - a) + c \times a}{255} \right)
\]

Each of the `mlib_GraphicsFillPolygon_G_(*`) functions draws a filled polygon with Gouraud shading.

Each of the `mlib_GraphicsFillPolygon_Z_(*`) functions draws a filled polygon with Z
buffering.

Each of the other functions draws a filled polygon with a combination of two or more features
like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

**Parameters**
Each of the functions takes some of the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `zbuffer` Pointer to the image that holds the Z buffer.
- `x` Pointer to the array of X coordinates of the vertices.
- `y` Pointer to the array of Y coordinates of the vertices.
- `z` Pointer to the array of Z coordinates of the vertices.
- `npoints` Number of vertices in the arrays.
- `c` Color used in the drawing, or pointer to array of colors of the points in the case of
  Gouraud shading.
- `c2` Alternation color.
- `a` Alpha value for blending. \(0 \leq a \leq 255\).

**Return Values**
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`. 
Attributes  See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_GraphicsDrawPolygon(3MLIB), attributes(5)
REFERENCE

Multimedia Library Functions - Part 2
Each of the `mlib_GraphicsFillRectangle` functions draws a filled rectangle with the upper-left corner at \((x, y)\), width \(w\), and height \(h\).

Each of the `mlib_GraphicsFillRectangle_X` functions draws a filled rectangle in Xor mode as follows:

\[
data[x,y] ^= c^c2
\]

Each of the `mlib_GraphicsFillRectangle_B` functions draws a filled rectangle with alpha blending as follows:

\[
data[x,y] = (data[x,y] * (255 - a) + c * a) / 255
\]

### Parameters

- **buffer**  
  Pointer to the image into which the function is drawing.
- **x**  
  X coordinate of the upper-left corner of the rectangle.
- **y**  
  Y coordinate of the upper-left corner of the rectangle.
- **w**  
  Width of the rectangle.
- **h**  
  Height of the rectangle.
- **c**  
  Color used in the drawing.
- **c2**  
  Alternation color.
a  Alpha value for blending. $0 \leq a \leq 255$.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_GraphicsDrawRectangle(3MLIB), attributes(5)
Name
mlib_GraphicsFillTriangle, mlib_GraphicsFillTriangle_8, mlib_GraphicsFillTriangle_32,
mlib_GraphicsFillTriangle_X_8, mlib_GraphicsFillTriangle_X_32,
mlib_GraphicsFillTriangle_A_8, mlib_GraphicsFillTriangle_A_32,
mlib_GraphicsFillTriangle_B_8, mlib_GraphicsFillTriangle_B_32,
mlib_GraphicsFillTriangle_G_8, mlib_GraphicsFillTriangle_G_32,
mlib_GraphicsFillTriangle_Z_8, mlib_GraphicsFillTriangle_Z_32,
mlib_GraphicsFillTriangle_AB_8, mlib_GraphicsFillTriangle_AB_32,
mlib_GraphicsFillTriangle_ABG_8, mlib_GraphicsFillTriangle_ABG_32,
mlib_GraphicsFillTriangle_ABGZ_8, mlib_GraphicsFillTriangle_ABGZ_32,
mlib_GraphicsFillTriangle_ABZ_8, mlib_GraphicsFillTriangle_ABZ_32,
mlib_GraphicsFillTriangle_AG_8, mlib_GraphicsFillTriangle_AG_32,
mlib_GraphicsFillTriangle_AGZ_8, mlib_GraphicsFillTriangle_AGZ_32,
mlib_GraphicsFillTriangle_AZ_8, mlib_GraphicsFillTriangle_AZ_32,
mlib_GraphicsFillTriangle_BG_8, mlib_GraphicsFillTriangle_BG_32,
mlib_GraphicsFillTriangle_BGZ_8, mlib_GraphicsFillTriangle_BGZ_32,
mlib_GraphicsFillTriangle_BZ_8, mlib_GraphicsFillTriangle_BZ_32,
mlib_GraphicsFillTriangle_GZ_8, mlib_GraphicsFillTriangle_GZ_32

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsFillTriangle_8(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_32(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_X_8(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsFillTriangle_X_32(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c, mlib_s32 c2);

mlib_status mlib_GraphicsFillTriangle_A_8(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_A_32(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_B_8(mlib_image *buffer,
mlib_s16 x1,
mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3,
mlib_s32 c,
mlib_s32 w);
mlib_status mlib_GraphicsFillTriangle_B_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_G_8(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 cl, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_G_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 cl, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_Z_8(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3, mlib_s16 z3, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_Z_32(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3, mlib_s16 z3, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_AB_8(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_AB_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_ABG_8(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_ABG_32(mlib_image *buffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3, mlib_s16 y3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3, mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1, mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3, mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangle_ABZ_32(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
    mlib_s16 z3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_AG_8(mlib_image *buffer,
    mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
    mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_AG_32(mlib_image *buffer,
    mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
    mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_AGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
    mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_AGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
    mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_AZ_8(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
    mlib_s32 c);

mlib_status mlib_GraphicsFillTriangle_AZ_32(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
    mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_BG_8(mlib_image *buffer,
    mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
    mlib_s32 c1, mlib_s32 c2, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_BG_32(mlib_image *buffer,
    mlib_s16 x1, mlib_s16 y1, mlib_s16 x2, mlib_s16 y2, mlib_s16 x3,
    mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_BGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
    mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_BGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
    mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_BZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangle_GZ_8(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2,
mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

mlib_status mlib_GraphicsFillTriangle_GZ_32(mlib_image *buffer,
mlib_image *zbuffer, mlib_s16 x1, mlib_s16 y1, mlib_s16 z1,
mlib_s16 x2, mlib_s16 y2, mlib_s16 z2, mlib_s16 x3, mlib_s16 y3,
mlib_s16 z3, mlib_s32 c1, mlib_s32 c2, mlib_s32 c3);

Description
Each of the mlib_GraphicsFillTriangle_*() functions draws a filled triangle with the vertices at (x1,y1), (x2,y2), and (x3,y3).

Each of the mlib_GraphicsFillTriangle_X_*() functions draws a filled triangle in Xor mode as follows:
\[ \text{data}[x,y] = \text{data}[x,y] \oplus c \oplus c^2 \]

Each of the mlib_GraphicsFillTriangle_A_*() functions draws a filled triangle with antialiasing.

Each of the mlib_GraphicsFillTriangle_B_*() functions draws a filled triangle with alpha blending as follows:
\[ \text{data}[x,y] = (\text{data}[x,y] \times (255 - a) + c \times a) / 255 \]

Each of the mlib_GraphicsFillTriangle_G_*() functions draws a filled triangle with Gouraud shading.

Each of the mlib_GraphicsFillTriangle_Z_*() functions draws a filled triangle with Z buffering.

Each of the other functions draws a filled triangle with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Parameters
Each of the functions takes some of the following arguments:
- buffer Pointer to the image into which the function is drawing.
- zbuffer Pointer to the image that holds the Z buffer.
- x1 X coordinate of the first vertex.
- y1 Y coordinate of the first vertex.
mlib_GraphicsFillTriangle(3MLIB)

- $z_1$: Z coordinate of the first vertex.
- $x_2$: X coordinate of the second vertex.
- $y_2$: Y coordinate of the second vertex.
- $z_2$: Z coordinate of the second vertex.
- $x_3$: X coordinate of the third vertex.
- $y_3$: Y coordinate of the third vertex.
- $z_3$: Z coordinate of the third vertex.
- $c$: Color used in the drawing.
- $c_1$: Color of the first vertex.
- $c_2$: Color of the second vertex, or the alternation color in Xor Mode.
- $c_3$: Color of the third vertex.
- $a$: Alpha value for blending. $0 \leq a \leq 255$.

**Return Values**
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_GraphicsDrawTriangle(3MLIB), attributes(5)
mlib_Status mlib_GraphicsFillTriangleFanSet_X_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);  
mlib_Status mlib_GraphicsFillTriangleFanSet_X_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_G_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_G_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_Z_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_Z_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_AB_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_AB_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_ABG_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_ABG_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_ABGZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_ABGZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_ABZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_ABZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_AG_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_AG_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_AGZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_AGZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_AZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_AZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_BG_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_BG_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_BGZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_BGZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_BZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_BZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

mlib_Status mlib_GraphicsFillTriangleFanSet_GZ_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);
mlib_Status mlib_GraphicsFillTriangleFanSet_GZ_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);

Name  

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>  
mlib_Status mlib_GraphicsFillTriangleFanSet_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);  
mlib_Status mlib_GraphicsFillTriangleFanSet_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);  
mlib_Status mlib_GraphicsFillTriangleFanSet_X_8(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);  
mlib_Status mlib_GraphicsFillTriangleFanSet_X_32(mlib_Image *buffer, const mlib_S16 *x, const mlib_S16 *y, mlib_S32 npoints, mlib_S32 c);  

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mlib_status mlib_GraphicsFillTriangleFanSet_G_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleFanSet_G_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleFanSet_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleFanSet_Z_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleFanSet_AB_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_AB_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_ABG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_ABG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleFanSet_AG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleFanSet_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleFanSet_AGZ_8(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleFanSet_AGZ_32(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleFanSet_AZ_8(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleFanSet_AZ_32(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleFanSet_BG_8(mlib_image *buffer,
  const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
  const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleFanSet_BG_32(mlib_image *buffer,
  const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
  const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleFanSet_BGZ_8(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleFanSet_BGZ_32(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleFanSet_BZ_8(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleFanSet_BZ_32(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleFanSet_GZ_8(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleFanSet_GZ_32(mlib_image *buffer,
  mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
  const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

Each of the mlib_GraphicsFillTriangleFanSet_() functions draws a set of filled triangles with vertices at \{ (x_1, y_1), (x_2, y_2), (x_3, y_3), \ldots \}, and \{ (x_1, y_1), (x_{n-1}, y_{n-1}), (x_n, y_n) \}.

Each of the mlib_GraphicsFillTriangleFanSet_X_() functions draws a set of filled triangles in Xor mode as follows:
Each of the `mlib_GraphicsFillTriangleFanSet_A_*( )` functions draws a set of filled triangles with antialiasing.

Each of the `mlib_GraphicsFillTriangleFanSet_B_*( )` functions draws a set of filled triangles with alpha blending as follows:

\[ \text{data}[x, y] = \frac{\text{data}[x, y] \times (255 - a) + c \times a}{255} \]

Each of the `mlib_GraphicsFillTriangleFanSet_G_*( )` functions draws a set of filled triangles with Gouraud shading.

Each of the `mlib_GraphicsFillTriangleFanSet_Z_*( )` functions draws a set of filled triangles with Z buffering.

Each of the other functions draws a set of filled triangles with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

**Parameters**

Each of the functions takes some of the following arguments:

- **buffer** Pointer to the image into which the function is drawing.
- **zbuffer** Pointer to the image that holds the Z buffer.
- **x** Pointer to array of X coordinates of the points.
- **y** Pointer to array of Y coordinates of the points.
- **z** Pointer to array of Z coordinates of the points.
- **npoints** Number of points in the arrays.
- **c** Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- **c2** Alternation color.
- **a** Alpha value for blending. \(0 \leq a \leq 255\).

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

---

`mlib_GraphicsFillTriangleFanSet(3MLIB)`

man pages section 3: Multimedia Library Functions • Last Revised 2 Mar 2007
See Also  mlib_GraphicsFillTriangle(3MLIB), mlib_GraphicsFillTriangleSet(3MLIB), mlib_GraphicsFillTriangleStripSet(3MLIB), attributes(5)
Name
mlib_GraphicsFillTriangleSet, mlib_GraphicsFillTriangleSet_8,
mlib_GraphicsFillTriangleSet_32, mlib_GraphicsFillTriangleSet_X_8,
mlib_GraphicsFillTriangleSet_X_32, mlib_GraphicsFillTriangleSet_A_8,
mlib_GraphicsFillTriangleSet_A_32, mlib_GraphicsFillTriangleSet_B_8,
mlib_GraphicsFillTriangleSet_B_32, mlib_GraphicsFillTriangleSet_G_8,
mlib_GraphicsFillTriangleSet_G_32, mlib_GraphicsFillTriangleSet_Z_8,
mlib_GraphicsFillTriangleSet_Z_32, mlib_GraphicsFillTriangleSet_AB_8,
mlib_GraphicsFillTriangleSet_AB_32, mlib_GraphicsFillTriangleSet_ABG_8,
mlib_GraphicsFillTriangleSet_ABG_32, mlib_GraphicsFillTriangleSet_ABGZ_8,
mlib_GraphicsFillTriangleSet_ABGZ_32, mlib_GraphicsFillTriangleSet_ABZ_8,
mlib_GraphicsFillTriangleSet_ABZ_32, mlib_GraphicsFillTriangleSet_AG_8,
mlib_GraphicsFillTriangleSet_AG_32, mlib_GraphicsFillTriangleSet_AGZ_8,
mlib_GraphicsFillTriangleSet_AGZ_32, mlib_GraphicsFillTriangleSet_AZ_8,
mlib_GraphicsFillTriangleSet_AZ_32, mlib_GraphicsFillTriangleSet_BG_8,
mlib_GraphicsFillTriangleSet_BG_32, mlib_GraphicsFillTriangleSet_BGZ_8,
mlib_GraphicsFillTriangleSet_BGZ_32, mlib_GraphicsFillTriangleSet_BZ_8,
mlib_GraphicsFillTriangleSet_BZ_32, mlib_GraphicsFillTriangleSet_GZ_8,
mlib_GraphicsFillTriangleSet_GZ_32 – draw filled triangle set where each member can have
different vertices

Synopsis
c [ flag... ] file... -tlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsFillTriangleSet_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleSet_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleSet_X_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsFillTriangleSet_X_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsFillTriangleSet_A_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleSet_A_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleSet_B_8(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_B_32(mlib_image *buffer,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_G_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleSet_G_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleSet_Z_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleSet_Z_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleSet_AB_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_AB_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_ABG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_ABG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_ABGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_ABGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_ABZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_ABZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleSet_AG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleSet_AG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c);
Each of the `mlib_GraphicsFillTriangleSet_AZ_8()` functions draws a set of filled triangles with vertices at \{(x1,y1), (x2,y2), (x3,y3)\}, \{(x4,y4), (x5,y5), (x6,y6)\}, ..., and \{(xn-2,yn-2), (xn-1,yn-1), (xn,yn)\}.

Each of the `mlib_GraphicsFillTriangleSet_X_*()` functions draws a set of filled triangles in Xor mode as follows:

---

### Description

Each of the `mlib_GraphicsFillTriangleSet_AZ_8()` functions draws a set of filled triangles with vertices at \{(x1,y1), (x2,y2), (x3,y3)\}, \{(x4,y4), (x5,y5), (x6,y6)\}, ..., and \{(xn-2,yn-2), (xn-1,yn-1), (xn,yn)\}.

Each of the `mlib_GraphicsFillTriangleSet_X_*()` functions draws a set of filled triangles in Xor mode as follows:

---

```c
mlib_status mlib_GraphicsFillTriangleSet_AGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleSet_AGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleSet_AZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleSet_AZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleSet_BG_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_BG_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints,
    const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_BGZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_BGZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_BZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_BZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleSet_GZ_8(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleSet_GZ_32(mlib_image *buffer,
    mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y,
    const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);```
Each of the `mlib_GraphicsFillTriangleSet_A_`(*) functions draws a set of filled triangles with antialiasing.

Each of the `mlib_GraphicsFillTriangleSet_B_`(*) functions draws a set of filled triangles with alpha blending as follows:

\[
data[x,y] = (data[x,y] \times (255 - a) + c \times a) / 255
\]

Each of the `mlib_GraphicsFillTriangleSet_G_`(*) functions draws a set of filled triangles with Gouraud shading.

Each of the `mlib_GraphicsFillTriangleSet_Z_`(*) functions draws a set of filled triangles with Z buffering.

Each of the other functions draws a set of filled triangles with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

**Parameters**

Each of the functions takes some of the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `zbuffer` Pointer to the image that holds the Z buffer.
- `x` Pointer to array of X coordinates of the points.
- `y` Pointer to array of Y coordinates of the points.
- `z` Pointer to array of Z coordinates of the points.
- `npoints` Number of points in the arrays. `npoints` must be a multiple of 3.
- `c` Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- `c2` Alternation color.
- `a` Alpha value for blending. \(0 \leq a \leq 255\).

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  mlib_GraphicsFillTriangle(3MLIB), mlib_GraphicsFillTriangleFanSet(3MLIB),
mlib_GraphicsFillTriangleStripSet(3MLIB), attributes(5)
Name

mlib_GraphicsFillTriangleStripSet, mlib_GraphicsFillTriangleStripSet_8,
mlib_GraphicsFillTriangleStripSet_32, mlib_GraphicsFillTriangleStripSet_X_8,
mlib_GraphicsFillTriangleStripSet_X_32, mlib_GraphicsFillTriangleStripSet_A_8,
mlib_GraphicsFillTriangleStripSet_A_32, mlib_GraphicsFillTriangleStripSet_B_8,
mlib_GraphicsFillTriangleStripSet_B_32, mlib_GraphicsFillTriangleStripSet_G_8,
mlib_GraphicsFillTriangleStripSet_G_32, mlib_GraphicsFillTriangleStripSet_Z_8,
mlib_GraphicsFillTriangleStripSet_Z_32, mlib_GraphicsFillTriangleStripSet_AB_8,
mlib_GraphicsFillTriangleStripSet_AB_32, mlib_GraphicsFillTriangleStripSet_ABG_8,
mlib_GraphicsFillTriangleStripSet_ABG_32, mlib_GraphicsFillTriangleStripSet_ABGZ_8,
mlib_GraphicsFillTriangleStripSet_ABGZ_32, mlib_GraphicsFillTriangleStripSet_ABZ_8,
mlib_GraphicsFillTriangleStripSet_ABZ_32, mlib_GraphicsFillTriangleStripSet_AG_8,
mlib_GraphicsFillTriangleStripSet_AG_32, mlib_GraphicsFillTriangleStripSet_AGZ_8,
mlib_GraphicsFillTriangleStripSet_AGZ_32, mlib_GraphicsFillTriangleStripSet_AZ_8,
mlib_GraphicsFillTriangleStripSet_AZ_32, mlib_GraphicsFillTriangleStripSet_BG_8,
mlib_GraphicsFillTriangleStripSet_BG_32, mlib_GraphicsFillTriangleStripSet_BGZ_8,
mlib_GraphicsFillTriangleStripSet_BGZ_32, mlib_GraphicsFillTriangleStripSet_BZ_8,
mlib_GraphicsFillTriangleStripSet_BZ_32, mlib_GraphicsFillTriangleStripSet_GZ_8,
mlib_GraphicsFillTriangleStripSet_GZ_32 – draw filled triangle set where the first side of
each member is common to the second side of the previous member

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsFillTriangleStripSet_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleStripSet_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleStripSet_X_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 c2);
mlib_status mlib_GraphicsFillTriangleStripSet_X_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 c2);
mlib_status mlib_GraphicsFillTriangleStripSet_A_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleStripSet_A_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c);
mlib_status mlib_GraphicsFillTriangleStripSet_B_8(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);
mlib_status mlib_GraphicsFillTriangleStripSet_B_32(mlib_image *buffer,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c,
    mlib_s32 a);


mlib_status mlib_GraphicsFillTriangleStripSet_G_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleStripSet_G_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleStripSet_Z_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleStripSet_Z_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleStripSet_AB_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_AB_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_ABG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_ABG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_ABGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_ABGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_ABZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_ABZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_AG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);
mlib_status mlib_GraphicsFillTriangleStripSet_AG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleStripSet_AGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleStripSet_AGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleStripSet_AZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleStripSet_AZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c);

mlib_status mlib_GraphicsFillTriangleStripSet_BG_8(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_BG_32(mlib_image *buffer, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_BGZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_BGZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_BZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_BZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, mlib_s32 c, mlib_s32 a);

mlib_status mlib_GraphicsFillTriangleStripSet_GZ_8(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);

mlib_status mlib_GraphicsFillTriangleStripSet_GZ_32(mlib_image *buffer, mlib_image *zbuffer, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *z, mlib_s32 npoints, const mlib_s32 *c);
Each of the `mlib_GraphicsFillTriangleStripSet_*()` functions draws a set of filled triangles with vertices at \((x_1, y_1), (x_2, y_2), (x_3, y_3), (x_4, y_4), \ldots\), and \((x_{n-2}, y_{n-2}), (x_{n-1}, y_{n-1}), (x_n, y_n)\).

Each of the `mlib_GraphicsFillTriangleStripSet_X_*()` functions draws a set of filled triangles in Xor mode as follows:

\[
data[x,y] ^= c ^ c2
\]

Each of the `mlib_GraphicsFillTriangleStripSet_A_*()` functions draws a set of filled triangles with antialiasing.

Each of the `mlib_GraphicsFillTriangleStripSet_B_*()` functions draws a set of filled triangles with alpha blending as follows:

\[
data[x,y] = (data[x,y] * (255 - a) + c * a) / 255
\]

Each of the `mlib_GraphicsFillTriangleStripSet_G_*()` functions draws a set of filled triangles with Gouraud shading.

Each of the `mlib_GraphicsFillTriangleStripSet_Z_*()` functions draws a set of filled triangles with Z buffering.

Each of the other functions draws a set of filled triangles with a combination of two or more features like antialiasing (A), alpha blending (B), Gouraud shading (G), and Z buffering (Z).

Each of the functions takes some of the following arguments:

- `buffer`: Pointer to the image into which the function is drawing.
- `zbuffer`: Pointer to the image that holds the Z buffer.
- `x`: Pointer to array of X coordinates of the points.
- `y`: Pointer to array of Y coordinates of the points.
- `z`: Pointer to array of Z coordinates of the points.
- `npoints`: Number of points in the arrays.
- `c`: Color used in the drawing, or pointer to array of colors of the points in the case of Gouraud shading.
- `c2`: Alternation color.
- `a`: Alpha value for blending. \(0 \leq a \leq 255\).

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:
### mlib_GraphicsFillTriangleStripSet(3MLIB)

<table>
<thead>
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**See Also**  
mlib_GraphicsFillTriangle(3MLIB), mlib_GraphicsFillTriangleSet(3MLIB),  
mlib_GraphicsFillTriangleFanSet(3MLIB), attributes(5)
mlib_GraphicsFloodFill_8, mlib_GraphicsFloodFill_32 – flood fill

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_GraphicsFloodFill_8(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 c2);
mlib_status mlib_GraphicsFloodFill_32(mlib_image *buffer, mlib_s16 x, mlib_s16 y, mlib_s32 c, mlib_s32 c2);
```

**Description**
Each of these functions performs flood fill.

**Parameters**
Each of the functions takes the following arguments:

- `buffer` Pointer to the image into which the function is drawing.
- `x` X coordinate of the starting point.
- `y` Y coordinate of the starting point.
- `c` Color used in the drawing.
- `c2` Color that defines the filling interior.

**Return Values**
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`attributes(5)`
The `mlib_ImageAbs()` function computes the absolute value of the image pixels. It uses the following equation:

\[ \text{dst}[x][y][i] = |\text{src}[x][y][i]| \]

The function takes the following arguments:
- \( \text{dst} \)  
  Pointer to destination image.
- \( \text{src} \)  
  Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_ImageAbs_Fp(3MLIB)`
- `mlib_ImageAbs_Fp_Inp(3MLIB)`
- `mlib_ImageAbs_Inp(3MLIB)`
- attributes(5)
mlib_ImageAbs_Fp – computes the absolute value of the image pixels

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAbs_Fp(mlib_image *dst, const mlib_image *src);

Description

The mlib_ImageAbs_Fp() function computes the floating-point absolute value of the image pixels.

It uses the following equation:

\[ \text{dst}[x][y][i] = |\text{src}[x][y][i]| \]

Parameters

The function takes the following arguments:

- \( \text{dst} \) Pointer to destination image.
- \( \text{src} \) Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise, it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageAbs(3MLIB), mlib_ImageAbs_Fp_Inp(3MLIB), mlib_ImageAbs_Inp(3MLIB), attributes(5)
**Name**  
mlib_ImageAbs_Fp_Inp – computes the absolute value of the image pixels

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>  

```c
mlib_status mlib_ImageAbs_Fp_Inp(mlib_image *srcdst);
```

**Description**  
The `mlib_ImageAbs_Fp_Inp()` function computes the floating-point absolute value of the image pixels, in place.

It uses the following equation:

```c
srcdst[x][y][i] = |srcdst[x][y][i]|
```

**Parameters**  
The function takes the following arguments:

- `srcdst`  
  Pointer to source and destination image.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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**See Also**  
mlib_ImageAbs(3MLIB), mlib_ImageAbs_Fp(3MLIB), mlib_ImageAbs_Inp(3MLIB), attributes(5)
Name mlib_ImageAbs_Inp – computes the absolute value of the image pixels, in place

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include "mlib.h"

mlib_status mlib_ImageAbs_Inp(mlib_image *srcdst);

Description The mlib_ImageAbs_Inp() function computes the absolute value of the image pixels in place.

It uses the following equation:
srcdst[x][y][i] = |srcdst[x][y][i]|

Parameters The function takes the following arguments:
srcdst Pointer to source and destination image.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageAbs(3MLIB), mlib_ImageAbs_Fp(3MLIB), mlib_ImageAbs_Fp_Inp(3MLIB), attributes(5)
### Name
mlib_ImageAdd – computes the addition of two images on a pixel-by-pixel basis

### Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAdd(mlib_image *dst, const mlib_image *src1,
             const mlib_image *src2);
```

### Description

The `mlib_ImageAdd()` function computes the addition of two images on a pixel-by-pixel basis.

It uses the following equation:

\[
dst[x][y][i] = src1[x][y][i] + src2[x][y][i]
\]

### Parameters

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src1** Pointer to first source image.
- **src2** Pointer to second source image.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

`mlib_ImageAdd_Fp(3MLIB), mlib_ImageAdd_Fp_Inp(3MLIB), mlib_ImageAdd_Inp(3MLIB), attributes(5)`
### Name
mlib_ImageAdd_Fp – computes the addition of two images on a pixel-by-pixel basis

### Synopsis
```
c -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAdd_Fp(mlib_image dst, const mlib_image *src1,
                           const mlib_image *src2);
```

### Description
The `mlib_ImageAdd_Fp()` function computes the addition of two floating-point images on a pixel-by-pixel basis.

It uses the following equation:

```
dst[x][y][i] = src1[x][y][i] + src2[x][y][i]
```

### Parameters
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- mlib_ImageAdd(3MLIB), mlib_ImageAdd_Fp_Inp(3MLIB), mlib_ImageAdd_Inp(3MLIB), attributes(5)
The `mlib_ImageAdd_Fp_Inp()` function computes the addition of two floating-point images on a pixel-by-pixel basis, in place.

It uses the following equation:

```
src1dst[x][y][i] = src1dst[x][y][i] + src2[x][y][i]
```

**Parameters**

- `src1dst` : Pointer to first source and destination image.
- `src2` : Pointer to second source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

- `mlib_ImageAdd(3MLIB)`, `mlib_ImageAdd_Fp(3MLIB)`, `mlib_ImageAdd_Inp(3MLIB)`, `attributes(5)`
The `mlib_ImageAdd_Inp()` function computes the addition of two images on a pixel-by-pixel basis, in place.

It uses the following equation:

```
src1dst[x][y][i] = src1dst[x][y][i] + src2[x][y][i]
```

The function takes the following arguments:

- `src1dst`: Pointer to first source and destination image.
- `src2`: Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See Also  `mlib_ImageAdd(3MLIB), mlib_ImageAdd_Fp(3MLIB), mlib_ImageAdd_Fp_Inp(3MLIB), attributes(5)`
#include <mlib.h>

mlib_status mlib_ImageAffine(mlib_image *dst, const mlib_image *src, 
const mlib_d64 *mtx, mlib_filter filter, mlib_edge edge);

The mlib_ImageAffine() function does affine transformation on an image according to the 
following equation:

\[
\begin{align*}
xd &= a*xs + b*ys + tx \\
yd &= c*xs + d*ys + ty
\end{align*}
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with 
coordinates \((xd, yd)\) in the destination image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or 
MLIB_INT.

The width and height of the destination image can be different from the width and height of 
the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The function takes the following arguments:

- **dst**  Pointer to destination image.
- **src**  Pointer to source image.
- **mtx**  Transformation matrix. \(\text{mtx}[0]\) holds \(a\); \(\text{mtx}[1]\) holds \(b\); \(\text{mtx}[2]\) holds \(tx\); \(\text{mtx}[3]\) holds \(c\); \(\text{mtx}[4]\) holds \(d\); \(\text{mtx}[5]\) holds \(ty\).
- **filter**  Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge**  Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED
mlib_ImageAffine(3MLIB)

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageAffine_Fp(3MLIB), mlib_ImageAffineIndex(3MLIB),
           mlib_ImageAffineTransform(3MLIB), mlib_ImageAffineTransform_Fp(3MLIB),
           mlib_ImageAffineTransformIndex(3MLIB), mlib_ImageSetPaddings(3MLIB),
           attributes(5)
mlib_ImageAffine_Fp() function does affine transformation on a floating-point image according to the following equation:

\[
\begin{align*}
xd &= a \cdot xs + b \cdot ys + tx \\
yd &= c \cdot xs + d \cdot ys + ty
\end{align*}
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be MLIB_FLOAT or MLIB_DOUBLE.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **mtx** Transformation matrix. \(mtx[0]\) holds \(a\); \(mtx[1]\) holds \(b\); \(mtx[2]\) holds \(tx\); \(mtx[3]\) holds \(c\); \(mtx[4]\) holds \(d\); \(mtx[5]\) holds \(ty\).
- **filter** Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageAffine(3MLIB), mlib_ImageAffineIndex(3MLIB), mlib_ImageAffineTransform(3MLIB), mlib_ImageAffineTransform_Fp(3MLIB), mlib_ImageAffineTransformIndex(3MLIB), mlib_ImageSetPaddings(3MLIB), attributes(5)
### Name
mlib_ImageAffineIndex – affine transformation on a color indexed image

### Synopsis
```
c
cc [ flag... ] file... -cmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAffineIndex(mlib_image *dst, const mlib_image *src,
       const mlib_d64 *mtx, mlib_filter filter, mlib_edge edge,
       const void *colormap);
```

### Description
The `mlib_ImageAffineIndex()` function does affine transformation on a color indexed image according to the following equation:

\[
\begin{align*}
    x_d &= a \times x_s + b \times y_s + tx \\
    y_d &= c \times x_s + d \times y_s + ty
\end{align*}
\]

where a point with coordinates \((x_s, y_s)\) in the source image is mapped to a point with coordinates \((x_d, y_d)\) in the destination image.

The image data type must be `MLIB_BYTE` or `MLIB_SHORT`.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

### Parameters
The function takes the following arguments:

- **dst**    Pointer to destination image.
- **src**    Pointer to source image.
- **mtx**    Transformation matrix. \(mtx[0]\) holds \(a\); \(mtx[1]\) holds \(b\); \(mtx[2]\) holds \(tx\); \(mtx[3]\) holds \(c\); \(mtx[4]\) holds \(d\); \(mtx[5]\) holds \(ty\).
- **filter** Type of resampling filter. It can be one of the following:
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`
- **edge**    Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`
- **colormap** Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also  mlib_ImageAffine(3MLIB), mlib_ImageAffine_Fp(3MLIB),
mlib_ImageAffineTransform(3MLIB), mlib_ImageAffineTransform_Fp(3MLIB),
mlib_ImageAffineTransformIndex(3MLIB), attributes(5)
The \texttt{mlib\_ImageAffineTable()} function does affine transformation on an image with table-driven interpolation.

The following equation represents the affine transformation:

\[
\begin{align*}
x_d &= a*x_s + b*y_s + t_x \\
y_d &= c*x_s + d*y_s + t_y
\end{align*}
\]

where a point with coordinates \((x_s, y_s)\) in the source image is mapped to a point with coordinates \((x_d, y_d)\) in the destination image.

The data type of the images can be \texttt{MLIB\_BYTE}, \texttt{MLIB\_SHORT}, \texttt{MLIB\_USHORT}, or \texttt{MLIB\_INT}.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The function takes the following arguments:

- \textit{dst} Pointer to destination image.
- \textit{src} Pointer to source image.
- \textit{mtx} Transformation matrix. \(\texttt{mtx[0]}\) holds \(a\); \(\texttt{mtx[1]}\) holds \(b\); \(\texttt{mtx[2]}\) holds \(t_x\); \(\texttt{mtx[3]}\) holds \(c\); \(\texttt{mtx[4]}\) holds \(d\); \(\texttt{mtx[5]}\) holds \(t_y\).
- \textit{interp\_table} Pointer to an interpolation table. The table is created by the \texttt{mlib\_ImageInterpTableCreate()} function.
- \textit{edge} Type of edge condition. It can be one of the following:
  - \texttt{MLIB\_EDGE\_DST\_NO\_WRITE}
  - \texttt{MLIB\_EDGE\_DST\_FILL\_ZERO}
  - \texttt{MLIB\_EDGE\_OP\_NEAREST}
  - \texttt{MLIB\_EDGE\_SRC\_EXTEND}
  - \texttt{MLIB\_EDGE\_SRC\_PADDDED}

The function returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

See attributes(5) for descriptions of the following attributes:
mlib_ImageAffineTable(3MLIB)

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
mlib_ImageInterpTableCreate(3MLIB), mlib_ImageInterpTableDelete(3MLIB), mlib_ImageAffineTable_Fp(3MLIB), mlib_ImageAffine(3MLIB), mlib_ImageAffine_Fp(3MLIB), attributes(5)
The `mlib_ImageAffineTable_Fp()` function does affine transformation on a floating-point image with table-driven interpolation.

The following equation represents the affine transformation:

\[
\begin{align*}
xd &= a \times xs + b \times ys + tx \\
yd &= c \times xs + d \times ys + ty
\end{align*}
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \(0.5, 0.5\).

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **mtx**: Transformation matrix. \(mtx[0]\) holds \(a\); \(mtx[1]\) holds \(b\); \(mtx[2]\) holds \(tx\); \(mtx[3]\) holds \(c\); \(mtx[4]\) holds \(d\); \(mtx[5]\) holds \(ty\).
- **interp_table**: Pointer to an interpolation table. The table is created by the `mlib_ImageInterpTableCreate()` function.
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`. 
Attributes
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also
mlib_ImageInterpTableCreate(3MLIB), mlib_ImageInterpTableDelete(3MLIB),
mlib_ImageAffineTable(3MLIB), mlib_ImageAffine(3MLIB),
mlib_ImageAffine_Fp(3MLIB), attributes(5)
mlib_ImageAffineTransform() function does affine transformation on an image, checking the matrix first and taking advantage of special cases.

The following equation represents the affine transformation:

\[ xd = a*xs + b*ys + tx \]
\[ yd = c*xs + d*ys + ty \]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

Parameters

The function takes the following arguments:

- \( \text{dst} \) Pointer to destination image.
- \( \text{src} \) Pointer to source image.
- \( \text{mtx} \) Transformation matrix. \( \text{mtx}[0] \) holds \( a \); \( \text{mtx}[1] \) holds \( b \); \( \text{mtx}[2] \) holds \( tx \); \( \text{mtx}[3] \) holds \( c \); \( \text{mtx}[4] \) holds \( d \); \( \text{mtx}[5] \) holds \( ty \).
- \( \text{filter} \) Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- \( \text{edge} \) Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  
mlib_ImageAffine(3MLIB), mlib_ImageAffine_Fp(3MLIB),  
mlib_ImageAffineIndex(3MLIB), mlib_ImageAffineTransform_Fp(3MLIB),  
mlib_ImageAffineTransformIndex(3MLIB), mlib_ImageSetPaddings(3MLIB),  
attributes(5)
**Name**  
mlib_ImageAffineTransform_Fp – affine transformation on an image, checking the matrix first

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_ImageAffineTransform_Fp(mlib_image *dst,
    const mlib_image *src, const mlib_d64 *mtx,
    mlib_filter filter,
    mlib_edge edge);
```

**Description**  
The `mlib_ImageAffineTransform_Fp()` function does affine transformation on a floating-point image, checking the matrix first and taking advantage of special cases.

The following equation represents the affine transformation:

\[
\begin{align*}
xd &= a*xs + b*ys + tx \\
yd &= c*xs + d*ys + ty
\end{align*}
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be **MLIB_FLOAT** or **MLIB_DOUBLE**.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

**Parameters**  
The function takes the following arguments:

- **dst**  
  Pointer to destination image.
- **src**  
  Pointer to source image.
- **mtx**  
- **filter**  
  Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge**  
  Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED

---

**mlib_ImageAffineTransform_Fp(3MLIB)**

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The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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**See Also**  
`mlib_ImageAffine(3MLIB), mlib_ImageAffine_Fp(3MLIB), mlib_ImageAffineIndex(3MLIB), mlib_ImageAffineTransform(3MLIB), mlib_ImageAffineTransformIndex(3MLIB), mlib_ImageSetPaddings(3MLIB), attributes(5)`
The *mlib_IMAGEAffineTransformIndex()* function does affine transformation on a color indexed image, checking the matrix first and taking advantage of special cases.

The following equation represents the affine transformation:

\[
\begin{align*}
xd &= a*xs + b*ys + tx \\
yd &= c*xs + d*ys + ty
\end{align*}
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The image data type must be MLIB_BYTE or MLIB_SHORT.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

**Parameters**

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **mtx** Transformation matrix. \(mtx[0]\) holds \(a\); \(mtx[1]\) holds \(b\); \(mtx[2]\) holds \(tx\); \(mtx[3]\) holds \(c\); \(mtx[4]\) holds \(d\); \(mtx[5]\) holds \(ty\).
- **filter** Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILLZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED
Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function. The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

`mlib_ImageAffine(3MLIB), mlib_ImageAffine_Fp(3MLIB),
mlib_ImageAffineIndex(3MLIB), mlib_ImageAffineTransform(3MLIB),
mlib_ImageAffineTransform_Fp(3MLIB), attributes(5)`
## mlib_ImageAnd(3MLIB)

### Name
mlib_ImageAnd – computes the And of two images

### Synopsis
c{ [ flag... ] file... -lmlib [ library... ]}
#include <mlib.h>

```c
mlib_status mlib_ImageAnd(mlib_image *dst, const mlib_image *src1,
                          const mlib_image *src2);
```

### Description
The `mlib_ImageAnd()` function computes the And of two images according to the following equation:

\[
dst[x][y][i] = src1[x][y][i] \& src2[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

### Parameters
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

### See Also
`mlib_ImageAnd_Inp(3MLIB)`, attributes(5)
**mlib_ImageAnd_Inp**

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAnd_Inp(mlib_image *src1dst, const mlib_image *src2);
```

**Description**
The mlib_ImageAnd_Inp() function computes the And of two images, in place, according to the following equation:
```
src1dst[x][y][i] = src1dst[x][y][i] & src2[x][y][i]
```

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

**Parameters**
The function takes the following arguments:
- *src1dst* Pointer to first source and destination image.
- *src2* Pointer to second source image.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_ImageAnd(3MLIB), attributes(5)
mlib_ImageAndNot1_Inp(3MLIB)

Name mlib_ImageAndNot1_Inp – computes the And of the first source image and the Not of the second source image, in place

Synopsis
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAndNot1_Inp(mlib_image *src1dst,
    const mlib_image *src2);
```

Description The mlib_ImageAndNot1_Inp() function computes the logical Not of the second source image and then computes the logical And of that result with the first source image, on a pixel-by-pixel basis, and stores the final result in the first source image. It uses the following equation:
```
src1dst[x][y][i] = src1dst[x][y][i] & (~src2[x][y][i])
```

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

Parameters
- The function takes the following arguments:
  - `src1dst` Pointer to first source and destination image.
  - `src2` Pointer to second source image.

Return Values
- The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_ImageAndNot(3MLIB), mlib_ImageAndNot2_Inp(3MLIB), attributes(5)
The mlib_ImageAndNot2_Inp function computes the logical Not of the second source image and then computes the logical And of that result with the first source image, on a pixel-by-pixel basis, and stores the final result in the second source image. It uses the following equation:

\[ \text{src2dst}[x][y][i] = \text{src1}[x][y][i] \& (\sim \text{src2dst}[x][y][i]) \]

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

The function takes the following arguments:

- **src2dst** Pointer to second source and destination image.
- **src1** Pointer to first source image.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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</table>

**See Also** mlib_ImageAnd(3MLIB), mlib_ImageAnd_Inp(3MLIB), attributes(5)
The `mlib_ImageAndNot()` function computes the logical Not of the second source image and then computes the logical And of the result with the first source image, on a pixel-by-pixel basis. It uses the following equation:

\[
dst[x][y][i] = src1[x][y][i] \& (~src2[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

### Parameters
- **dst** Pointer to destination image.
- **src1** Pointer to first source image.
- **src2** Pointer to second source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_ImageAndNot1_Inp(3MLIB)`
- `mlib_ImageAndNot2_Inp(3MLIB)`
- `attributes(5)`
mlib_ImageAutoCorrel(3MLIB)

**Name**
mlib_ImageAutoCorrel – auto-correlation of an image

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAutoCorrel(mlib_d64 *correl, const mlib_image *img,
   mlib_s32 dx, mlib_s32 dy);
```

**Description**
The `mlib_ImageAutoCorrel()` function computes the auto-correlation of an image, given an offset.

It uses the following equation:

\[
\frac{1}{(w-dx) \times (h-dy)} \sum_{x=0}^{w-dx-1} \sum_{y=0}^{h-dy-1} (img[x][y][i] \times img[x+dx][y+dy][i])
\]

where \(w\) and \(h\) are the width and height of the image, respectively.

**Parameters**
The function takes the following arguments:

- `correl` Pointer to auto-correlation array where size is equal to the number of channels.
  `correl[i]` contains the auto-correlation of channel \(i\).

- `img` Pointer to image.

- `dx` Displacement in the X direction.

- `dy` Displacement in the Y direction.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageAutoCorrel_Fp(3MLIB)`, `mlib_ImageCrossCorrel(3MLIB)`, `mlib_ImageCrossCorrel_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageAutoCorrel_Fp()` function computes the auto-correlation of a floating-point image, given an offset.

It uses the following equation:

\[
\text{correl}[i] = \frac{1}{(w-dx) \times (h-dy)} \sum_{x=0}^{w-dx-1} \sum_{y=0}^{h-dy-1} \text{img}[x+y][i] \times \text{img}[x+dx+y+dy][i]
\]

where \(w\) and \(h\) are the width and height of the image, respectively.

**Parameters**
The function takes the following arguments:

- `correl` Pointer to auto-correlation array where size is equal to the number of channels. `correl[i]` contains the auto-correlation of channel \(i\).
- `img` Pointer to image.
- `dx` Displacement in the X direction.
- `dy` Displacement in the Y direction.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageAutoCorrel(3MLIB), mlib_ImageCrossCorrel(3MLIB), mlib_ImageCrossCorrel_Fp(3MLIB), attributes(5)`
The `mlib_ImageAve()` function computes the average of two images on a pixel-by-pixel basis. It uses the following equation:

\[ dst[x][y][i] = \frac{src1[x][y][i] + src2[x][y][i] + 1}{2} \]

**Parameters**
- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- `mlib_ImageAve_Fp(3MLIB)`, `mlib_ImageAve_Fp_Inp(3MLIB)`, `mlib_ImageAve_Inp(3MLIB)`,
# mlib_ImageAve_Fp

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageAve_Fp(mlib_image *dst, const mlib_image *src1, const mlib_image *src2);
```

## Description

The `mlib_ImageAve_Fp()` function computes the average of two floating-point images on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = \frac{\text{src1}[x][y][i] + \text{src2}[x][y][i]}{2}
\]

## Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_ImageAve(3MLIB)`, `mlib_ImageAve_Fp_Inp(3MLIB)`, `mlib_ImageAve_Inp(3MLIB)`, `attributes(5)`
mlib_ImageAve_Fp_Inp – average of two images, in place

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageAve_Fp_Inp(mlib_image *src1dst,
    const mlib_image *src2);

Description
The mlib_ImageAve_Fp_Inp() function computes the average of two floating-point images on a pixel-by-pixel basis, in place.

It uses the following equation:
src1dst[x][y][i] = (src1dst[x][y][i] + src2[x][y][i]) / 2

Parameters
The function takes the following arguments:
src1dst Pointer to first source and destination image.
src2 Pointer to second source image.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_ImageAve(3MLIB), mlib_ImageAve_Fp(3MLIB), mlib_ImageAve_Inp(3MLIB), attributes(5)
The `mlib_ImageAve_Inp()` function computes the average of two images on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
\text{src1dst}[x][y][i] = \frac{\text{src1dst}[x][y][i] + \text{src2}[x][y][i] + 1}{2}
\]

**Parameters**
- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
- `mlib_ImageAve(3MLIB)`, `mlib_ImageAve_Fp(3MLIB)`, `mlib_ImageAve_Fp_Inp(3MLIB)`, attributes(5)
**mlib_ImageBlend1_Fp_Inp**

**Name**
mlib_ImageBlend1_Fp_Inp - blend with an alpha image

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageBlend1_Fp_Inp(mlib_image *src1dst,
const mlib_image *src2, const mlib_image *alpha);
```

**Description**
The `mlib_ImageBlend1_Fp_Inp()` function blends two images together, in place, on a pixel-by-pixel basis using an alpha image, when alpha is also on a pixel basis. The alpha image can be a single-channel image or have the same number of channels as the source and destination images.

It uses the following equation when the alpha image is a single-channel image:

```
src1dst[x][y][i] = alpha[x][y][0]*src1dst[x][y][i] +
(1 - alpha[x][y][0])*src2[x][y][i]
```

It uses the following equation when the alpha image has the same number of channels as the source and destination images:

```
src1dst[x][y][i] = alpha[x][y][i]*src1dst[x][y][i] +
(1 - alpha[x][y][i])*src2[x][y][i]
```

**Parameters**
The function takes the following arguments:
- **src1dst** Pointer to first source and destination image.
- **src2** Pointer to second source image.
- **alpha** Alpha image used to control blending. The pixels in this image should have values in the range of [0.0, 1.0].

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_ImageBlend(3MLIB), mlib_ImageBlend_Fp(3MLIB), mlib_ImageBlend1_Inp(3MLIB), mlib_ImageBlend2_Fp_Inp(3MLIB), mlib_ImageBlend2_Inp(3MLIB), attributes(5)
mlib_ImageBlend1_Inp

**Name**  
mlib_ImageBlend1_Inp – blend with an alpha image, in place

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_ImageBlend1_Inp(mlib_image *src1dst,  
const mlib_image *src2, const mlib_image *alpha);
```

**Description**  
The `mlib_ImageBlend1_Inp()` function blends two images together, in place, on a pixel-by-pixel basis using an alpha image, when alpha is also on a pixel basis. The `alpha` image can be a single-channel image or have the same number of channels as the source and destination images.

It uses the following equation when the `alpha` image is a single-channel image:

\[
src1dst[x][y][i] = a[x][y][0] \times src1dst[x][y][i] + (1 - a[x][y][0]) \times src2[x][y][i]
\]

It uses the following equation when the `alpha` image has the same number of channels as the source and destination images:

\[
src1dst[x][y][i] = a[x][y][i] \times src1dst[x][y][i] + (1 - a[x][y][i]) \times src2[x][y][i]
\]

**Parameters**  
The function takes the following arguments:

- `src1dst`  
  Pointer to first source and destination image.

- `src2`  
  Pointer to second source image.

- `alpha`  
  Alpha image used to control blending. The value equals \((alpha \times 2^{-8})\) for `MLIB_BYTE` image, \((alpha \times 2^{-15})\) for `MLIB_SHORT` image, \((alpha \times 2^{-16})\) for `MLIB_USHORT` image, and \((alpha \times 2^{-31})\) for `MLIB_INT` image.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**  
mlib_ImageBlend(3MLIB), mlib_ImageBlend_Fp(3MLIB),  
mlib_ImageBlend1_Fp_Inp(3MLIB), mlib_ImageBlend2_Fp_Inp(3MLIB),  
mlib_ImageBlend2_Inp(3MLIB), attributes(5)
The `mlib_ImageBlend2_Fp_Inp()` function blends two images together, in place, on a pixel-by-pixel basis using an alpha image, when a is also on a pixel basis. The *alpha* image can be a single-channel image or have the same number of channels as the source and destination images.

It uses the following equation when the *alpha* image is a single-channel image:

$$
src2dst[x][y][i] = \text{alpha}[x][y][0] * src1[x][y][i] + \\
(1 - \text{alpha}[x][y][0]) * src2dst[x][y][i]
$$

It uses the following equation when the *alpha* image has the same number of channels as the source and destination images:

$$
src2dst[x][y][i] = \text{alpha}[x][y][i] * src1[x][y][i] + \\
(1 - \text{alpha}[x][y][i]) * src2dst[x][y][i]
$$

It uses the following equation:

**Parameters**
The function takes the following arguments:

- `src2dst` Pointer to second source and destination image.
- `src1` Pointer to first source image.
- `alpha` Alpha image used to control blending. The pixels in this image should have values in the range of [0.0, 1.0].

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
`mlib_ImageBlend(3MLIB), mlib_ImageBlend_Fp(3MLIB), mlib_ImageBlend1_Fp_Inp(3MLIB), mlib_ImageBlend1_Inp(3MLIB), mlib_ImageBlend2_Inp(3MLIB), attributes(5)"
mlib_ImageBlend2_Inp() function blends two images together, in place, on a pixel-by-pixel basis using an alpha image, when alpha is also on a pixel basis. The alpha image can be a single-channel image or have the same number of channels as the source and destination images.

It uses the following equation when the alpha image is a single-channel image:

\[
src2dst[x][y][i] = a[x][y][0]*src1[x][y][i] + (1 - a[x][y][0])*src2dst[x][y][i]
\]

It uses the following equation when the alpha image has the same number of channels as the source and destination images:

\[
src2dst[x][y][i] = a[x][y][i]*src1[x][y][i] + (1 - a[x][y][i])*src2dst[x][y][i]
\]

**Parameters**

- `src2dst` Pointer to second source and destination image.
- `src1` Pointer to first source image.
- `alpha` Alpha image used to control blending. The value equals \((alpha * 2^{**(-8)})\) for MLIB_BYTE image, \((alpha * 2^{**(-15)})\) for MLIB_SHORT image, \((alpha * 2^{**(-16)})\) for MLIB_USHORT image, and \((alpha * 2^{**(-31)})\) for MLIB_INT image.

**Return Values**

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
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</tbody>
</table>

**See Also**

mlib_ImageBlend(3MLIB), mlib_ImageBlend_Fp(3MLIB),
mlib_ImageBlend1_Fp_Inp(3MLIB), mlib_ImageBlend1_Inp(3MLIB),
mlib_ImageBlend2_Fp_Inp(3MLIB), attributes(5)
include "mlib.h"

mlib_status mlib_ImageBlend(mlib_image *dst, const mlib_image *src1, 
const mlib_image *src2, const mlib_image *alpha);

The `mlib_ImageBlend()` function blends two images together on a pixel-by-pixel basis using an alpha image, when alpha is also on a pixel basis. The alpha image can be a single-channel image or have the same number of channels as the source and destination images.

It uses the following equation when the alpha image is a single-channel image:

\[
dst[x][y][i] = a[x][y][0]*src1[x][y][i] + (1 - a[x][y][0])*src2[x][y][i]
\]

It uses the following equation when the alpha image has the same number of channels as the source and destination images:

\[
dst[x][y][i] = a[x][y][i]*src1[x][y][i] + (1 - a[x][y][i])*src2[x][y][i]
\]

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src1** Pointer to first source image.
- **src2** Pointer to second source image.
- **alpha** Alpha image used to control blending. The a value equals \( (alpha * 2**(-8)) \) for MLIB_BYTE image, \( (alpha * 2**(-15)) \) for MLIB_SHORT image, \( (alpha * 2**(-16)) \) for MLIB_USHORT image, and \( (alpha * 2**(-31)) \) for MLIB_INT image.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See Also [mlib_ImageBlend_Fp(3MLIB)](3MLIB), [mlib_ImageBlend1_Fp_Inp(3MLIB)](3MLIB), [mlib_ImageBlend1_Inp(3MLIB)](3MLIB), [mlib_ImageBlend2_Fp_Inp(3MLIB)](3MLIB), [mlib_ImageBlend2_Inp(3MLIB)](3MLIB), [attributes(5)](5)
This group of functions supports digital image composition. They are low-level, non-in-place, blending functions.

The image type must be `MLIB_BYTE`. The input and output images must contain three or four channels. For three-channel images, the alpha value is as if the alpha value is 1.
BSRC1 is one of the following: ZERO, ONE, SC, OMSC, DA, SA, OMDA, or OMSA. BSRC2 is one of the following: ZERO, ONE, DC, OMDC, DA, SA, OMDA, OMSA, or SAS.

The following are predefined blend factor types used in mediaLib image composition functions.

```c
/* image blend factors */
typedef enum {
    MLIB_BLEND_ZERO,
    MLIB_BLEND_ONE,
    MLIB_BLEND_DST_COLOR,
    MLIB_BLEND_SRC_COLOR,
    MLIB_BLEND_ONE_MINUS_DST_COLOR,
    MLIB_BLEND_ONE_MINUS_SRC_COLOR,
    MLIB_BLEND_DST_ALPHA,
    MLIB_BLEND_SRC_ALPHA,
    MLIB_BLEND_ONE_MINUS_DST_ALPHA,
    MLIB_BLEND_ONE_MINUS_SRC_ALPHA,
    MLIB_BLEND_SRC_ALPHA_SATURATE
} mlib_blend;
```

See the following table for the definitions of the blend factors.

<table>
<thead>
<tr>
<th>Type</th>
<th>Blend Factor[*]</th>
<th>Abbr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BLEND_ZERO</td>
<td>(0,0,0,0)</td>
<td>ZERO</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE</td>
<td>(1,1,1,1)</td>
<td>ONE</td>
</tr>
<tr>
<td>MLIB_BLEND_DST_COLOR</td>
<td>(Rd,Gd,Bd,Ad)</td>
<td>DC</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_COLOR</td>
<td>(Rs,Gs,Bs,As)</td>
<td>SC</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_COLOR</td>
<td>(1,1,1,1)-(Rd,Gd,Bd,Ad)</td>
<td>OMDC</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_SRC_COLOR</td>
<td>(1,1,1,1)-(Rs,Gs,Bs,As)</td>
<td>OMSC</td>
</tr>
<tr>
<td>MLIB_BLEND_DST_ALPHA</td>
<td>(Ad,Ad,Ad,Ad)</td>
<td>DA</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_ALPHA</td>
<td>(As,As,As,As)</td>
<td>SA</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_ALPHA</td>
<td>(1,1,1,1)-(Ad,Ad,Ad,Ad)</td>
<td>OMDA</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_SRC_ALPHA</td>
<td>(1,1,1,1)-(As,As,As,As)</td>
<td>OMSA</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_ALPHA_SATURATE</td>
<td>(f,f,f,1)</td>
<td>SAS</td>
</tr>
</tbody>
</table>

[*]: The components of the first source image pixel are (Rd,Gd,Bd,Ad), and the components of the second source pixel are (Rs,Gs,Bs,As). Function \( f = \min(As,1-Ad) \).

The blending formula for non-in-place processing is:
Cd = Cs1*S1 + Cs2*S2

where Cd is the destination pixel (Rd,Gd,Bd,Ad), Cs1 is the first source pixel (Rs1,Gs1,Bs1,As1), Cs2 is the second source pixel (Rs2,Gs2,Bs2,As2), and S1 and S2 are the blend factors for the first and second sources, respectively.

**Parameters** Each of the functions takes the following arguments:

- **dst** Pointer to destination image.
- **src1** Pointer to the first source image.
- **src2** Pointer to the second source image.
- **cmask** Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit is the alpha channel. *cmask* must be either 0x01 or 0x08.

**Return Values** Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See attributes(5) for descriptions of the following attributes:

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<tr>
<th>ATTRIBUTE TYPE</th>
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<tr>
<td>MT-Level</td>
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</tbody>
</table>

**See Also** mlib_ImageBlend_BSRC1_BSRC2(3MLIB), mlib_ImageComposite(3MLIB), mlib_ImageComposite_Inp(3MLIB), attributes(5)
Name  
mlib_ImageBlend_BSRC1_BSRC2_Inp, mlib_ImageBlend_DA_DA_Inp,  
mlib_ImageBlend_DA_DC_Inp, mlib_ImageBlend_DA_OMDA_Inp,  
mlib_ImageBlend_DA_OMDC_Inp, mlib_ImageBlend_DA_OMSA_Inp,  
mlib_ImageBlend_DA_ONE_Inp, mlib_ImageBlend_DA_SA_Inp,  
mlib_ImageBlend_DA_SAS_Inp, mlib_ImageBlend_DA_ZERO_Inp,  
mlib_ImageBlend_OMDA_DA_Inp, mlib_ImageBlend_OMDA_DC_Inp,  
mlib_ImageBlend_OMDA_OMDA_Inp, mlib_ImageBlend_OMDA_OMDC_Inp,  
mlib_ImageBlend_OMDA_OMSA_Inp, mlib_ImageBlend_OMDA_ONE_Inp,  
mlib_ImageBlend_OMDA_SA_Inp, mlib_ImageBlend_OMDA_SAS_Inp,  
mlib_ImageBlend_OMDA_ZERO_Inp, mlib_ImageBlend_OMSA_DA_Inp,  
mlib_ImageBlend_OMSA_DC_Inp, mlib_ImageBlend_OMSA_OMDA_Inp,  
mlib_ImageBlend_OMSA_OMDC_Inp, mlib_ImageBlend_OMSA_OMSA_Inp,  
mlib_ImageBlend_OMSA_ONE_Inp, mlib_ImageBlend_OMSA_SA_Inp,  
mlib_ImageBlend_OMSA_SAS_Inp, mlib_ImageBlend_OMSA_ZERO_Inp,  
mlib_ImageBlend_OMSC_DA_Inp, mlib_ImageBlend_OMSC_DC_Inp,  
mlib_ImageBlend_OMSC_OMDA_Inp, mlib_ImageBlend_OMSC_OMDC_Inp,  
mlib_ImageBlend_OMSC_OMSA_Inp, mlib_ImageBlend_OMSC_ONE_Inp,  
mlib_ImageBlend_OMSC_SA_Inp, mlib_ImageBlend_OMSC_SAS_Inp,  
mlib_ImageBlend_OMSC_ZERO_Inp, mlib_ImageBlend_ONE_DA_Inp,  
mlib_ImageBlend_ONE_DC_Inp, mlib_ImageBlend_ONE_OMDA_Inp,  
mlib_ImageBlend_ONE_OMDC_Inp, mlib_ImageBlend_ONE_OMSA_Inp,  
mlib_ImageBlend_ONE_ONE_Inp, mlib_ImageBlend_ONE_SA_Inp,  
mlib_ImageBlend_ONE_SAS_Inp, mlib_ImageBlend_ONE_ZERO_Inp,  
mlib_ImageBlend_SA_DA_Inp, mlib_ImageBlend_SA_DC_Inp,  
mlib_ImageBlend_SA_OMDA_Inp, mlib_ImageBlend_SA_OMDC_Inp,  
mlib_ImageBlend_SA_OMSA_Inp, mlib_ImageBlend_SA_ONE_Inp,  
mlib_ImageBlend_SA_SA_Inp, mlib_ImageBlend_SA_SAS_Inp,  
mlib_ImageBlend_SA_ZERO_Inp, mlib_ImageBlend_SC_DA_Inp,  
mlib_ImageBlend_SC_DC_Inp, mlib_ImageBlend_SC_OMDA_Inp,  
mlib_ImageBlend_SC_OMDC_Inp, mlib_ImageBlend_SC_OMSA_Inp,  
mlib_ImageBlend_SC_ONE_Inp, mlib_ImageBlend_SC_SA_Inp,  
mlib_ImageBlend_SC_SAS_Inp, mlib_ImageBlend_SC_ZERO_Inp,  
mlib_ImageBlend_ZERO_DA_Inp, mlib_ImageBlend_ZERO_DC_Inp,  
mlib_ImageBlend_ZERO_OMDA_Inp, mlib_ImageBlend_ZERO_OMDC_Inp,  
mlib_ImageBlend_ZERO_OMSA_Inp, mlib_ImageBlend_ZERO_ONE_Inp,  
mlib_ImageBlend_ZERO_SA_Inp, mlib_ImageBlend_ZERO_SAS_Inp,  
mlib_ImageBlend_ZERO_ZERO_Inp – blending, in place

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_ImageBlend_BSRC1_BSRC2_Inp(mlib_image *srcdst,  
const mlib_image *src2, mlib_s32 cmask);
This group of functions supports digital image composition. They are low-level, in-place, blending functions.

The image type must be MLIB_BYTE. The input and output images must contain three or four channels. For three-channel images, the alpha value is as if the alpha value is 1.

BSRC1 is one of the following: ZERO, ONE, SC, OMSC, DA, SA, OMDA, or OMSA. BSRC2 is one of the following: ZERO, ONE, DC, OMDC, DA, SA, OMDA, OMSA, or SAS.

The following are predefined blend factor types used in mediaLib image composition functions.

```c
/* image blend factors */
typedef enum {
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    MLIB_BLEND_SRC_COLOR,
    MLIB_BLEND_ONE_MINUS_DST_COLOR,
    MLIB_BLEND_ONE_MINUS_SRC_COLOR,
    MLIB_BLEND_DST_ALPHA,
    MLIB_BLEND_SRC_ALPHA,
    MLIB_BLEND_ONE_MINUS_DST_ALPHA,
    MLIB_BLEND_ONE_MINUS_SRC_ALPHA,
    MLIB_BLEND_SRC_ALPHA_SATURATE
} mlib_blend;
```

See the following table for the definitions of the blend factors.

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<tr>
<td>MLIB_BLEND_DST_COLOR</td>
<td>(Rd,Gd,Bd,Ad)</td>
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<tr>
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<td>(Rs,Gs, Bs, As)</td>
<td>SC</td>
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<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_COLOR</td>
<td>(1,1,1,1)-(Rd,Gd,Bd,Ad)</td>
<td>OMDC</td>
</tr>
<tr>
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<td>(1,1,1,1)-(Rs, Gs, Bs, As)</td>
<td>OMSC</td>
</tr>
<tr>
<td>MLIB_BLEND_DST_ALPHA</td>
<td>(Ad, Ad, Ad, Ad)</td>
<td>DA</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_ALPHA</td>
<td>(As, As, As, As)</td>
<td>SA</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_ALPHA</td>
<td>(1,1,1,1)-(Ad, Ad, Ad, Ad)</td>
<td>OMDA</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_SRC_ALPHA</td>
<td>(1,1,1,1)-(As, As, As, As)</td>
<td>OMSA</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_ALPHA_SATURATE</td>
<td>(fff, f, f, f)</td>
<td>SAS</td>
</tr>
</tbody>
</table>
The components of the first source image pixel are (Rd,Gd,Bd,Ad), and the components of
the second source pixel are (Rs,Gs,Bs,As). Function $f = \min(As, 1-Ad)$. The first source image
is also the destination image.

The blending formula for in-place processing is:

$$Cd = Cd*D + Cs*S$$

where $Cd$ is the destination pixel $(Rd,Gd,Bd,Ad)$, $Cs$ is the source pixel $(Rs,Gs,Bs,As)$, and $D$
and $S$ are the blend factors for the destination and source, respectively.

**Parameters**

Each of the functions takes the following arguments:

- **src1dst** Pointer to the first source and the destination image.
- **src2** Pointer to the second source image.
- **cmask** Channel mask to indicate the alpha channel. Each bit of the mask represents a
channel in the image. The channel corresponding to the 1 bit is the alpha channel.
$cmask$ must be either 0x01 or 0x08.

**Return Values**

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See [attributes(5)](5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

- [mlib_ImageBlend_BSRC1_BSRC2_Inp(3MLIB)](3MLIB)
- [mlib_ImageComposite(3MLIB)](3MLIB)
- [mlib_ImageComposite_Inp(3MLIB)](3MLIB)
- [attributes(5)](5)
The `mlib_ImageBlendColor()` function blends an image and a color with the alpha channel. It uses the following equation:

\[
    C_d = C_s \cdot A_s + C_c \cdot (1 - A_s)
\]

\[
    A_d = 1.0
\]

where, \(C_s\) and \(C_d\) are the RGB color components of the source and destination images, respectively. \(A_s\) and \(A_d\) are the alpha components of the source and destination images, respectively. \(C_c\) is the color component of the constant color.

For `MLIB_BYTE` images, the alpha coefficients are in Q8 format. For `MLIB_SHORT` images, the alpha coefficients are in Q15 format and must be positive. For `MLIB_USHORT` images, the alpha coefficients are in Q16 format. For `MLIB_INT` images, the alpha coefficients are in Q31 format and must be positive.

The images can have two to four channels. The length of color array must not be less than the number of channels in the images.

**Parameters**

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `color` Array of constant color components.
- `cmask` Channel mask to indicate the alpha channel. Each bit of `cmask` represents a channel in the image. The channel corresponding to the highest bit with value 1 is the alpha channel.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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</tbody>
</table>
See Also  

mlib_ImageBlendColor_Inp(3MLIB), mlib_ImageBlendColor_Fp(3MLIB),
mlib_ImageBlendColor_Fp_Inp(3MLIB), attributes(5)
# mlib_ImageBlendColor_Fp

The `mlib_ImageBlendColor_Fp()` function blends an image and a color with the alpha channel.

It uses the following equation:

\[
Cd = Cs*As + Cc*(1 - As) \\
Ad = 1.0
\]

where, `Cs` and `Cd` are the RGB color components of the source and destination images, respectively. `As` and `Ad` are the alpha components of the source and destination images, respectively. `Cc` is the color component of the constant color.

For `MLIB_FLOAT` and `MLIB_DOUBLE` images, the alpha coefficients are assumed to be in the range of \([0.0, 1.0]\).

The images can have two to four channels. The length of color array must not be less than the number of channels in the images.

## Parameters

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **color**: Array of constant color components.
- **cmask**: Channel mask to indicate the alpha channel. Each bit of `cmask` represents a channel in the image. The channel corresponding to the highest bit with value 1 is the alpha channel.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(3)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<tbody>
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</tbody>
</table>
See Also  
mlib_ImageBlendColor_Fp(3MLIB), mlib_ImageBlendColor(3MLIB),
mlib_ImageBlendColor_Inp(3MLIB), attributes(5)
The `mlib_ImageBlendColor_Fp_Inp()` function blends an image and a color with the alpha channel.

It uses the following equation:

\[ C_d = C_s * A_s + C_c * (1 - A_s) \]
\[ A_d = 1.0 \]

where, \( C_s \) and \( C_d \) are the RGB color components of the source and destination images, respectively. \( A_s \) and \( A_d \) are the alpha components of the source and destination images, respectively. \( C_c \) is the color component of the constant color.

For `MLIB_FLOAT` and `MLIB_DOUBLE` images, the alpha coefficients are assumed to be in the range of \([0.0, 1.0]\).

The images can have two to four channels. The length of color array must not be less than the number of channels in the images.

The function takes the following arguments:

- `srcdst` Pointer to the source and destination image.
- `color` Array of constant color components.
- `cmask` Channel mask to indicate the alpha channel. Each bit of cmask represents a channel in the image. The channel corresponding to the highest bit with value 1 is the alpha channel.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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</table>

See also `mlib_ImageBlendColor_Fp(3MLIB), mlib_ImageBlendColor(3MLIB), mlib_ImageBlendColor_Inp(3MLIB), attributes(5)`
mlib_ImageBlendColor_Inp() function blends an image and a color with the alpha channel.

It uses the following equation:

\[ C_d = C_s A_s + C_c (1 - A_s) \]
\[ A_d = 1.0 \]

where, \( C_s \) and \( C_d \) are the RGB color components of the source and destination images, respectively. \( A_s \) and \( A_d \) are the alpha components of the source and destination images, respectively. \( C_c \) is the color component of the constant color.

For MLIB_BYTE images, the alpha coefficients are in Q8 format. For MLIB_SHORT images, the alpha coefficients are in Q15 format and must be positive. For MLIB_USHORT images, the alpha coefficients are in Q16 format. For MLIB_INT images, the alpha coefficients are in Q31 format and must be positive.

The images can have two to four channels. The length of color array must not be less than the number of channels in the images.

Parameters
- The function takes the following arguments:
  - \( srcdst \): Pointer to the source and destination image.
  - \( color \): Array of constant color components.
  - \( cmask \): Channel mask to indicate the alpha channel. Each bit of \( cmask \) represents a channel in the image. The channel corresponding to the highest bit with value 1 is the alpha channel.

Return Values
- The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
- See attributes(5) for descriptions of the following attributes:
See Also  
mlib_ImageBlendColor(3MLIB), mlib_ImageBlendColor_Fp(3MLIB),
mlib_ImageBlendColor_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageBlend_Fp()` function blends two images together on a pixel-by-pixel basis using an alpha image, when alpha is also on a pixel basis. The *alpha* image can be a single-channel image or have the same number of channels as the source and destination images.

It uses the following equation when the *alpha* image is a single-channel image:

\[
\text{dst}[x][y][i] = \text{alpha}[x][y][0] \times \text{src1}[x][y][i] + (1 - \text{alpha}[x][y][0]) \times \text{src2}[x][y][i]
\]

It uses the following equation when the *alpha* image has the same number of channels as the source and destination images:

\[
\text{dst}[x][y][i] = \text{alpha}[x][y][i] \times \text{src1}[x][y][i] + (1 - \text{alpha}[x][y][i]) \times \text{src2}[x][y][i]
\]

**Parameters**

- **dst** Pointer to destination image.
- **src1** Pointer to first source image.
- **src2** Pointer to second source image.
- **alpha** Alpha image used to control blending. The pixels in this image should have values in the range of [0.0, 1.0].

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

See Also `mlib_ImageBlend(3MLIB), mlib_ImageBlend1_Fp_Inp(3MLIB), mlib_ImageBlend1_Inp(3MLIB), mlib_ImageBlend2_Fp_Inp(3MLIB), mlib_ImageBlend2_Inp(3MLIB), attributes(5)`
The `mlib_ImageBlendMulti()` function blends multiple source images, using multiple alpha images, into a single destination image.

All images involved should have the same data type and same size and the source and destination images should have the same number of channels. The alpha images should have either 1 channel or the same number of channels as the sources and destination. A single-channel alpha image would be applied to all channels of the corresponding source image. Single and multi-channel alpha images can be mixed in the same invocation.

It uses the following equation:

\[
\text{dst}[x][y][i] = \frac{\sum_{k=0}^{n-1} \text{alphas}[k][x][y][j] \times \text{srcs}[k][x][y][i]}{\sum_{k=0}^{n-1} \text{alphas}[k][x][y][j]}
\]

or

\[
\text{dst}[x][y][i] = \text{c}[i] \quad \text{if} \quad \sum_{k=0}^{n-1} \text{alphas}[k][x][y][j] = 0
\]

where \(j = i\) for multi-channel alpha images; \(j = 0\) for single-channel alpha images.

**Parameters**

- `dst` Pointer to destination image.
- `srcs` Pointer to an array of source images.
- `alphas` Pointer to an array of alpha images.
- `c` Background color.
- `n` Number of source images to be blended.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.
Attributes  See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also  mlib_ImageBlendMulti_Fp(3MLIB), mlib_ImageBlend(3MLIB), mlib_ImageBlend_Fp(3MLIB), attributes(5)
### Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageBlendMulti_Fp(mlib_image *dst,
    const mlib_image **srcs, const mlib_image **alphas,
    const mlib_d64 *c,
    mlib_s32 n);
```

### Description

The `mlib_ImageBlendMulti_Fp()` function blends multiple source images, using multiple alpha images, into a single destination image.

All images involved should have the same data type and same size and the source and destination images should have the same number of channels. The alpha images should have either 1 channel or the same number of channels as the sources and destination. A single-channel alpha image would be applied to all channels of the corresponding source image. Single and multi-channel alpha images can be mixed in the same invocation.

It uses the following equation:

\[
\text{dst}[x][y][i] = \frac{\sum_{k=0}^{n-1} \text{alphas}[k][x][y][j] \times \text{srcs}[k][x][y][i]}{\sum_{k=0}^{n-1} \text{alphas}[k][x][y][j]}
\]

or

\[
\text{dst}[x][y][i] = c[i] \quad \text{if} \quad \sum_{k=0}^{n-1} \text{alphas}[k][x][y][j] = 0
\]

where \( j = i \) for multi-channel alpha images; \( j = 0 \) for single-channel alpha images.

### Parameters

- **dst** Pointer to destination image.
- **srcs** Pointer to an array of source images.
- **alphas** Pointer to an array of alpha images.
- **c** Background color.
- **n** Number of source images to be blended.

### Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageBlendMulti(3MLIB), mlib_ImageBlend(3MLIB), mlib_ImageBlend_Fp(3MLIB), attributes(5)
mlib_ImageBlendRGBA2ARGB() function blends the source image of the RGBA format into the destination image of the ARGB format. The image type must be MLIB_BYTE. The source and destination images must contain four channels.

It uses the following equation:

\[
Cd = Cs \cdot As + Cd \cdot (1 - As) \\
Ad = Ad
\]

where, \(Cs\) and \(Cd\) are the RGB color components of the source and destination images, respectively. \(As\) and \(Ad\) are the alpha components of the source and destination images, respectively.

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_ImageBlendRGBA2BGRA(3MLIB), mlib_ImageBlend_OMSA_SA_Inp(3MLIB), attributes(5)
The `mlib_ImageBlendRGBA2BGRA()` function blends the source image of the RGBA format into the destination image of the BGRA format.

The image type must be `MLIB_BYTE`. The source and destination images must contain four channels.

It uses the following equation:

\[
C_{d} = C_{s} A_{s} + C_{d} (1 - A_{s})
\]

\[
A_{d} = A_{d}
\]

where, \( C_{s} \) and \( C_{d} \) are the RGB color components of the source and destination images, respectively. \( A_{s} \) and \( A_{d} \) are the alpha components of the source and destination images, respectively.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageBlendRGBA2ARGB(3MLIB), mlib_ImageBlend_OMSA_SA_Inp(3MLIB), attributes(5)`
# mlib_ImageChannelCopy

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageChannelCopy(mlib_image *dst, const mlib_image *src,
                   mlib_s32 cmask);
```

## Description

The `mlib_ImageChannelCopy()` function copies the selected channels of the source image into the corresponding channels of the destination image. The data type of the image can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

## Parameters

- **dst**: Pointer to a destination image.
- **src**: Pointer to a source image.
- **cmask**: Source or destination channel selection mask. Each bit of the mask represents a channel in the image data. The least significant bit (LSB) of the mask corresponds to the last channel in the image data. A bit with a value of 1 indicates that the channel is selected.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See [attributes(5)](attributes) for descriptions of the following attributes:

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</tbody>
</table>

## See Also

- `mlib_ImageChannelExtract(3MLIB)`, `mlib_ImageChannelInsert(3MLIB)`, `mlib_ImageChannelMerge(3MLIB)`, `mlib_ImageChannelSplit(3MLIB)`, `attributes(5)`
**mlib_ImageChannelExtract(3MLIB)**

**Name**
mlib_ImageChannelExtract – channel extract

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageChannelExtract(mlib_image *dst,
                                     const mlib_image *src, mlib_s32 cmask);
```

**Description**
In the `mlib_ImageChannelExtract()` function, the selected N channels in the source image are copied into the destination image, where N is the number of channels in the destination image. If more than N channels are selected, then the leftmost N channels are extracted. If less than N channels are selected, then the function returns failure status. The channel mask is defined with respect to the source image. The data type of the image can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

**Parameters**
The function takes the following arguments:
- `dst` Pointer to a destination image.
- `src` Pointer to a source image.
- `cmask` Source or destination channel selection mask. Each bit of the mask represents a channel in the image data. The least significant bit (LSB) of the mask corresponds to the last channel in the image data. A bit with a value of 1 indicates that the channel is selected.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
`mlib_ImageChannelCopy(3MLIB), mlib_ImageChannelInsert(3MLIB),
mlib_ImageChannelMerge(3MLIB), mlib_ImageChannelSplit(3MLIB), attributes(5)`
# mlib_ImageChannelInsert(3MLIB)

## Name
mlib_ImageChannelInsert – channel insert

## Synopsis
```c
cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageChannelInsert(mlib_image *dst, const mlib_image *src,
                           mlib_s32 cmask);
```

## Description
In the `mlib_ImageChannelInsert()` function, all N channels in the source image are copied into the selected channels in the destination image, where N is the number of channels in the source image. If more than N channels are selected, then the leftmost N channels are inserted. If less than N channels are selected, then the function returns failure status. The channel mask is defined with respect to the destination image. The data type of the image can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

## Parameters
The function takes the following arguments:
- `dst` Pointer to a destination image.
- `src` Pointer to a source image.
- `cmask` Source or destination channel selection mask. Each bit of the mask represents a channel in the image data. The least significant bit (LSB) of the mask corresponds to the last channel in the image data. A bit with a value of 1 indicates that the channel is selected.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

## See Also
`mlib_ImageChannelCopy(3MLIB), mlib_ImageChannelExtract(3MLIB), mlib_ImageChannelMerge(3MLIB), mlib_ImageChannelSplit(3MLIB), attributes(5)`
#include <mlib.h>

mlib_status mlib_ImageChannelMerge(mlib_image *dst,
const mlib_image **srcs);

The mlib_ImageChannelMerge() function converts an array of single-channel images into a
multi-channel image.

A0 A1 A2 ...
B0 B1 B2 ... ===> A0 B0 C0 A1 B1 C1 A2 B2 C2 ...
C0 C1 C2 ...

All images must have the same type, same width, and same height. The data type of the images
can be MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE. The
destination image must have the number of channels equal to the number of images in the srcs
array. The source images must be single-channel images.

Parameters
The function takes the following arguments:

dst Pointer to a multi-channel destination image.

srcs Pointer to an array of single-channel source images.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_ImageChannelCopy(3MLIB), mlib_ImageChannelExtract(3MLIB),
mlib_ImageChannelInsert(3MLIB), mlib_ImageChannelSplit(3MLIB), attributes(5)
The `mlib_ImageChannelSplit()` function converts a multi-channel image into an array of single-channel images.

A0 A1 A2 ...
A0 B0 C0 A1 B1 C1 A2 B2 C2 ... ===> B0 B1 B2 ...
C0 C1 C2 ...

All images must have the same type, same width, and same height. The data type of the images can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`. The source image must have the number of channels equal to the number of images in the `dsts` array. The destination images must be single-channel images.

### Parameters
The function takes the following arguments:

- `dsts` Pointer to an array of single-channel destination images.
- `src` Pointer to a multi-channel source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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### See Also
`mlib_ImageChannelCopy(3MLIB)`, `mlib_ImageChannelExtract(3MLIB)`, `mlib_ImageChannelInsert(3MLIB)`, `mlib_ImageChannelMerge(3MLIB)`, `attributes(5)`
# mlib_ImageClear

## Synopsis

```bash
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageClear(mlib_image *img, const mlib_s32 *color);
```

## Description

The `mlib_ImageClear()` function sets an image to a specific color. The data type of the image can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

It uses the following equation:

\[
\text{img}[x][y][i] = \text{color}[i]
\]

## Parameters

The function takes the following arguments:

- `img`: Pointer to an image.
- `color`: Array of color values by channel. `color[i]` contains the value for channel `i`.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_ImageClear_Fp(3MLIB)`, `mlib_ImageClearEdge(3MLIB)`, `mlib_ImageClearEdge_Fp(3MLIB)`, `attributes(5)`
mlib_ImageClearEdge sets edges of an image to a specific color. This function can be used in conjunction with the convolve and other spatial functions to fill in the pixel values along the edges. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

The function takes the following arguments:

- `img` Pointer to an image.
- `dx` Number of columns on the left and right edges of the image to be cleared.
- `dy` Number of rows at the top and bottom edges of the image to be cleared.
- `color` Array of color values by channel. `color[i]` contains the value for channel i.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

- mlib_ImageClear(3MLIB), mlib_ImageClear_Fp(3MLIB), mlib_ImageClearEdge_Fp(3MLIB), attributes(5)
Name
mlib_ImageClearEdge_Fp – sets edges of an image to a specific color

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageClearEdge_Fp(mlib_image *img, mlib_s32 dx,
mlib_s32 dy, const mlib_d64 *color);

Description
The mlib_ImageClearEdge_Fp() function sets edges of an image to a specific color. This function can be used in conjunction with the convolve and other spatial functions to fill in the pixel values along the edges. The data type of the image can be MLIB_FLOAT or MLIB_DOUBLE.

Parameters
The function takes the following arguments:

- **img**: Pointer to an image.
- **dx**: Number of columns on the left and right edges of the image to be cleared.
- **dy**: Number of rows at the top and bottom edges of the image to be cleared.
- **color**: Array of color values by channel. color[i] contains the value for channel i.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</tbody>
</table>

See Also
mlib_ImageClear(3MLIB), mlib_ImageClearEdge(3MLIB),
mlib_ImageClearEdge_Fp(3MLIB), attributes(5)
mlib_ImageClear_Fp

**Name**  
mlib_ImageClear_Fp – clear

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_ImageClear_Fp(mlib_image *img, const mlib_d64 *color);
```

**Description**  
The `mlib_ImageClear_Fp()` function sets an image to a specific color. The data type of the image can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

It uses the following equation:

```
img[x][y][i] = color[i]
```

**Parameters**  
The function takes the following arguments:

- `img`  
  Pointer to an image.

- `color`  
  Array of color values by channel. `color[i]` contains the value for channel `i`.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
`mlib_ImageClear(3MLIB), mlib_ImageClearEdge(3MLIB), mlib_ImageClearEdge_Fp(3MLIB), attributes(5)`
The `mlib_ImageColorConvert1()` function takes a 3x3 floating-point conversion matrix and converts the source color image to the destination color image.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][0] &= \text{cmat}[0] \times \text{src}[x][y][0] \\
\text{dst}[x][y][1] &= \text{cmat}[3] \times \text{src}[x][y][1] \\
\text{dst}[x][y][2] &= \text{cmat}[6] \times \text{src}[x][y][2]
\end{align*}
\]

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **cmat** Conversion matrix in row major order.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

<table>
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</tr>
</thead>
<tbody>
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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See also `mlib_ImageColorConvert1_Fp(3MLIB), mlib_ImageColorConvert2(3MLIB), mlib_ImageColorConvert2_Fp(3MLIB), mlib_ImageColorRGB2XYZ(3MLIB), mlib_ImageColorRGB2XYZ_Fp(3MLIB), mlib_ImageColorXYZ2RGB(3MLIB), mlib_ImageColorXYZ2RGB_Fp(3MLIB), attributes(5)`
mlib_ImageColorConvert1_Fp(3MLIB)

**Name**
mlib_ImageColorConvert1_Fp – color conversion using a 3x3 floating-point matrix

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorConvert1_Fp(mlib_image *dst,
const mlib_image *src, const mlib_d64 *cmat);
```

**Description**
The `mlib_ImageColorConvert1_Fp()` function takes a 3x3 floating point conversion matrix and converts the floating-point source color image to the destination color image.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][0] &= \text{cmat}[0] \times \text{src}[x][y][0] \\
\text{dst}[x][y][1] &= \text{cmat}[3] \times \text{src}[x][y][1] \\
\text{dst}[x][y][2] &= \text{cmat}[6] \times \text{src}[x][y][2]
\end{align*}
\]

**Parameters**
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **cmat** Conversion matrix in row major order.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

**See Also**
mlib_ImageColorConvert1(3MLIB), mlib_ImageColorConvert2(3MLIB),
mlib_ImageColorConvert2_Fp(3MLIB), mlib_ImageColorRGB2XYZ(3MLIB),
mlib_ImageColorRGB2XYZ_Fp(3MLIB), mlib_ImageColorXYZ2RGB(3MLIB),
mlib_ImageColorXYZ2RGB_Fp(3MLIB), attributes(5)
mlib_ImageColorConvert2(3MLIB)

Name  mlib_ImageColorConvert2 – color conversion using a 3x3 floating-point matrix and a three-element offset

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorConvert2(mlib_image *dst, const mlib_image *src,
const mlib_d64 *cmat, const mlib_d64 *offset);

Description  The mlib_ImageColorConvert2() function takes a 3x3 floating-point conversion matrix and a three-element offset and converts the source color image to the destination color image.

The source and destination images must be three-channel images.

It uses the following equation:

|dst[x][y][0]| |cmat[0] cmat[1] cmat[2]| |src[x][y][0]| |offset[0]|

Parameters  The function takes the following arguments:

dst  Pointer to destination image.
src  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</tr>
</thead>
<tbody>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageColorConvert1(3MLIB), mlib_ImageColorConvert1_Fp(3MLIB),
mlib_ImageColorConvert2_Fp(3MLIB), mlib_ImageColorRGB2YCC(3MLIB),
mlib_ImageColorRGB2YCC_Fp(3MLIB), mlib_ImageColorYCC2RGB(3MLIB),
mlib_ImageColorYCC2RGB_Fp(3MLIB), attributes(5)
mlib_ImageColorConvert2_Fp - color conversion using a 3x3 floating-point matrix and a three-element offset

Synopsis
```c
#include <mlib.h>

mlib_status mlib_ImageColorConvert2_Fp(mlib_image *dst,
    const mlib_image *src, const mlib_d64 *cmat,
    const mlib_d64 *offset);
```

Description
The `mlib_ImageColorConvert2_Fp` function takes a 3x3 floating-point conversion matrix and a three-element offset and converts the floating-point source color image to the destination color image.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{align*}
|dst[x][y][0]| &= |cmat[0] cmat[1] cmat[2]| * |src[x][y][0]| + |offset[0]| \\
\end{align*}
\]

Parameters
The function takes the following arguments:
- `dst` - Pointer to destination image.
- `src` - Pointer to source image.
- `cmat` - Conversion matrix in row major order.
- `offset` - Offset array.

Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes
See `attributes(5)` for descriptions of the following attributes:

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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
- `mlib_ImageColorConvert1(3MLIB)`, `mlib_ImageColorConvert1_Fp(3MLIB)`,
- `mlib_ImageColorConvert2(3MLIB)`, `mlib_ImageColorRGB2YCC(3MLIB)`,
- `mlib_ImageColorRGB2YCC_Fp(3MLIB)`, `mlib_ImageColorYCC2RGB(3MLIB)`,
mlib_ImageColorDitherFree(3MLIB)

Name
mlib_ImageColorDitherFree – release the internal data structure for image dithering

Synopsis
cc [ flag ... ] file ... -lmlib [ library ... ]
#include <mlib.h>

void mlib_ImageColorDitherFree(void * colormap);

Description
The mlib_ImageColorDitherFree() function releases an internal data structure, colormap, which was created by mlib_ImageColorDitherInit() and was used by one of the following functions for image dithering:

mlib_ImageColorErrorDiffusion3x3
mlib_ImageColorErrorDiffusionMxN
mlib_ImageColorOrderedDither8x8
mlib_ImageColorOrderedDitherMxN

Parameters
The function takes the following arguments:

colormap Internal data structure for image dithering.

Return Values
None.

Attributes
See attributes(5) for descriptions of the following attributes:

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</tr>
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<tbody>
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</tr>
<tr>
<td>MT-Level</td>
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</tr>
</tbody>
</table>

See Also
mlib_ImageColorDitherInit(3MLIB), mlib_ImageColorErrorDiffusion3x3(3MLIB),
mlib_ImageColorErrorDiffusionMxN(3MLIB),
mlib_ImageColorOrderedDither8x8(3MLIB),
mlib_ImageColorOrderedDitherMxN(3MLIB), attributes(5)
The `mlib_ImageColorDitherInit()` function creates an internal data structure, `colormap`, which can be used by one of the following functions for image dithering:

- `mlib_ImageColorErrorDiffusion3x3`
- `mlib_ImageColorErrorDiffusionMxN`
- `mlib_ImageColorOrderedDither8x8`
- `mlib_ImageColorOrderedDitherMxN`

The `lut` might have either 1 or 3 channels. The type of the `lut` can be one of the following:

- `MLIB_BYTE in, MLIB_BYTE out` (i.e., BYTE-to-BYTE)
- `MLIB_BIT in, MLIB_BYTE out` (i.e., BIT-to-BYTE)

If `dimensions == NULL`, then no colorcube will be created. In this case, the user-provided lookup table, `lut`, will be used for dithering.

If `dimensions != NULL`, then a colorcube is created from scratch in a way shown in the following example.

To dither an RGB image of type `MLIB_BYTE` to a color-indexed image of type `MLIB_BYTE`, we can use the following parameters:

```c
cint32 dimensions[] = {2, 3, 4};
cint32 intype = MLIB_BYTE;
cint32 outtype = MLIB_BYTE;
cint32 channels = 3;
cint32 offset = 6;
```

These values would lead to the creation of a colorcube that would dither red values in the source image to one of 2 red levels, green values to one of 3 green levels, and blue values to one of 4 blue levels. You could picture this colorcube as a cube with dimensions of 2, 3, and 4. The index values assigned to the elements in that cube can be described by the following lookup table:

<table>
<thead>
<tr>
<th>Indexes</th>
<th>Red Values</th>
<th>Green Values</th>
<th>Blue Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>5</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Indexes</td>
<td>Red Values</td>
<td>Green Values</td>
<td>Blue Values</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>255</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>128</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>255</td>
<td>128</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>255</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>255</td>
<td>255</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>0</td>
<td>85</td>
</tr>
<tr>
<td>13</td>
<td>255</td>
<td>0</td>
<td>85</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>128</td>
<td>85</td>
</tr>
<tr>
<td>15</td>
<td>255</td>
<td>128</td>
<td>85</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>255</td>
<td>85</td>
</tr>
<tr>
<td>17</td>
<td>255</td>
<td>255</td>
<td>85</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0</td>
<td>170</td>
</tr>
<tr>
<td>19</td>
<td>255</td>
<td>0</td>
<td>170</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>128</td>
<td>170</td>
</tr>
<tr>
<td>21</td>
<td>255</td>
<td>128</td>
<td>170</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>255</td>
<td>170</td>
</tr>
<tr>
<td>23</td>
<td>255</td>
<td>255</td>
<td>170</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0</td>
<td>255</td>
</tr>
<tr>
<td>25</td>
<td>255</td>
<td>0</td>
<td>255</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>128</td>
<td>255</td>
</tr>
<tr>
<td>27</td>
<td>255</td>
<td>128</td>
<td>255</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>255</td>
<td>255</td>
</tr>
<tr>
<td>29</td>
<td>255</td>
<td>255</td>
<td>255</td>
</tr>
</tbody>
</table>

The distance between level changes in each channel of the lookup table is determined by the following formulas:
multipliers[0] = signof(dimensions[0])*1;
multipliers[i] = signof(dimensions[i])*abs(multipliers[i-1]*dimension[i-1]);

A negative dimensions[i], so as to a negative multipliers[i], indicates that the values in a color ramp for channel i should appear in decreasing as opposed to increasing order.

For each channel i, the values of the levels are determined by the following formulas:

double delta = (dataMax - dataMin)/(abs(dimensions[i]) - 1);
int levels[j] = (int)(j*delta + 0.5);

where dataMax and dataMin are the maximum and minimum values, respectively, for data type intype.

Whenever a colorcube is created, if `lut != NULL`, the lookup table will be filled according to the colorcube and supplied parameters like offset. For the example shown above, the lookup table will start from line 6. In this case, it is the user’s responsibility to allocate memory for the lookup table.

**Parameters** The function takes the following arguments:

- colormap Internal data structure for image dithering.
- dimensions Dimensions of the colorcube in the colormap structure.
- intype Data type of the source image and the lookup table.
- outtype Data type of the destination indexed image.
- channels Number of channels of the lookup table and source image.
- entries Number of entries of the lookup table.
- offset Index offset of the lookup table.
- lut Lookup table.

**Return Values** The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also** mlib_ImageColorDitherFree(3MLIB), mlib_ImageColorErrorDiffusion3x3(3MLIB), mlib_ImageColorErrorDiffusionMxN(3MLIB), mlib_ImageColorOrderedDither8x8(3MLIB), mlib_ImageColorOrderedDitherMxN(3MLIB), attributes(5)
The `mlib_ImageColorErrorDiffusion3x3()` function converts a true color image to a pseudo color image with the method of error diffusion dithering. The source image can be an `MLIB_BYTE` or `MLIB_SHORT` image with three or four channels. The destination must be a single-channel `MLIB_BYTE` or `MLIB_SHORT` image.

The last parameter, `colormap`, is an internal data structure for inverse color mapping. Create it by calling the `mlib_ImageColorTrue2IndexInit()` function.

The function takes the following arguments:

- **dst** Pointer to destination or destination image.
- **src** Pointer to source or source image.
- **kernel** Pointer to the 3x3 error-distribution kernel, in row major order.
- **scale** The scaling factor for kernel to convert the input integer coefficients into floating-point coefficients:

  \[
  \text{floating-point coefficient} = \text{integer coefficient} \times 2^{-\text{scale}}
  \]

- **colormap** Internal data structure for inverse color mapping.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageColorOrderedDither8x8(3MLIB)`, `mlib_ImageColorTrue2Index(3MLIB)`, `mlib_ImageColorTrue2IndexFree(3MLIB)`, `mlib_ImageColorTrue2IndexInit(3MLIB)`, `attributes(5)`
mlib_ImageColorErrorDiffusionMxN - true-color to indexed-color or grayscale to black-white conversion, using error diffusion

#include <mlib.h>

mlib_status mlib_ImageColorErrorDiffusionMxN(mlib_image *dst, const mlib_image *src, const mlib_s32 *kernel, mlib_s32 m, mlib_s32 n, mlib_s32 dm, mlib_s32 dn, mlib_s32 scale, const void *colormap);

The mlib_ImageColorErrorDiffusionMxN() function converts a 3-channel image to a 1-channel indexed image, or converts a 1-channel grayscale image to a 1-channel MLIB_BIT image, with the method of error diffusion.

The src can be an MLIB_BYTE image with 1 or 3 channels. The dst must be a 1-channel MLIB_BIT or MLIB_BYTE image.

The colormap must be created by mlib_ImageColorDitherInit(). It may or may not have a colorcube included. If it does, the colorcube is used. Otherwise, the general lookup table included in colormap is used.

The kernel is required to have the following property:

kernel[0] = kernel[1] = ... = kernel[m*dn+dm] = 0;
kerneld[m*dn+dm+1] + ... + kernel[m*n-1] = 2**scale;
scale ≥ 0

The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.
kernel Pointer to the error-distribution kernel, in row major order.
m Kernel width. m > 1.
n Kernel height. n > 1.
dm X coordinate of the key element in the kernel. 0 ≤ dm < m.
dn Y coordinate of the key element in the kernel. 0 ≤ dn < n.
scale The scaling factor for kernel to convert the input integer coefficients into floating-point coefficients:

floating-point coefficient = integer coefficient \× 2**(scale)

colormap Internal data structure for image dithering.
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

See Also  mlib_ImageColorDitherInit(3MLIB), mlib_ImageColorDitherFree(3MLIB),
          mlib_ImageColorErrorDiffusion3x3(3MLIB),
          mlib_ImageColorOrderedDither8x8(3MLIB),
          mlib_ImageColorOrderedDitherMxN(3MLIB), attributes(5)
# mlib_ImageColorHSL2RGB

## Name
mlib_ImageColorHSL2RGB – HSL to RGB color conversion

## Synopsis
c
```
c [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_ImageColorHSL2RGB(mlib_image *dst, const mlib_image *src);
```

## Description
The `mlib_ImageColorHSL2RGB()` function performs a conversion from hue/saturation/lightness to red/green/blue. The source and destination images must be three-channel images.

It uses the following equations:

\[
L' = L \text{ if } L \leq 1/2 \\
L' = 1 - L \text{ if } L > 1/2 \\
\]

\[
V = L + S \times L' \\
P = L - S \times L' \\
Q = L + S \times L' \times (1 - 2 \times \text{fraction}(H \times 6)) \\
T = L - S \times L' \times (1 - 2 \times \text{fraction}(H \times 6)) \\
\]

\[
R, G, B = V, T, P \text{ if } 0 \leq H < 1/6 \\
R, G, B = Q, V, P \text{ if } 1/6 \leq H < 2/6 \\
R, G, B = P, Q, V \text{ if } 2/6 \leq H < 3/6 \\
R, G, B = P, T, V \text{ if } 3/6 \leq H < 4/6 \\
R, G, B = T, P, V \text{ if } 4/6 \leq H < 5/6 \\
R, G, B = V, P, Q \text{ if } 5/6 \leq H < 1 \\
\]

where \( 0 \leq H < 1 \) and \( 0 \leq S, L, L', V, P, Q, T, R, G, B \leq 1 \).

Assuming a pixel in the source image is \((h, s, l)\) and its corresponding pixel in the destination image is \((r, g, b)\), then for MLIB_BYTE images, the following applies:

\[
H = h/256 \\
S = s/255 \\
L = l/255 \\
r = R*255 \\
g = G*255 \\
b = B*255 \\
\]

for MLIB_SHORT images, the following applies:

\[
H = (h + 32768)/65536 \\
S = (s + 32768)/65535 \\
L = (l + 32768)/65535 \\
r = R*65535 - 32768 \\
g = G*65535 - 32768 \\
b = B*65535 - 32768 \\
\]

for MLIB_USHORT images, the following applies:
H = h/65536
S = s/65535
L = l/65535
r = R*65535
g = G*65535
b = B*65535

and for MLIB_INT images, the following applies:

H = (h + 2147483648)/4294967296
S = (s + 2147483648)/4294967295
L = (l + 2147483648)/4294967295
r = R*4294967295 - 2147483648
g = G*4294967295 - 2147483648
b = B*4294967295 - 2147483648

Parameters
The function takes the following arguments:

dst Pointer to destination image.

src Pointer to source image.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageColorHSL2RGB(3MLIB), mlib_ImageColorRGB2HSL(3MLIB),
mlib_ImageColorRGB2HSL_Fp(3MLIB), attributes(5)
mlib_ImageColorHSL2RGB_Fp – HSL to RGB color conversion

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorHSL2RGB_Fp(mlib_image *dst,
const mlib_image *src);

Description

The `mlib_ImageColorHSL2RGB_Fp()` function performs a conversion from hue/saturation/lightness to red/green/blue. The source and destination images must be three-channel images.

It uses the following equations:

\[
L' = L \quad \text{if } L \leq 1/2 \\
L' = 1 - L \quad \text{if } L > 1/2 \\
V = L + S \cdot L' \\
P = L - S \cdot L' \\
Q = L + S \cdot L' \cdot (1 - 2 \cdot \text{fraction}(H \cdot 6)) \\
T = L - S \cdot L' \cdot (1 - 2 \cdot \text{fraction}(H \cdot 6)) \\
R, G, B = V, T, P \quad \text{if } 0 \leq H < 1/6 \\
R, G, B = Q, V, P \quad \text{if } 1/6 \leq H < 2/6 \\
R, G, B = P, V, T \quad \text{if } 2/6 \leq H < 3/6 \\
R, G, B = P, Q, V \quad \text{if } 3/6 \leq H < 4/6 \\
R, G, B = T, P, V \quad \text{if } 4/6 \leq H < 5/6 \\
R, G, B = V, P, Q \quad \text{if } 5/6 \leq H < 1
\]

where \(0 \leq H < 1\) and \(0 \leq S, L, L', V, P, Q, T, R, G, B \leq 1\).

For MLIB_FLOAT and MLIB_DOUBLE images, the above equations are followed verbatim. Input \(H\) component values must be limited to the \([0.0, 1.0)\) range. Input \(S\) and \(L\) component values must be limited to the \([0.0, 1.0]\) range.

Parameters

The function takes the following arguments:

- *dst*: Pointer to destination image.
- *src*: Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageColorHSL2RGB(3MLIB), mlib_ImageColorRGB2HSL(3MLIB),
mlib_ImageColorRGB2HSL_Fp(3MLIB), attributes(5)
The `mlib_ImageColorHSV2RGB()` function performs a conversion from hue/saturation/value to red/green/blue. The source and destination images must be three-channel images.

It uses the following equations:

\[
\begin{align*}
P &= V \times (1 - S) \\
Q &= V \times (1 - S \times \text{fraction}(H \times 6)) \\
T &= V \times (1 - S \times (1 - \text{fraction}(H \times 6)))
\end{align*}
\]

\[
\begin{align*}
R, G, B &= V, T, P \quad \text{if } 0 \leq H < 1/6 \\
R, G, B &= Q, V, P \quad \text{if } 1/6 \leq H < 2/6 \\
R, G, B &= P, V, T \quad \text{if } 2/6 \leq H < 3/6 \\
R, G, B &= P, Q, V \quad \text{if } 3/6 \leq H < 4/6 \\
R, G, B &= T, P, V \quad \text{if } 4/6 \leq H < 5/6 \\
R, G, B &= V, P, Q \quad \text{if } 5/6 \leq H < 1
\end{align*}
\]

where \(0 \leq H < 1\) and \(0 \leq S, V, P, Q, T, R, G, B \leq 1\).

Assuming a pixel in the source image is \((h, s, v)\) and its corresponding pixel in the destination image is \((r, g, b)\), then for MLIB_BYTE images, the following applies:

\[
\begin{align*}
H &= h/256 \\
S &= s/255 \\
V &= v/255 \\
r &= R \times 255 \\
g &= G \times 255 \\
b &= B \times 255
\end{align*}
\]

for MLIB_SHORT images, the following applies:

\[
\begin{align*}
H &= (h + 32768)/65536 \\
S &= (s + 32768)/65535 \\
V &= (v + 32768)/65535 \\
r &= R \times 65535 - 32768 \\
g &= G \times 65535 - 32768 \\
b &= B \times 65535 - 32768
\end{align*}
\]

for MLIB_USHORT images, the following applies:

\[
\begin{align*}
H &= h/65536 \\
S &= s/65535 \\
V &= v/65535 \\
r &= R \times 65535 \\
g &= G \times 65535 \\
b &= B \times 65535
\end{align*}
\]
and for MLIB_INT images, the following applies:

\[
H = \frac{(h + 2147483648)}{4294967296} \\
S = \frac{(s + 2147483648)}{4294967295} \\
V = \frac{(v + 2147483648)}{4294967295} \\
r = R \times 4294967295 - 2147483648 \\
g = G \times 4294967295 - 2147483648 \\
b = B \times 4294967295 - 2147483648
\]

**Parameters** The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.

**Return Values** The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** mlib_ImageColorHSV2RGB_Fp(3MLIB), mlib_ImageColorRGB2HSV(3MLIB), mlib_ImageColorRGB2HSV_Fp(3MLIB), attributes(5)
The `mlib_ImageColorHSV2RGB_Fp()` function performs a conversion from hue/saturation/value to red/green/blue. The source and destination images must be three-channel images.

It uses the following equations:

\[
\begin{align*}
P &= V \times (1 - S) \\
Q &= V \times (1 - S \times \text{fraction}(H \times 6)) \\
T &= V \times (1 - S \times (1 - \text{fraction}(H \times 6)))
\end{align*}
\]

\[
\begin{align*}
R, G, B &= V, T, P & \text{if } 0 \leq H < 1/6 \\
R, G, B &= Q, V, P & \text{if } 1/6 \leq H < 2/6 \\
R, G, B &= P, V, T & \text{if } 2/6 \leq H < 3/6 \\
R, G, B &= P, Q, V & \text{if } 3/6 \leq H < 4/6 \\
R, G, B &= T, P, V & \text{if } 4/6 \leq H < 5/6 \\
R, G, B &= V, P, Q & \text{if } 5/6 \leq H < 1
\end{align*}
\]

where \( 0 \leq H < 1 \) and \( 0 \leq S, V, P, Q, T, R, G, B \leq 1 \).

For MLIB_FLOAT and MLIB_DOUBLE images, the above equations are followed verbatim. Input \( H \) component values must be limited to the \([0.0, 1.0)\) range. Input \( S \) and \( V \) component values must be limited to the \([0.0, 1.0]\) range.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageColorHSV2RGB(3MLIB), mlib_ImageColorRGB2HSV(3MLIB),
mlib_ImageColorRGB2HSV_Fp(3MLIB), attributes(5)
The `mlib_ImageColorOrderedDither8x8()` function converts a true color image to a pseudo color image with the method of ordered dithering. The source image can be an MLIB_BYTE or MLIB_SHORT image with three or four channels. The destination must be a single-channel MLIB_BYTE or MLIB_SHORT image.

This function works only with a colorcube, rather than a general lookup table. The last parameter, `colormap`, is an internal data structure (which may include a colorcube) for inverse color mapping. Create it by calling the `mlib_ImageColorTrue2IndexInit()` function.

The function takes the following arguments:

- `dst`: Pointer to destination or destination image.
- `src`: Pointer to source or source image.
- `dmask`: Pointer to the 8x8 dither mask, in row major order. The dither mask is transposed differently for different channels to reduce artifacts.
- `scale`: Scaling factor for dmask to convert the input integer coefficients into floating-point coefficients:
  
  \[
  \text{floating-point coefficient} = \text{integer coefficient} \times \frac{1}{2^{\text{scale}}} \]

- `colormap`: Internal data structure for inverse color mapping.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageColorErrorDiffusion3x3(3MLIB), mlib_ImageColorTrue2Index(3MLIB), mlib_ImageColorTrue2IndexFree(3MLIB), mlib_ImageColorTrue2IndexInit(3MLIB), attributes(5)`
mlib_ImageColorOrderedDitherMxN – true-color to indexed-color or grayscale to black-white conversion, using ordered dithering

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorOrderedDitherMxN(mlib_image *dst,  
const mlib_image *src, const mlib_s32 **dmask, mlib_s32 m,  
mlib_s32 n, mlib_s32 scale, const void *colormap);
```

Description

The `mlib_ImageColorOrderedDitherMxN()` function converts a 3-channel image to a 1-channel indexed image, or converts a 1-channel grayscale image to a 1-channel MLIB_BIT image, with the method of ordered dithering.

The `src` can be an MLIB_BYTE image with 1 or 3 channels. The `dst` must be a 1-channel MLIB_BIT or MLIB_BYTE image.

The `colormap` must be created by `mlib_ImageColorDitherInit()`, and it must have a colorcube included.

The dither masks are required to have the following property:

\[ 0 \leq dmask[i][j] < 2^{scale}; \quad scale > 0 \]

Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `dmask` Pointer to the dither masks, one per channel, in row major order.
- `m` Mask width. `m > 1`.
- `n` Mask height. `n > 1`.
- `scale` Scaling factor for `dmask` to convert the input integer coefficients into floating-point coefficients:
  \[
  \text{floating-point coefficient} = \text{integer coefficient} \times \frac{1}{2^{scale}}
  \]
- `colormap` Internal data structure for image dithering.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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mlib_ImageColorOrderedDitherMxN(3MLIB)

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See Also:  
mlib_ImageColorDitherInit(3MLIB), mlib_ImageColorDitherFree(3MLIB),
mlib_ImageColorErrorDiffusion3x3(3MLIB),
mlib_ImageColorErrorDiffusionMxN(3MLIB),
mlib_ImageColorOrderedDither8x8(3MLIB), attributes(5)
The `mlib_ImageColorRGB2CIEMono()` function performs a conversion from a red/green/blue to a monochromatic image. The source image must be a three-channel image. The destination image must be a single-channel image.

It uses the following equation:

\[
\text{dst}[x][y][0] = 0.2125 \times \text{src}[x][y][0] + 0.7154 \times \text{src}[x][y][1] + 0.0721 \times \text{src}[x][y][2]
\]

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See Also: `mlib_ImageColorRGB2CIEMono_Fp(3MLIB), mlib_ImageColorRGB2Mono(3MLIB), mlib_ImageColorRGB2Mono_Fp(3MLIB), attributes(5)`
The `mlib_ImageColorRGB2CIEMono_Fp()` function performs a conversion from a red/green/blue to a monochromatic image. The source image must be a three-channel image. The destination image must be a single-channel image.

It uses the following equation:

\[
dst[x][y][0] = 0.2125*src[x][y][0] + 0.7154*src[x][y][1] + 0.0721*src[x][y][2]
\]

**Parameters** The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values** The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** `mlib_ImageColorRGB2CIEMono(3MLIB)`, `mlib_ImageColorRGB2Mono(3MLIB)`, `mlib_ImageColorRGB2Mono_Fp(3MLIB)`, attributes(5)
mlib_ImageColorRGB2HSL – RGB to HSL color conversion

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorRGB2HSL(mlib_image *dst, const mlib_image *src);

Description The mlib_ImageColorRGB2HSL() function performs a conversion from red/green/blue to hue/saturation/lightness. The source and destination images must be three-channel images.

It uses the following equations:

\[ V = \max(R, G, B) \]
\[ V_{\text{min}} = \min(R, G, B) \]
\[ L = \frac{V + V_{\text{min}}}{2} \]
\[ S = \begin{cases} 
\frac{V - V_{\text{min}}}{V + V_{\text{min}}} & \text{if } L \leq \frac{1}{2} \\
\frac{V - V_{\text{min}}}{2 - V - V_{\text{min}}} & \text{if } L > \frac{1}{2} 
\end{cases} \]
\[ H = \begin{cases} 
\frac{5.0 + (V - B)/(V - V_{\text{min}})}{6} & \text{if } R = V \text{ and } G = V_{\text{min}} \\
\frac{1.0 - (V - G)/(V - V_{\text{min}})}{6} & \text{if } R = V \text{ and } B = V_{\text{min}} \\
\frac{1.0 + (V - R)/(V - V_{\text{min}})}{6} & \text{if } G = V \text{ and } B = V_{\text{min}} \\
\frac{3.0 - (V - B)/(V - V_{\text{min}})}{6} & \text{if } G = V \text{ and } R = V_{\text{min}} \\
\frac{3.0 + (V - G)/(V - V_{\text{min}})}{6} & \text{if } B = V \text{ and } R = V_{\text{min}} \\
\frac{5.0 - (V - R)/(V - V_{\text{min}})}{6} & \text{if } B = V \text{ and } G = V_{\text{min}} \\
0.0 & \text{if } R = G = B 
\end{cases} \]

where \( 0 \leq R, G, B, V, V_{\text{min}}, L, S \leq 1 \) and \( 0 \leq H < 1 \).

Assuming a pixel in the source image is \((r, g, b)\) and its corresponding pixel in the destination image is \((h, s, l)\), then for MLIB_BYTE images, the following applies:

\[ R = \frac{r}{255} \]
\[ G = \frac{g}{255} \]
\[ B = \frac{b}{255} \]
\[ h = H\times256 \]
\[ s = S\times255 \]
\[ l = L\times255 \]

for MLIB_SHORT images, the following applies:

\[ R = \frac{(r + 32768)/65535} \]
\[ G = \frac{(g + 32768)/65535} \]
\[ B = \frac{(b + 32768)/65535} \]
\[ h = H\times65536 - 32768 \]
\[ s = S\times65535 - 32768 \]
\[ l = L\times65535 - 32768 \]

for MLIB_USHORT images, the following applies:
R = r/65535  
G = g/65535  
B = b/65535  
h = H*65536  
s = S*65535  
l = L*65535

and for MLIB_INT images, the following applies:

R = (r + 2147483648)/4294967295  
G = (g + 2147483648)/4294967295  
B = (b + 2147483648)/4294967295  
h = H*4294967296 - 2147483648  
s = S*4294967296 - 2147483648  
l = L*4294967296 - 2147483648

Parameters  
The function takes the following arguments:

    dst    Pointer to destination image.
    src    Pointer to source image.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageColorHSL2RGB(3MLIB), mlib_ImageColorHSL2RGB_Fp(3MLIB),  
mlib_ImageColorRGB2HSL_Fp(3MLIB), attributes(5)
mlib_ImageColorRGB2HSL_Fp – RGB to HSL color conversion

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorRGB2HSL_Fp(mlib_image *dst,
    const mlib_image *src);
```

Description

The `mlib_ImageColorRGB2HSL_Fp()` function performs a conversion from red/green/blue to hue/saturation/lightness. The source and destination images must be three-channel images.

It uses the following equations:

\[
\begin{align*}
V &= \max(R, G, B) \\
V_{\text{min}} &= \min(R, G, B) \\
L &= \frac{(V + V_{\text{min}})}{2} \\
S &= \frac{(V - V_{\text{min}})}{(V + V_{\text{min}})} & \text{if } L \leq \frac{1}{2} \\
S &= \frac{(V - V_{\text{min}})}{(2 - V - V_{\text{min}})} & \text{if } L > \frac{1}{2} \\
H &= \begin{cases} 
5.0 + \frac{(V - B)}{(V - V_{\text{min}})}/6 & \text{if } R = V \text{ and } G = V_{\text{min}} \\
1.0 - \frac{(V - G)}{(V - V_{\text{min}})}/6 & \text{if } R = V \text{ and } B = V_{\text{min}} \\
1.0 - \frac{(V - R)}{(V - V_{\text{min}})}/6 & \text{if } G = V \text{ and } B = V_{\text{min}} \\
3.0 + \frac{(V - G)}{(V - V_{\text{min}})}/6 & \text{if } G = V \text{ and } R = V_{\text{min}} \\
3.0 - \frac{(V - B)}{(V - V_{\text{min}})}/6 & \text{if } B = V \text{ and } R = V_{\text{min}} \\
5.0 - \frac{(V - R)}{(V - V_{\text{min}})}/6 & \text{if } B = V \text{ and } G = V_{\text{min}} \\
0.0 & \text{if } R = G = B 
\end{cases}
\end{align*}
\]

where \(0 \leq R, G, B, V, V_{\text{min}}, L, S \leq 1\) and \(0 \leq H < 1\).

For MLIB_FLOAT and MLIB_DOUBLE images, the above equations are followed verbatim. Input \(R, G,\) and \(B\) component values must be limited to the \([0.0, 1.0]\) range.

Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also  
mlib_ImageColorHSL2RGB(3MLIB), mlib_ImageColorHSL2RGB_Fp(3MLIB),
mlib_ImageColorRGB2HSL(3MLIB), attributes(5)
mlib_ImageColorRGB2HSV() function performs a conversion from red/green/blue to hue/saturation/value. The source and destination images must be three-channel images.

It uses the following equations:

\[
V = \max(R, G, B) \\
V_{\text{min}} = \min(R, G, B) \\
S = \frac{V - V_{\text{min}}}{V} \\
H = \begin{cases} 
5.0 + \frac{V - B}{V - V_{\text{min}}} & \text{if } R = V \text{ and } G = V_{\text{min}} \\
1.0 - \frac{V - G}{V - V_{\text{min}}} & \text{if } R = V \text{ and } B = V_{\text{min}} \\
1.0 + \frac{V - R}{V - V_{\text{min}}} & \text{if } G = V \text{ and } B = V_{\text{min}} \\
3.0 - \frac{V - B}{V - V_{\text{min}}} & \text{if } G = V \text{ and } R = V_{\text{min}} \\
3.0 + \frac{V - G}{V - V_{\text{min}}} & \text{if } B = V \text{ and } R = V_{\text{min}} \\
5.0 - \frac{V - R}{V - V_{\text{min}}} & \text{if } B = V \text{ and } G = V_{\text{min}} \\
0.0 & \text{if } R = G = B 
\end{cases}
\]

where \(0 \leq R, G, B, V, V_{\text{min}}, S \leq 1\) and \(0 \leq H < 1\).

Assuming a pixel in the source image is \((r, g, b)\) and its corresponding pixel in the destination image is \((h, s, v)\), then for MLIB_BYTE images, the following applies:

\[
R = \frac{r}{255} \\
G = \frac{g}{255} \\
B = \frac{b}{255} \\
h = H \times 256 \\
s = S \times 256 \\
v = V \times 256
\]

for MLIB_SHORT images, the following applies:

\[
R = \frac{(r + 32768)}{65535} \\
G = \frac{(g + 32768)}{65535} \\
B = \frac{(b + 32768)}{65535} \\
h = H \times 65536 - 32768 \\
s = S \times 65535 - 32768 \\
v = V \times 65535 - 32768
\]

for MLIB_USHORT images, the following applies:

\[
R = \frac{r}{65535} \\
G = \frac{g}{65535} \\
B = \frac{b}{65535}
\]
and for MLIB_INT images, the following applies:

\[
R = \frac{r + 2147483648}{4294967295} \\
G = \frac{g + 2147483648}{4294967295} \\
B = \frac{b + 2147483648}{4294967295} \\
h = H*4294967296 - 2147483648 \\
s = S*4294967295 - 2147483648 \\
v = V*4294967295 - 2147483648
\]

**Parameters**
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_ImageColorHSV2RGB(3MLIB), mlib_ImageColorHSV2RGB_Fp(3MLIB), mlib_ImageColorRGB2HSV_Fp(3MLIB), attributes(5)
The `mlib_ImageColorRGB2HSV_Fp()` function performs a conversion from red/green/blue to hue/saturation/value. The source and destination images must be three-channel images. It uses the following equations:

\[ V = \max(R, G, B) \]
\[ V_{\text{min}} = \min(R, G, B) \]
\[ S = \frac{V - V_{\text{min}}}{V} \]
\[ H = \begin{cases} 
    \frac{5.0 + (V - B)/(V - V_{\text{min}})}{6} & \text{if } R = V \text{ and } G = V_{\text{min}} \\
    \frac{1.0 - (V - G)/(V - V_{\text{min}})}{6} & \text{if } R = V \text{ and } B = V_{\text{min}} \\
    \frac{1.0 + (V - R)/(V - V_{\text{min}})}{6} & \text{if } G = V \text{ and } B = V_{\text{min}} \\
    \frac{3.0 - (V - G)/(V - V_{\text{min}})}{6} & \text{if } G = V \text{ and } R = V_{\text{min}} \\
    \frac{3.0 + (V - R)/(V - V_{\text{min}})}{6} & \text{if } B = V \text{ and } R = V_{\text{min}} \\
    \frac{5.0 - (V - R)/(V - V_{\text{min}})}{6} & \text{if } B = V \text{ and } G = V_{\text{min}} \\
    0.0 & \text{if } R = G = B 
\end{cases} \]

where \(0 \leq R, G, B, V, V_{\text{min}}, S \leq 1\) and \(0 \leq H < 1\).

For MLIB_FLOAT and MLIB_DOUBLE images, the above equations are followed verbatim. Input \(R, G,\) and \(B\) component values must be limited to the \([0.0, 1.0]\) range.

**Parameters** The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values** The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageColorHSV2RGB(3MLIB), mlib_ImageColorHSV2RGB_Fp(3MLIB),
mlib_ImageColorRGB2HSV(3MLIB), attributes(5)
The `mlib_ImageColorRGB2Mono()` function performs a conversion from a red/green/blue to a monochromatic image. The source image must be a three-channel image. The destination image must be a single-channel image.

It uses the following equation:

\[
\text{dst}[x][y][0] = \text{weight}[0]*\text{src}[x][y][0] + \\
\text{weight}[1]*\text{src}[x][y][1] + \\
\text{weight}[2]*\text{src}[x][y][2]
\]

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `weight` Array of three blending coefficients. It is recommended that these sum to 1.0, but it is not required.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also  `mlib_ImageColorRGB2CIEMono(3MLIB)`, `mlib_ImageColorRGB2CIEMono_Fp(3MLIB)`, `mlib_ImageColorRGB2Mono_Fp(3MLIB)`, attributes(5)
The `mlib_ImageColorRGB2Mono_Fp()` function performs a conversion from a red/green/blue to a monochromatic image. The source image must be a three-channel image. The destination image must be a single-channel image.

It uses the following equation:

\[
dst[x][y][0] = weight[0]*src[x][y][0] + weight[1]*src[x][y][1] + weight[2]*src[x][y][2]
\]

**Parameters** The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `weight` Array of three blending coefficients. It is recommended that these sum to 1.0, but it is not required.

**Return Values** The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** `mlib_ImageColorRGB2CIEMono(3MLIB)`, `mlib_ImageColorRGB2CIEMono_Fp(3MLIB)`, `mlib_ImageColorRGB2Mono(3MLIB)`, attributes(5)
The `mlib_ImageColorRGB2XYZ()` function performs a color space conversion from ITU-R Rec.709 RGB with D64 white point to CIE XYZ.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{bmatrix}
X \\
Y \\
Z
\end{bmatrix} =
\begin{bmatrix}
\end{bmatrix}
\begin{bmatrix}
R \\
G \\
B
\end{bmatrix}
\]

where

\[
cmat[] = \{ 0.412453, 0.357580, 0.180423, \\
0.212671, 0.715160, 0.072169, \\
0.019334, 0.119193, 0.950227 \};
\]

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also:
- `mlib_ImageColorConvert1(3MLIB)`, `mlib_ImageColorConvert1_Fp(3MLIB)`,
- `mlib_ImageColorRGB2XYZ_Fp(3MLIB)`, `mlib_ImageColorXYZ2RGB(3MLIB)`,
- `mlib_ImageColorXY2ZRG_Fp(3MLIB)`, `mlib_ImageColorYCC2RGB(3MLIB)`,
- `mlib_ImageColorYCC2RGB_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageColorRGB2XYZ_Fp()` function performs a color space conversion from ITU-R Rec.708 RGB with D65 white point to CIE XYZ.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{bmatrix}
X \\
Y \\
Z \\
\end{bmatrix} =
\begin{bmatrix}
| \text{cmat}[0] & \text{cmat}[1] & \text{cmat}[2] | & R \\
| \text{cmat}[3] & \text{cmat}[4] & \text{cmat}[5] | & G \\
| \text{cmat}[6] & \text{cmat}[7] & \text{cmat}[8] | & B \\
\end{bmatrix}
\]

where

\[
\text{cmat}[] = \{ 0.412453, 0.357580, 0.180423, \\
0.212671, 0.715160, 0.072169, \\
0.019334, 0.119193, 0.950227 \};
\]

\[
\text{src}[x][y] = \{ R, G, B \};
\]

\[
\text{dst}[x][y] = \{ X, Y, Z \};
\]

The function takes the following arguments:

- `dst`  Pointer to destination image.
- `src`  Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageColorConvert1(3MLIB), mlib_ImageColorConvert1_Fp(3MLIB), mlib_ImageColorRGB2XYZ(3MLIB), mlib_ImageColorXYZ2RGB(3MLIB), mlib_ImageColorXYZ2RGB_Fp(3MLIB), mlib_ImageColorYCC2RGB(3MLIB), mlib_ImageColorYCC2RGB_Fp(3MLIB), attributes(5)`
The `mlib_ImageColorRGB2YCC()` function performs a color space conversion from computer 
R'G'B' to ITU-R Rec.601 Y'CbCr.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{align*}
|Y'| &= \text{cmat}[0] \times |R'| + \text{offset}[0] \\
|Cb| &= \text{cmat}[3] \times |G'| + \text{cmat}[5] \times |G'| + \text{offset}[1] \\
|Cr| &= \text{cmat}[7] \times |B'| + \text{cmat}[8] \times |B'| + \text{offset}[2]
\end{align*}
\]

where

\[
\text{cmat}[\] = \{ 65.738/256, 129.057/256, 25.064/256, \-37.945/256, -74.494/256, 112.439/256, \\
112.439/256, -94.154/256, -18.285/256 \};
\]

\[
\text{offset}[\] = \{ 16, 128, 128 \};
\]

\[
\text{src}[x][y] = \{ R', G', B' \};
\]

\[
\text{dst}[x][y] = \{ Y', Cb, Cr \};
\]

### Parameters

The function takes the following arguments:

- **`dst`** Pointer to destination image.
- **`src`** Pointer to source image.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_ImageColorConvert2(3MLIB)`, `mlib_ImageColorConvert2_Fp(3MLIB)`,
- `mlib_ImageColorRGB2YCC_Fp(3MLIB)`, `mlib_ImageColorXYZ2RGB(3MLIB)`,
- `mlib_ImageColorXYZ2RGB_Fp(3MLIB)`, `mlib_ImageColorYCC2RGB(3MLIB)`,
- `mlib_ImageColorYCC2RGB_Fp(3MLIB)`, attributes(5)
mlib_ImageColorRGB2YCC_Fp – RGB to YCC color conversion

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorRGB2YCC_Fp(mlib_image *dst,
const mlib_image *src);

Description

The mlib_ImageColorRGB2YCC_Fp() function performs a color space conversion
from computer R’G’B’ to ITU-R Rec.601 Y’CbCr.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{array}{c|c|c|c|c}
|Y'| & |\text{cmat}[0]| & |\text{cmat}[1]| & |\text{cmat}[2]| & |R'| & |\text{offset}[0]| \\
|Cb| = |\text{cmat}[3]| & |\text{cmat}[4]| & |\text{cmat}[5]| & |G'| & |\text{offset}[1]| \\
|Cr| & |\text{cmat}[6]| & |\text{cmat}[7]| & |\text{cmat}[8]| & |B'| & |\text{offset}[2]| \\
\end{array}
\]

where

\[
\begin{align*}
\text{cmat}[] & = \{ \frac{65.738}{256}, \frac{129.057}{256}, \frac{25.064}{256}, \\
& \quad \frac{-37.945}{256}, \frac{-74.494}{256}, \frac{112.439}{256}, \\
& \quad \frac{112.439}{256}, \frac{-94.154}{256}, \frac{-18.285}{256} \}; \\
\text{offset}[] & = \{ 16, 128, 128 \}; \\
\text{src}[x][y] & = \{ R', G', B' \}; \\
\text{dst}[x][y] & = \{ Y',Cb,Cr \};
\end{align*}
\]

Parameters

The function takes the following arguments:

\[\begin{align*}
dst & \quad \text{Pointer to destination image.} \\
src & \quad \text{Pointer to source image.}
\end{align*}\]

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_ImageColorConvert2(3MLIB), mlib_ImageColorConvert2_Fp(3MLIB),
mlib_ImageColorRGB2YCC(3MLIB), mlib_ImageColorXYZ2RGB(3MLIB),
mlib_ImageColorXYZ2RGB_Fp(3MLIB), mlib_ImageColorYCC2RGB(3MLIB),
mlib_ImageColorYCC2RGB_Fp(3MLIB), attributes(5)
mlib_ImageColorTrue2Index

Name

mlib_ImageColorTrue2Index – true color to indexed color using nearest matched LUT entries

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorTrue2Index(mlib_image *dst,
                const mlib_image *src, const void *colormap);

Description

The mlib_ImageColorTrue2Index() function converts a true color image to a pseudo color image with the method of finding the nearest matched lookup table entry for each pixel. The source image can be an MLIB_BYTE or MLIB_SHORT image with three or four channels. The destination must be a single-channel MLIB_BYTE or MLIB_SHORT image.

The last parameter, colormap, is an internal data structure (which includes the lookup table) for inverse color mapping. Create it by calling the mlib_ImageColorTrue2IndexInit() function.

Parameters

The function takes the following arguments:

- *dst* Pointer to destination or destination image.
- *src* Pointer to source or source image.
- *colormap* Internal data structure for inverse color mapping.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageColorErrorDiffusion3x3(3MLIB),
mlib_ImageColorOrderedDither8x8(3MLIB), mlib_ImageColorTrue2IndexFree(3MLIB),
mlib_ImageColorTrue2IndexInit(3MLIB), attributes(5)
mlib_ImageColorTrue2IndexFree

Name
mlib_ImageColorTrue2IndexFree – releases the internal data structure for true color to indexed color conversion

Synopsis
cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

void mlib_ImageColorTrue2IndexFree(void *colormap);

Description
The mlib_ImageColorTrue2IndexFree() function releases the internal data structure, colormap, which was created by mlib_ImageColorTrue2IndexInit() and was used by one of the following functions:

mlib_ImageColorTrue2Index
mlib_ImageColorErrorDiffusion3x3
mlib_ImageColorOrderedDither8x8

Parameters
The function takes the following arguments:

colormap Internal data structure for inverse color mapping.

Return Values
None.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageColorErrorDiffusion3x3(3MLIB),
mlib_ImageColorOrderedDither8x8(3MLIB), mlib_ImageColorTrue2Index(3MLIB), mlib_ImageColorTrue2IndexInit(3MLIB), attributes(5)
Name  
mlib_ImageColorTrue2IndexInit — initialization for true color to indexed color conversion

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorTrue2IndexInit(void **colormap, mlib_s32 bits,
mlib_type intype, mlib_type outtype, mlib_s32 channels,
mlib_s32 entries, mlib_s32 offset, const void **table);

Description  
The mlib_ImageColorTrue2IndexInit() function creates and initializes an internal data
structure based on the input lookup table and other parameters for inverse color mapping.

The lookup table can have either three or four channels. The number of channels of the
lookup table should match that of the source image provided to the function that will use the
colormap structure created by this function.

The type of the lookup table can be one of the following:

MLIB_BYTE in, MLIB_BYTE out (i.e., BYTE-to-BYTE)
MLIB_SHORT in, MLIB_SHORT out (i.e., SHORT-to-SHORT)
MLIB_SHORT in, MLIB_BYTE out (i.e., SHORT-to-BYTE)

The input type of the lookup table should match the type of the destination image; the output
type of the lookup table should match the source image type. The source and destination
images are the images provided to the function that is going to use the colormap structure
created by mlib_ImageColorTrue2IndexInit() to do inverse color mapping.

Parameters  
The function takes the following arguments:

colormap  Internal data structure for inverse color mapping.
bits  Number of bits per color component used in the colorcube of the colormap
structure. (If bits = 0, then no colorcube is created. But the inverse color
mapping might be done by using the original lookup table.)
intype  Data type of the source image and lookup table.
outtype  Data type of the destination indexed image.
channels  Number of channels of the lookup table.
entries  Number of entries of the lookup table.
offset  The first entry offset of the lookup table.
table  The lookup table (LUT).

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_ImageColorErrorDiffusion3x3(3MLIB)`, `mlib_ImageColorOrderedDither8x8(3MLIB)`, `mlib_ImageColorTrue2Index(3MLIB)`, `mlib_ImageColorTrue2IndexFree(3MLIB)`, attributes(5)
The `mlib_ImageColorXYZ2RGB()` function performs a color space conversion from CIE XYZ to ITU-R Rec.709 RGB with D64 white point.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{align*}
R &= [\text{cmat}[0] \text{ cmat}[1] \text{ cmat}[2]] \cdot [X] \\
G &= [\text{cmat}[3] \text{ cmat}[4] \text{ cmat}[5]] \cdot [Y] \\
B &= [\text{cmat}[6] \text{ cmat}[7] \text{ cmat}[8]] \cdot [Z]
\end{align*}
\]

where

\[
\text{cmat[]} = \{ 3.240479, -1.537150, -0.498535, \\
-0.969256, 1.875992, 0.041566, \\
0.055648, -0.204043, 1.057311 \};
\]

\[
\text{src}[x][y] = \{ X, Y, Z \};
\]

\[
\text{dst}[x][y] = \{ R, G, B \};
\]

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageColorConvert1(3MLIB), mlib_ImageColorConvert1_Fp(3MLIB), mlib_ImageColorRGB2XYZ(3MLIB), mlib_ImageColorRGB2XYZ_Fp(3MLIB), mlib_ImageColorRGB2YCC(3MLIB), mlib_ImageColorRGB2YCC_Fp(3MLIB), mlib_ImageColorXYZ2RGB_Fp(3MLIB), attributes(5)`
mlib_ImageColorXYZ2RGB_Fp – XYZ to RGB color conversion

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorXYZ2RGB_Fp(mlib_image *dst,
const mlib_image *src);
```

Description

The mlib_ImageColorXYZ2RGB_Fp() function performs a color space conversion from CIE XYZ to ITU-R Rec.709 RGB with D64 white point. The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{bmatrix}
R \\
G \\
B
\end{bmatrix}
= \begin{bmatrix}
\end{bmatrix}
\begin{bmatrix}
X \\
Y \\
Z
\end{bmatrix}
\]

where

\[
cmat[] = \{ 3.240479, -1.537150, -0.498535, \\
-0.969256, 1.875992, 0.041566, \\
0.055648, -0.204043, 1.057311 \};
\]

src[x][y] = \{ X, Y, Z \};

dst[x][y] = \{ R, G, B \};

Parameters

The function takes the following arguments:

- \textit{dst} Pointer to destination image.
- \textit{src} Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_ImageColorConvert1(3MLIB), mlib_ImageColorConvert1_Fp(3MLIB),
mlib_ImageColorRGB2XYZ(3MLIB), mlib_ImageColorRGB2XYZ_Fp(3MLIB),
mlib_ImageColorRGB2YCC(3MLIB), mlib_ImageColorRGB2YCC_Fp(3MLIB),
mlib_ImageColorXYZ2RGB(3MLIB), attributes(5)
The `mlib_ImageColorYCC2RGB()` function performs a color space conversion from ITU-R Rec. 601 Y'CbCr to computer R'G'B'.

The source and destination images must be three-channel images.

It uses the following equation:

\[
\begin{align*}
|R'| &= \begin{bmatrix} cmat[0] & cmat[1] & cmat[2] \end{bmatrix} \begin{bmatrix} Y' \end{bmatrix} + \begin{bmatrix} offset[0] \end{bmatrix} \\
|G'| &= \begin{bmatrix} cmat[3] & cmat[4] & cmat[5] \end{bmatrix} \begin{bmatrix} Cb \end{bmatrix} + \begin{bmatrix} offset[1] \end{bmatrix} \\
|B'| &= \begin{bmatrix} cmat[6] & cmat[7] & cmat[8] \end{bmatrix} \begin{bmatrix} Cr \end{bmatrix} + \begin{bmatrix} offset[2] \end{bmatrix}
\end{align*}
\]

where

\[
\begin{align*}
\text{cmat}[] &= \{ 298.082/256, 0.000/256, 408.583/256, 298.082/256, -100.291/256, -208.120/256, 298.082/256, 516.411/256, 0.000/256 \}; \\
\text{offset}[] &= \{ -222.922, 135.575, -276.836 \}; \\
\text{src}[x][y] &= \{ Y', Cb, Cr \}; \\
\text{dst}[x][y] &= \{ R', G', B' \};
\end{align*}
\]

### Parameters
- **dst** Pointer to destination image.
- **src** Pointer to source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
- `mlib_ImageColorConvert2(3MLIB)`, `mlib_ImageColorConvert2_Fp(3MLIB)`,
- `mlib_ImageColorRGB2XYZ(3MLIB)`, `mlib_ImageColorRGB2XYZ_Fp(3MLIB)`,
- `mlib_ImageColorRGB2YCC(3MLIB)`, `mlib_ImageColorRGB2YCC_Fp(3MLIB)`,
- `mlib_ImageColorYCC2RGB_Fp(3MLIB)`, `attributes(5)`
mlib_ImageColorYCC2RGB_Fp – YCC to RGB color conversion

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageColorYCC2RGB_Fp(mlib_image *dst,
          const mlib_image *src);
```

**Description**
The `mlib_ImageColorYCC2RGB_Fp()` function performs a color space conversion from ITU-R Rec.601 Y'CbCr to computer R'G'B'.

The source and destination images must be three-channel images.

It uses the following equation:

```
\[
\begin{align*}
\end{align*}
\]
```

where

\[
\begin{align*}
\text{cmat}[] &= \{ 298.082/256, 0.000/256, 408.583/256, \\
& 298.082/256, -100.291/256, -208.120/256, \\
& 298.082/256, 516.411/256, 0.000/256 \}; \\
\text{offset}[] &= \{ -222.922, 135.575, -276.836 \}; \\
\text{src}[x][y] &= \{ Y', \text{Cb}, \text{Cr} \}; \\
\text{dst}[x][y] &= \{ R', G', B' \};
\end{align*}
\]

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</tr>
</tbody>
</table>

**See Also**
- `mlib_ImageColorConvert2(3MLIB)`, `mlib_ImageColorConvert2_Fp(3MLIB)`, `mlib_ImageColorRGB2XYZ(3MLIB)`, `mlib_ImageColorRGB2XYZ_Fp(3MLIB)`, `mlib_ImageColorRGB2YCC(3MLIB)`, `mlib_ImageColorRGB2YCC_Fp(3MLIB)`, `mlib_ImageColorYCC2RGB(3MLIB)`, `attributes(5)`
mlib_ImageComposite – image composition

Synopsis

cc [ flag... ] file... -mlib [ library... ]

#include <mlib.h>

mlib_status mlib_ImageComposite(mlib_image *dst, const mlib_image *src1,
const mlib_image *src2, mlib_blend bsrc1, mlib_blend bsrc2,
mlib_s32 cmask);

Description

The mlib_ImageComposite() function supports digital image composition.

It is a wrapper of the mlib_ImageBlend_BSCR1_BSRC2 group of functions and can perform
various types of composition based on the parameters passed in, whereas each function in that
group can perform only the one kind of composition denoted by its name.

The image type must be MLIB_BYTE. The input and output images must contain three or four
channels. For three-channel images, the alpha value is 1. For four-channel images, the alpha value is 1.

The following are predefined blend factor types used in mediaLib image composition
functions.

/* image blend factors */
typedef enum {
    MLIB_BLEND_ZERO,
    MLIB_BLEND_ONE,
    MLIB_BLEND_DST_COLOR,
    MLIB_BLEND_SRC_COLOR,
    MLIB_BLEND_ONE_MINUS_DST_COLOR,
    MLIB_BLEND_ONE_MINUS_SRC_COLOR,
    MLIB_BLEND_DST_ALPHA,
    MLIB_BLEND_SRC_ALPHA,
    MLIB_BLEND_ONE_MINUS_DST_ALPHA,
    MLIB_BLEND_ONE_MINUS_SRC_ALPHA,
    MLIB_BLEND_SRC_ALPHA_SATURATE
} mlib_blend;

See the following table for the definitions of the blend factors.

<table>
<thead>
<tr>
<th>Type</th>
<th>Blend Factor [*]</th>
<th>Abbr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BLEND_ZERO</td>
<td>(0,0,0,0)</td>
<td>ZERO</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE</td>
<td>(1,1,1,1)</td>
<td>ONE</td>
</tr>
<tr>
<td>MLIB_BLEND_DST_COLOR</td>
<td>(Rd,Gd,Bd,Ad)</td>
<td>DC</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_COLOR</td>
<td>(Rs,Gs,Bs,As)</td>
<td>SC</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_COLOR</td>
<td>(1,1,1,1)-(Rd,Gd,Bd,Ad)</td>
<td>OMDC</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_SRC_COLOR</td>
<td>(1,1,1,1)-(Rs,Gs,Bs,As)</td>
<td>OMSC</td>
</tr>
</tbody>
</table>
Type Blend Factor [*] Abbr.
MLIB_BLEND_DST_ALPHA (Ad,Ad,Ad,Ad) DA
MLIB_BLEND_SRC_ALPHA (As,As,As,As) SA
MLIB_BLEND_ONE_MINUS_DST_ALPHA (1,1,1,1)-(Ad,Ad,Ad,Ad) OMDA
MLIB_BLEND_ONE_MINUS_SRC_ALPHA (1,1,1,1)-(As,As,As,As) OMSA
MLIB_BLEND_SRC_ALPHA_SATURATE (f,f,f,1) SAS

[*]: The components of the first source image pixel are \((R_d, G_d, B_d, A_d)\), and the components of the second source pixel are \((R_s, G_s, B_s, A_s)\). Function \(f = \min(A_s, 1 - A_d)\).

The blending formula for non-in-place processing is:

\[
C_d = C_s1 \times S1 + C_s2 \times S2
\]

where \(C_d\) is the destination pixel \((R_d, G_d, B_d, A_d)\), \(C_s1\) is the first source pixel \((R_s1, G_s1, B_s1, A_s1)\), \(C_s2\) is the second source pixel \((R_s2, G_s2, B_s2, A_s2)\), and \(S1\) and \(S2\) are the blend factors for the first and second sources, respectively.

**Parameters**
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src1** Pointer to the first source image.
- **src2** Pointer to the second source image.
- **bsrc1** Blend factor type for the first source image.
- **bsrc2** Blend factor type for the second source image.
- **cmask** Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit is the alpha channel. cmask must be either 0x01 or 0x08.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</thead>
<tbody>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  
mlib_ImageBlend_BSRC1_BSRC2(3MLIB), mlib_ImageBlend_BSRC1_BSRC2_Inp(3MLIB), 
mlib_ImageComposite_Inp(3MLIB), attributes(5)
### Name
mlib_ImageComposite_Inp – image composition, in place

### Synopsis
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageComposite_Inp(mlib_image *src1dst,
    const mlib_image *src2, mlib_blend bsrc1, mlib_blend bsrc2,
    mlib_s32 cmask);
```

### Description
The `mlib_ImageComposite_Inp()` function supports digital image composition.

It is a wrapper of the `mlib_ImageBlend_BSCR1_BSRC2_Inp` group of functions and can perform various types of composition based on the parameters passed in, whereas each function in the `mlib_ImageBlend_BSCR1_BSRC2_Inp` group can perform only the one kind of composition denoted by its name.

The image type must be `MLIB_BYTE`. The input and output images must contain three or four channels. For three-channel images, the alpha value is as if the alpha value is 1.

The following are predefined blend factor types used in mediaLib image composition functions.

```c
/* image blend factors */
typedef enum {
    MLIB_BLEND_ZERO,
    MLIB_BLEND_ONE,
    MLIB_BLEND_DST_COLOR,
    MLIB_BLEND_SRC_COLOR,
    MLIB_BLEND_ONE_MINUS_DST_COLOR,
    MLIB_BLEND_ONE_MINUS_SRC_COLOR,
    MLIB_BLEND_DST_ALPHA,
    MLIB_BLEND_SRC_ALPHA,
    MLIB_BLEND_ONE_MINUS_DST_ALPHA,
    MLIB_BLEND_ONE_MINUS_SRC_ALPHA,
    MLIB_BLEND_SRC_ALPHA_SATURATE
} mlib_blend;
```

See the following table for the definitions of the blend factors.

<table>
<thead>
<tr>
<th>Type</th>
<th>Blend Factor [*]</th>
<th>Abbr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BLEND_ZERO</td>
<td>(0,0,0,0)</td>
<td>ZERO</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE</td>
<td>(1,1,1,1)</td>
<td>ONE</td>
</tr>
<tr>
<td>MLIB_BLEND_DST_COLOR</td>
<td>(Rd,Gd,Bd,Ad)</td>
<td>DC</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_COLOR</td>
<td>(Rs,Gs,Bs,As)</td>
<td>SC</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_COLOR</td>
<td>(1,1,1,1)-(Rd,Gd,Bd,Ad)</td>
<td>OMDC</td>
</tr>
<tr>
<td>Type</td>
<td>Blend Factor [*]</td>
<td>Abbr.</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------</td>
<td>---------</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_SRC_COLOR</td>
<td>(1,1,1,1)-(Rs, Gs, Bs, As)</td>
<td>OMSC</td>
</tr>
<tr>
<td>MLIB_BLEND_DST_ALPHA</td>
<td>(Ad,Ad,Ad,Ad)</td>
<td>DA</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_ALPHA</td>
<td>(As,As,As,As)</td>
<td>SA</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_DST_ALPHA</td>
<td>(1,1,1,1)-(Ad,Ad,Ad,Ad)</td>
<td>OMDA</td>
</tr>
<tr>
<td>MLIB_BLEND_ONE_MINUS_SRC_ALPHA</td>
<td>(1,1,1,1)-(As,As,As,As)</td>
<td>OMSA</td>
</tr>
<tr>
<td>MLIB_BLEND_SRC_ALPHA_SATURATE</td>
<td>(f,f,f,1)</td>
<td>SAS</td>
</tr>
</tbody>
</table>

[*]: The components of the first source image pixel are \((R_d, G_d, B_d, A_d)\), and the components of the second source pixel are \((R_s, G_s, B_s, A_s)\). Function \(f = \min(As, 1 - Ad)\). The first source image is also the destination image.

The blending formula for in-place processing is:

\[
C_d = C_d \ast D + C_s \ast S
\]

where \(C_d\) is the destination pixel \((R_d, G_d, B_d, A_d)\), \(C_s\) is the source pixel \((R_s, G_s, B_s, A_s)\), and \(D\) and \(S\) are the blend factors for the destination and source, respectively.

**Parameters**
The function takes the following arguments:

- `src1dst` Pointer to the first source and the destination image.
- `src2` Pointer to the second source image.
- `bsrc1` Blend factor type for the first source image.
- `bsrc2` Blend factor type for the second source image.
- `cmask` Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit is the alpha channel. `cmask` must be either 0x01 or 0x08.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  `mlib_ImageBlend_BSRC1_BSRC2(3MLIB)`,
`mlib_ImageBlend_BSRC1_BSRC2_Inp(3MLIB)`,
`mlib_ImageComposite(3MLIB)`,
`attributes(5)`
mlib_ImageConstAdd – addition with a constant

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConstAdd(mlib_image *dst, const mlib_image *src,
const mlib_s32 *c);

Description The mlib_ImageConstAdd() function adds a constant to an image on a pixel-by-pixel basis. It uses the following equation:
dst[x][y][i] = c[i] + src[x][y][i]

Parameters The function takes the following arguments:
dst Pointer to destination image.
src Pointer to source image.
c An array of constants to be added to each pixel by channel. c[i] contains the constant for channel i.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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<tr>
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<td>MT-Level</td>
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</tr>
</tbody>
</table>

See Also mlib_ImageConstAdd_Fp(3MLIB), mlib_ImageConstAdd_Fp_Inp(3MLIB), mlib_ImageConstAdd_Inp(3MLIB), attributes(5)
Name  mlib/ImageConstAdd_Fp – addition with a constant

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

  mlib_status mlib_ImageConstAdd_Fp(mlib_image *dst, const mlib_image *src,
const mlib_d64 *c);

Description  The mlib_ImageConstAdd_Fp() function adds a constant to a floating-point image on a
pixel-by-pixel basis.

It uses the following equation:
  
  dst[x][y][i] = c[i] + src[x][y][i]

Parameters  The function takes the following arguments:
  
  dst  Pointer to destination image.
  src  Pointer to source image.
  c    An array of constants to be added to each pixel by channel. c[i] contains the constant
       for channel i.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib/ImageConstAdd(3MLIB), mlib/ImageConstAdd_Fp_Inp(3MLIB),
mlib/ImageConstAdd_Inp(3MLIB), attributes(5)
mlib_ImageConstAdd_Fp_Inp

**Name**  
mlib_ImageConstAdd_Fp_Inp – addition with a constant

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

        mlib_status mlib_ImageConstAdd_Fp_Inp(mlib_image *srcdst,
                                                const mlib_d64 *c);

**Description**  
The mlib_ImageConstAdd_Fp_Inp() function adds a constant to a floating-point image on a pixel-by-pixel basis, in place.

It uses the following equation:

srcdst[x][y][i] = c[i] + srcdst[x][y][i]

**Parameters**  
The function takes the following arguments:

- **srcdst**  
  Pointer to source and destination image.

- **c**  
  An array of constants to be added to each pixel by channel. c[i] contains the constant for channel i.

**Return Values**  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  
mlib_ImageConstAdd(3MLIB), mlib_ImageConstAdd_Fp(3MLIB),  
mlib_ImageConstAdd_Inp(3MLIB), attributes(5)
Name  mlib_ImageConstAdd_Inp – addition with a constant

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConstAdd_Inp(mlib_image *srcdst, const mlib_s32 *c);

Description  The mlib_ImageConstAdd_Inp() function adds a constant to an image on a pixel-by-pixel basis, in place.

It uses the following equation:
srcdst[x][y][i] = c[i] + srcdst[x][y][i]

Parameters  The function takes the following arguments:

srcdst  Pointer to source and destination image.
c  An array of constants to be added to each pixel by channel. c[i] contains the constant for channel i.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

See Also   mlib_ImageConstAdd(3MLIB), mlib_ImageConstAdd_Fp(3MLIB), mlib_ImageConstAdd_Fp_Inp(3MLIB), attributes(5)
mlib_ImageConstAnd() function computes the And of the source image with a constant. It uses the following equation:

\[
dst[x][y][i] = c[i] \& src[x][y][i]
\]

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants to be applied to each pixel. c[i] contains the constant for channel i.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

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</thead>
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<td>Committed</td>
</tr>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_ImageConstAnd_Init(3MLIB), attributes(5)
The `mlib_ImageConstAnd_Inp()` function computes the And of the source image with a constant, in place.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = c[i] \& \text{srcdst}[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `srcdst` Pointer to first source and destination image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also `mlib_ImageConstAnd(3MLIB), attributes(5)`
The `mlib_ImageConstAndNot()` function computes the And of the Not of the source image with a constant.

It uses the following equation:
\[
\text{dst}[x][y][i] = c[i] \& \neg \text{src}[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

**See Also**
`mlib_ImageConstAndNot_Inp(3MLIB)`, attributes(5)
# mlib_ImageConstAndNot_Inp

The `mlib_ImageConstAndNot_Inp()` function computes the And of the Not of the source image with a constant, in place.

It uses the following equation:

\[
srcdst[x][y][i] = c[i] \& (~srcdst[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

## Parameters

The function takes the following arguments:

- `srcdst` Pointer to first source and destination image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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<tr>
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</tbody>
</table>

See Also `mlib_ImageConstAndNot(3MLIB)`, `attributes(5)`
The `mlib_ImageConstDiv()` function divides each pixel in an image into a constant value on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = \frac{\text{c}[i]}{\text{src}[x][y][i]}
\]

In the case of \(\text{src}[x][y][i] = 0\),

\[
\begin{align*}
\text{dst}[x][y][i] &= 0 & \text{if } \text{c}[i] &= 0 \\
\text{dst}[x][y][i] &= \text{DATA\_TYPE\_MAX} & \text{if } \text{c}[i] &> 0 \\
\text{dst}[x][y][i] &= \text{DATA\_TYPE\_MIN} & \text{if } \text{c}[i] &< 0
\end{align*}
\]

where \text{DATA\_TYPE} is \text{MLIB\_U8}, \text{MLIB\_S16}, \text{MLIB\_U16}, or \text{MLIB\_S32} for an image of type \text{MLIB\_BYTE}, \text{MLIB\_SHORT}, \text{MLIB\_USHORT}, or \text{MLIB\_INT}, respectively.

**Parameters** The function takes the following arguments:

- \text{dst} Pointer to destination image.
- \text{src} Pointer to source image.
- \text{c} Constant into which each pixel is divided. \text{c}[i] contains the constant for channel \text{i}.

**Return Values** The function returns \text{MLIB\_SUCCESS} if successful. Otherwise it returns \text{MLIB\_FAILURE}.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** `mlib_ImageConstDiv_Fp(3MLIB)`, `mlib_ImageConstDiv_Fp_Inp(3MLIB)`, `mlib_ImageConstDiv_Inp(3MLIB)`, `mlib_ImageConstDivShift(3MLIB)`, `mlib_ImageConstDivShift_Inp(3MLIB)`, attributes(5)
The `mlib_ImageConstDiv_Fp()` function divides each pixel in a floating-point image by a constant value on a pixel-by-pixel basis.

It uses the following equation:

\[
dst[x][y][i] = c[i] \div src[x][y][i]
\]

where the operation follows the IEEE-754 standard.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Constant into which each pixel is divided. `c[i]` contains the constant for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageConstDiv(3MLIB), mlib_ImageConstDiv_Fp_Inp(3MLIB), mlib_ImageConstDiv_Inp(3MLIB), mlib_ImageConstDivShift(3MLIB), mlib_ImageConstDivShift_Inp(3MLIB), attributes(5)`
The `mlib_ImageConstDiv_Fp_Inp()` function divides each pixel in a floating-point image by a constant value on a pixel-by-patch basis, in place.

It uses the following equation:

\[ \text{srcdst}[x][y][i] = \frac{c[i]}{\text{srcdst}[x][y][i]} \]

where the operation follows the IEEE-754 standard.

**Parameters**
- **srcdst**: Pointer to source and destination image.
- **c**: Constant into which each pixel is divided. \(c[i]\) contains the constant for channel \(i\).

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**
- `mlib_ImageConstDiv(3MLIB)`, `mlib_ImageConstDiv_Fp(3MLIB)`,
- `mlib_ImageConstDiv_Inp(3MLIB)`, `mlib_ImageConstDivShift(3MLIB)`,
- `mlib_ImageConstDivShift_Inp(3MLIB)`, `attributes(5)`
The `mlib_ImageConstDiv_Inp()` function divides each pixel in an image by a constant value on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{srcdst}[x][y][i] = c[i] / \text{srcdst}[x][y][i] \]

In the case of \( \text{srcdst}[x][y][i] = 0 \),

\[ \begin{align*}
\text{srcdst}[x][y][i] &= 0 & \text{if } c[i] = 0 \\
\text{srcdst}[x][y][i] &= \text{DATA_TYPE_MAX} & \text{if } c[i] > 0 \\
\text{srcdst}[x][y][i] &= \text{DATA_TYPE_MIN} & \text{if } c[i] < 0
\end{align*} \]

where \( \text{DATA_TYPE} \) is \texttt{MLIB_U8}, \texttt{MLIB_S16}, \texttt{MLIB_U16}, or \texttt{MLIB_S32} for an image of type \texttt{MLIB_BYTE}, \texttt{MLIB_SHORT}, \texttt{MLIB_USHORT}, or \texttt{MLIB_INT}, respectively.

### Parameters

The function takes the following arguments:

- ***srcdst*** Pointer to source and destination image.
- ***c*** Constant into which each pixel is divided. \( c[i] \) contains the constant for channel \( i \).

### Return Values

The function returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

### Attributes

See **attributes(5)** for descriptions of the following attributes:

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### See Also

- `mlib_ImageConstDiv_Inp(3MLIB)`, `mlib_ImageConstDiv_Fp(3MLIB)`, `mlib_ImageConstDiv_Fp_Inp(3MLIB)`, `mlib_ImageConstDivShift(3MLIB)`, `mlib_ImageConstDivShift_Inp(3MLIB)`, attributes(5)
# mlib_ImageConstDivShift

The `mlib_ImageConstDivShift()` function divides each pixel in an image into a constant value on a pixel-by-p-pixel basis. It scales the result by a left shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = \frac{c[i]}{\text{src}[x][y][i]} \times 2^{\text{shift}}
\]

In the case of \(\text{src}[x][y][i] = 0\),

\[
\begin{align*}
\text{dst}[x][y][i] &= 0 & \text{if } c[i] = 0 \\
\text{dst}[x][y][i] &= \text{DATA\_TYPE\_MAX} & \text{if } c[i] > 0 \\
\text{dst}[x][y][i] &= \text{DATA\_TYPE\_MIN} & \text{if } c[i] < 0
\end{align*}
\]

where \(\text{DATA\_TYPE}\) is \(\text{MLIB\_U8}, \text{MLIB\_S16}, \text{MLIB\_U16},\) or \(\text{MLIB\_S32}\) for an image of type \(\text{MLIB\_BYTE}, \text{MLIB\_SHORT}, \text{MLIB\_USHORT},\) or \(\text{MLIB\_INT}\), respectively.

## Parameters

The function takes the following arguments:

- \(\text{dst}\) Pointer to destination image.
- \(\text{src}\) Pointer to source image.
- \(c\) Constant into which each pixel is divided. \(c[i]\) contains the constant for channel \(i\).
- \(\text{shift}\) Left shifting factor. \(0 \leq \text{shift} \leq 31\).

## Return Values

The function returns `MLIB\_SUCCESS` if successful. Otherwise it returns `MLIB\_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_ImageConstDiv(3MLIB)`, `mlib_ImageConstDiv_Fp(3MLIB)`, `mlib_ImageConstDiv_Fp_Inp(3MLIB)`, `mlib_ImageConstDiv_Inp(3MLIB)`, `mlib_ImageConstDivShift_Inp(3MLIB)`, `attributes(5)`
The `mlib_ImageConstDivShift_Inp()` function divides each pixel in an image into a constant value on a pixel-by-pixel basis, in place. It scales the result by a left shift and writes the result to the image on a pixel-by-pixel basis.

It uses the following equation:

```
srcdst[x][y][i] = c[i] / srcdst[x][y][i] * 2**shift
```

In the case of `srcdst[x][y][i] = 0`,

- `srcdst[x][y][i] = 0` if `c[i] = 0`
- `srcdst[x][y][i] = DATA_TYPE_MAX` if `c[i] > 0`
- `srcdst[x][y][i] = DATA_TYPE_MIN` if `c[i] < 0`

where `DATA_TYPE` is `MLIB_U8`, `MLIB_S16`, `MLIB_U16`, or `MLIB_S32` for an image of type `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`, respectively.

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `c` Constant into which each pixel is divided. `c[i]` contains the constant for channel `i`.
- `shift` Left shifting factor. `0 ≤ shift ≤ 31`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageConstDiv(3MLIB)`, `mlib_ImageConstDiv_Fp(3MLIB)`, `mlib_ImageConstDiv_Fp_Inp(3MLIB)`, `mlib_ImageConstDiv_Inp(3MLIB)`, `mlib_ImageConstDivShift(3MLIB)`, attributes(5)
The `mlib_ImageConstMul()` function multiplies each pixel in an image by a constant value on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = c[i] \times \text{src}[x][y][i]
\]

The function takes the following arguments:

- \( \text{dst} \) Pointer to destination image.
- \( \text{src} \) Pointer to source image.
- \( c \) Constant by which each pixel is multiplied. \( c[i] \) contains the constant for channel \( i \).

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageConstMul_Fp(3MLIB), mlib_ImageConstMul_Fp_Inp(3MLIB), mlib_ImageConstMul_Inp(3MLIB), mlib_ImageConstMulShift(3MLIB), mlib_ImageConstMulShift_Inp(3MLIB), attributes(5)`
The `mlib_ImageConstMul_Fp()` function multiplies each pixel in a floating-point image by a constant value on a pixel-by-pixel basis. It uses the following equation:

\[ dst[x][y][i] = c[i] \times src[x][y][i] \]

### Parameters
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Constant by which each pixel is multiplied. `c[i]` contains the constant for channel `i`.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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### See Also
- `mlib_ImageConstMul(3MLIB), mlib_ImageConstMul_Fp_Inp(3MLIB), mlib_ImageConstMul_Inp(3MLIB), mlib_ImageConstMulShift(3MLIB), mlib_ImageConstMulShift_Inp(3MLIB) , attributes(5)`
mlib_ImageConstMul_Fp_Inp(3MLIB)

Name  mlib_ImageConstMul_Fp_Inp - multiply with a constant

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConstMul_Fp_Inp(mlib_image *srcdst,
    const mlib_d64 *c);

Description  The mlib_ImageConstMul_Fp_Inp() function multiplies each pixel in a floating-point image by a constant value on a pixel-by-pixel basis, in place.

It uses the following equation:

srcdst[x][y][i] = c[i] * srcdst[x][y][i]

Parameters  The function takes the following arguments:

srcdst    Pointer to source and destination image.
c    Constant by which each pixel is multiplied. c[i] contains the constant for channel i.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConstMul(3MLIB), mlib_ImageConstMul_Fp(3MLIB),
mlib_ImageConstMul_Inp(3MLIB), mlib_ImageConstMulShift(3MLIB),
mlib_ImageConstMulShift_Inp(3MLIB), attributes(5)
The `mlib_ImageConstMul_Inp()` function multiplies each pixel in an image by a constant value on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = c[i] \times \text{srcdst}[x][y][i]
\]

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `c` Constant by which each pixel is multiplied. `c[i]` contains the constant for channel `i`.

The function returns `MLIB_SUCCESS` if successful. Otherwise, it returns `MLIB_FAILURE`.

See Also `mlib_ImageConstMul(3MLIB)`, `mlib_ImageConstMul_Fp(3MLIB)`, `mlib_ImageConstMul_Fp_Inp(3MLIB)`, `mlib_ImageConstMulShift(3MLIB)`, `mlib_ImageConstMulShift_Inp(3MLIB)`, `attributes(5)`
mlib_ImageConstMulShift – multiply with a constant, with shifting

Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageConstMulShift(mlib_image *dst, const mlib_image *src,
                                   const mlib_s32 *c, mlib_s32 shift);
```

Description
The `mlib_ImageConstMulShift()` function multiplies each pixel in an image by a constant value on a pixel-by-pixel basis. It scales the result by a right shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[
dst[x][y][i] = c[i] \cdot src[x][y][i] \cdot 2^{-\text{shift}}
\]

Parameters
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Constant by which each pixel is multiplied. \(c[i]\) contains the constant for channel \(i\).
- `shift` Right shifting factor. \(0 \leq \text{shift} \leq 31\).

Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes
See `attributes(5)` for descriptions of the following attributes:

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See Also
`mlib_ImageConstMul(3MLIB), mlib_ImageConstMul_Fp(3MLIB),
mlib_ImageConstMul_Fp_Inp(3MLIB), mlib_ImageConstMul_Inp(3MLIB),
mlib_ImageConstMulShift_Inp(3MLIB), attributes(5)`
Name  mlib_ImageConstMulShift_Inp – multiply with a constant, with shifting

Synopsis  
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConstMulShift_Inp(mlib_image *srcdst,
    const mlib_s32 *c, mlib_s32 shift);
```

Description  The mlib_ImageConstMulShift_Inp() function multiplies each pixel in an image by a constant value on a pixel-by-pixel basis. It scales the result by a right shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:
```
srcdst[x][y][i] = c[i] * srcdst[x][y][i] * 2**{-shift}
```

Parameters  The function takes the following arguments:
- **srcdst**   Pointer to source and destination image.
- **c**   Constant by which each pixel is multiplied. c[i] contains the constant for channel i.
- **shift**   Right shifting factor. 0 ≤ shift ≤ 31.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConstMul(3MLIB), mlib_ImageConstMul_Fp(3MLIB), mlib_ImageConstMul_Fp_Inp(3MLIB), mlib_ImageConstMul_Inp(3MLIB), mlib_ImageConstMulShift(3MLIB), attributes(5)
# mlib_ImageConstNotAnd

## synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageConstNotAnd(mlib_image *dst, const mlib_image *src, const mlib_s32 *c);
```

## Description

The `mlib_ImageConstNotAnd()` function computes the logical And of the source image with a constant and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = \neg(c[i] \& src[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

## Parameters

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **c** Array of constants to be applied to each pixel. \( c[i] \) contains the constant for channel \( i \).

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

`mlib_ImageConstNotAnd_Inp(3MLIB), attributes(5)`
The `mlib_ImageConstNotAnd_Inp()` function computes the logical And of the source image with a constant and then takes the logical Not of that result on a pixel-by-p-pixel basis, in place.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = \neg(c[i] \& \text{srcdst}[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
The function takes the following arguments:
- **srcdst**: Pointer to first source and destination image.
- **c**: Array of constants to be applied to each pixel. \(c[i]\) contains the constant for channel \(i\).

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageConstNotAnd(3MLIB), attributes(5)`
#include <mlib.h>

mlib_status mlib_ImageConstNotOr(mlib_image *dst, const mlib_image *src, const mlib_s32 *c);

The `mlib_ImageConstNotOr()` function computes the logical Or of the source image with a constant and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

```
dst[x][y][i] = ~(c[i] | src[x][y][i])
```

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

## Parameters
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See attributes(5) for descriptions of the following attributes:

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## See Also
`mlib_ImageConstNotOr_Inp(3MLIB)`, attributes(5)
The `mlib_ImageConstNotOr_Inp()` function computes the logical Or of the source image with a constant and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = \neg(c[i] \mid \text{srcdst}[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

### Parameters
- **srcdst**: Pointer to first source and destination image.
- **c**: Array of constants to be applied to each pixel. \(c[i]\) contains the constant for channel \(i\).

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_ImageConstNotOr(3MLIB)`, attributes(5)
The `mlib_ImageConstNotXor()` function computes the logical exclusive Or of the source image with a constant and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

\[ \text{dst}[x][y][i] = \neg(c[i] \ ^{\lor} \ src[x][y][i]) \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

### Parameters

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **c** Array of constants to be applied to each pixel. \( c[i] \) contains the constant for channel \( i \).

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

### See Also

`mlib_ImageConstNotXor_Inp(3MLIB)`, attributes(5)
The `mlib_ImageConstNotXor_Inp()` function computes the logical exclusive Or of the source image with a constant and then takes the logical Not of that result on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{srcdst}[x][y][i] = \neg (c[i] \ ^{\lor} \ \text{srcdst}[x][y][i]) \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `srcdst` Pointer to first source and destination image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageConstNotXor(3MLIB)`, attributes(5)
The `mlib_ImageConstOr()` function computes the logical Or of the source image with a constant on a pixel-by-pixel basis.

It uses the following equation:

\[ dst[x][y][i] = c[i] \lor src[x][y][i] \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageConstOr_Inp(3MLIB), attributes(5)`
The `mlib_ImageConstOr_Inp()` function computes the logical Or of the source image with a constant on a pixel-by-p-pixel basis, in place.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = c[i] \lor \text{srcdst}[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:
- `srcdst` Pointer to first source and destination image.
- `c` Array of constants to be applied to each pixel. \( c[i] \) contains the constant for channel \( i \).

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageConstOr(3MLIB), attributes(5)`
mlib_ImageConstOrNot–OrNot with a constant

Synopsis

```c
#include <mli.h>

mlib_status mlib_ImageConstOrNot(mlib_image *dst, const mlib_image *src, 
    const mlib_s32 *c);
```

Description

The `mlib_ImageConstOrNot()` function computes the logical Not of the source image and then takes the logical Or of that result with a constant on a pixel-by-pixel basis.

It uses the following equation:

```
dst[x][y][i] = c[i] | (~src[x][y][i])
```

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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See Also

`mlib_ImageConstOrNot_Inp(3MLIB)`, attributes(5)
The `mlib_ImageConstOrNot_Inp()` function computes the logical Not of the source image and then takes the logical Or of that result with a constant on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
srcdst[x][y][i] = c[i] \lor (\neg srcdst[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
- `srcdst` Pointer to first source and destination image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageConstOrNot(3MLIB)`, `attributes(5)`
The `mlib_ImageConstSub()` function subtracts a pixel from a constant on a pixel-by-pixel basis. It uses the following equation:

\[ \text{dst}[x][y][i] = c[i] - \text{src}[x][y][i] \]

The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants from which each pixel is subtracted by channel. `c[i]` contains the constant for channel `i`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageConstSub_Fp(3MLIB), mlib_ImageConstSub_Fp_Inp(3MLIB), mlib_ImageConstSub_Inp(3MLIB), attributes(5)`
### mlib_ImageConstSub_Fp(3MLIB)

#### Name
mlib_ImageConstSub_Fp – Subtraction with a constant

#### Synopsis
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConstSub_Fp(mlib_image *dst, const mlib_image *src,
     const mlib_d64 *c);
```

#### Description
The `mlib_ImageConstSub_Fp()` function subtracts a floating-point image pixel from a constant on a pixel-by-pixel basis.

It uses the following equation:

\[ dst[x][y][i] = c[i] - src[x][y][i] \]

#### Parameters

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **c**  
  Array of constants from which each pixel is subtracted by channel. \( c[i] \) contains the constant for channel \( i \).

#### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

#### Attributes
See attributes(5) for descriptions of the following attributes:

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#### See Also
- `mlib_ImageConstSub(3MLIB)`, `mlib_ImageConstSub_Fp_Inp(3MLIB)`, `mlib_ImageConstSub_Inp(3MLIB)`, attributes(5)
The `mlib_ImageConstSub_Fp_Inp()` function subtracts a floating-point image pixel from a constant on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = c[i] - \text{srcdst}[x][y][i]
\]

**Parameters**

- `srcdst` Pointer to source and destination image.
- `c` Array of constants from which each pixel is subtracted by channel. \( c[i] \) contains the constant for channel \( i \).

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

`mlib_ImageConstSub(3MLIB), mlib_ImageConstSub_Fp(3MLIB), mlib_ImageConstSub_Inp(3MLIB), attributes(5)`
#include <mlib.h>
mlib_status mlib_ImageConstSub_Inp(mlib_image *srcdst, const mlib_s32 *c);

The mlib_ImageConstSub_Inp() function subtracts an image pixel from a constant on a pixel-by-pixel basis, in place.

It uses the following equation:
srcdst[x][y][i] = c[i] - srcdst[x][y][i]

The function takes the following arguments:
srcdst Pointer to source and destination image.
c Array of constants from which each pixel is subtracted by channel. c[i] contains the constant for channel i.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageConstSub(3MLIB), mlib_ImageConstSub_Fp(3MLIB), mlib_ImageConstSub_Fp_Inp(3MLIB), attributes(5)
#include <mlib.h>

mlib_status mlib_ImageConstXor(mlib_image *dst, const mlib_image *src,
                               const mlib_s32 *c);

The `mlib_ImageConstXor()` function computes the exclusive Or of the source image with a constant on a pixel-by-pixel basis.

It uses the following equation:

\[
dst[x][y][i] = c[i] \oplus src[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Array of constants to be applied to each pixel. `c[i]` contains the constant for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageConstXor_Inp(3MLIB)`, `attributes(5)`
mlib_ImageConstXor_Inp - Xor with a constant, in place

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConstXor_Inp(mlib_image *srcdst, const mlib_s32 *c);

Description

The mlib_ImageConstXor_Inp() function computes the exclusive Or of the source image with a constant on a pixel-by-pixel basis, in place.

It uses the following equation:

srcdst[x][y][i] = c[i] ^ srcdst[x][y][i]

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

Parameters

The function takes the following arguments:

srcdst Pointer to first source and destination image.
c Array of constants to be applied to each pixel. c[i] contains the constant for channel i.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_ImageConstXor(3MLIB), attributes(5)
mlib_ImageConv2x2 – 2x2 convolution

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConv2x2(mlib_image *dst, const mlib_image *src,
const mlib_s32 *kernel, mlib_s32 scale, mlib_s32 cmask,
mlib_edge edge);

Description

The mlib_ImageConv2x2() function performs a 2x2 convolution on the source image by
using the user-supplied kernel.

The input image and the output image must have the same image type and have the same
number of channels. The unselected channels in the output image are not overwritten. For
single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at (0, 0) of the
kernel matrix.

It uses the following equation:

\[
\begin{align*}
    dst[x][y][i] &= \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i]*k[p][q]*2^{(-scale)} \\
\end{align*}
\]

where \( m = 2 \), \( n = 2 \), \( dm = (m - 1) / 2 = 0 \), \( dn = (n - 1) / 2 = 0 \).

Parameters

The function takes the following arguments:

dstPointer to destination image.
srcPointer to source image.
kernelPointer to the convolution kernel, in row major order.
scaleScaling factor.
cmaskChannel mask to indicate the channels to be convolved, each bit of which
represents a channel in the image. The channels corresponding to bits with a value
of 1 are those to be processed. For a single-channel image, the channel mask is
ignored.
edgeType of edge condition. It can be one of the following:
MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_DST_COPY_SRC
MLIB_EDGE_SRC_EXTEND
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**

- `mlib_ImageConv2x2_Fp(3MLIB)`, `mlib_ImageConv2x2Index(3MLIB)`, `mlib_ImageConv3x3(3MLIB)`, `mlib_ImageConv3x3_Fp(3MLIB)`, `mlib_ImageConv3x3Index(3MLIB)`, `mlib_ImageConv4x4(3MLIB)`, `mlib_ImageConv4x4_Fp(3MLIB)`, `mlib_ImageConv4x4Index(3MLIB)`, `mlib_ImageConv5x5(3MLIB)`, `mlib_ImageConv5x5_Fp(3MLIB)`, `mlib_ImageConv5x5Index(3MLIB)`, `mlib_ImageConv7x7(3MLIB)`, `mlib_ImageConv7x7_Fp(3MLIB)`, `mlib_ImageConv7x7Index(3MLIB)`, `mlib_ImageConvKernelConvert(3MLIB)`, `mlib_ImageConvMxN(3MLIB)`, `mlib_ImageConvMxN_Fp(3MLIB)`, `mlib_ImageConvMxNIndex(3MLIB)`, `mlib_ImageConvolveMxN(3MLIB)`, `mlib_ImageConvolveMxN_Fp(3MLIB)`, `mlib_ImageSConv3x3(3MLIB)`, `mlib_ImageSConv3x3_Fp(3MLIB)`, `mlib_ImageSConv5x5(3MLIB)`, `mlib_ImageSConv5x5_Fp(3MLIB)`, `mlib_ImageSConv7x7(3MLIB)`, `mlib_ImageSConv7x7_Fp(3MLIB)`, `mlib_ImageSConvKernelConvert(3MLIB)`, `attributes(5)`
The `mlib_ImageConv2x2_Fp()` function performs a 2x2 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at (0, 0) of the kernel matrix.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i] \times k[p][q]
\]

where \( m = 2 \), \( n = 2 \), \( dm = (m - 1)/2 = 0 \), \( dn = (n - 1)/2 = 0 \).

**Parameters**

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `kernel` Pointer to the convolution kernel, in row major order.
- `cmask` Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:
### mlib_ImageConv2x2_Fp(3MLIB)

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**See Also**
- mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB), mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv2x2Index()` function performs a 2x2 convolution on the color indexed source image by using the user-supplied kernel.

The input and output images must have the same image type and size.

For this convolution, the key element of the convolution kernel is located at (0, 0) of the kernel matrix.

This function performs the convolution on color indexed image. The input image and the output image must be single-channel images. The image type must be `MLIB_BYTE` or `MLIB_SHORT`.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i] * k[p][q] * 2^{(-scale)}
\]

where \( m = 2 \), \( n = 2 \), \( dm = (m - 1)/2 = 0 \), \( dn = (n - 1)/2 = 0 \).

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **kernel** Pointer to the convolution kernel, in row major order.
- **scale** Scaling factor.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
- **colormap** Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
          mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB),
          mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB),
          mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB),
          mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
          mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),
          mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
          mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
          mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
          mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
          mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB),
          mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
          mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
          mlib_ImageConvKernelConvert(3MLIB), attributes(5)
mlib_ImageConv3x3 – 3x3 convolution

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageConv3x3(mlib_image *dst,
const mlib_image *src,
const mlib_s32 *kernel, mlib_s32 scale, mlib_s32 cmask,
mlib_edge edge);
```

**Description**
The `mlib_ImageConv3x3()` function performs a 3x3 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

The data type of source and destination images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i]*k[p][q]*2^{(-scale)}
\]

where \( m = 3 \), \( n = 3 \), \( dm = (m - 1)/2 = 1 \), \( dn = (n - 1)/2 = 1 \).

**Parameters**
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **kernel** Pointer to the convolution kernel, in row major order.
- **scale** Scaling factor.
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3_Fp(3MLIB),
mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB),
mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB),
mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv3x3_Fp()` function performs a floating-point 3x3 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i] \times k[p][q]
\]

where \( m = 3 \), \( n = 3 \), \( dm = (m-1)/2 = 1 \), \( dn = (n-1)/2 = 1 \).

**Parameters**
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `kernel` Pointer to the convolution kernel, in row major order.
- `cmask` Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:
mlib_ImageConv3x3_Fp (3MLIB)

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See Also  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),  
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),  
mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB),  
mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB),  
mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),  
mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),  
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),  
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),  
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),  
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),  
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),  
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),  
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),  
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv3x3Index()` function performs a 3x3 convolution on the color indexed source image by using the user-supplied kernel.

The input and output images must have the same image type and size.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

This function performs the convolution on color indexed image. The input image and the output image must be single-channel images. The image type must be `MLIB_BYTE` or `MLIB_SHORT`.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i] \times k[p][q] \times 2^{-\text{scale}}
\]

where \( m = 3 \), \( n = 3 \), \( dm = (m - 1)/2 = 1 \), \( dn = (n - 1)/2 = 1 \).

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `kernel` Pointer to the convolution kernel, in row major order.
- `scale` Scaling factor.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

- `colormap` Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function. The source and destination images must be single-channel images.
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv4x4(3MLIB),
mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB),
mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
mlib_ImageConv4x4 – 4x4 convolution

Synopsis  
```
c c [ f lag . . . ] f ile . . . - l mlib [ l ibrary... ]
#include <mlib.h>

mlib_status mlib_ImageConv4x4(mlib_image *dst, const mlib_image *src,
    const mlib_s32 *kernel, mlib_s32 scale, mlib_s32 cmask,
    mlib_edge edge);
```

Description  
The `mlib_ImageConv4x4()` function performs a 4x4 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at (1, 1) of the kernel matrix.

It uses the following equation:

\[
    dst[x][y][i] = \sum_{p=-dm}^{m-1} \sum_{q=-dn}^{n-1} src[x+p][y+q][i]*k[p][q]*2^{(-scale)}
\]

where \( m = 4 \), \( n = 4 \), \( dm = (m - 1)/2 = 1 \), \( dn = (n - 1)/2 = 1 \).

Parameters  
The function takes the following arguments:

- `dst`  
  Pointer to destination image.

- `src`  
  Pointer to source image.

- `kernel`  
  Pointer to the convolution kernel, in row major order.

- `scale`  
  Scaling factor.

- `cmask`  
  Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.

- `edge`  
  Type of edge condition. It can be one of the following:

  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
           mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
           mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
           mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB),
           mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
           mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),
           mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
           mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
           mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
           mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
           mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
           mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
           mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
           mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv4x4_Fp()` function performs a floating-point 4x4 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at (1, 1) of the kernel matrix.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-\text{dm}}^{\text{dm}} \sum_{q=-\text{dn}}^{\text{dn}} \text{src}[x+p][y+q][i] \cdot \text{kernel}[p][q]
\]

where \( m = 4 \), \( n = 4 \), \( \text{dm} = (m - 1)/2 = 1 \), \( \text{dn} = (n - 1)/2 = 1 \).

The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `kernel` Pointer to the convolution kernel, in row major order.
- `cmask` Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- `edge` Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILLZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SRC_EXTEND

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:
### mlib_ImageConv4x4_Fp(3MLIB)

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See Also  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB), mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB), mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
mlib_ImageConv4x4Index – 4x4 convolution on a color indexed image

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConv4x4Index(mlib_image *dst, const mlib_image *src,
const mlib_s32 *kernel, mlib_s32 scale, mlib_edge edge,
const void *colormap);

Description

The mlib_ImageConv4x4Index() function performs a 4x4 convolution on the color indexed source image by using the user-supplied kernel.

The input and output images must have the same image type and size.

For this convolution, the key element of the convolution kernel is located at (1, 1) of the kernel matrix.

This function performs the convolution on color indexed image. The input image and the output image must be single channel images. The image type must be MLIB_BYTE or MLIB_SHORT.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i]*k[p][q]*2^{(-scale)}
\]

where \( m = 4, n = 4, dm = (m - 1)/2 = 1, dn = (n - 1)/2 = 1 \).

Parameters

The function takes the following arguments:

- \( dst \) Pointer to destination image.
- \( src \) Pointer to source image.
- \( kernel \) Pointer to the convolution kernel, in row major order.
- \( scale \) Scaling factor.
- \( edge \) Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SRC_EXTEND
- \( colormap \) Internal data structure for inverse color mapping. This data structure is generated by the mlib_ImageColorTrue2IndexInit() function.
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
          mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
          mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
          mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
          mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
          mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),
          mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
          mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
          mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
          mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
          mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
          mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
          mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
          mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
Name  

mlib_ImageConv5x5 – 5x5 convolution

Synopsis  

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConv5x5(mlib_image *dst, const mlib_image *src,
                    const mlib_s32 *kernel, mlib_s32 scale, mlib_s32 cmask,
                    mlib_edge edge);

Description  

The mlib_ImageConv5x5() function performs a 5x5 convolution on the source image by
using the user-supplied kernel.

The input image and the output image must have the same image type and have the same
number of channels. The unselected channels in the output image are not overwritten. For
single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at the center of the
kernel matrix.

It uses the following equation:

\[
m-1-dm \quad n-1-dn
\]

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1} \sum_{q=-dn}^{n-1} src[x+p][y+q][i]*k[p][q]*2^(-scale)
\]

where \( m = 5 \), \( n = 5 \), \( dm = (m - 1)/2 = 2 \), \( dn = (n - 1)/2 = 2 \).

Parameters  

The function takes the following arguments:

dst  Pointer to destination image.
src  Pointer to source image.
kernel  Pointer to the convolution kernel, in row major order.
scale  Scaling factor.
cmask  Channel mask to indicate the channels to be convolved, each bit of which
represents a channel in the image. The channels corresponding to bits with a value
of 1 are those to be processed. For a single-channel image, the channel mask is
ignored.
edge  Type of edge condition. It can be one of the following:
MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_DST_COPY_SRC
MLIB_EDGE_SRC_EXTEND
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv7x7(3MLIB),
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv5x5_Fp()` function performs a floating-point 5x5 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not over written. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1} \sum_{q=-dn}^{n-1} \text{src}[x+p][y+q][i] \times k[p][q]
\]

where \( m = 5 \), \( n = 5 \), \( dm = (m - 1)/2 = 2 \), and \( dn = (n - 1)/2 = 2 \).

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `kernel` Pointer to the convolution kernel, in row major order.
- `cmask` Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:
mlib_ImageConv5x5_Fp(3MLIB)

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See Also  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),  
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),  
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),  
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),  
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),  
mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB),  
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),  
mlib_ImageConv KernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),  
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),  
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),  
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),  
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),  
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),  
mlib_ImageSConv KernelConvert(3MLIB), attributes(5)
mlib_ImageConv5x5Index – 5x5 convolution on a color indexed image

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConv5x5Index(mlib_image *dst, const mlib_image *src,
            const mlib_s32 *kernel, mlib_s32 scale, mlib_edge edge,
            const void *colormap);
```

Description

The `mlib_ImageConv5x5Index()` function performs a 5x5 convolution on the color indexed source image by using the user-supplied kernel. The source and destination images must be single-channel images.

The input and output images must have the same image type and size.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

This function performs the convolution on color indexed image. The input image and the output image must be single channel images. The image type must be `MLIB_BYTE` or `MLIB_SHORT`.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i]*k[p][q]*2^{-scale}
\]

where \( m = 5, n = 5, dm = (m - 1)/2 = 2, dn = (n - 1)/2 = 2 \).

Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `kernel` Pointer to the convolution kernel, in row major order.
- `scale` Scaling factor.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
- `colormap` Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv7x7(3MLIB),
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv7x7()` function performs a 7x7 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i] \times k[p][q] \times 2^{-\text{scale}}
\]

where \( m = 7 \), \( n = 7 \), \( dm = (m - 1)/2 = 3 \), \( dn = (n - 1)/2 = 3 \).

**Parameters**
The function takes the following arguments:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dst</code></td>
<td>Pointer to destination image.</td>
</tr>
<tr>
<td><code>src</code></td>
<td>Pointer to source image.</td>
</tr>
<tr>
<td><code>kernel</code></td>
<td>Pointer to the convolution kernel, in row major order.</td>
</tr>
<tr>
<td><code>scale</code></td>
<td>Scaling factor.</td>
</tr>
<tr>
<td><code>cmask</code></td>
<td>Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.</td>
</tr>
<tr>
<td><code>edge</code></td>
<td>Type of edge condition. It can be one of the following:</td>
</tr>
</tbody>
</table>

```c
MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_DST_COPY_SRC
MLIB_EDGE_SRC_EXTEND
```
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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</table>

See Also

mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),
mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageConv7x7_Fp()` function performs a floating-point 7x7 convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

It uses the following equation:

\[
    dst[x][y][i] = \sum_{p=-dm}^{dm-1} \sum_{q=-dn}^{dn-1} src[x+p][y+q][i] \times k[p][q]
\]

where \( m = 7 \), \( n = 7 \), \( dm = (m - 1)/2 = 3 \), \( dn = (n - 1)/2 = 3 \).

### Parameters

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **kernel** Pointer to the convolution kernel, in row major order.
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:
mlib_ImageConv7x7_Fp(3MLIB)

<table>
<thead>
<tr>
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See Also  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),  
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),  
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),  
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),  
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),  
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),  
mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7Index(3MLIB),  
mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB),  
mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),  
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),  
mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),  
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),  
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),  
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
mlib_ImageConv7x7Index — 7x7 convolution on a color indexed image

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConv7x7Index(mlib_image *dst, const mlib_image *src,
const mlib_s32 *kernel, mlib_s32 scale, mlib_edge edge,
const void *colormap);

Description

The mlib_ImageConv7x7Index() function performs a 7x7 convolution the color indexed source image by using the user-supplied kernel. The source and destination images must be single-channel images.

The input and output images must have the same image type and size.

For this convolution, the key element of the convolution kernel is located at the center of the kernel matrix.

This function performs the convolution on color indexed image. The input image and the output image must be single channel images. The image type must be MLIB_BYTE or MLIB_SHORT.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i]*k[p][q]*2^{(-scale)}
\]

where \(m = 7\), \(n = 7\), \(dm = (m - 1)/2 = 3\), \(dn = (n - 1)/2 = 3\).

Parameters

The function takes the following arguments:

\(dst\) Pointer to destination image.

\(src\) Pointer to source image.

\(kernel\) Pointer to the convolution kernel, in row major order.

\(scale\) Scaling factor.

\(edge\) Type of edge condition. It can be one of the following:

MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_DST_COPY_SRC
MLIB_EDGE_SRC_EXTEND

\(colormap\) Internal data structure for inverse color mapping. This data structure is generated by the mlib_ImageColorTrue2IndexInit() function.
Return Values  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  See `attributes(5)` for descriptions of the following attributes:

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See Also  `mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB), mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB), mlib_ImageSConvKernelConvert(3MLIB), attributes(5)`
The `mlib_ImageConvKernelConvert()` function converts a floating-point convolution kernel to an integer kernel with its scaling factor suitable to be used in convolution functions.

The function takes the following arguments:

- `ikernel` Pointer to integer convolution kernel, in row major order.
- `iscale` Pointer to scaling factor of the integer convolution kernel.
- `fkernel` Pointer to floating-point convolution kernel, in row major order.
- `m` Width of the convolution kernel. \( m \geq 1 \).
- `n` Height of the convolution kernel. \( n \geq 1 \).
- `type` The image type. It can be one of the following:
  - MLIB_BIT
  - MLIB_BYTE
  - MLIB_SHORT
  - MLIB_USHORT
  - MLIB_INT

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

See Also

- `mlib_ImageConv2x2(3MLIB)`
- `mlib_ImageConv2x2_Fp(3MLIB)`
- `mlib_ImageConv2x2Index(3MLIB)`
- `mlib_ImageConv3x3(3MLIB)`
- `mlib_ImageConv3x3_Fp(3MLIB)`
- `mlib_ImageConv3x3Index(3MLIB)`
- `mlib_ImageConv4x4(3MLIB)`
- `mlib_ImageConv4x4_Fp(3MLIB)`
- `mlib_ImageConv4x4Index(3MLIB)`
- `mlib_ImageConv5x5(3MLIB)`
- `mlib_ImageConv5x5_Fp(3MLIB)`
- `mlib_ImageConv5x5Index(3MLIB)`
- `mlib_ImageConv7x7(3MLIB)`
- `mlib_ImageConv7x7_Fp(3MLIB)`
- `mlib_ImageConv7x7Index(3MLIB)`
- `mlib_ImageConvMxN(3MLIB)`
- `mlib_ImageConvolveMxN_Fp(3MLIB)`
- `mlib_ImageConvolveMxN(3MLIB)`
mlib(ImageConvKernelConvert(3MLIB))

mlib(ImageSConv3x3(3MLIB), mlib(ImageSConv3x3_Fp(3MLIB),
mlib(ImageSConv5x5(3MLIB), mlib(ImageSConv5x5_Fp(3MLIB),
mlib(ImageSConv7x7(3MLIB), mlib(ImageSConv7x7_Fp(3MLIB),
mlib(ImageSConvKernelConvert(3MLIB), attributes(5))
The `mlib_ImageConvMxN()` function performs an MxN convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at \((dm, dn)\) of the kernel matrix.

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **kernel**: Pointer to the convolution kernel, in row-major order.
- **m**: Width of the convolution kernel. \(m \geq 1\).
- **n**: Height of the convolution kernel. \(n \geq 1\).
- **dm**: X coordinate of the key element in the convolution kernel. \(0 \leq dm < m\).
- **dn**: Y coordinate of the key element in the convolution kernel. \(0 \leq dn < n\).
- **scale**: Scaling factor.
- **cmask**: Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.
- **edge**: Type of edge condition. It can be one of the following:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} \text{src}[x+p][y+q][i] \times k[p][q] \times 2^{-\text{scale}}
\]
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<tr>
<th>ATTRIBUTE TYPE</th>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
          mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
          mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
          mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
          mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
          mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),
          mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
          mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),
          mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
          mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
          mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
          mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
          mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
          mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
### Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConvMxN_Fp(mlib_image *dst, const mlib_image *src,
const mlib_d64 *kernel, mlib_s32 m, mlib_s32 n, mlib_s32 dm,
mlib_s32 dn, mlib_s32 cmask, mlib_edge edge);
```

### Description

The `mlib_ImageConvMxN_Fp()` function performs a MxN convolution on the source image by using the user-supplied kernel.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

For this convolution, the key element of the convolution kernel is located at \((d_m, d_n)\) of the kernel matrix.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-d_m}^{m-1-d_m} \sum_{q=-d_n}^{n-1-d_n} src[x+p][y+q][i] \times kernel[p][q]
\]

where \(m \geq 1\), \(n \geq 1\), \(0 \leq d_m < m\), \(0 \leq d_n < n\).

### Parameters

The function takes the following arguments:

- `dst`  
  Pointer to destination image.

- `src`  
  Pointer to source image.

- `kernel`  
  Pointer to the convolution kernel, in row major order.

- `m`  
  Width of the convolution kernel. \(m \geq 1\).

- `n`  
  Height of the convolution kernel. \(n \geq 1\).

- `dm`  
  X coordinate of the key element in the convolution kernel. \(0 \leq d_m < m\).

- `dn`  
  Y coordinate of the key element in the convolution kernel. \(0 \leq d_n < n\).

- `cmask`  
  Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to bits with a value of 1 are those to be processed. For a single-channel image, the channel mask is ignored.

- `edge`  
  Type of edge condition. It can be one of the following:

  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
MLIB_EDGE_SRC_EXTEND

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Indexx3(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv4x4Index(3MLIB),
mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB),
mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv5x5Index(3MLIB),
mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),
mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxNIndex(3MLIB),
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), attributes(5)
mlib_ImageConvMxNIndex

**Name**
mlib_ImageConvMxNIndex - MxN convolution on a color indexed image

**Synopsis**
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConvMxNIndex(mlib_image *dst, const mlib_image *src,
    const mlib_s32 *kernel, mlib_s32 m, mlib_s32 n, mlib_s32 dm,
    mlib_s32 dn, mlib_s32 scale, mlib_edge edge, const void *colormap);

**Description**
The mlib_ImageConvMxNIndex() function performs a MxN convolution on the color indexed
source image by using the user-supplied kernel.

The input and output images must have the same image type and size.

For this convolution, the key element of the convolution kernel is located at (dm, dn) of the
kernel matrix.

This function performs the convolution on a color indexed image. The input image and the
output image must be single-channel images. The image type must be MLIB_BYTE or
MLIB_SHORT.

It uses the following equation:

$$dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i] * k[p][q] * 2^{-\text{scale}}$$

where m > 1, n > 1, 0 ≤ dm < m, 0 ≤ dn < n.

**Parameters**
The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **kernel**: Pointer to the convolution kernel, in row major order.
- **m**: Width of the convolution kernel. m > 1.
- **n**: Height of the convolution kernel. n > 1.
- **dm**: X coordinate of the key element in the convolution kernel. 0 ≤ dm < m.
- **dn**: Y coordinate of the key element in the convolution kernel. 0 ≤ dn < n.
- **scale**: Scaling factor.
- **edge**: Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SRC_EXTEND
**colormap**  Internal data structure for inverse color mapping. This data structure is generated by the *mlib_ImageColorTrue2IndexInit()* function.

**Return Values**  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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**See Also**  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB), mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB), mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
mlib_ImageConvolveMxN — MxN convolution, with kernel analysis for taking advantage of special cases

Synopsis

```c
#include <mlib.h>
mlib_status mlib_ImageConvolveMxN(mlib_image *dst, const mlib_image *src,
const mlib_d64 *kernel, mlib_s32 m, mlib_s32 n, mlib_s32 dm,
mlib_s32 dn, mlib_s32 cmask, mlib_edge edge);
```

Description

The `mlib_ImageConvolveMxN()` function analyzes the convolution kernel, converts the floating-point kernel to an integer kernel, then performs a MxN convolution on the source image by calling either one of the functions like `mlib_ImageSConv3x3()`, `mlib_ImageConv3x3()`, and etc. in special cases or `mlib_ImageConvMxN()` in other cases.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i] \times k[p][q]
\]

where \( m \geq 1, n \geq 1, 0 \leq dm < m, 0 \leq dn < n \).

Parameters

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **kernel** Pointer to the convolution kernel, in row major order.
- **m** Width of the convolution kernel. \( m \geq 1 \).
- **n** Height of the convolution kernel. \( n \geq 1 \).
- **dm** X coordinate of the key element in the convolution kernel. \( 0 \leq dm < m \).
- **dn** Y coordinate of the key element in the convolution kernel. \( 0 \leq dn < n \).
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single-channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB), mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB), mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB), mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB), mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB), mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB), mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB), mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB), mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
Name mlib_ImageConvolveMxN_Fp - MxN convolution, with kernel analysis for taking advantage of special cases

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageConvolveMxN_Fp(mlib_image *dst,
const mlib_image *src, const mlib_d64 *kernel, mlib_s32 m,
mlib_s32 n, mlib_s32 dm, mlib_s32 dn, mlib_s32 cmask, mlib_edge edge);

Description The mlib_ImageConvolveMxN_Fp() function analyzes the convolution kernel, then performs a MxN convolution on the source image by calling either one of the functions like mlib_ImageSConv3x3_Fp(), mlib_ImageConv3x3_Fp(), and etc. in special cases or mlib_ImageConvMxN_Fp() in other cases.

The input image and the output image must have the same image type and have the same number of channels. The unselected channels in the output image are not overwritten. For single-channel images, the channel mask is ignored.

It uses the following equation:

\[ \text{dst}[x][y][i] = \sum \sum \text{src}[x+p][y+q][i] \times k[p][q] \]

\[ p=-\text{dm} \quad q=-\text{dn} \]

where \( m \geq 1, n \geq 1, 0 \leq dm < m, 0 \leq dn < n \).

Parameters The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.
kernel Pointer to the convolution kernel, in row major order.
m Width of the convolution kernel. \( m \geq 1 \).
n Height of the convolution kernel. \( n \geq 1 \).

dm X coordinate of the key element in the convolution kernel. \( 0 \leq dm < m \).

dn Y coordinate of the key element in the convolution kernel. \( 0 \leq dn < n \).

cmask Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single-channel image, the channel mask is ignored.

edge Type of edge condition. It can be one of the following:

MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_DST_COPY_SRC
MLIB_EDGE_SRC_EXTEND
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mli b_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
           mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
           mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
           mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
           mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
           mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),
           mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
           mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),
           mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB),
           mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB),
           mlib_Ima geConv3x3(3MLIB), mlib_ImageConv3x3_Fp(3MLIB),
           mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
           mlib_ImageSConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
           mlib_ImageConvKernelConvert(3MLIB), attributes(5)
Name  mlib_ImageCopy – image copy

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageCopy(mlib_image *dst, const mlib_image *src);

Description  The mlib_ImageCopy() function copies the source image to the destination image. The data
type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT,  
MLIB_FLOAT, or MLIB_DOUBLE.

It uses the following equation:
dst[x][y][i] = src[x][y][i]

Parameters  The function takes the following arguments:

dst  Pointer to destination image.
src  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageCopyArea(3MLIB), mlib_ImageCopyMask(3MLIB),  
mlib_ImageCopyMask_Fp(3MLIB), mlib_ImageCopySubimage(3MLIB), attributes(5)
**Name**
mlib_ImageCopyArea – copy an area

**Synopsis**
```plaintext
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageCopyArea(mlib_image *img, mlib_s32 x, mlib_s32 y,
                               mlib_s32 w, mlib_s32 h, mlib_s32 dx, mlib_s32 dy);
```

**Description**
The `mlib_ImageCopyArea()` function copies a specified rectangular area from one portion of the image to another portion of the same image. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

It uses the following equation:
```
img[x+dx+i][y+dy+j][i] = img[x+i][y+j][i]
```
where \( i = 0, 1, \ldots, w-1; \ j = 0, 1, \ldots, h-1. \)

**Parameters**
The function takes the following arguments:
- **img** Pointer to source image.
- **x** X coordinate of the area origin in the source.
- **y** Y coordinate of the area origin in the source.
- **w** Width of the area to be copied.
- **h** Height of the area to be copied.
- **dx** Horizontal displacement in pixels of the area to be copied.
- **dy** Vertical displacement in pixels of the area to be copied.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
- mlib_ImageCopy(3MLIB)
- mlib_ImageCopyMask(3MLIB)
- mlib_ImageCopyMask_Fp(3MLIB)
- mlib_ImageCopySubimage(3MLIB)
- attributes(5)
The `mlib_ImageCopyMask()` function copies one image to another image via a mask image by using it as a yes/no indicator. The data type of the images can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

It uses the following equation:

\[
\text{dst}[x][y][i] = \text{src}[x][y][i] \text{ if } \text{mask}[x][y][i] \leq \text{thresh}[i] \\
\text{dst}[x][y][i] = \text{dst}[x][y][i] \text{ if } \text{mask}[x][y][i] > \text{thresh}[i]
\]

**Parameters**

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `mask` Pointer to mask image.
- `thresh` Threshold for the mask image. `thresh[i]` contains the threshold for channel `i`.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_ImageCopy(3MLIB), mlib_ImageCopyArea(3MLIB), mlib_ImageCopyMask_Fp(3MLIB), mlib_ImageCopySubimage(3MLIB), attributes(5)`
The `mlib_ImageCopyMask_Fp()` function copies one image to another image via a mask image by using it as a yes/no indicator. The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][i] &= \text{src}[x][y][i] \text{ if mask}[x][y][i] \leq \text{thresh}[i] \\
\text{dst}[x][y][i] &= \text{dst}[x][y][i] \text{ if mask}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

**Parameters**

The function takes the following arguments:

- **dst**  : Pointer to destination image.
- **src**  : Pointer to source image.
- **mask** : Pointer to mask image.
- **thresh** : Threshold for the mask image. thresh[i] contains the threshold for channel i.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

`mlib_ImageCopy(3MLIB), mlib_ImageCopyArea(3MLIB), mlib_ImageCopyMask(3MLIB), mlib_ImageCopySubimage(3MLIB), attributes(5)`
The `mlib_ImageCopySubimage()` function copies a specified rectangular area from one image to a specified area of another image. The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

It uses the following equation:

\[ \text{dst}[xd+i][yd+j][i] = \text{src}[xs+i][ys+j][i] \]

where \( i = 0, 1, \ldots, w-1 \); \( j = 0, 1, \ldots, h-1 \).

### Parameters
- **`dst`**: Pointer to destination image.
- **`src`**: Pointer to source image.
- **`xd`**: X coordinate of the area origin in the destination.
- **`yd`**: Y coordinate of the area origin in the destination.
- **`xs`**: X coordinate of the area origin in the source.
- **`ys`**: Y coordinate of the area origin in the source.
- **`w`**: Width of the area to be copied.
- **`h`**: Height of the area to be copied.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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### See Also
- `mlib_ImageCopy(3MLIB)`, `mlib_ImageCopyArea(3MLIB)`, `mlib_ImageCopyMask(3MLIB)`, `mlib_ImageCopyMask_Fp(3MLIB)`
The `mlib_ImageCreate()` function creates a mediaLib image data structure and allocates memory space for image data. The data type of the image can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

To obtain the best performance, it is recommended that you use this function to create a mediaLib image whenever possible, as this guarantees alignment.

The function takes the following arguments:

- `type`  
  Image data type.
- `channels`  
  Number of channels in the image.
- `width`  
  Width of image in pixels.
- `height`  
  Height of image in pixels.

The function returns a pointer to the `mlib_image` data structure.

See attributes(5) for descriptions of the following attributes:

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See Also  
`mlib_ImageCreateStruct(3MLIB)`, `mlib_ImageCreateSubimage(3MLIB)`,  
`mlib_ImageDelete(3MLIB)`, `mlib_ImageSetPaddings(3MLIB)`, attributes(5)
mlib_ImageCreateStruct(3MLIB)

**Name**
mlib_ImageCreateStruct – image structure creation

**Synopsis**

c{ [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_image *mlib_ImageCreateStruct(mlib_type type, mlib_s32 channels,
mlib_s32 width, mlib_s32 height, mlib_s32 stride, const void *datbuf);

**Description**
The mlib_ImageCreateStruct() function creates a mediaLib image data structure with parameters supplied by the user.

**Parameters**
The function takes the following arguments:

- **type**: Image data type. It can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT,
MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

- **channels**: Number of channels in the image.

- **width**: Width of image in pixels.

- **height**: Height of image in pixels.

- **stride**: Stride of each row of the data space in bytes.

- **datbuf**: Pointer to the image data buffer.

**Return Values**
The function returns a pointer to the mlib_image data structure.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_ImageCreate(3MLIB), mlib_ImageCreateSubimage(3MLIB),
mlib_ImageSetStruct(3MLIB), mlib_ImageResetStruct(3MLIB),
mlib_ImageDelete(3MLIB), mlib_ImageSetFormat(3MLIB),
mlib_ImageSetPaddings(3MLIB), attributes(5)
**Name**
mlib_ImageCreateSubimage – subimage creation

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_image *mlib_ImageCreateSubimage(mlib_image *img,
                                     mlib_s32 x,
                                     mlib_s32 y,
                                     mlib_s32 w,
                                     mlib_s32 h);
```

**Description**
The `mlib_ImageCreateSubimage()` function creates a mediaLib image data structure for a subimage based on a source image. Note that the memory space of the source image data is used for the subimage data. The data type of the image can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

**Parameters**
The function takes the following arguments:
- `img` Pointer to source image.
- `x` X coordinate of subimage origin in the source.
- `y` Y coordinate of subimage origin in the source.
- `w` Width of the subimage in pixels.
- `h` Height of the subimage in pixels.

**Return Values**
The function returns a pointer to the `mlib_image` data structure.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageCreate(3MLIB), mlib_ImageCreateStruct(3MLIB), mlib_ImageDelete(3MLIB), mlib_ImageSetPaddings(3MLIB), attributes(5)`
# mlib_ImageCrossCorrel(3MLIB)

## Name
mlib_ImageCrossCorrel – cross correlation

## Synopsis
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageCrossCorrel(mlib_d64 *correl, const mlib_image *img1,
                                 const mlib_image *img2);
```

## Description
The `mlib_ImageCrossCorrel` function computes the cross-correlation between a pair of images.

It uses the following equation:

\[
    \text{correl}[i] = \frac{1}{\text{w}\times\text{h}} \sum_{x=0}^{\text{w}-1} \sum_{y=0}^{\text{h}-1} (\text{img1}[x][y][i] \times \text{img2}[x][y][i])
\]

where w and h are the width and height of the images, respectively.

## Parameters
The function takes the following arguments:

- **correl**
  Pointer to cross correlation array on a channel basis. The array must be the size of channels in the images. `correl[i]` contains the cross-correlation of channel i.

- **img1**
  Pointer to first image.

- **img2**
  Pointer to second image.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See attributes(5) for descriptions of the following attributes:

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## See Also
mlib_ImageAutoCorrel(3MLIB), mlib_ImageAutoCorrel_Fp(3MLIB), mlib_ImageCrossCorrel_Fp(3MLIB), mlib_ImageNormCrossCorrel(3MLIB), mlib_ImageNormCrossCorrel_Fp(3MLIB), attributes(5)
mlib_ImageCrossCorrel_Fp(3MLIB)

Name  mlib_ImageCrossCorrel_Fp – cross correlation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          #include <mlib.h>

          mlib_status mlib_ImageCrossCorrel_Fp(mlib_d64 *correl,
                           const mlib_image *img1,
                           const mlib_image *img2);

Description  The mlib_ImageCrossCorrel_Fp() function computes the cross-correlation between a pair of floating-point images.

It uses the following equation:

\[
\text{correl}[i] = \frac{1}{w \times h} \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} (\text{img1}[x][y][i] \times \text{img2}[x][y][i])
\]

where \(w\) and \(h\) are the width and height of the images, respectively.

Parameters  The function takes the following arguments:

- **correl**: Pointer to cross correlation array on a channel basis. The array must be the size of channels in the images. \(\text{correl}[i]\) contains the cross-correlation of channel \(i\).
- **img1**: Pointer to first image.
- **img2**: Pointer to second image.

Return Values  The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageAutoCorrel(3MLIB), mlib_ImageAutoCorrel_Fp(3MLIB),
          mlib_ImageCrossCorrel(3MLIB), mlib_ImageNormCrossCorrel(3MLIB),
          mlib_ImageNormCrossCorrel_Fp(3MLIB), attributes(5)
The `mlib_ImageDataTypeConvert()` function converts between data types `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, and `MLIB_DOUBLE`.

The input and output data images must have the same width, height, and number of channels. Conversion to a smaller pixel format clamps the source value to the dynamic range of the destination pixel.

See the following table for available variations of the data type conversion function.

<table>
<thead>
<tr>
<th>Source Type</th>
<th>Dest. Type</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_BIT</td>
<td>$(x &gt; 0) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_BIT</td>
<td>$(x &gt; 0) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_BIT</td>
<td>$(x &gt; 0) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_BIT</td>
<td>$(x &gt; 0) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_BIT</td>
<td>$(x &gt; 0) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_BIT</td>
<td>$(x &gt; 0) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_BIT</td>
<td>MLIB_BYTE</td>
<td>$(x == 1) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_BYTE</td>
<td>$(\text{mlib}_u8)\text{clamp}(x, 0, 255)$</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_BYTE</td>
<td>$(\text{mlib}_u8)\text{clamp}(x, 0, 255)$</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_BYTE</td>
<td>$(\text{mlib}_u8)\text{clamp}(x, 0, 255)$</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_BYTE</td>
<td>$(\text{mlib}_u8)\text{clamp}(x, 0, 255)$</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_BYTE</td>
<td>$(\text{mlib}_u8)\text{clamp}(x, 0, 255)$</td>
</tr>
<tr>
<td>MLIB_BIT</td>
<td>MLIB_SHORT</td>
<td>$(x == 1) , ? , 1 : 0$</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_SHORT</td>
<td>$(\text{mlib}_s16)x$</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_SHORT</td>
<td>$(\text{mlib}_s16)\text{clamp}(x, -32768, 32767)$</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_SHORT</td>
<td>$(\text{mlib}_s16)\text{clamp}(x, -32768, 32767)$</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_SHORT</td>
<td>$(\text{mlib}_s16)\text{clamp}(x, -32768, 32767)$</td>
</tr>
<tr>
<td>Source Type</td>
<td>Dest. Type</td>
<td>Action</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_SHORT</td>
<td>(mlib_s16)clamp(x, -32768, 32767)</td>
</tr>
<tr>
<td>MLIB_BIT</td>
<td>MLIB_USHORT</td>
<td>(x == 1) ? 1 : 0</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_BIT</td>
<td>MLIB_INT</td>
<td>(x == 1) ? 1 : 0</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_INT</td>
<td>(mlib_s32)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_INT</td>
<td>(mlib_s32)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_INT</td>
<td>(mlib_s32)x</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_INT</td>
<td>(mlib_s32)clamp(x, -2147483647-1, 2147483647)</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_INT</td>
<td>(mlib_s32)clamp(x, -2147483647-1, 2147483647)</td>
</tr>
<tr>
<td>MLIB_BIT</td>
<td>MLIB_FLOAT</td>
<td>(x == 1) ? 1.0 : 0</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_BIT</td>
<td>MLIB_DOUBLE</td>
<td>(x == 1) ? 1.0 : 0</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
</tbody>
</table>

Multimedia Library Functions - Part 2 345
The actions are defined in C-style pseudo-code. All type casts follow the rules of standard C. `clamp()` can be defined as a macro:

```c
#define clamp(x, low, high) (((x) < (low)) ? (low) : (((x) > (high)) ? (high) : (x)))
```

**Parameters**
The function takes the following arguments:

- `dst`  Pointer to destination image.
- `src`  Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
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</tbody>
</table>

**See Also**
`mlib_ImageDataTypeConvert(3MLIB), attributes(5)`
**Name**
mlib_ImageDelete – image delete

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_ImageDelete(mlib_image *img);
```

**Description**
The `mlib_ImageDelete()` function deletes the mediaLib image data structure and frees the memory space of the image data only if it is allocated through `mlib_ImageCreate()`. The data type of the image can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

**Parameters**
The function takes the following arguments:

- `img` Pointer to mediaLib image structure.

**Return Values**
None.

**Attributes**
See [attributes(5)] for descriptions of the following attributes:

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<th>ATTRIBUTE TYPE</th>
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</tbody>
</table>

**See Also**
`mlib_ImageCreate(3MLIB)`, `mlib_ImageCreateStruct(3MLIB)`,
`mlib_ImageCreateSubimage(3MLIB)`, [attributes(5)]
The `mlib_ImageDilate4()` function performs a dilation operation on an image by using each pixel's four orthogonal neighbors. The source and destination images must be single-channel images. The data type can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

For 4-neighbor binary images, it uses the following equation:

\[
dst[x][y][0] = \text{OR}\{ \text{src}[x][y][0], \text{src}[x-1][y][0], \text{src}[x+1][y][0], \text{src}[x][y-1][0], \text{src}[x][y+1][0] \}
\]

For 4-neighbor grayscale images, it uses the following equation:

\[
dst[x][y][0] = \text{MAX}\{ \text{src}[x][y][0], \text{src}[x-1][y][0], \text{src}[x+1][y][0], \text{src}[x][y-1][0], \text{src}[x][y+1][0] \}
\]

where \(x = 1, \ldots, w-2; y = 1, \ldots, h-2\).

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

**See Also**
`mlib_ImageDilate4_Fp(3MLIB), mlib_ImageDilate8(3MLIB), mlib_ImageDilate8_Fp(3MLIB), attributes(5)`
The `mlib_ImageDilate4_Fp()` function performs a floating-point dilation operation on an image by using each pixel’s four orthogonal neighbors. The source and destination images must be single-channel images. The data type can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

For 4-neighbor grayscale images, it uses the following equation:

\[
\text{dst}[x][y][0] = \max\{ \text{src}[x][y][0], \text{src}[x-1][y][0], \text{src}[x+1][y][0], \text{src}[x][y-1][0], \text{src}[x][y+1][0] \}
\]

where \( x = 1, \ldots, w-2; y = 1, \ldots, h-2 \).

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
`mlib_ImageDilate4(3MLIB), mlib_ImageDilate8(3MLIB),
mlib_ImageDilate8_Fp(3MLIB), attributes(5)`
The `mlib_ImageDilate8()` function performs a dilation operation on an image by using all eight of each pixel's neighbors. The source and destination images must be single-channel images. The data type can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

For 8-neighbor binary images, it uses the following equation:
\[
dst[x][y][0] = \text{OR}\{ \text{src}[p][q][0], \quad x-1 \leq p \leq x+1; y-1 \leq q \leq y+1 \}
\]

For 8-neighbor grayscale images, it uses the following equation:
\[
dst[x][y][0] = \text{MAX}\{ \text{src}[p][q][0], \quad x-1 \leq p \leq x+1; y-1 \leq q \leq y+1 \}
\]

where \( x = 1, \ldots, w-2; \ y = 1, \ldots, h-2. \)

The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

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</thead>
<tbody>
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</tr>
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</tr>
</tbody>
</table>

See Also `mlib_ImageDilate4(3MLIB), mlib_ImageDilate4_Fp(3MLIB), mlib_ImageDilate8_Fp(3MLIB), attributes(5)`
The `mlib_ImageDilate8_Fp()` function performs a floating-point dilation operation on an image by using all eight of each pixel's neighbors. The source and destination images must be single-channel images. The data type can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

For 8-neighbor grayscale images, it uses the following equation:

\[
\text{dst}[x][y][0] = \text{MAX}\{ \text{src}[p][q][0], \\
\quad x-1 \leq p \leq x+1; \quad y-1 \leq q \leq y+1\}
\]

where \( x = 1, \ldots, \text{w}-2; \quad y = 1, \ldots, \text{h}-2. \)

### Parameters
- **dst** Pointer to destination image.
- **src** Pointer to source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
- `mlib_ImageDilate4(3MLIB)`, `mlib_ImageDilate4_Fp(3MLIB)`
- `mlib_ImageDilate8(3MLIB)`, `attributes(5)`
The `mlib_ImageDiv1_Fp_Inp()` function divides the second floating-point source image into the first floating-point source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
src1dst[x][y][i] = src1dst[x][y][i] / src2[x][y][i]
\]

where the operation follows the IEEE-754 standard.

### Parameters

- **src1dst** Pointer to first source and destination image.
- **src2** Pointer to second source image.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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<tr>
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</tbody>
</table>

See Also `mlib_ImageDiv_Fp(3MLIB), mlib_ImageDiv2_Fp_Inp(3MLIB), attributes(5)`
The `mlib_ImageDiv2_Fp_Inp()` function divides the second floating-point source image into the first floating-point source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{src2dst}[x][y][i] = \frac{\text{src1}[x][y][i]}{\text{src2dst}[x][y][i]} \]

where the operation follows the IEEE-754 standard.

### Parameters

- `src2dst` Pointer to second source and destination image.
- `src1` Pointer to first source image.

### Return Values

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Attributes

See [attributes(5)] for descriptions of the following attributes:

<table>
<thead>
<tr>
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<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_ImageDiv_Fp(3MLIB)`, `mlib_ImageDiv1_Fp_Inp(3MLIB)`, [attributes(5)]
# mlib_ImageDivAlpha

The `mlib_ImageDivAlpha()` function divides color channels by the alpha channel on a pixel-by-pixel basis.

For the `MLIB_BYTE` image, it uses the following equation:

\[
dst[x][y][c] = src[x][y][c] / (src[x][y][a] \times 2^{-8})
\]

For the `MLIB_SHORT` image, it uses the following equation:

\[
dst[x][y][c] = src[x][y][c] / (src[x][y][a] \times 2^{-15})
\]

For the `MLIB_USHORT` image, it uses the following equation:

\[
dst[x][y][c] = src[x][y][c] / (src[x][y][a] \times 2^{-16})
\]

For the `MLIB_INT` image, it uses the following equation:

\[
dst[x][y][c] = src[x][y][c] / (src[x][y][a] \times 2^{-31})
\]

where \(c\) and \(a\) are the indices for the color channels and the alpha channel, respectively, so \(c \neq a\).

In the case of \(src[x][y][a] = 0\),

\[
\begin{align*}
dst[x][y][c] &= 0 & \text{if } src[x][y][c] = 0 \\
dst[x][y][c] &= \text{DATA\_TYPE\_MAX} & \text{if } src[x][y][c] > 0 \\
dst[x][y][c] &= \text{DATA\_TYPE\_MIN} & \text{if } src[x][y][c] < 0
\end{align*}
\]

where `DATA\_TYPE` is `MLIB_U8`, `MLIB_S16`, `MLIB_U16`, or `MLIB_S32` for an image of type `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`, respectively.

## Parameters

The function takes the following arguments:

- `dst`  Pointer to destination image.
- `src`  Pointer to source image.
- `cmask`  Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`. 

## Attributes

See attributes(5) for descriptions of the following attributes:

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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

mlib_ImageDivAlpha_Inp(3MLIB), mlib_ImageDivAlpha_fp(3MLIB), mlib_ImageDivAlpha_fp_Inp(3MLIB), attributes(5)
The `mlib_ImageDivAlpha_Fp()` function divides floating-point color channels by the alpha channel on a pixel-by-pixel basis.

It uses the following equation:
\[
dst[x][y][c] = src[x][y][c] / src[x][y][a]
\]

where \(c\) and \(a\) are the indices for the color channels and the alpha channel, respectively, so \(c \neq a\).

The operation follows the IEEE-754 standard.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `cmask` Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageDivAlpha(3MLIB), mlib_ImageDivAlpha_Fp_Inp(3MLIB), mlib_ImageDivAlpha_Inp(3MLIB), attributes(5)`
The `mlib_ImageDivAlpha_Fp_Inp()` function divides floating-point color channels by the alphachannel on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{srcdst}[x][y][c] = \frac{\text{srcdst}[x][y][c]}{\text{srcdst}[x][y][a]} \]

where \( c \) and \( a \) are the indices for the color channels and the alpha channel, respectively, so \( c \neq a \).

The operation follows the IEEE-754 standard.

**Parameters**

- `srcdst` Pointer to source and destination image.
- `cmask` Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

**See Also**

- `mlib_ImageDivAlpha(3MLIB)`, `mlib_ImageDivAlpha_Fp(3MLIB)`, `mlib_ImageDivAlpha_Inp(3MLIB)`, `attributes(5)`
The `mlib_ImageDivAlpha_Inp()` function divides color channels by the alpha channel on a pixel-by-pixel basis, in place.

### Parameters

- **srcdst**
  - Pointer to source and destination image.

- **cmask**
  - Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

### Return Values

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Attributes

See [attributes(5)](attributes(5)) for descriptions of the following attributes:

```c
#include <mlib.h>

mlib_status mlib_ImageDivAlpha_Inp(mlib_image *srcdst, mlib_s32 cmask);
```

For the **MLIB_BYTE** image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \frac{\text{srcdst}[x][y][c]}{(\text{srcdst}[x][y][a] \times 2^{-8})}
\]

For the **MLIB_SHORT** image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \frac{\text{srcdst}[x][y][c]}{(\text{srcdst}[x][y][a] \times 2^{-15})}
\]

For the **MLIB_USHORT** image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \frac{\text{srcdst}[x][y][c]}{(\text{srcdst}[x][y][a] \times 2^{-16})}
\]

For the **MLIB_INT** image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \frac{\text{srcdst}[x][y][c]}{(\text{srcdst}[x][y][a] \times 2^{-31})}
\]

where `c` and `a` are the indices for the color channels and the alpha channel, respectively, so `c != a`.

In the case of `srcdst[x][y][a] = 0`,

- `srcdst[x][y][c] = 0` if `srcdst[x][y][c] = 0`
- `srcdst[x][y][c] = DATA_TYPE_MAX` if `srcdst[x][y][c] > 0`
- `srcdst[x][y][c] = DATA_TYPE_MIN` if `srcdst[x][y][c] < 0`

where `DATA_TYPE` is **MLIB_U8**, **MLIB_S16**, **MLIB_U16**, or **MLIB_S32** for an image of type **MLIB_BYTE**, **MLIB_SHORT**, **MLIB_USHORT**, or **MLIB_INT**, respectively.

### Name

**mlib_ImageDivAlpha_Inp** – alpha channel division, in place

### Synopsis

```c
cc [ flag... ] file... -tmlib [ library... ]

#include <mlib.h>

mlib_status mlib_ImageDivAlpha_Inp(mlib_image *srcdst, mlib_s32 cmask);
```
<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
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<tr>
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</tr>
</tbody>
</table>

See Also  `mlib_ImageDivAlpha(3MLIB), mlib_ImageDivAlpha_Fp(3MLIB), mlib_ImageDivAlpha_Fp_Inp(3MLIB), attributes(5)`
The `mlib_ImageDivConstShift()` function divides each pixel in an image by a constant value on a pixel-by-pixel basis. It scales the result by a left shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[ \text{dst}[x][y][i] = \frac{\text{src}[x][y][i]}{c[i]} \times 2^{\text{shift}} \]

In the case of \( c[i] = 0 \),

\[ \text{dst}[x][y][i] = \begin{cases} 0 & \text{if src}[x][y][i] = 0 \\ \text{DATA_TYPE_MAX} & \text{if src}[x][y][i] > 0 \\ \text{DATA_TYPE_MIN} & \text{if src}[x][y][i] < 0 \end{cases} \]

where `DATA_TYPE` is `MLIB_U8`, `MLIB_S16`, `MLIB_U16`, or `MLIB_S32` for an image of type `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`, respectively.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `c` Constant by which each pixel is divided. `c[i]` contains the constant for channel `i`.
- `shift` Left shifting factor. \( 0 \leq \text{shift} \leq 31 \).

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageDivConstShift_Inp(3MLIB)`, attributes(5)
The `mlib_ImageDivConstShift_Inp()` function divides each pixel in an image by a constant value on a pixel-by-pixel basis, in place. It scales the result by a left shift and writes the result to the image on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = \frac{\text{srcdst}[x][y][i]}{c[i]} \times 2^{\text{shift}}
\]

In the case of \(c[i] = 0\),

- \(\text{srcdst}[x][y][i] = 0\) if \(\text{srcdst}[x][y][i] = 0\)
- \(\text{srcdst}[x][y][i] = \text{DATA\_TYPE\_MAX}\) if \(\text{srcdst}[x][y][i] > 0\)
- \(\text{srcdst}[x][y][i] = \text{DATA\_TYPE\_MIN}\) if \(\text{srcdst}[x][y][i] < 0\)

where `DATA\_TYPE` is `MLIB\_U8`, `MLIB\_S16`, `MLIB\_U16`, or `MLIB\_S32` for an image of type `MLIB\_BYTE`, `MLIB\_SHORT`, `MLIB\_USHORT`, or `MLIB\_INT`, respectively.

**Parameters**

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `c` Constant by which each pixel is divided. `c[i]` contains the constant for channel `i`.
- `shift` Left shifting factor. \(0 \leq \text{shift} \leq 31\).

**Return Values**

The function returns `MLIB\_SUCCESS` if successful. Otherwise it returns `MLIB\_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageDivConstShift(3MLIB), attributes(5)`
mlib_ImageDiv_Fp() function divides the second floating-point source image into the first floating-point source image on a pixel-by-pixel basis.

It uses the following equation:
\[ \text{dst}[x][y][i] = \frac{\text{src1}[x][y][i]}{\text{src2}[x][y][i]} \]

where the operation follows the IEEE-754 standard.

The function takes the following arguments:
- **dst**: Pointer to destination image.
- **src1**: Pointer to first source image.
- **src2**: Pointer to second source image.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageDiv1_Fp_Inp(3MLIB), mlib_ImageDiv2_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageDivShift1_Inp()` function divides the second source image into the first source image on a pixel-by-pixel basis. It scales the result by a left shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{src1dst}[x][y][i] = \text{src1dst}[x][y][i] / \text{src2}[x][y][i] \times 2^{\text{shift}}
\]

In the case of `\text{src2}[x][y][i] = 0`,

\[
\text{src1dst}[x][y][i] = 0 \quad \text{if} \quad \text{src1dst}[x][y][i] = 0
\]

\[
\text{src1dst}[x][y][i] = \text{DATA\_TYPE\_MAX} \quad \text{if} \quad \text{src1dst}[x][y][i] > 0
\]

\[
\text{src1dst}[x][y][i] = \text{DATA\_TYPE\_MIN} \quad \text{if} \quad \text{src1dst}[x][y][i] < 0
\]

where `DATA\_TYPE` is `MLIB_U8`, `MLIB_S16`, `MLIB_U16`, or `MLIB_S32` for an image of type `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`, respectively.

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.
- `shift` Left shifting factor. \(0 \leq \text{shift} \leq 31\).

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageDivShift(3MLIB), mlib_ImageDivShift2_Inp(3MLIB), attributes(5)`
Reference

Multimedia Library Functions - Part 3
Name
mlib_ImageDivShift2_Inp – division with shifting, in place

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageDivShift2_Inp(mlib_image *src2dst,
const mlib_image *src1, mlib_s32 shift);

Description
The mlib_ImageDivShift2_Inp() function divides the second source image into the first
source image on a pixel-by-pixel basis. It scales the result by a left shift and writes the result to
the destination image on a pixel-by-pixel basis.

It uses the following equation:
src2dst[x][y][i] = src1[x][y][i] / src2dst[x][y][i] * 2**shift

In the case of src2dst[x][y][i] = 0,
src2dst[x][y][i] = 0 if src1[x][y][i] = 0
src2dst[x][y][i] = DATA_TYPE_MAX if src1[x][y][i] > 0
src2dst[x][y][i] = DATA_TYPE_MIN if src1[x][y][i] < 0

where DATA_TYPE is MLIB_U8, MLIB_S16, MLIB_U16, or MLIB_S32 for an image of type
MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT, respectively.

Parameters
The function takes the following arguments:

src2dst Pointer to second source and destination image.
src1 Pointer to first source image.
shift Left shifting factor. 0 ≤ shift ≤ 31.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageDivShift(3MLIB), mlib_ImageDivShift1_Inp(3MLIB), attributes(5)
**mlib_ImageDivShift**

**Synopsis**

```c
#include <mlib.h>

mlib_status mlib_ImageDivShift(mlib_image *dst, const mlib_image *src1, const mlib_image *src2, mlib_s32 shift);
```

**Description**

The `mlib_ImageDivShift()` function divides the second source image into the first source image on a pixel-by-pixel basis. It scales the result by a left shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = \text{src1}[x][y][i] / \text{src2}[x][y][i] \times 2^\text{shift}
\]

In the case of `src2[x][y][i] = 0`,

\[
\text{dst}[x][y][i] = \begin{cases} 
\text{0} & \text{if src1[x][y][i] = 0} \\
\text{DATA_TYPE_MAX} & \text{if src1[x][y][i] > 0} \\
\text{DATA_TYPE_MIN} & \text{if src1[x][y][i] < 0}
\end{cases}
\]

where `DATA_TYPE` is `MLIB_U8`, `MLIB_S16`, `MLIB_U16`, or `MLIB_S32` for an image of type `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`, respectively.

**Parameters**

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src1** Pointer to first source image.
- **src2** Pointer to second source image.
- **shift** Left shifting factor. \(0 \leq \text{shift} \leq 31\).

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_ImageDivShift1_Inp(3MLIB)`, `mlib_ImageDivShift2_Inp(3MLIB)`, attributes(5)
mlib_ImageErode4 (3MLIB)

Name  mlib_ImageErode4 – four neighbor erode

Synopsis  cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageErode4(mlib_image *dst, const mlib_image *src);

Description  The mlib_ImageErode4() function performs an erode operation on an image by using each pixel’s four orthogonal neighbors. The source and destination images must be single-channel images. The data type can be MLIB_BIT, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

For 4-neighbor binary images, it uses the following equation:

\[ \text{dst}[x][y][0] = \text{AND} \{ \text{src}[x][y][0], \text{src}[x-1][y][0], \text{src}[x+1][y][0], \text{src}[x][y-1][0], \text{src}[x][y+1][0] \} \]

For 4-neighbor grayscale images, it uses the following equation:

\[ \text{dst}[x][y][0] = \text{MIN} \{ \text{src}[x][y][0], \text{src}[x-1][y][0], \text{src}[x+1][y][0], \text{src}[x][y-1][0], \text{src}[x][y+1][0] \} \]

where \( x = 1, \ldots, w-2 \); \( y = 1, \ldots, h-2 \).

Parameters  The function takes the following arguments:

- \( \text{dst} \)  Pointer to destination image.
- \( \text{src} \)  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageErode4_Fp(3MLIB), mlib_ImageErode8(3MLIB), mlib_ImageErode8_Fp(3MLIB), attributes(5)
mlib_ImageErode4_Fp(3MLIB)

**Name**  mlib_ImageErode4_Fp – four neighbor erode

**Synopsis**  
```
cc [flag...] file... -lmlib [library...] 
#include <mlib.h>
mlib_status mlib_ImageErode4_Fp(mlib_image *dst, const mlib_image *src);
```

**Description**  The `mlib_ImageErode4_Fp()` function performs an erode operation on an image by using each pixel’s four orthogonal neighbors. The source and destination images must be single-channel images. The data type of the images can be MLIB_FLOAT or MLIB_DOUBLE.

For 4-neighbor grayscale images, it uses the following equation:

\[
dst[x][y][0] = \min\{ src[x][y][0], src[x-1][y][0], src[x+1][y][0], src[x][y-1][0], src[x][y+1][0] \}
\]

where \( x = 1, \ldots, w-2; y = 1, \ldots, h-2 \).

**Parameters**  The function takes the following arguments:
- `dst`  Pointer to destination image.
- `src`  Pointer to source image.

**Return Values**  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See `attributes(5)` for descriptions of the following attributes:

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**See Also**  `mlib_ImageErode4(3MLIB), mlib_ImageErode8(3MLIB), mlib_ImageErode8_Fp(3MLIB), attributes(5)`
# mlib_ImageErode8

## Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageErode8(mlib_image *dst, const mlib_image *src);
```

## Description

The `mlib_ImageErode8()` function performs an erode operation on an image by using all eight of each pixel's neighbors. The source and destination images must be single-channel images. The data type can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

For 8-neighbor binary images, it uses the following equation:

\[
dst[x][y][0] = \text{AND}\{ src[p][q][0], \\
x-1 \leq p \leq x+1; y-1 \leq q \leq y+1 \}
\]

For 8-neighbor grayscale images, it uses the following equation:

\[
dst[x][y][0] = \text{MIN}\{ src[p][q][0], \\
x-1 \leq p \leq x+1; y-1 \leq q \leq y+1 \}
\]

where \(x = 1, \ldots, w-2; y = 1, \ldots, h-2\).

## Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See [attributes(5)] for descriptions of the following attributes:

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## See Also

- `mlib_ImageErode4(3MLIB)`, `mlib_ImageErode4_Fp(3MLIB)`,
- `mlib_ImageErode8_Fp(3MLIB)`, [attributes(5)]
The `mlib_ImageErode8_Fp()` function performs an erode operation on an image by using all eight of each pixel’s neighbors. The source and destination images must be single-channel images. The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

For 8-neighbor grayscale images, it uses the following equation:

\[
dst[x][y][0] = \min\{ src[p][q][0], \\
\quad x-1 \leq p \leq x+1; \quad y-1 \leq q \leq y+1 \}
\]

where \( x = 1, \ldots, w-2; \quad y = 1, \ldots, h-2. \)

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageErode4(3MLIB)`, `mlib_ImageErode4_Fp(3MLIB)`, `mlib_ImageErode8(3MLIB)`, attributes(5)
mlib_ImageExp – computes the exponent of the image pixels

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageExp(mlib_image *dst, const mlib_image *src);

Description

The mlib_ImageExp() function computes the exponent of the image pixels.

It uses the following equation:

dst[x][y][i] = e**src[x][y][i]

Parameters

The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageExp_Fp(3MLIB), mlib_ImageExp_Fp_Inp(3MLIB), mlib_ImageExp_Inp(3MLIB), attributes(5)
The `mlib_ImageExp_Fp()` function computes the exponent of the floating-point image pixels. It uses the following equation:

\[ \text{dst}[x][y][i] = e^{\text{src}[x][y][i]} \]

**Parameters**
- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- `mlib_ImageExp(3MLIB)`, `mlib_ImageExp_Fp_Inp(3MLIB)`, `mlib_ImageExp_Inp(3MLIB)`, attributes(5)
mlib_ImageExp_Fp_Inp(3MLIB)

**Name**
mlib_ImageExp_Fp_Inp – computes the exponent of the image pixels

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageExp_Fp_Inp(mlib_image *srcdst);
```

**Description**
The `mlib_ImageExp_Fp_Inp()` function computes the exponent of the floating-point image pixels.

It uses the following equation:
```
srcdst[x][y][i] = e**srcdst[x][y][i]
```

**Parameters**
The function takes the following arguments:
- `srcdst` Pointer to source and destination image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageExp(3MLIB), mlib_ImageExp_Fp(3MLIB), mlib_ImageExp_Inp(3MLIB), attributes(5)`
### Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageExp_Inp(mlib_image *srcdst);
```

### Description

The `mlib_ImageExp_Inp()` function computes the exponent of the image pixels, in place.

It uses the following equation:

\[
srcdst[x][y][i] = e^{srcdst[x][y][i]}
\]

### Parameters

- **srcdst**: Pointer to source and destination image.

### Return Values

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Attributes

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</tr>
<tr>
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<td>MT-Safe</td>
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</tbody>
</table>

### See Also

`mlib_ImageExp(3MLIB), mlib_ImageExp_Fp(3MLIB), mlib_ImageExp_Fp_Inp(3MLIB), attributes(5)`
mlib_ImageExtrema2(3MLIB)

Name  mlib_ImageExtrema2, mlib_ImageExtrema2_Fp – image extrema

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageExtrema2(mlib_s32 *min, mlib_s32 *max,
    const mlib_image *img, mlib_s32 xStart, mlib_s32 yStart,
    mlib_s32 xPeriod, mlib_s32 yPeriod);

mlib_status mlib_ImageExtrema2_Fp(mlib_d64 *min, mlib_d64 *max,
    const mlib_image *img, mlib_s32 xStart, mlib_s32 yStart,
    mlib_s32 xPeriod, mlib_s32 yPeriod);

Description  Each of the functions determines the extrema values for each channel in an image, possibly with subsampling.

It uses the following equation:

min[i] = MIN{ img[x][y][i] }
max[i] = MAX{ img[x][y][i] }

where

x = xStart + p*xPeriod; 0 ≤ p < (w - xStart)/xPeriod
y = yStart + q*yPeriod; 0 ≤ q < (h - yStart)/yPeriod

Parameters  Each of the functions takes the following arguments:

min  Pointer to minimum vector, where length is the number of channels in the image.
     min[i] contains the minimum of channel i.

max  Pointer to maximum vector, where length is the number of channels in the image.
     max[i] contains the maximum of channel i.

img  Pointer to a source image.

xStart  Initial X sample coordinate.

yStart  Initial Y sample coordinate.

xPeriod  X sample rate. xPeriod ≥ 1.

yPeriod  Y sample rate. yPeriod ≥ 1.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
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### mlib_ImageExtrema2(3MLIB)

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</table>

**See Also**  
mlib_ImageExtremaLocations(3MLIB), mlib_ImageMaximum(3MLIB),  
mlib_ImageMaximum_Fp(3MLIB), mlib_ImageMinimum(3MLIB),  
mlib_ImageMinimum_Fp(3MLIB), attributes(5)
mlib_ImageExtremaLocations

**Synopsis**

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageExtremaLocations( mlib_s32 *min, mlib_s32 *max,
const mlib_image *img, mlib_s32 xStart, mlib_s32 yStart,
mlib_s32 xPeriod, mlib_s32 yPeriod, mlib_s32 saveLocations,
mlib_s32 maxRuns, mlib_s32 *minCounts, mlib_s32 *maxCounts,
mlib_s32 **minLocations, mlib_s32 **maxLocations, mlib_s32 len);
```

```c
mlib_status mlib_ImageExtremaLocations_Fp( mlib_d64 *min, mlib_d64 *max,
const mlib_image *img, mlib_s32 xStart, mlib_s32 yStart,
mlib_s32 xPeriod, mlib_s32 yPeriod, mlib_s32 saveLocations,
mlib_s32 maxRuns, mlib_s32 *minCounts, mlib_s32 *maxCounts,
mlib_s32 **minLocations, mlib_s32 **maxLocations, mlib_s32 len);
```

**Description**

Each of the functions finds the image-wise minimum and maximum pixel values for each channel, and optionally, their locations.

Each of the functions scans an image, finds the minimum and maximum pixel values for each channel, and finds the locations of those pixels with the minimum or maximum values.

The user provides initial minimum/maximum values through the arguments min and max. This function will update them based on findings.

The set of pixels scanned may furthermore be reduced by specifying xPeriod and yPeriod parameters that specify the sampling rate along each axis.

The set of pixels to be scanned may be obtained from the following equation:

\[
x = xStart + p \times xPeriod; \quad 0 \leq p < (w - xStart) / xPeriod
\]

\[
y = yStart + q \times yPeriod; \quad 0 \leq q < (h - yStart) / yPeriod
\]

The locations of the minimum/maximum, if asked, are recorded in a format of run-length coding. Each run-length code, or simply called a run, has a format of \((xStart, yStart, length)\). Here length is defined on the low-resolution image (with downsampling factors of \(1/xPeriod, 1/yPeriod\)) and does not cross rows. So the run-length code \((xStart, yStart, length)\) means that the pixels at \((xStart, yStart), (xStart + xPeriod, yStart), \ldots, (xStart + (length - 1) \times xPeriod, yStart)\) of the original image have a value of the minimum/maximum.

The buffers for minLocations and maxLocations are organized in the following format for each channel i:

- \(\text{minLocations}[i][0] = xStart0; \quad \text{the 1st run}\)
- \(\text{minLocations}[i][1] = yStart0;\)
- \(\text{minLocations}[i][2] = length0;\)
- \(\text{minLocations}[i][3] = xStart1; \quad \text{the 2nd run}\)
minLocations[i][4] = yStart1;
minLocations[i][5] = length1;
...... // more runs
minLocations[i][len-1] = ...;

It is the user's responsibility to allocate enough memory for the buffers for minLocations and maxLocations. This function may return MLIB_OUTOFRANGE, if any of the buffers is not big enough.

**Parameters**

The function takes the following arguments:

- **min** Pointer to the minimum values.
- **max** Pointer to the maximum values.
- **img** Pointer to the input image.
- **xStart** Initial X sample coordinate.
- **yStart** Initial Y sample coordinate.
- **xPeriod** X sampling rate. \( xPeriod \geq 1 \).
- **yPeriod** Y sampling rate. \( yPeriod \geq 1 \).
- **saveLocations** If true (i.e., saveLocations \(!= 0\)), find the extrema locations; otherwise only find the extrema.
- **maxRuns** Number of runs of the minimum/maximum the caller expects for each channel. maxRuns \( \geq 1 \). If it is MLIB_S32_MAX, all the minimum/maximum locations should be recorded.
- **minCounts** Pointer to the numbers of runs of the minimum recorded in minLocations.
- **maxCounts** Pointer to the numbers of runs of the maximum recorded in maxLocations.
- **minLocations** Pointer to the minimum locations in a format of run-length coding.
- **maxLocations** Pointer to the maximum locations in a format of run-length coding.
- **len** Length of the buffers for the minimum/maximum locations in each channel.

**Return Values**

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageExtrema2(3MLIB), mlib_ImageMaximum(3MLIB),
mlib_ImageMaximum_Fp(3MLIB), mlib_ImageMinimum(3MLIB),
mlib_ImageMinimum_Fp(3MLIB), attributes(5)
Name  mlib_ImageFilteredSubsample, mlib_ImageFilteredSubsample_Fp – antialias filters and subsamples an image

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageFilteredSubsample(mlib_image *dst,
    const mlib_image *src, mlib_s32 scaleX, mlib_s32 scaleY,
    mlib_s32 transX, mlib_s32 transY,
    const mlib_d64 *hKernel, const mlib_d64 *vKernel, mlib_s32 hSize,
    mlib_s32 vSize, mlib_s32 hParity, mlib_s32 vParity, mlib_edge edge);

mlib_status mlib_ImageFilteredSubsample_Fp(mlib_image *dst,
    const mlib_image *src, mlib_s32 scaleX, mlib_s32 scaleY,
    mlib_s32 transX, mlib_s32 transY,
    const mlib_d64 *hKernel, const mlib_d64 *vKernel, mlib_s32 hSize,
    mlib_s32 vSize, mlib_s32 hParity, mlib_s32 vParity, mlib_edge edge);
```

Description  Each of the functions antialias filters and subsamples an image.

The effect of one of the functions on an image is equivalent to performing convolution (filter) followed by subsampling (zoom out).

The functions are similar to the mlib_ImageZoomTranslate() and mlib_ImageZoomTranslate_Fp() functions. But they have different definitions on scale factors and translations, hence use different coordinate mapping equations. The scaleX and scaleY used by mlib_ImageFilteredSubsample() and mlib_ImageFilteredSubsample_Fp() are the reciprocals of the zoomx and zoomy, respectively, used by mlib_ImageZoomTranslate() and mlib_ImageZoomTranslate_Fp().

The functions use the following equations for coordinate mapping:

$$x_S = x_D \times \text{scaleX} + \text{transX}$$

$$y_S = y_D \times \text{scaleY} + \text{transY}$$

where, a point (xD, yD) in the destination image is backward mapped to a point (xS, yS) in the source image. The arguments transX and transY are provided to support tiling.

The subsample terms, i.e., the scale factors scaleX and scaleY, are restricted to positive integral values. Geometrically, one destination pixel maps to scaleX by scaleY source pixels. With odd scale factors, destination pixel centers map directly onto source pixel centers. With even scale factors, destination pixel centers map squarely between source pixel centers. Below are examples of even, odd, and combination cases.

```
s s s s s s  s s s s s s
  d   d   d   
```

```
s s s s s s  s d s s d s
```

```
s s s s s s  s d s s d d
```

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s s s s s s s s s s s
s s s s s s s d s s d s
s d d d d d d d d d
s s s s s s s s s s s

Even scaleX/Y factors
Odd scaleX/Y factors

s s s s s s s s s s s
s d s d s d s s d s
s d d d d d d d d d
s s s s s s s s s s s

Odd/even scaleX/Y factors
Even/odd scaleX/Y factors

where
s = source pixel centers
d = destination pixel centers mapped to source

The applied filter is quadrant symmetric (typically antialias + resample). The filter is product-separable, quadrant symmetric, and is defined by half of its span. Parity is used to signify whether the symmetric kernel has a double center (even parity) or a single center value (odd parity). For example, if hParity == 0 (even), the horizontal kernel is defined as:

\[ hKernel[hSize-1], \ldots, hKernel[0], hKernel[0], \ldots, hKernel[hSize-1] \]

Otherwise, if hParity == 1 (odd), the horizontal kernel is defined as:

\[ hKernel[hSize-1], \ldots, hKernel[0], \ldots, hKernel[hSize-1] \]

Horizontal and vertical kernels representing convolved resample (i.e., the combined separable kernels) can be computed from a convolution filter (with odd parity), a resample filter, and because the subsample factors affect resample weights, the subsample scale factors. It is the user’s responsibility to provide meaningful combined kernels.

To compute the value of a pixel centered at point \((xD, yD)\) in the destination image, apply the combined kernel to the source image by aligning the kernel’s geometric center to the backward mapped point \((xS, yS)\) in the source image. In the cases that it can not be exactly
on top of point \((x_S, y_S)\), the kernel’s center should be half-pixel right and/or below that point. When this is done in a separable manner, the centers of horizontal and vertical kernels should align with \(x_S\) and \(y_S\), respectively.

The combination of subsampling and filtering has performance benefits over sequential function usage in part due to the symmetry constraints imposed by only allowing integer parameters for scaling and only allowing separable symmetric filters.

**Parameters**

The function takes the following arguments:

- \(dst\) Pointer to destination image.
- \(src\) Pointer to source image.
- \(scaleX\) The x scale factor of subsampling.
- \(scaleY\) The y scale factor of subsampling.
- \(transX\) The x translation.
- \(transY\) The y translation.
- \(hKernel\) Pointer to the compact form of horizontal kernel.
- \(vKernel\) Pointer to the compact form of vertical kernel.
- \(hSize\) Size of array \(hKernel\).
- \(vSize\) Size of array \(vKernel\).
- \(hParity\) Parity of horizontal kernel (0: even, 1: odd).
- \(vParity\) Parity of vertical kernel (0: even, 1: odd).
- \(edge\) Type of edge condition. It can be one of the following:

  - MLIB EDGE DST NO WRITE

**Return Values**

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

mlib_ImageFilteredSubsample(3MLIB), mlib_ImageZoomTranslate(3MLIB), mlib_ImageZoomTranslate_Fp(3MLIB), attributes(5)
The `mlib_ImageFlipAntiDiag()` function flips an image on the anti-diagonal axis.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See also `mlib_ImageFlipAntiDiag_Fp(3MLIB), mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB), mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB), mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB), mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB), mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)`
# mlib_ImageFlipAntiDiag_Fp

## Name
mlib_ImageFlipAntiDiag_Fp – anti-diagonal flip

## Synopsis
cc [ fflag...] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageFlipAntiDiag_Fp(mlib_image *dst,
    const mlib_image *src);
```

## Description
The `mlib_ImageFlipAntiDiag_Fp()` function flips a floating-point image on the anti-diagonal axis.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

## Parameters
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See attributes(5) for descriptions of the following attributes:

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## See Also
- `mlib_ImageFlipAntiDiag(3MLIB)`, `mlib_ImageFlipMainDiag(3MLIB)`,
- `mlib_ImageFlipMainDiag_Fp(3MLIB)`, `mlib_ImageFlipX(3MLIB)`,
- `mlib_ImageFlipX_Fp(3MLIB)`, `mlib_ImageFlipY(3MLIB)`, `mlib_ImageFlipY_Fp(3MLIB)`,
- `mlib_ImageRotate90(3MLIB)`, `mlib_ImageRotate90_Fp(3MLIB)`,
- `mlib_ImageRotate180(3MLIB)`, `mlib_ImageRotate180_Fp(3MLIB)`,
- `mlib_ImageRotate270(3MLIB)`, `mlib_ImageRotate270_Fp(3MLIB)`

attributes(5)
mlib_ImageFlipMainDiag – main diagonal flip

Synopsis

```
cc [ flag... ] file... -tmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageFlipMainDiag(mlib_image *dst, const mlib_image *src);
```

Description

The `mlib_ImageFlipMainDiag()` function flips an image on the main diagonal.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

```
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```

See Also

`mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag_Fp(3MLIB), mlib_ImageFlipX(3MLIB),
mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB), mlib_ImageFlipY_Fp(3MLIB),
mlib_ImageRotate90(3MLIB), mlib_ImageRotate90_Fp(3MLIB),
mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB),
mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)`
The `mlib_ImageFlipMainDiag_Fp()` function flips a floating-point image on the main diagonal.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See also `mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB), mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB), mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB), mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB), mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)`
mlib_ImageFlipX – X-axis flip

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageFlipX(mlib_image *dst, const mlib_image *src);

Description

The mlib_ImageFlipX() function flips an image on its X axis.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

Parameters

The function takes the following arguments:

dst Pointer to destination image.

src Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB), mlib_ImageFlipY_Fp(3MLIB),
mlib_ImageRotate90(3MLIB), mlib_ImageRotate90_Fp(3MLIB),
mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB),
mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)
The `mlib_ImageFlipX_Fp()` function flips a floating-point image on its X axis. The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The function takes the following arguments:

- `dst`  Pointer to destination image.
- `src`  Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also

- `mlib_ImageFlipAntiDiag(3MLIB)`, `mlib_ImageFlipAntiDiag_Fp(3MLIB)`,
- `mlib_ImageFlipMainDiag(3MLIB)`, `mlib_ImageFlipMainDiag_Fp(3MLIB)`,
- `mlib_ImageFlipX(3MLIB)`, `mlib_ImageFlipY(3MLIB)`, `mlib_ImageFlipY_Fp(3MLIB)`,
- `mlib_ImageRotate90(3MLIB)`, `mlib_ImageRotate90_Fp(3MLIB)`,
- `mlib_ImageRotate180(3MLIB)`, `mlib_ImageRotate180_Fp(3MLIB)`,
- `mlib_ImageRotate270(3MLIB)`, `mlib_ImageRotate270_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageFlipY()` function flips an image on its Y axis. The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See Also

- `mlib_ImageFlipAntiDiag(3MLIB)`, `mlib_ImageFlipAntiDiag_Fp(3MLIB)`, `mlib_ImageFlipMainDiag(3MLIB)`, `mlib_ImageFlipMainDiag_Fp(3MLIB)`, `mlib_ImageFlipX(3MLIB)`, `mlib_ImageFlipX_Fp(3MLIB)`, `mlib_ImageFlipY_Fp(3MLIB)`, `mlib_ImageRotate90(3MLIB)`, `mlib_ImageRotate90_Fp(3MLIB)`, `mlib_ImageRotate180(3MLIB)`, `mlib_ImageRotate180_Fp(3MLIB)`, `mlib_ImageRotate270(3MLIB)`, `mlib_ImageRotate270_Fp(3MLIB)`
The `mlib_ImageFlipY_Fp()` function flips a floating-point image on its Y axis. The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See also `mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB), mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB), mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB), mlib_ImageRotate90(3MLIB), mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB), mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)`
The `mlib_ImageFourierTransform()` function performs a two-dimensional Fourier transformation. The source and destination images must be the same type and the same size. The data type of the images can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`. The height and width of the images must be some positive power of 2 (but they do not have to be equal).

They can have 1 or 2 channels. If the source image has just one channel the imaginary parts are assumed to be zero. If the destination image has just one channel, then it is assumed that the imaginary parts of the output can be discarded. But in case both source and destination images are one-channel images, then `MLIB_FAILURE` is returned.

The predefined modes used in the image Fourier transform function are as follows:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>MLIB_DFT_SCALE_NONE</code></td>
<td>Forward DFT without scaling</td>
</tr>
<tr>
<td><code>MLIB_DFT_SCALE_MXN</code></td>
<td>Forward DFT with scaling of 1/(M*N)</td>
</tr>
<tr>
<td><code>MLIB_DFT_SCALE_SQRT</code></td>
<td>Forward DFT with scaling of 1/sqrt(M*N)</td>
</tr>
<tr>
<td><code>MLIB_IDFT_SCALE_NONE</code></td>
<td>Inverse DFT without scaling</td>
</tr>
<tr>
<td><code>MLIB_IDFT_SCALE_MXN</code></td>
<td>Inverse DFT with scaling of 1/(M*N)</td>
</tr>
<tr>
<td><code>MLIB_IDFT_SCALE_SQRT</code></td>
<td>Inverse DFT with scaling of 1/sqrt(M*N)</td>
</tr>
</tbody>
</table>

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `mode` Mode of the transform.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>ATTRIBUTE TYPE</td>
<td>ATTRIBUTE VALUE</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  `attributes(5)`
#include <mlib.h>

mlib_s32 mlib_ImageGetBitOffset(const mlib_image *img);

A query function that returns the bit offset public field of a mediaLib image structure. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

The function takes the following arguments:

**img** Pointer to a mediaLib image structure.

The function returns the offset, in terms of bits, of an image from the beginning of the data buffer to the first pixel.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_ImageGetChannels(3MLIB), mlib_ImageGetData(3MLIB), mlib_ImageGetFlags(3MLIB), mlib_ImageGetHeight(3MLIB), mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB), mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)
**Name**
mlib_ImageGetChannels – get channels

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_s32 mlib_ImageGetChannels(const mlib_image *img);

**Description**
A query function that returns the channels public field of a mediaLib image structure. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

**Parameters**
The function takes the following arguments:

- **img** Pointer to a mediaLib image structure.

**Return Values**
The function returns the number of channels in an image.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
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<td>MT-Level</td>
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</tr>
</tbody>
</table>

**See Also**
mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetData(3MLIB),
mlib_ImageGetFlags(3MLIB), mlib_ImageGetHeight(3MLIB),
mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB),
mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)
The `mlib_ImageGetData()` function returns the data public field of a mediaLib image structure. The data type of the image can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

The function takes the following arguments:

- `img` Pointer to source image.

The function returns a pointer to the image data.

See also `mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB), mlib_ImageGetFlags(3MLIB), mlib_ImageGetHeight(3MLIB), mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB), mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)`
Name  mlib_ImageGetFlags – get flags

Synopsis cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

    mlib_s32 mlib_ImageGetFlags(const mlib_image *img);

Description The mlib_ImageGetFlags() function returns the attribute flags of an image. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

Parameters The function takes the following arguments:

    img    Pointer to source image.

Return Values The function returns the value of the attribute flags.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB), mlib_ImageGetData(3MLIB), mlib_ImageGetHeight(3MLIB), mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB), mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)
mlib_ImageGetFormat — get format

Synopsis  

```
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_format mlib_ImageGetFormat(const mlib_image *img);
```

Description  
A query function that returns the format public field of a mlib_image structure. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

Parameters  
The function takes the following arguments:

```
ing    Pointer to a mediaLib image structure.
```

Return Values  
The function returns the value of the format of an image.

Attributes  
See attributes(5) for descriptions of the following attributes:

```

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
```

See Also  
mlib_ImageSetFormat(3MLIB), mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB), mlib_ImageGetData(3MLIB), mlib_ImageGetFlags(3MLIB), mlib_ImageGetHeight(3MLIB), mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB), mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)
Name  
mlib_ImageGetHeight – get height

Synopsis  
cc [ flag... ] file... -Lmlib [ library... ]
#include <mlib.h>

mlib_s32 mlib_ImageGetHeight(const mlib_image *img);

Description  
A query function that returns the height public field of a mediaLib image structure. The data
type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT,
MLIB_FLOAT, or MLIB_DOUBLE.

Parameters  
The function takes the following arguments:

    img    Pointer to source image.

Return Values  
The function returns the value of the height (in pixels) of an image.

Attributes  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB),
mlib_ImageGetData(3MLIB), mlib_ImageGetFlags(3MLIB),
mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB),
mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)
mlib_ImageGetPaddings

Name
mlib_ImageGetPaddings – get paddings

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_u8 *mlib_ImageGetPaddings(const mlib_image *img);

Description
A query function that returns the borders public field of a mediaLib image structure. The data
type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT,
MLIB_FLOAT, or MLIB_DOUBLE.

Parameters
The function takes the following arguments:

img Pointer to a mediaLib image structure.

Return Values
The function returns a pointer to the image paddings. paddings[0] holds leftPadding;
bottomPadding.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB),
mlib_ImageGetData(3MLIB), mlib_ImageGetFlags(3MLIB),
mlib_ImageGetHeight(3MLIB), mlib_ImageGetStride(3MLIB),
mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB),
mlib_ImageSetPaddings(3MLIB), attributes(5)
Name mlib_ImageGetStride – get stride

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_s32 mlib_ImageGetStride(const mlib_image *img);

Description

A query function that returns the stride public field of a mediaLib image structure. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

Parameters

The function takes the following arguments:

  img Pointer to source image.

Return Values

The function returns the value of the stride (in bytes) of an image.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB),
mlib_ImageGetData(3MLIB), mlib_ImageGetFlags(3MLIB),
mlib_ImageGetHeight(3MLIB), mlib_ImageGetPaddings(3MLIB),
mlib_ImageGetType(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)
mlib_ImageGetType – get type

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_type mlib_ImageGetType(const mlib_image *img);
```

Description

A query function that returns the type public field of a mediaLib image structure. The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

Parameters

The function takes the following arguments:

- `img` Pointer to source image.

Return Values

The function returns the value of the type of an image.

Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

`mlib_ImageGetBitOffset(3MLIB), mlib_ImageGetChannels(3MLIB), mlib_ImageGetData(3MLIB), mlib_ImageGetFlags(3MLIB), mlib_ImageGetHeight(3MLIB), mlib_ImageGetPaddings(3MLIB), mlib_ImageGetStride(3MLIB), mlib_ImageGetWidth(3MLIB), attributes(5)`
# mlib_ImageGetWidth

## Synopsis

```c
#include <mlib.h>

mlib_s32 mlib_ImageGetWidth(const mlib_image *img);
```

## Description

A query function that returns the width public field of a mediaLib image structure. The data type of the image can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

## Parameters

- **img**: Pointer to source image.

## Return Values

The function returns the value of the width of an image.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

## See Also

- `mlib_ImageGetBitOffset(3MLIB)`, `mlib_ImageGetChannels(3MLIB)`,
- `mlib_ImageGetData(3MLIB)`, `mlib_ImageGetFlags(3MLIB)`,
- `mlib_ImageGetHeight(3MLIB)`, `mlib_ImageGetPaddings(3MLIB)`,
- `mlib_ImageGetStride(3MLIB)`, `mlib_ImageGetType(3MLIB)`, `attributes(5)`
The `mlib_ImageGradient3x3()` function performs edge detection by computing the magnitude of the image gradient vector in two orthogonal directions using 3x3 gradient filtering.

It uses the following equation:

$$\text{dst}[x][y][i] = (SH(x,y,i)^2 + SV(x,y,i)^2)^{0.5}$$

where \(SH()\) and \(SV()\) are the horizontal and vertical gradient images generated from the corresponding channel of the source image by correlating it with the supplied orthogonal (horizontal and vertical) gradient masks.

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **hmask** Pointer to horizontal mask in row-major order.
- **vmask** Pointer to vertical mask in row-major order.
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SR_EXTEND`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  

mlib_ImageGradient3x3_Fp(3MLIB), mlib_ImageGradientMxN(3MLIB), 
mlib_ImageGradientMxN_Fp(3MLIB), attributes(5)
### mlib_ImageGradient3x3_Fp - 3x3 gradient filter

#### Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageGradient3x3_Fp(mlib_image *dst,
    const mlib_image *src, const mlib_d64 *hmask,
    const mlib_d64 *vmask, mlib_s32 cmask, mlib_edge edge);
```

#### Description

The `mlib_ImageGradient3x3_Fp()` function performs floating-point edge detection by computing the magnitude of the image gradient vector in two orthogonal directions using 3x3 gradient filtering.

It uses the following equation:

\[
\text{dst}[x][y][i] = (\text{SH}(x,y,i)^2 + \text{SV}(x,y,i)^2)^{0.5}
\]

where \( \text{SH}(\) and \( \text{SV}(\) are the horizontal and vertical gradient images generated from the corresponding channel of the source image by correlating it with the supplied orthogonal (horizontal and vertical) gradient masks.

#### Parameters

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **hmask** Pointer to horizontal mask in row-major order.
- **vmask** Pointer to vertical mask in row-major order.
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DS_FILL_ZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SR_EXTEND

#### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

#### Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>
mlib_ImageGradient3x3_Fp(3MLIB)

See Also  
mlib_ImageGradient3x3(3MLIB), mlib_ImageGradientMxN(3MLIB),
mlib_ImageGradientMxN_Fp(3MLIB), attributes(5)
The `mlib_ImageGradientMxN()` function performs edge detection by computing the magnitude of the image gradient vector in two orthogonal directions using MxN gradient filtering.

It uses the following equation:

```
dst[x][y][i] = ( SH(x,y,i)**2 + SV(x,y,i)**2 )**0.5
```

where `SH()` and `SV()` are the horizontal and vertical gradient images generated from the corresponding channel of the source image by correlating it with the supplied orthogonal (horizontal and vertical) gradient masks.

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **hmask** Pointer to horizontal mask in row-major order.
- **vmask** Pointer to vertical mask in row-major order.
- **m** Width of the convolution kernel. \( m > 1 \).
- **n** Height of the convolution kernel. \( n > 1 \).
- **dm** X coordinate of the key element in the convolution kernel. \( 0 \leq dm < m \).
- **dn** Y coordinate of the key element in the convolution kernel. \( 0 \leq dn < n \).
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:

  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DS_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SR_EXTEND`
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</tbody>
</table>

See Also

mlib_ImageGradientMxN_Fp(3MLIB), mlib_ImageGradient3x3(3MLIB),
mlib_ImageGradient3x3_Fp(3MLIB), attributes(5)


**Name**  
mlib\_ImageGradientMxN\_Fp – MxN gradient filter

**Synopsis**  
c\ c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib\_status mlib\_ImageGradientMxN\_Fp(mlib\_image *dst,
 const mlib\_image *src, const mlib\_d64 *hmask,
 const mlib\_d64 *vmask, mlib\_s32 m, mlib\_s32 n, mlib\_s32 dm,
 mlib\_s32 dn, mlib\_s32 cmask, mlib\_edge edge);
```

**Description**  
The `mlib\_ImageGradientMxN\_Fp()` function performs floating-point edge detection by computing the magnitude of the image gradient vector in two orthogonal directions using \( M\times N \) gradient filtering.

It uses the following equation:

\[ \text{dst}[x][y][i] = ( \text{SH}(x,y,i)**2 + \text{SV}(x,y,i)**2 )**0.5 \]

where \( \text{SH}() \) and \( \text{SV}() \) are the horizontal and vertical gradient images generated from the corresponding channel of the source image by correlating it with the supplied orthogonal (horizontal and vertical) gradient masks.

**Parameters**  
The function takes the following arguments:

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **hmask**  
  Pointer to horizontal mask in row-major order.

- **vmask**  
  Pointer to vertical mask in row-major order.

- **m**  
  Width of the convolution kernel. \( m > 1 \).

- **n**  
  Height of the convolution kernel. \( n > 1 \).

- **dm**  
  X coordinate of the key element in the convolution kernel. \( 0 \leq dm < m \).

- **dn**  
  Y coordinate of the key element in the convolution kernel. \( 0 \leq dn < n \).

- **cmask**  
  Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single channel image, the channel mask is ignored.

- **edge**  
  Type of edge condition. It can be one of the following:

  - `MLIB\_EDGE\_DST\_NO\_WRITE`
  - `MLIB\_EDGE\_DST\_FILL\_ZERO`
  - `MLIB\_EDGE\_DST\_COPY\_SRC`
  - `MLIB\_EDGE\_SR\_EXTEND`
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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<tr>
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</tbody>
</table>

**See Also**  `mlib_ImageGradientMxN_Fp(3MLIB)`, `mlib_ImageGradient3x3(3MLIB)`, `mlib_ImageGradient3x3_Fp(3MLIB)`, attributes(5)
The `mlib_ImageGridWarp()` function performs a regular grid-based image warp. The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`. The two images may have different sizes.

The image pixels are assumed to be centered at \(0.5\) coordinate points. For example, the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

For each pixel in the destination image, its center point \(D\) is, first, backward mapped to a point \(S\) in the source image; then the source pixels with their centers surrounding point \(S\) are selected to do one of the interpolations specified by the filter parameter to generate the pixel value for point \(D\).

The mapping from destination pixels to source positions is described by bilinear interpolation between a rectilinear grid of points with known mappings.

Given a destination pixel coordinate \((x, y)\) that lies within a cell having corners at \((x_0, y_0)\), \((x_1, y_0)\), \((x_0, y_1)\) and \((x_1, y_1)\), with source coordinates defined at each respective corner equal to \((s_0, t_0)\), \((s_1, t_0)\), \((s_0, t_1)\) and \((s_1, t_1)\), the source position \((s, t)\) that maps onto \((x, y)\) is given by the formulas:

\[
xfract = \frac{x - x_0}{x_1 - x_0}\]
\[
yfract = \frac{y - y_0}{y_1 - y_0}\]
\[
s = s_0 + (s_1 - s_0) \cdot xfract\]
\[
t = t_0 + (t_1 - t_0) \cdot yfract\]
\[
u = s_0 + (s_3 - s_0) \cdot xfract\]
\[
v = t_0 + (t_3 - t_0) \cdot yfract\]
\[
sx = s + (u - s) \cdot yfract - postShiftX\]
\[
sy = t + (v - t) \cdot yfract - postShiftY\]

In other words, the source \(x\) and \(y\) values are interpolated horizontally along the top and bottom edges of the grid cell, and the results are interpolated vertically:
Theresultsofaboveinterpolationareshiftedby (-postShiftX, -postShiftY) to produce the source pixel coordinates.

The destination pixels that lie outside of any grid cells are kept intact. The grid is defined by a set of equal-sized cells. The grid starts at (xStart, yStart). Each cell has width equal to xStep and height equal to yStep, and there are xNumCells cells horizontally and yNumCells cells vertically.

The degree of warping within each cell is defined by the values in xWarpPos and yWarpPos parameters. Each of these parameters must contain (xNumCells + 1)*(yNumCells + 1) values, which, respectively, contain the source X and source Y coordinates that map to the upper-left corner of each cell in the destination image. The cells are enumerated in row-major order. That is, all the grid points along a row are enumerated first, then the grid points for the next row are enumerated, and so on.

For example, suppose xNumCells is equal to 2 and yNumCells is equal to 1. Then the order of the data in the xWarpPos would be:

\(x00, x10, x20, x01, x11, x21\)

and in the yWarpPos:

\(y00, y10, y20, y01, y11, y21\)

for a total of \((2 + 1)*(1 + 1) = 6\) elements in each table.

**Parameters** The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
xWarpPos  A float array of length \((x\text{NumCells} + 1) \times (y\text{NumCells} + 1)\) containing horizontal warp positions at the grid points, in row-major order.

yWarpPos  A float array of length \((x\text{NumCells} + 1) \times (y\text{NumCells} + 1)\) containing vertical warp positions at the grid points, in row-major order.

postShiftX  The displacement to apply to source X positions.

postShiftY  The displacement to apply to source Y positions.

xStart  The minimum X coordinate of the grid.

xStep  The horizontal spacing between grid cells.

xNumCells  The number of grid cell columns.

yStart  The minimum Y coordinate of the grid.

yStep  The vertical spacing between grid cells.

yNumCells  The number of grid cell rows.

filter  Type of resampling filter. It can be one of the following:

- MLIB_NEAREST
- MLIB_BILINEAR
- MLIB_BICUBIC
- MLIB_BICUBIC2

edge  Type of edge condition. It can be one of the following:

- MLIB_EDGE_DST_NO_WRITE
- MLIB_EDGE_SRC_PADDED

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageGridWarp_Fp(3MLIB), mlib_ImageGridWarpTable(3MLIB), mlib_ImageGridWarpTable_Fp(3MLIB), attributes(5)
#include <mlib.h>

mlib_status mlib_ImageGridWarp_Fp(mlib_image *dst, const mlib_image *src, const mlib_f32 *xWarpPos, const mlib_f32 *yWarpPos, mlib_d64 postShiftX, mlib_d64 postShiftY, mlib_s32 xStart, mlib_s32 xStep, mlib_s32 xNumCells, mlib_s32 yStart, mlib_s32 yStep, mlib_s32 yNumCells, mlib_filter filter, mlib_edge edge);

The `mlib_ImageGridWarp_Fp()` function performs a regular grid-based image warp on a floating-point image. The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`. The two images may have different sizes.

The image pixels are assumed to be centered at 0.5 coordinate points. For example, the upper-left corner pixel of an image is located at (0.5, 0.5).

For each pixel in the destination image, its center point D is, first, backward mapped to a point S in the source image; then the source pixels with their centers surrounding point S are selected to do one of the interpolations specified by the filter parameter to generate the pixel value for point D.

The mapping from destination pixels to source positions is described by bilinear interpolation between a rectilinear grid of points with known mappings.

Given a destination pixel coordinate (x, y) that lies within a cell having corners at (x0, y0), (x1, y0), (x0, y1) and (x1, y1), with source coordinates defined at each respective corner equal to (sx0, sy0), (sx1, sy1), (sx2, sy2) and (sx3, sy3), the source position (sx, sy) that maps onto (x, y) is given by the formulas:

\[
\begin{align*}
    xfrac &= (x - x0)/(x1 - x0) \\
    yfrac &= (y - y0)/(y1 - y0) \\
    s &= sx0 + (sx1 - sx0)\times xfrac \\
    t &= sy0 + (sy1 - sy0)\times yfrac \\
    u &= sx2 + (sx3 - sx2)\times xfrac \\
    v &= sy2 + (sy3 - sy2)\times yfrac \\
    sx &= s + (u - s)\times yfrac - postShiftX \\
    sy &= t + (v - t)\times yfrac - postShiftY
\end{align*}
\]

In other words, the source x and y values are interpolated horizontally along the top and bottom edges of the grid cell, and the results are interpolated vertically.
The results of above interpolation are shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates.

The destination pixels that lie outside of any grid cells are kept intact. The grid is defined by a set of equal-sized cells. The grid starts at \((x_{\text{start}}, y_{\text{start}})\). Each cell has width equal to \(x_{\text{step}}\) and height equal to \(y_{\text{step}}\), and there are \(x_{\text{numCells}}\) cells horizontally and \(y_{\text{numCells}}\) cells vertically.

The degree of warping within each cell is defined by the values in \(x_{\text{warpPos}}\) and \(y_{\text{warpPos}}\) parameters. Each of these parameters must contain \((x_{\text{numCells}} + 1)*(y_{\text{numCells}} + 1)\) values, which, respectively, contain the source X and source Y coordinates that map to the upper-left corner of each cell in the destination image. The cells are enumerated in row-major order. That is, all the grid points along a row are enumerated first, then the grid points for the next row are enumerated, and so on.

For example, suppose \(x_{\text{numCells}}\) is equal to 2 and \(y_{\text{numCells}}\) is equal to 1. Then the order of the data in the \(x_{\text{warpPos}}\) would be:

\[x00, x10, x20, x01, x11, x21\]

and in the \(y_{\text{warpPos}}\):

\[y00, y10, y20, y01, y11, y21\]

for a total of \((2 + 1)*(1 + 1) = 6\) elements in each table.

**Parameters**

The function takes the following arguments:

- \(dst\)  
  Pointer to destination image.

- \(src\)  
  Pointer to source image.
xWarpPos  A float array of length \((xNumCells + 1)\times(yNumCells + 1)\) containing horizontal warp positions at the grid points, in row-major order.

yWarpPos  A float array of length \((xNumCells + 1)\times(yNumCells + 1)\) containing vertical warp positions at the grid points, in row-major order.

postShiftX  The displacement to apply to source X positions.

postShiftY  The displacement to apply to source Y positions.

xStart  The minimum X coordinate of the grid.

xStep  The horizontal spacing between grid cells.

xNumCells  The number of grid cell columns.

yStart  The minimum Y coordinate of the grid.

yStep  The vertical spacing between grid cells.

yNumCells  The number of grid cell rows.

filter  Type of resampling filter. It can be one of the following:

- MLIB_NEAREST
- MLIB_BILINEAR
- MLIB_BICUBIC
- MLIB_BICUBIC2

edge  Type of edge condition. It can be one of the following:

- MLIB_EDGE_DST_NO_WRITE
- MLIB_EDGE_SRC_PADDED

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageGridWarp(3MLIB), mlib_ImageGridWarpTable(3MLIB), mlib_ImageGridWarpTable_Fp(3MLIB), attributes(5)
### Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageGridWarpTable(mlib_image *dst, const mlib_image *src, 
const mlib_f32 *xWarpPos, const mlib_f32 *yWarpPos, 
mlib_d64 postShiftX, mlib_d64 postShiftY, 
mlib_s32 xStart, mlib_s32 xStep, mlib_s32 xNumCells, 
mlib_s32 yStart, mlib_s32 yStep, mlib_s32 yNumCells, 
const void *interp_table, mlib_edge edge);
```

### Description

The `mlib_ImageGridWarpTable()` function performs a regular grid-based image warp with table-driven interpolation. The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`. The two images may have different sizes.

The image pixels are assumed to be centered at .5 coordinate points. For example, the upper-left corner pixel of an image is located at (0.5, 0.5).

For each pixel in the destination image, its center point D is, first, backward mapped to a point S in the source image; then the source pixels with their centers surrounding point S are selected to do one of the interpolations specified by the filter parameter to generate the pixel value for point D.

The mapping from destination pixels to source positions is described by bilinear interpolation between a rectilinear grid of points with known mappings.

Given a destination pixel coordinate \((x, y)\) that lies within a cell having corners at \((x0, y0)\), \((x1, y0)\), \((x0, y1)\), and \((x1, y1)\), with source coordinates defined at each respective corner equal to \((sx0, sy0)\), \((sx1, sy1)\), \((sx2, sy2)\) and \((sx3, sy3)\), the source position \((sx, sy)\) that maps onto \((x, y)\) is given by the formulas:

\[
xfrac = (x - x0)/(x1 - x0)
yfrac = (y - y0)/(y1 - y0)
\]

\[
s = sx0 + (sx1 - sx0)*xfrac
t = sy0 + (sy1 - sy0)*xfrac
\]

\[
u = sx2 + (sx3 - sx2)*xfrac
v = sy2 + (sy3 - sy2)*xfrac
\]

\[
sx = s + (u - s)*yfrac - postShiftX
sy = t + (v - t)*yfrac - postShiftY
\]

In other words, the source x and y values are interpolated horizontally along the top and bottom edges of the grid cell, and the results are interpolated vertically.
The results of above interpolation are shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates.

The destination pixels that lie outside of any grid cells are kept intact. The grid is defined by a set of equal-sized cells. The grid starts at \((x_{\text{Start}}, y_{\text{Start}})\). Each cell has width equal to \(x_{\text{Step}}\) and height equal to \(y_{\text{Step}}\), and there are \(x_{\text{NumCells}}\) cells horizontally and \(y_{\text{NumCells}}\) cells vertically.

The degree of warping within each cell is defined by the values in \(x_{\text{WarpPos}}\) and \(y_{\text{WarpPos}}\) parameters. Each of these parameters must contain \((x_{\text{NumCells}} + 1) \times (y_{\text{NumCells}} + 1)\) values, which, respectively, contain the source X and source Y coordinates that map to the upper-left corner of each cell in the destination image. The cells are enumerated in row-major order. That is, all the grid points along a row are enumerated first, then the grid points for the next row are enumerated, and so on.

For example, suppose \(x_{\text{NumCells}}\) is equal to 2 and \(y_{\text{NumCells}}\) is equal to 1. Then the order of the data in the \(x_{\text{WarpPos}}\) would be:

\[
x00, x10, x20, x01, x11, x21
\]

and in the \(y_{\text{WarpPos}}:\)

\[
y00, y10, y20, y01, y11, y21
\]

for a total of \((2 + 1) \times (1 + 1) = 6\) elements in each table.

**Parameters**

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
\( x_{\text{WarpPos}} \) A float array of length \((x_{\text{NumCells}} + 1)*(y_{\text{NumCells}} + 1)\) containing horizontal warp positions at the grid points, in row-major order.

\( y_{\text{WarpPos}} \) A float array of length \((x_{\text{NumCells}} + 1)*(y_{\text{NumCells}} + 1)\) containing vertical warp positions at the grid points, in row-major order.

\( postShiftX \) The displacement to apply to source X positions.

\( postShiftY \) The displacement to apply to source Y positions.

\( x_{\text{Start}} \) The minimum X coordinate of the grid.

\( x_{\text{Step}} \) The horizontal spacing between grid cells.

\( x_{\text{NumCells}} \) The number of grid cell columns.

\( y_{\text{Start}} \) The minimum Y coordinate of the grid.

\( y_{\text{Step}} \) The vertical spacing between grid cells.

\( y_{\text{NumCells}} \) The number of grid cell rows.

\( interp\_table \) Pointer to an interpolation table. The table is created by the \texttt{mlib\_ImageInterpTableCreate()} function.

\( edge \) Type of edge condition. It can be one of the following:

- \texttt{MLIB\_EDGE\_DST\_NO\_WRITE}
- \texttt{MLIB\_EDGE\_SRC\_PADDED}

**Return Values** The function returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

**Attributes** See attributes(5) for descriptions of the following attributes:

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<tr>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** \texttt{mlib\_ImageInterpTableCreate(3MLIB)}, \texttt{mlib\_ImageInterpTableDelete(3MLIB)}, \texttt{mlib\_ImageGridWarp(3MLIB)}, \texttt{mlib\_ImageGridWarp\_Fp(3MLIB)}, \texttt{mlib\_ImageGridWarpTable\_Fp(3MLIB)}, attributes(5)
mlib_ImageGridWarpTable_Fp–grid-based image warp with table-driven interpolation

```c
#include <mlib.h>
mlib_status mlib_ImageGridWarpTable_Fp(mlib_image *dst,
                                   const mlib_image *src,
                                   const mlib_f32 *xWarpPos,
                                   const mlib_f32 *yWarpPos,
                                   mlib_d64 postShiftX, mlib_d64 postShiftY,
                                   mlib_s32 xStart, mlib_s32 xStep, mlib_s32 xNumCells,
                                   mlib_s32 yStart, mlib_s32 yStep, mlib_s32 yNumCells,
                                   const void *interp_table, mlib_edge edge);
```

**Description**

The `mlib_ImageGridWarpTable_Fp()` function performs a regular grid-based image warp on a floating-point image with table-driven interpolation. The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`. The two images may have different sizes.

The image pixels are assumed to be centered at .5 coordinate points. For example, the upper-left corner pixel of an image is located at (0.5, 0.5).

For each pixel in the destination image, its center point `D` is, first, backward mapped to a point `S` in the source image; then the source pixels with their centers surrounding point `S` are selected to do one of the interpolations specified by the filter parameter to generate the pixel value for point `D`.

The mapping from destination pixels to source positions is described by bilinear interpolation between a rectilinear grid of points with known mappings.

Given a destination pixel coordinate `(x, y)` that lies within a cell having corners at `(x0, y0)`, `(x1, y0)`, `(x0, y1)` and `(x1, y1)`, with source coordinates defined at each respective corner equal to `(sx0, sy0)`, `(sx1, sy1)`, `(sx2, sy2)` and `(sx3, sy3)`, the source position `(sx, sy)` that maps onto `(x, y)` is given by the formulas:

\[
xfrac = (x - x0)/(x1 - x0)
yfrac = (y - y0)/(y1 - y0)
\]

\[
s = sx0 + (sx1 - sx0)*xfrac
t = sy0 + (sy1 - sy0)*xfrac
\]

\[
u = sx2 + (sx3 - sx2)*xfrac
v = sy2 + (sy3 - sy2)*xfrac
\]

\[
sx = s + (u - s)*yfrac - postShiftX
sy = t + (v - t)*yfrac - postShiftY
\]

In other words, the source x and y values are interpolated horizontally along the top and bottom edges of the grid cell, and the results are interpolated vertically.
The results of above interpolation are shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates.

The destination pixels that lie outside of any grid cells are kept intact. The grid is defined by a set of equal-sized cells. The grid starts at \((\text{xStart}, \text{yStart})\). Each cell has width equal to \(\text{xStep}\) and height equal to \(\text{yStep}\), and there are \(\text{xNumCells}\) cells horizontally and \(\text{yNumCells}\) cells vertically.

The degree of warping within each cell is defined by the values in \(\text{xWarpPos}\) and \(\text{yWarpPos}\) parameters. Each of these parameters must contain \((\text{xNumCells} + 1) \times (\text{yNumCells} + 1)\) values, which, respectively, contain the source X and source Y coordinates that map to the upper-left corner of each cell in the destination image. The cells are enumerated in row-major order. That is, all the grid points along a row are enumerated first, then the grid points for the next row are enumerated, and so on.

For example, suppose \(\text{xNumCells}\) is equal to 2 and \(\text{yNumCells}\) is equal to 1. Then the order of the data in the \(\text{xWarpPos}\) would be:

\[
\begin{align*}
(x0, y0) & \rightarrow (x0, y1) \\
(x1, y0) & \rightarrow (x1, y1)
\end{align*}
\]

and in the \(\text{yWarpPos}\):

\[
\begin{align*}
(x0, y0) & \rightarrow (x1, y0) \\
(x0, y1) & \rightarrow (x1, y1)
\end{align*}
\]

for a total of \((2 + 1) \times (1 + 1) = 6\) elements in each table.

**Parameters**  
The function takes the following arguments:

- **\(\text{dst}\)**  
  Pointer to destination image.

- **\(\text{src}\)**  
  Pointer to source image.
xWarpPos  A float array of length \((x\text{NumCells} + 1)\ast(y\text{NumCells} + 1)\) containing horizontal warp positions at the grid points, in row-major order.

yWarpPos  A float array of length \((x\text{NumCells} + 1)\ast(y\text{NumCells} + 1)\) containing vertical warp positions at the grid points, in row-major order.

postShiftX  The displacement to apply to source X positions.

cxWarpPos  The displacement to apply to source Y positions.

xStart  The minimum X coordinate of the grid.

xStep  The horizontal spacing between grid cells.

xNumCells  The number of grid cell columns.

yStart  The minimum Y coordinate of the grid.

cyWarpPos  The vertical spacing between grid cells.

cyNumCells  The number of grid cell rows.

interp_table  Pointer to an interpolation table. The table is created by the `mlib_ImageInterpTableCreate()` function.

edge  Type of edge condition. It can be one of the following:

- `MLIB_EDGE_DST_NO_WRITE`
- `MLIB_EDGE_SRC_PADDED`

Return Values  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  `mlib_ImageInterpTableCreate(3MLIB)`, `mlib_ImageInterpTableDelete(3MLIB)`, `mlib_ImageGridWarp(3MLIB)`, `mlib_ImageGridWarp_Fp(3MLIB)`, `mlib_ImageGridWarpTable(3MLIB)`, `attributes(5)`
The `mlib_ImageHistogram2()` function creates a histogram by scanning an image, counting the number of pixels within a given range for each channel of the image, and then generating a histogram.

The image can have 1, 2, 3 or 4 channels. The data type of the image can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`. The histogram must have the same number of channels as the image has.

One entry of the histogram, or a bin, is used to accumulate the number of pixels within a certain sub-range. The legal pixel range and the number of bins may be controlled separately.

If `binWidth` is defined as 
\[
\frac{\text{highValue} - \text{lowValue}}{\text{numBins}}
\]
then bin `i` counts pixel values in the following range:
\[
\text{lowValue} + i*\text{binWidth} \leq x < \text{lowValue} + (i + 1)*\text{binWidth}
\]

The set of pixels scanned may furthermore be reduced by specifying `xPeriod` and `yPeriod` parameters that specify the sampling rate along each axis.

The set of pixels to be accumulated may be obtained from the following equation:
\[
x = xStart + p*xPeriod; \quad 0 \leq p < \frac{w - xStart}{xPeriod} \\
y = yStart + q*yPeriod; \quad 0 \leq q < \frac{h - yStart}{yPeriod}
\]

It is the user’s responsibility to clear the histogram table before this function is called and to ensure that the histogram table supplied is suitable for the source image and the parameters. Otherwise, the result of this function is undefined.

The range from `lowValue[k]` to `(highValue[k] - 1)` must be a valid subrange of the image type range.

**Parameters**

The function takes the following arguments:

- `histo` Pointer to histogram. The format of the histogram is `histo[channel][index]`. The index values for channel `i` can be `0, 1, ..., numBins[i]-1`.
- `img` Pointer to source image.
- `numBins` The number of bins for each channel of the image.
- `lowValue` The lowest pixel value checked for each channel.
**highValue**  The highest pixel value checked for each channel. When counting the pixel values, **highValue** is not included.

**xStart**  The initial X sample coordinate.

**yStart**  The initial Y sample coordinate.

**xPeriod**  The X sampling rate. **xPeriod** ≥ 1.

**yPeriod**  The Y sampling rate. **yPeriod** ≥ 1.

**Return Values**  The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  mlib_ImageHistogram(3MLIB), attributes(5)
The `mlib_ImageHistogram()` function creates a histogram. The data type of the image can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
The function takes the following arguments:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>histo</code></td>
<td>Pointer to histogram. The format of the histogram is histo[channel][index]. The <code>MLIB_BYTE</code> type entries are indexed from 0 to 255. The <code>MLIB_SHORT</code> type entries are indexed from -32768 to -1, then from 0 to 32767. The <code>MLIB_USHORT</code> type entries are indexed from 0 to 65535. The <code>MLIB_INT</code> type entries are indexed from -2147483648 to -1, then from 0 to 2147483647.</td>
</tr>
<tr>
<td><code>img</code></td>
<td>Pointer to source image.</td>
</tr>
</tbody>
</table>

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
`mlib_ImageHistogram2(3MLIB), attributes(5)`
The `mlib_ImageInterpTableCreate()` function creates an interpolation table based on parameters specified.

This function creates an internal data structure, an interpolation table, which can be used by some image geometric functions for implementing a table-driven interpolation algorithm.

The parameter `type` defines the type of dataH/dataV input arrays and can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.

The dataH array should have at least `width*2**subsampleBitsH` entries. `dataH[i*2**subsampleBitsH]` holds the coefficient for the leftmost neighboring pixel, `dataH[i*2**subsampleBitsH + 1]` holds the coefficient for the second neighboring pixel from left, ..., and `dataH[i*2**subsampleBitsH + width - 1]` holds the coefficient for the rightmost neighboring pixel, where `i = 0, 1, 2, ..., 2**subsampleBitsH - 1`.

The dataV array should have at least `height*2**subsampleBitsV` entries or should be NULL. If dataV is NULL, then dataH is used in its place, and in this case the parameters `topPadding`, `height`, and `subsampleBitsV` are ignored.

The function takes the following arguments:

- `type` Data type of the coefficients.
- `width` Width of the interpolation kernel in pixels.
- `height` Height of the interpolation kernel in pixels.
- `leftPadding` Number of pixels lying to the left of the interpolation kernel key position.
- `topPadding` Number of pixels lying above the interpolation kernel key position.
- `subsampleBitsH` Numbers of bits used for the horizontal subsample position.
- `subsampleBitsV` Numbers of bits used for the vertical subsample position.
- `precisionBits` Number of fractional bits used to describe the coefficients.
- `dataH` Pointer to horizontal coefficient data.
- `dataV` Pointer to vertical coefficient data.
mlib_ImageInterpTableCreate(3MLIB)

**Return Values**  The function returns a pointer to an interpolation table.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  mlib_ImageInterpTableDelete(3MLIB), mlib_ImageAffineTable(3MLIB),
mlib_ImageZoomTranslateTable(3MLIB), mlib_ImageGridWarpTable(3MLIB),
mlib_ImagePolynomialWarpTable(3MLIB), attributes(5)
The `mlib_ImageInterpTableDelete()` function deletes an interpolation table. This function deletes the structure of an interpolation table and frees the memory allocated by `mlib_ImageInterpTableCreate()`.

The function takes the following arguments:

- `interp_table` Pointer to an interpolation table.

None.

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also `mlib_ImageInterpTableCreate(3MLIB), mlib_ImageAffineTable(3MLIB), mlib_ImageZoomTranslateTable(3MLIB), mlib_ImageGridWarpTable(3MLIB), mlib_ImagePolynomialWarpTable(3MLIB), attributes(5)"
The `mlib_ImageInvert()` function performs the inversion of an image such that white becomes black, light gray becomes dark gray, and so on. It uses the following equation:

\[
\text{dst}[x][y][i] = (G\text{white} + G\text{black}) - \text{src}[x][y][i]
\]

The values of Gwhite and Gblack for different types of images are:

<table>
<thead>
<tr>
<th>Image Type</th>
<th>Gwhite</th>
<th>Gblack</th>
<th>Gwhite + Gblack</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BYTE</td>
<td>255</td>
<td>0</td>
<td>255 (0xFF)</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>32767</td>
<td>-32768</td>
<td>-1 (0xFFFF)</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>65535</td>
<td>0</td>
<td>65535 (0xFFFF)</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>2147483647</td>
<td>-2147483648</td>
<td>-1 (0xFFFFFFFF)</td>
</tr>
</tbody>
</table>

Given that integer data are in the two’s complement representation, `mlib_ImageInvert()` is the same as `mlib_ImageNot()`, while `mlib_ImageInvert_Inp()` is the same as `mlib_ImageNot_Inp()`.

**Parameters**

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

`mlib_ImageInvert_Inp(3MLIB), mlib_ImageInvert_Fp(3MLIB), mlib_ImageInvert_Fp_Inp(3MLIB), attributes(5)`
# mlib_ImageInvert_Fp

**Synopsis**

```c
#include <mlib.h>

mlib_status mlib_ImageInvert_Fp(mlib_image *dst, const mlib_image *src);
```

**Description**

The `mlib_ImageInvert_Fp()` function performs the floating-point inversion of an image such that white becomes black, light gray becomes dark gray, and so on. It uses the following equation:

\[
\text{dst}[x][y][i] = -\text{src}[x][y][i]
\]

**Parameters**

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

`mlib_ImageInvert_Fp_Inp(3MLIB), mlib_ImageInvert(3MLIB), mlib_ImageInvert_Inp(3MLIB), attributes(5)`
The `mlib_ImageInvert_Fp_Inp()` function performs the floating-point inversion of an image such that white becomes black, light gray becomes dark gray, and so on, in place. It uses the following equation:

\[ \text{srcdst}[x][y][i] = -\text{srcdst}[x][y][i] \]

**Parameters**
The function takes the following arguments:

- `srcdst` Pointer to source and destination image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
`mlib_ImageInvert_Fp(3MLIB)`, `mlib_ImageInvert(3MLIB)`, `mlib_ImageInvert_Inp(3MLIB)`, attributes(5)
The `mlib_ImageInvert_Inp()` function performs the in-place inversion of an image such that white becomes black, light gray becomes dark gray, and so on. It uses the following equation:

\[ \text{srcdst}[x][y][i] = (G_{white} + G_{black}) - \text{srcdst}[x][y][i] \]

The values of \( G_{white} \) and \( G_{black} \) for different types of images are:

<table>
<thead>
<tr>
<th>Image Type</th>
<th>( G_{white} )</th>
<th>( G_{black} )</th>
<th>( G_{white} + G_{black} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BYTE</td>
<td>255</td>
<td>0</td>
<td>255 (0xFF)</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>32767</td>
<td>-32768</td>
<td>-1 (0xFFFFFFFF)</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>65535</td>
<td>0</td>
<td>65535 (0xFFFF)</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>2147483647</td>
<td>-2147483648</td>
<td>-1 (0xFFFFFFFF)</td>
</tr>
</tbody>
</table>

Given that integer data are in the two’s complement representation, `mlib_ImageInvert()` is the same as `mlib_ImageNot()`, while `mlib_ImageInvert_Inp()` is the same as `mlib_ImageNot_Inp()`.

Parameters

- The function takes the following arguments:
  - `srcdst` Pointer to source and destination image.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

- `mlib_ImageInvert(3MLIB)`, `mlib_ImageInvert_Fp(3MLIB)`
- `mlib_ImageInvert_Fp_Inp(3MLIB)`
- attributes(5)
mlib_ImageIsNotAligned2() – image query, two-byte aligned

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

int mlib_ImageIsNotAligned2(const mlib_image *img);
```

Description

The `mlib_ImageIsNotAligned2()` function tests for a specific alignment of a mediaLib image structure.

Parameters

The function takes the following arguments:

- `img`  Pointer to source image.

Return Values

Returns 0 if data address is two-byte aligned; otherwise, returns nonzero.

Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

`mlib_ImageIsNotAligned4(3MLIB)`, `mlib_ImageIsNotAligned8(3MLIB)`,
`mlib_ImageIsNotAligned64(3MLIB)`, `mlib_ImageIsNotHeight2X(3MLIB)`,
`mlib_ImageIsNotHeight4X(3MLIB)`, `mlib_ImageIsNotHeight8X(3MLIB)`,
`mlib_ImageIsNotOneDvector(3MLIB)`, `mlib_ImageIsNotStride8X(3MLIB)`,
`mlib_ImageIsNotWidth2X(3MLIB)`, `mlib_ImageIsNotWidth4X(3MLIB)`,
`mlib_ImageIsNotWidth8X(3MLIB)`, `mlib_ImageIsUserAllocated(3MLIB)`, `attributes(5)`
**Name**
mllib\_ImageIsNotAligned4 – image query, four-byte aligned

**Synopsis**

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

    int mlib\_ImageIsNotAligned4(const mlib\_image *img);

**Description**
The `mlib\_ImageIsNotAligned4()` function tests for a specific alignment of a mediaLib image structure.

**Parameters**
The function takes the following arguments:

    img    Pointer to source image.

**Return Values**
Returns 0 if data address is four-byte aligned; otherwise, returns nonzero.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

mllib\_ImageIsNotAligned2(3MLIB), mlib\_ImageIsNotAligned8(3MLIB),
mlib\_ImageIsNotAligned64(3MLIB), mlib\_ImageIsNotHeight2X(3MLIB),
mlib\_ImageIsNotHeight4X(3MLIB), mlib\_ImageIsNotHeight8X(3MLIB),
mlib\_ImageIsNotOneDvector(3MLIB), mlib\_ImageIsNotStride8X(3MLIB),
mlib\_ImageIsNotWidth2X(3MLIB), mlib\_ImageIsNotWidth4X(3MLIB),
mlib\_ImageIsNotWidth8X(3MLIB), mlib\_ImageIsUserAllocated(3MLIB), attributes(5)
mlib_ImageIsNotAligned64(3MLIB)

Name mlib_ImageIsNotAligned64 – image query, 64-byte aligned

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

int mlib_ImageIsNotAligned64(const mlib_image *img);

Description The mlib_ImageIsNotAligned64() function tests for a specific alignment characteristic of a multimediaLib image structure.

Parameters The function takes the following arguments:

img Pointer to source image.

Return Values Returns 0 if data address is 64-byte aligned; otherwise, returns nonzero.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_ImageIsNotAligned2(3MLIB), mlib_ImageIsNotAligned4(3MLIB), mlib_ImageIsNotAligned8(3MLIB), mlib_ImageIsNotHeight2X(3MLIB), mlib_ImageIsNotHeight4X(3MLIB), mlib_ImageIsNotHeight8X(3MLIB), mlib_ImageIsNotOneDvector(3MLIB), mlib_ImageIsNotStride8X(3MLIB), mlib_ImageIsNotWidth2X(3MLIB), mlib_ImageIsNotWidth4X(3MLIB), mlib_ImageIsNotWidth8X(3MLIB), mlib_ImageIsUserAllocated(3MLIB), attributes(5)
mlib_ImageIsNotAligned8(3MLIB)

Name
mlib_ImageIsNotAligned8 – image query, eight-byte aligned

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

int mlib_ImageIsNotAligned8(const mlib_image *img);

Description
The mlib_ImageIsNotAligned8() function tests for a specific alignment of a mediaLib image structure.

Parameters
The function takes the following arguments:

img Pointer to source image.

Return Values
Returns 0 if data address is eight-byte aligned; otherwise, returns nonzero.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_ImageIsNotAligned2(3MLIB), mlib_ImageIsNotAligned4(3MLIB),
mlib_ImageIsNotAligned64(3MLIB), mlib_ImageIsNotHeight2X(3MLIB),
mlib_ImageIsNotHeight4X(3MLIB), mlib_ImageIsNotHeight8X(3MLIB),
mlib_ImageIsNotOneDvector(3MLIB), mlib_ImageIsNotStride8X(3MLIB),
mlib_ImageIsNotWidth2X(3MLIB), mlib_ImageIsNotWidth4X(3MLIB),
mlib_ImageIsNotWidth8X(3MLIB), mlib_ImageIsUserAllocated(3MLIB), attributes(5)
# mlib_ImageIsNotHeight2X(3MLIB)

## Name
mlib_ImageIsNotHeight2X – image query, 2X height

## Synopsis
c

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
```

```c
int mlib_ImageIsNotHeight2X(const mlib_image *img);
```

## Description
The mlib_ImageIsNotHeight2X() function tests for a specific height characteristic of a mediaLib image structure.

## Parameters
The function takes the following arguments:

- `img`  Pointer to source image.

## Return Values
Returns 0 if height is a multiple of two; otherwise, returns nonzero.

## Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

## See Also
mlib_ImageIsNotAligned2(3MLIB), mlib_ImageIsNotAligned4(3MLIB),
mlib_ImageIsNotAligned8(3MLIB), mlib_ImageIsNotAligned64(3MLIB),
mlib_ImageIsNotHeight4X(3MLIB), mlib_ImageIsNotHeight8X(3MLIB),
mlib_ImageIsNotOneDvector(3MLIB), mlib_ImageIsNotStride8X(3MLIB),
mlib_ImageIsNotWidth2X(3MLIB), mlib_ImageIsNotWidth4X(3MLIB),
mlib_ImageIsNotWidth8X(3MLIB), mlib_ImageIsUserAllocated(3MLIB), attributes(5)
The `mlib_ImageIsNotHeight4X()` function tests for a specific height characteristic of a mediaLib image structure. The function takes the following arguments:

- **img**  
  Pointer to source image.

Returns 0 if height is a multiple of four; otherwise, returns nonzero.

See also `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

Multimedia Library Functions - Part 3 439
# mlib_ImageIsNotHeight8X

## Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

int mlib_ImageIsNotHeight8X(const mlib_image *img);
```

## Description

The `mlib_ImageIsNotHeight8X()` function tests for a specific height characteristic of a mediaLib image structure.

## Parameters

The function takes the following arguments:

- `img` : Pointer to source image.

## Return Values

Returns 0 if height is a multiple of eight; otherwise, returns nonzero.

## Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

## See Also

- `mlib_ImageIsNotAligned2(3MLIB)`
- `mlib_ImageIsNotAligned4(3MLIB)`
- `mlib_ImageIsNotAligned8(3MLIB)`
- `mlib_ImageIsNotAligned64(3MLIB)`
- `mlib_ImageIsNotHeight2X(3MLIB)`
- `mlib_ImageIsNotHeight4X(3MLIB)`
- `mlib_ImageIsNotHeight8X(3MLIB)`
- `mlib_ImageIsNotOneDvector(3MLIB)`
- `mlib_ImageIsNotStride8X(3MLIB)`
- `mlib_ImageIsNotWidth2X(3MLIB)`
- `mlib_ImageIsNotWidth4X(3MLIB)`
- `mlib_ImageIsNotWidth8X(3MLIB)`
- `mlib_ImageIsUserAllocated(3MLIB)`
- attributes(5)
The `mlib_ImageIsNotOneDvector()` function tests for a specific dimension characteristic of a mediaLib image structure.

**Parameters**
The function takes the following arguments:

- `img`  
  Pointer to source image.

**Return Values**
Returns 0 if data space can be treated as a 1D vector; otherwise, returns nonzero.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
`mlib_ImageIsNotAligned2(3MLIB), mlib_ImageIsNotAligned4(3MLIB), mlib_ImageIsNotAligned8(3MLIB), mlib_ImageIsNotAligned64(3MLIB), mlib_ImageIsNotHeight2X(3MLIB), mlib_ImageIsNotHeight4X(3MLIB), mlib_ImageIsNotHeight8X(3MLIB), mlib_ImageIsNotStride8X(3MLIB), mlib_ImageIsNotWidth2X(3MLIB), mlib_ImageIsNotWidth4X(3MLIB), mlib_ImageIsNotWidth8X(3MLIB), mlib_ImageIsUserAllocated(3MLIB), attributes(5)`
mlib_ImageIsNotStride8X() function tests for a specific stride characteristic of a mediaLib image structure.

The function takes the following arguments:

**img**  
Pointer to source image.

Returns 0 if stride is a multiple of eight; otherwise, returns nonzero.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
mlib_ImageIsNotAligned2(3MLIB), mlib_ImageIsNotAligned4(3MLIB), mlib_ImageIsNotAligned8(3MLIB), mlib_ImageIsNotAligned64(3MLIB), mlib_ImageIsNotHeight2X(3MLIB), mlib_ImageIsNotHeight4X(3MLIB), mlib_ImageIsNotHeight8X(3MLIB), mlib_ImageIsNotOneDvector(3MLIB), mlib_ImageIsNotWidth2X(3MLIB), mlib_ImageIsNotWidth4X(3MLIB), mlib_ImageIsNotWidth8X(3MLIB), mlib_ImageIsUserAllocated(3MLIB), attributes(5)
### mlib_ImageIsNotWidth2X(3MLIB)

**Name**  
mlib_ImageIsNotWidth2X – image query, 2X width

**Synopsis**  
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

int mlib_IMAGEISNOTWIDTH2X(const mlib_image *img);
```

**Description**  
The `mlib_IMAGEISNOTWIDTH2X()` function tests for a specific width characteristic of a mediaLib image structure.

**Parameters**  
The function takes the following arguments:

- `img`  
  Pointer to source image.

**Return Values**  
Returns 0 if width is a multiple of two; otherwise, returns nonzero.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
mlib_IMAGEISNOTHEIGHT2X(3MLIB), mlib_IMAGEISNOTHEIGHT4X(3MLIB), mlib_IMAGEISNOTHEIGHT8X(3MLIB), mlib_IMAGEISNOTHEIGHT16X(3MLIB), mlib_IMAGEISNOTONEVECTOR(3MLIB), mlib_IMAGEISNOTSTRIDEX8(3MLIB), mlib_IMAGEISNOTSTRIDEX16(3MLIB), mlib_IMAGEISNOTWIDTH4X(3MLIB), mlib_IMAGEISNOTWIDTH8X(3MLIB), mlib_IMAGEISUSERALLOCATED(3MLIB), attributes(5)
The \texttt{mlib\_ImageIsNotWidth4X()} function tests for a specific width characteristic of a mediaLib image structure.

\textbf{Parameters}  
- \texttt{img}  
  Pointer to source image.

\textbf{Return Values}  
- Returns 0 if width is a multiple of four; otherwise, returns nonzero.

\textbf{Attributes}  
See \texttt{attributes(5)} for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

\textbf{See Also}  
- \texttt{mlib\_ImageIsNotAligned2(3MLIB)}, \texttt{mlib\_ImageIsNotAligned4(3MLIB)}, \texttt{mlib\_ImageIsNotAligned8(3MLIB)}, \texttt{mlib\_ImageIsNotAligned64(3MLIB)}, \texttt{mlib\_ImageIsNotHeight2X(3MLIB)}, \texttt{mlib\_ImageIsNotHeight4X(3MLIB)}, \texttt{mlib\_ImageIsNotHeight8X(3MLIB)}, \texttt{mlib\_ImageIsNotOneDvector(3MLIB)}, \texttt{mlib\_ImageIsNotStride8X(3MLIB)}, \texttt{mlib\_ImageIsNotWidth2X(3MLIB)}, \texttt{mlib\_ImageIsNotWidth8X(3MLIB)}, \texttt{mlib\_ImageIsUserAllocated(3MLIB)}, \texttt{attributes(5)}
### Name
mlib_ImageIsNotWidth8X – image query, 8X width

### Synopsis
c{ flag... } file... -lmlib [ library... ]
#include <mlib.h>

int mlib_ImageIsNotWidth8X(const mlib_image *img);

### Description
The `mlib_ImageIsNotWidth8X()` function tests for a specific width characteristic of a mediaLib image structure.

### Parameters
The function takes the following arguments:

- **img** Pointer to source image.

### Return Values
Returns 0 if width is a multiple of eight; otherwise, returns nonzero.

### Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
mlib_ImageIsNotAligned2(3MLIB), mlib_ImageIsNotAligned4(3MLIB),
mlib_ImageIsNotAligned8(3MLIB), mlib_ImageIsNotAligned64(3MLIB),
mlib_ImageIsNotHeight2X(3MLIB), mlib_ImageIsNotHeight4X(3MLIB),
mlib_ImageIsNotHeight8X(3MLIB), mlib_ImageIsNotOneDvector(3MLIB),
mlib_ImageIsNotStride8X(3MLIB), mlib_ImageIsNotWidth2X(3MLIB),
mlib_ImageIsNotWidth4X(3MLIB), mlib_ImageIsUserAllocated(3MLIB), attributes(5)
The `mlib_ImageIsUserAllocated()` function tests for a specific allocation characteristic of a mediaLib image structure.

The function takes the following arguments:

- `src` Pointer to source image.

Returns 0 if data space has been allocated by mediaLib; otherwise, returns nonzero.

### Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_ImageIsNotAligned2(3MLIB)`, `mlib_ImageIsNotAligned4(3MLIB)`, `mlib_ImageIsNotAligned8(3MLIB)`, `mlib_ImageIsNotAligned64(3MLIB)`, `mlib_ImageIsNotHeight2X(3MLIB)`, `mlib_ImageIsNotHeight4X(3MLIB)`, `mlib_ImageIsNotHeight8X(3MLIB)`, `mlib_ImageIsNotOneDvector(3MLIB)`, `mlib_ImageIsNotStride8X(3MLIB)`, `mlib_ImageIsNotWidth2X(3MLIB)`, `mlib_ImageIsNotWidth4X(3MLIB)`, `mlib_ImageIsNotWidth8X(3MLIB)`, `attributes(5)`
mlib_ImageLog function computes the natural logarithm of the image pixels.

It uses the following equation:
\[ \text{dst}[x][y][i] = \log(\text{src}[x][y][i]) \]

The function takes the following arguments:
- \text{dst} Pointer to destination image.
- \text{src} Pointer to source image.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See also mlib_ImageLog_Fp(3MLIB), mlib_ImageLog_Fp_Inp(3MLIB), mlib_ImageLog_Inp(3MLIB), attributes(5)
The `mlib_ImageLog_Fp()` function computes the natural logarithm of the image pixels.

It uses the following equation:

\[ \text{dst}[x][y][i] = \log(\text{src}[x][y][i]) \]

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See also `mlib_ImageLog(3MLIB), mlib_ImageLog_Fp_Inp(3MLIB), mlib_ImageLog_Inp(3MLIB), attributes(5)`
The `mlib_ImageLog_Fp_Inp` function computes the natural logarithm of the image pixels, in place.

It uses the following equation:

\[ \text{srcdst}[x][y][i] = \log(\text{srcdst}[x][y][i]) \]

### Parameters

- `srcdst` Pointer to source and destination image.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_ImageLog(3MLIB)`, `mlib_ImageLog_Fp(3MLIB)`, `mlib_ImageLog_Inp(3MLIB)`, `attributes(5)`
mlib_ImageLog_Inp(3MLIB)

Name  mlib_ImageLog_Inp – computes the natural logarithm of the image pixels, in place

Synopsis  

cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>  

mlib_status mlib_ImageLog_Inp(mlib_image *srcdst);

Description  The mlib_ImageLog_Inp() function computes the natural logarithm of the image pixels in place.

It uses the following equation:

\[ \text{srcdst}[x][y][i] = \log(\text{srcdst}[x][y][i]) \]

Parameters  The function takes the following arguments:

srcdst  Pointer to source and destination image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageLog(3MLIB), mlib_ImageLog_Fp(3MLIB), mlib_ImageLog_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageLookUp2` function maps the source image to the destination image by using the user-specified lookup table and an offset.

The source and destination images must have the same width and height.

The source and destination images can have different data types. See the following table for available variations of the table lookup function on image types:

<table>
<thead>
<tr>
<th>Type[*]</th>
<th>BYTE</th>
<th>SHORT</th>
<th>USHORT</th>
<th>INT</th>
<th>FLOAT</th>
<th>DOUBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BIT</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

The source and destination images also can have a different number of channels. The source image can be a single-channel image or can have the same number of channels as the destination image. The lookup table can have one channel or have the same channels as the destination image. See the following table for possible variations on the number of channels in the images and the lookup table:

<table>
<thead>
<tr>
<th># of channels in</th>
<th># of channels in</th>
<th># of channels in</th>
</tr>
</thead>
<tbody>
<tr>
<td>the input image</td>
<td>the lookup table</td>
<td>the output image</td>
</tr>
<tr>
<td>l</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td>n</td>
<td>l</td>
<td>n</td>
</tr>
<tr>
<td>n</td>
<td>n</td>
<td>n</td>
</tr>
</tbody>
</table>

where, n = 1, 2, 3, 4.

Each of the following equations is used in the corresponding case shown in the table above.
The function takes the following arguments:

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **table**  
  Pointer to lookup table. The data type of the lookup table is the same as that of the destination image. The format of the lookup table is:
  
  ```
  table[channel][index]
  ```

  The entries are indexed from 0 to 1, 2, ..., and so on. It is the user’s responsibility to provide a lookup table that has enough entries to cover all possible values of the pixel components deducted by the offset in each channel of the source image.

- **offsets**  
  Offset values subtracted from the src pixel before table lookup.

- **channels**  
  Number of channels in the lookup table. If the number of channels equals 1, then the same table is applied to all channels. Otherwise, the number of channels must be no less than the number of channels in the destination image.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- mlib_ImageLookUp(3MLIB), mlib_ImageLookUp_Inp(3MLIB), mlib_ImageLookUpMask(3MLIB), attributes(5)
The `mlib_ImageLookUp()` function maps the source image to the destination image by using the user-specified lookup table.

The source and destination images must have the same width and height. The source image can be a single channel image or can have the same number of channels as the destination image. One of the following equations is used accordingly:

\[
\begin{align*}
\text{dst}[x][y][i] &= \text{table}[i][\text{src}[x][y][0]] \\
\text{dst}[x][y][i] &= \text{table}[i][\text{src}[x][y][i]]
\end{align*}
\]

The source and destination images can have different data types. See the following table for available variations of the table lookup function on image types:

<table>
<thead>
<tr>
<th>Type[*]</th>
<th>BYTE</th>
<th>SHORT</th>
<th>USHORT</th>
<th>INT</th>
<th>FLOAT</th>
<th>DOUBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BIT</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB USHORT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

**Parameters**

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `table` Pointer to lookup table. The data type of the lookup table is the same as the destination image. The number of entries in the lookup table is determined by the type of the input image. The format of the lookup table is:

  \[
  \text{table[channel][index]}
  \]

  The MLIB_BIT type entries are indexed from 0 to 1. The MLIB_BYTE type entries are indexed from 0 to 255. The MLIB_SHORT type entries are indexed from -32768 to -1,
then from 0 to 32767. The MLIB_USHORT type entries are indexed from 0 to 65535. The MLIB_INT type entries are indexed from -2147483648 to -1, and then from 0 to 2147483647.

If a table covering the full range of input data type is not available or not realistic, which is mostly true for doing table lookup with an MLIB_INT input image, a smaller table can be used. In this case, the pointer to the table has to be adjusted as if it is pointing to the element for the smallest value of the input data type. For example, to use a table covering input data range of [-65536, 65535], the pointer needs to be adjusted as follows:

\[
\text{table}_{16\_32}[0] += \text{MLIB\_S32\_MIN} + 65536;
\]

This might cause a pointer arithmetic overflow in 32-bit mode, but probably works if the overflow is handled as a wrap-around. If possible, function

\text{mlib\_ImageLookUp2}() should be used instead.

**Return Values**  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
mlib\_ImageLookUp\_Inp(3MLIB), mlib\_ImageLookUp2(3MLIB), mlib\_ImageLookUpMask(3MLIB), attributes(5)
mlib_ImageLookUp_Inp(3MLIB)

Name  mlib_ImageLookUp_Inp – table lookup, in place

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageLookUp_Inp(mlib_image *srcdst, const void **table);

Description  The mlib_ImageLookUp_Inp() function maps the source image to the destination image, in place, by using the user-specified lookup table.

The following equation is used:
srcdst[x][y][i] = table[i][srcdst[x][y][i]]

Parameters  The function takes the following arguments:

srcdst  Pointer to first source and destination image.

Table  Pointer to lookup table. The data type of the lookup table is the same as the destination image. The number of entries in the lookup table is determined by the type of the input image. The format of the lookup table is:

table[channel][index]

The MLIB_BYTE type entries are indexed from 0 to 255. The MLIB_SHORT type entries are indexed from -32768 to -1, then from 0 to 32767. The MLIB_USHORT type entries are indexed from 0 to 65535. The MLIB_INT type entries are indexed from -2147483648 to -1, and then from 0 to 2147483647.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageLookUp(3MLIB), mlib_ImageLookUp2(3MLIB), mlib_ImageLookUpMask(3MLIB), attributes(5)
The `mlib_ImageLookUpMask()` function maps the source image to the destination image by using the user-specified lookup table and applying a channel mask.

The source and destination images must have the same width and height. The source image can be a single channel image or can have the same number of channels as the destination image. One of the following equations is used accordingly:

\[ \text{dst}[x][y][i] = \text{table}[i][\text{src}[x][y][0]] \]
\[ \text{dst}[x][y][i] = \text{table}[i][\text{src}[x][y][i]] \]

The source and destination images can have different data types. See the following table for available variations of the table lookup function on image types:

<table>
<thead>
<tr>
<th>Type [*]</th>
<th>BYTE</th>
<th>SHORT</th>
<th>USHORT</th>
<th>INT</th>
<th>FLOAT</th>
<th>DOUBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BIT</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

**Parameters**

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `table` Pointer to lookup table. The data type of the lookup table is the same as the destination image. The number of entries in the lookup table is determined by the type of the input image. The format of the lookup table is:

  \[ \text{table}[\text{channel}][\text{index}] \]

  The MLIB_BIT type entries are indexed from 0 to 1. The MLIB_BYTE type entries are indexed from 0 to 255. The MLIB_SHORT type entries are indexed from -32768 to 32767.
to -1, then from 0 to 32767. The MLIB_USHORT type entries are indexed from 0 to 65535. The MLIB_INT type entries are indexed from -2147483648 to -1, and then from 0 to 2147483647.

channels Number of channels in the lookup table. If the number of channels is equal to 1, then the same table is applied to all channels. Otherwise, the number of channels must be no less than the number of valid 1s in the channel mask.

cmask Channel mask. Each bit of the mask represents a channel of an image or a lookup table. Only the rightmost four bits of cmask are considered, where the least significant bit of cmask is for the last channel. The channels corresponding to 0 bits of cmask are not processed or used. cmask is always applied to the destination image dst. If the source image src has the same number of channels as dst, then cmask is also applied to src. Otherwise, each channel of src is used for each cmask bit with a value of 1, in this order: the first channel for the first 1 from the left in cmask. If src has only one channel, then the same src channel is used for every cmask bit with a value of 1. If the lookup table has the same number of channels as dst, then cmask is also applied to table. Otherwise, each table channel is used for each cmask bit with a value of 1, in this order: the first channel for the first 1 from the left in cmask. If table has only one channel, then the same table channel is used for every cmask bit with a value of 1.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_ImageLookUp(3MLIB), mlib_ImageLookUp_Inp(3MLIB), mlib_ImageLookUp2(3MLIB), attributes(5)
The `mlib_ImageMax()` function accepts input from the two source images and writes the maximum to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[
de\_{x,y} = \max\{ s\_{1x,y}, s\_{2x,y} \}
\]

Parameters

- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

`mlib_ImageMax(3MLIB), mlib_ImageMax_Fp(3MLIB), mlib_ImageMax_Fp_Inp(3MLIB), mlib_ImageMax_Inp(3MLIB), attributes(5)`
**Name**  
mlib_ImageMaxFilter3x3 - 3x3 maximum filter

**Synopsis**  
cc [ flag... ] file... -lmllib [ library... ]  
#include <mlib.h>  

mlib_status mlib_ImageMaxFilter3x3(mlib_image *dst, const mlib_image *src);

**Description**  
The mlib_ImageMaxFilter3x3() function replaces the center pixel in a neighborhood with the maximum value in that neighborhood for each 3x3 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
dst\{x,y\}[0] = \text{MAX} \{ \text{src}\{p,q\}[0], \quad x-1 \leq p \leq x+1; \ y-1 \leq q \leq y+1 \} 
\]

where \( x = 1, \ldots, w - 2; \ y = 1, \ldots, h - 2 \).

**Parameters**  
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.

**Return Values**  
The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**See Also**  
mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB), mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter3x3(3MLIB)

mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name  mlib_ImageMaxFilter3x3_Fp – 3x3 maximum filter

Synopsis  cc [ flag... ] file... -lm lib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMaxFilter3x3_Fp(mlib_image *dst,
const mlib_image *src);

Description  The mlib_ImageMaxFilter3x3_Fp() function replaces the center pixel in a neighborhood
with the floating-point maximum value in that neighborhood for each 3x3 neighborhood in
the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[ \text{dst}[x][y][0] = \text{MAX}\{ \text{src}[p][q][0], \]
\[ x-1 \leq p \leq x+1; \ y-1 \leq q \leq y+1 \} \]

where \( x = 1, \ldots, w - 2; \ y = 1, \ldots, h - 2 \).

Parameters  The function takes the following arguments:

\( \text{dst} \)  Pointer to destination image.
\( \text{src} \)  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
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<tr>
<td>MT-Level</td>
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</tr>
</tbody>
</table>

See Also  mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter5x5(3MLIB),
mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB),
mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB),
mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter3x3_US(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
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mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageMaxFilter3x3_Fp(3MLIB)

mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name | mlib_ImageMaxFilter5x5 - 5x5 Max Filter

Synopsis | cc [ flag...] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMaxFilter5x5(mlib_image *dst, const mlib_image *src);

Description | The mlib_ImageMaxFilter5x5() function replaces the center pixel in a neighborhood with the maximum value in that neighborhood for each 5x5 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
dst[x][y][0] = \text{MAX} \{ \text{src}[p][q][0], \quad x-2 \leq p \leq x+2; \quad y-2 \leq q \leq y+2 \}
\]

where \( x = 2, \ldots, w - 3; \quad y = 2, \ldots, h - 3 \).

Parameters | The function takes the following arguments:

- **dst** | Pointer to destination image.
- **src** | Pointer to source image.

Return Values | The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes | See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also | mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB), mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB),

mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name        mlib_ImageMaxFilter5x5_Fp − 5x5 Max Filter

Synopsis    cc [ flag... ] file... -lmblib [ library... ]
            #include <mlib.h>

            mlib_status mlib_ImageMaxFilter5x5_Fp(mlib_image *dst,
            const mlib_image *src);

Description The mlib_ImageMaxFilter5x5_Fp() function replaces the center pixel in a neighborhood with the floating-point maximum value in that neighborhood for each 5x5 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
    \text{dst}\{x\}\{y\}\{0\} = \text{MAX}\{ \text{src}\{p\}\{q\}\{0\}, \\
    x-2 \leq p \leq x+2; y-2 \leq q \leq y+2 \}
\]

where \(x = 2, \ldots, w - 3; y = 2, \ldots, h - 3\).

Parameters The function takes the following arguments:

\( \text{dst} \) Pointer to destination image.
\( \text{src} \) Pointer to source image.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes\( (5) \) for descriptions of the following attributes:

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See Also mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageMaxFilter5x5_Fp(3MLIB)

mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMaxFilter7x7()` function replaces the center pixel in a neighborhood with the maximum value in that neighborhood for each 7x7 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
\text{dst}[x][y][0] = \max\{ \text{src}[p][q][0], \quad x-3 \leq p \leq x+3; \quad y-3 \leq q \leq y+3 \}
\]

where \( x = 3, \ldots, w - 4; \ y = 3, \ldots, h - 4 \).

**Parameters**
- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
- `mlib_ImageMaxFilter3x3(3MLIB)`
- `mlib_ImageMaxFilter3x3_Fp(3MLIB)`
- `mlib_ImageMaxFilter5x5(3MLIB)`
- `mlib_ImageMaxFilter5x5_Fp(3MLIB)`
- `mlib_ImageMaxFilter7x7_Fp(3MLIB)`
- `mlib_ImageMedianFilter3x3(3MLIB)`
- `mlib_ImageMedianFilter3x3_US(3MLIB)`
- `mlib_ImageMedianFilter5x5(3MLIB)`
- `mlib_ImageMedianFilter5x5_Fp(3MLIB)`
- `mlib_ImageMedianFilter7x7_US(3MLIB)`
- `mlib_ImageMedianFilterMxN(3MLIB)`
- `mlib_ImageMinFilter3x3(3MLIB)`
- `mlib_ImageMinFilter5x5(3MLIB)`
- `mlib_ImageMinFilter7x7(3MLIB)`
- `mlib_ImageMinFilter7x7_Fp(3MLIB)`
- `mlib_ImageRankFilter3x3(3MLIB)`
- `mlib_ImageRankFilter3x3_US(3MLIB)`
- `mlib_ImageRankFilter5x5(3MLIB)`
- `mlib_ImageRankFilter5x5_Fp(3MLIB)`
mlib_ImageMaxFilter7x7(3MLIB)

mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name  mlib_ImageMaxFilter7x7_Fp - 7x7 Max Filter

Synopsis  cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMaxFilter7x7_Fp(mlib_image *dst,
                                   const mlib_image *src);

Description  The mlib_ImageMaxFilter7x7_Fp() function replaces the center pixel in a neighborhood
with the floating-point maximum value in that neighborhood for each 7x7 neighborhood in
the image.

The source and destination images must be single-channel images.

It uses the following equation:

dst[x][y][0] = MAX{ src[p][q][0],
    x-3 ≤ p ≤ x+3; y-3 ≤ q ≤ y+3 }

where x = 3, ..., w - 4; y = 3, ..., h - 4.

Parameters  The function takes the following arguments:

dst  Pointer to destination image.

src  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
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mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
The `mlib_ImageMax_Fp()` function accepts input from the two floating-point source images and writes the maximum to the destination image on a pixel-by-pixel basis.

It uses the following equation:
\[
dst[x][y][i] = \text{MAX} \{ \text{src1}[x][y][i], \text{src2}[x][y][i] \}
\]

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageMax(3MLIB), mlib_ImageMax_Fp_Inp(3MLIB), mlib_ImageMax_Inp(3MLIB), attributes(5)`
The `mlib_ImageMax_Fp_Inp()` function accepts input from the two floating-point source images and writes the maximum, in place, on a pixel-by-pixel basis. It uses the following equation:

```
src1dst[x][y][i] = MAX{ src1dst[x][y][i], src2[x][y][i] }
```

The function takes the following arguments:

- `src1dst` Pointer to source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageMax(3MLIB), mlib_ImageMax_Fp(3MLIB), mlib_ImageMax_Inp(3MLIB), attributes(5)`
The `mlib_ImageMaximum()` function determines the maximum value for each channel in an image.

It uses the following equation:

\[
\text{max}[i] = \text{MAX} \{ \text{img}[x][y][i]; \ 0 \leq x < w, \ 0 \leq y < h \}
\]

**Parameters**
The function takes the following arguments:

- `max` Pointer to maximum vector, where length is the number of channels in the image.
  `max[i]` contains the maximum of channel `i`.
- `img` Pointer to a source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_ImageMaximum_Fp(3MLIB)`, `mlib_ImageMinimum(3MLIB)`, `mlib_ImageMinimum_Fp(3MLIB)`, `attributes(5)`
mlib_ImageMaximum_Fp(3MLIB)

Name  mlib_ImageMaximum_Fp – image maximum

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          
          #include <mlib.h>

          mlib_status mlib_ImageMaximum_Fp(mlib_d64 *max, const mlib_image *img);

Description  The mlib_ImageMaximum_Fp() function determines the maximum value for each channel in a
              floating-point image.

              It uses the following equation:

              \[ \text{max}[i] = \text{MAX} \{ \text{img}[x][y][i]; \ 0 \leq x < w, \ 0 \leq y < h \} \]

Parameters  The function takes the following arguments:

              max      Pointer to maximum vector, where length is the number of channels in the image.
              \text{max}[i] contains the maximum of channel \text{i}.

              img      Pointer to a source image.

Return Values  The function returns \text{MLIB_SUCCESS} if successful. Otherwise it returns \text{MLIB_FAILURE}.

Attributes  See attributes(5) for descriptions of the following attributes:

\begin{table}[h]
\centering
\begin{tabular}{ |l|l| }
\hline
ATTRIBUTE TYPE & ATTRIBUTE VALUE \\
\hline
Interface Stability & Committed \\
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MT-Level & MT-Safe \\
\hline
\end{tabular}
\end{table}

See Also  mlib_ImageMaximum(3MLIB), mlib_ImageMinimum(3MLIB),
          mlib_ImageMinimum_Fp(3MLIB), attributes(5)
The `mlib_ImageMax_Inp()` function accepts input from the two source images and writes the maximum in place on a pixel-by-pixel basis.

It uses the following equation:

\[
src\text{dst}[x][y][i] = \text{MAX}\{ src\text{dst}[x][y][i], src2[x][y][i] \}
\]

**Parameters**
The function takes the following arguments:
- `srcdst` Pointer to source and destination image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageMax(3MLIB), mlib_ImageMax_Fp(3MLIB), mlib_ImageMax_Fp_Inp(3MLIB), attributes(5)`
mlib_ImageMean(3MLIB)

Name  mlib_ImageMean – image mean

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMean(mlib_d64 *mean, const mlib_image *img);

Description  The mlib_ImageMean() function computes the mean value of all the pixels in the image. It uses the following equation:

\[
\text{mean}[i] = \frac{1}{w \times h - 1} \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img}[x][y][i]
\]

Parameters  The function takes the following arguments:

- **mean**: Pointer to mean array, where length is the number of channels in the image. mean[i] contains the mean of channel i.
- **img**: Pointer to an image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageMean_Fp(3MLIB), mlib_ImageStdDev(3MLIB), mlib_ImageStdDev_Fp(3MLIB), attributes(5)
The `mlib_ImageMean_Fp()` function computes the mean value of all the pixels in the image.

It uses the following equation:

\[
\text{mean}[i] = \frac{1}{w \cdot h - 1} \cdot \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img}[x][y][i]
\]

The function takes the following arguments:

- `mean` Pointer to mean array, where length is the number of channels in the image. `mean[i]` contains the mean of channel `i`.
- `img` Pointer to an image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageMean(3MLIB), mlib_ImageStdDev(3MLIB), mlib_ImageStdDev_Fp(3MLIB), attributes(5)`
The `mlib_ImageMedianFilter3x3()` function performs median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**
- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **mmask**: Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- **cmask**: Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilter3x3_Fp(3MLIB)`,
mlib_ImageMedianFilter3x3(3MLIB)

mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB),
mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB),
mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter3x3_Fp()` function performs floating-point median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **mmask** Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- **cmask** Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_US(3MLIB),`
mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB),
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mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter3x3_US()` function performs median filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `mmask` Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- `cmask` Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
- `bits` The number of unsigned bits for pixel dynamic range. $9 \leq \text{bits} \leq 15$.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>
mlib_ImageMedianFilter3x3_US(3MLIB)

See Also  
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMaxFilterMxN(3MLIB), mlib_ImageMaxFilterMxN_Fp(3MLIB),
mlib_ImageMaxFilter3x3_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageMinFilterMxN(3MLIB),
mlib_ImageMinFilterMxN_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter5x5()` function performs median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

### Parameters

- **dst**
  - Pointer to destination image.

- **src**
  - Pointer to source image.

- **mmask**
  - Shape of the mask to be used for median filtering. It can be one of the following:
    - `MLIB_MEDIAN_MASK_RECT`
    - `MLIB_MEDIAN_MASK_PLUS`
    - `MLIB_MEDIAN_MASK_X`
    - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`

- **cmask**
  - Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.

- **edge**
  - Type of edge condition. It can be one of the following:
    - `MLIB_EDGE_DST_NO_WRITE`
    - `MLIB_EDGE_DST_FILL_ZERO`
    - `MLIB_EDGE_DST_COPY_SRC`
    - `MLIB_EDGE_SRC_EXTEND`

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_FP(3MLIB)`
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_FP(3MLIB)`
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_FP(3MLIB)`
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_FP(3MLIB)`
- `mlib_ImageMedianFilter3x3_US(3MLIB)`, `mlib_ImageMedianFilter5x5_FP(3MLIB)`
mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB),
mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB),
mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter5x5_Fp()` function performs floating-point median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `mmask` Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- `cmask` Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`, `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`, `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`, `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`
mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB),
mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB),
mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB),
mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter5x5_US()` function performs median filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **mmask** Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- **cmask** Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`
- **bits** The number of unsigned bits for pixel dynamic range. $9 \leq \text{bits} \leq 15$.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
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mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
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mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter7x7()` function performs median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `mmask` Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- `cmask` Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB)`.
mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB),
mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
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mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilter7x7_Fp()` function performs floating-point median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **mmask** Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- **cmask** Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`,
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mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageMedianFilter7x7_US – 7x7 median filter, unsigned

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ] 
#include <mlib.h>
mlib_status mlib_ImageMedianFilter7x7_US(mlib_image *dst,
    const mlib_image *src, mlib_median_mask mmask, mlib_s32 cmask,
    mlib_edge edge, mlib_s32 bits);
```

**Description**
The `mlib_ImageMedianFilter7x7_US()` function performs median filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**
The function takes the following arguments:

- `dst` — Pointer to destination image.
- `src` — Pointer to source image.
- `mmask` — Shape of the mask to be used for median filtering. It can be one of the following:
  - MLIB_MEDIAN_MASK_RECT
  - MLIB_MEDIAN_MASK_PLUS
  - MLIB_MEDIAN_MASK_X
  - MLIB_MEDIAN_MASK_RECT_SEPARABLE
- `cmask` — Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- `edge` — Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SRC_EXTEND
- `bits` — The number of unsigned bits for pixel dynamic range. $9 \leq \text{bits} \leq 15$.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
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<tbody>
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<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
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</tbody>
</table>
See Also  
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB),
mlib_ImageMedianFilterMxN_US(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMedianFilterMxN()` function performs MxN median filtering on an image. Each pixel of the destination image is the pixel with rank middle in the filter window.

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **m**: Width of the filter window. `m` must be an odd number greater than 1.
- **n**: Height of the filter window. `n` must be an odd number greater than 1.
- **mmask**: Shape of the mask to be used for median filtering. It can be one of the following:
  - `MLIB_MEDIAN_MASK_RECT`
  - `MLIB_MEDIAN_MASK_PLUS`
  - `MLIB_MEDIAN_MASK_X`
  - `MLIB_MEDIAN_MASK_RECT_SEPARABLE`
- **cmask**: Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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<tr>
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</tr>
</tbody>
</table>
mlib_ImageMedianFilterMxN(3MLIB)

See Also
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter5x5_US_Fp(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter3x3_US(3MLIB), mlib_ImageMaxFilter3x3_US_Fp(3MLIB),
mlib_ImageMaxFilter5x5_US(3MLIB), mlib_ImageMaxFilter5x5_US_Fp(3MLIB),
mlib_ImageMaxFilter7x7_US(3MLIB), mlib_ImageMaxFilter7x7_US_Fp(3MLIB),
mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageMinFilter7x7_US(3MLIB),
mlib_ImageMinFilter7x7_US_Fp(3MLIB), mlib_ImageMinFilterMxN(3MLIB),
mlib_ImageMinFilterMxN_Fp(3MLIB), mlib_ImageMinFilterMxN_US(3MLIB),
mlib_ImageMinFilterMxN_US_Fp(3MLIB), mlib_ImageMinFilterMxN_US_US(3MLIB),
mlib_ImageMinFilterMxN_US_US_Fp(3MLIB), mlib_ImageMinFilterMxN_US_US_US(3MLIB),
mlib_ImageMinFilterMxN_US_US_US_US_Fp(3MLIB), attributes(5)
mlib_ImageMedianFilterMxN_Fp\(\text{--MxN median filter}\)

**Synopsis**

```c
cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>
mlib_status mlib_ImageMedianFilterMxN_Fp(mlib_image *dst,
    const mlib_image *src, mlib_s32 m, mlib_s32 n, mlib_median_mask mmask,
    mlib_s32 cmask, mlib_edge edge);
```

**Description**
The `mlib_ImageMedianFilterMxN_Fp()` function performs MxN median filtering on a floating-point image. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `m` Width of the filter window. `m` must be odd number greater than 1.
- `n` Height of the filter window. `n` must be odd number greater than 1.
- `mmask` Shape of the mask to be used for median filtering. It can be one of the following:
  - MLIB_MEDIAN_MASK_RECT
  - MLIB_MEDIAN_MASK_PLUS
  - MLIB_MEDIAN_MASK_X
  - MLIB_MEDIAN_MASK_RECT_SEPARABLE
- `cmask` Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- `edge` Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SRC_EXTEND

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes\(5\) for descriptions of the following attributes:

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See Also

- mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
- mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
- mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
- mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
- mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
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- mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB),
- mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB),
- mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB),
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- mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
- mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
- mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageMedianFilterMxN_US

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_ImageMedianFilterMxN_US(mlib_image *dst, const mlib_image *src, mlib_s32 m, mlib_s32 n, mlib_median_mask mmask, mlib_s32 cmask, mlib_edge edge, mlib_s32 bits);
```

**Description**
The `mlib_ImageMedianFilterMxN_US()` function performs MxN median filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with rank middle in the filter window.

**Parameters**
The function takes the following arguments:
- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **m** Width of the filter window. \( m \) must be odd number greater than 1.
- **n** Height of the filter window. \( n \) must be odd number greater than 1.
- **mmask** Shape of the mask to be used for median filtering. It can be one of the following:
  - MLIB_MEDIAN_MASK_RECT
  - MLIB_MEDIAN_MASK_PLUS
  - MLIB_MEDIAN_MASK_X
  - MLIB_MEDIAN_MASK_RECT_SEPARABLE
- **cmask** Channel mask to indicate the channels to be filtered. Each bit of which represents a channel in the image. The channels corresponded to 1 bits are those to be processed.
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_DST_COPY_SRC
  - MLIB_EDGE_SRC_EXTEND
- **bits** The number of unsigned bits for pixel dynamic range. \( 9 \leq \text{bits} \leq 15 \).

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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See Also mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB),
mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB),
mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMinFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
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mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageMin (3MLIB)

Name       mlib_ImageMin – two-image minimum
Synopsis    cc [ flag... ] file... -lmlib [ library... ]
            #include <mlib.h>

            mlib_status mlib_ImageMin(mlib_image *dst, const mlib_image *src1,
                        const mlib_image *src2);

Description    The mlib_ImageMin() function accepts input from the two source images and writes
                the minimum to the destination image on a pixel-by-pixel basis.

                It uses the following equation:

                dst[x][y][i] = MIN{ src1[x][y][i], src2[x][y][i] }

Parameters   The function takes the following arguments:

                dst     Pointer to destination image.
                src1    Pointer to first source image.
                src2    Pointer to second source image.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes    See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
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</table>

See Also    mlib_ImageMin_Fp(3MLIB), mlib_ImageMin_Fp_Inp(3MLIB), mlib_ImageMin_Inp(3MLIB),
             attributes(5)
**mlib_ImageMinFilter3x3** – 3x3 Min Filter

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMinFilter3x3(mlib_image *dst, const mlib_image *src);
```

**Description**

The `mlib_ImageMinFilter3x3()` function replaces the center pixel in a neighborhood with the minimum value in that neighborhood for each 3x3 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
\text{dst}[x][y][0] = \text{MIN}\{ \text{src}[p][q][0], \text{ } \text{ } \text{ } \text{ } \text{ } \text{ } \text{ } x-1 \leq p \leq x+1; \text{ } \text{ } \text{ } \text{ } \text{ } \text{ } \text{ } y-1 \leq q \leq y+1 \}
\]

where \( x = 1, \ldots, w - 2; \text{ } \text{ } y = 1, \ldots, h - 2. \)

**Parameters**

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMedianFilter3x5_US(3MLIB)`, `mlib_ImageMaxFilter3x5_US(3MLIB)`,
- `mlib_ImageMedianFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageRankFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
mlib_ImageMinFilter3x3(3MLIB)

mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name  mlib_ImageMinFilter3x3_Fp – 3x3 Min Filter, floating point

Synopsis  cc [ flag... ] file... -lmilib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMinFilter3x3_Fp(mlib_image *dst,
const mlib_image *src);

Description  The mlib_ImageMinFilter3x3_Fp() function replaces the center pixel in a neighborhood
with the floating-point minimum value in that neighborhood for each 3x3 neighborhood in
the image.

The source and destination images must be single-channel images.

It uses the following equation:

dst[x][y][0] = MIN{ src[p][q][0],
x-1 ≤ p ≤ x+1; y-1 ≤ q ≤ y+1 }

where x = 1, ..., w - 2; y = 1, ..., h - 2.

Parameters  The function takes the following arguments:

dst   Pointer to destination image.

src   Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB),
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mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter5x5(3MLIB),
mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageMinFilter3x3_Fp(3MLIB)

mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
# mlib_ImageMinFilter5x5(3MLIB)

## Name
mlib_ImageMinFilter5x5 – 5x5 Min Filter

## Synopsis

```c
cc [-flag...] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMinFilter5x5(mlib_image *dst, const mlib_image *src);
```

## Description
The `mlib_ImageMinFilter5x5()` function replaces the center pixel in a neighborhood with the minimum value in that neighborhood for each 5x5 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
\text{dst}[x][y][0] = \text{MIN}\{ \text{src}[p][q][0], \\
\quad x-2 \leq p \leq x+2; \ y-2 \leq q \leq y+2 \}
\]

where \( x = 2, \ldots, w - 3 \); \( y = 2, \ldots, h - 3 \).

## Parameters
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See `attributes(5)` for descriptions of the following attributes:

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</table>

## See Also
- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`, `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`, `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`, `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`, `mlib_ImageMedianFilter3x3_US(3MLIB)`, `mlib_ImageMedianFilter5x5(3MLIB)`, `mlib_ImageMedianFilter5x5_Fp(3MLIB)`, `mlib_ImageMedianFilter5x5_US(3MLIB)`, `mlib_ImageMedianFilter7x7(3MLIB)`, `mlib_ImageMedianFilter7x7_Fp(3MLIB)`, `mlib_ImageMedianFilter7x7_US(3MLIB)`, `mlib_ImageMedianFilterMxN_Fp(3MLIB)`, `mlib_ImageMedianFilterMxN_US(3MLIB)`, `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`, `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter5x5_Fp(3MLIB)`, `mlib_ImageMinFilter7x7(3MLIB)`, `mlib_ImageMinFilter7x7_Fp(3MLIB)`, `mlib_ImageRankFilter3x3(3MLIB)`, `mlib_ImageRankFilter3x3_US(3MLIB)`, `mlib_ImageRankFilter5x5(3MLIB)`, `mlib_ImageRankFilter5x5_Fp(3MLIB)`
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMinFilter5x5_Fp()` function replaces the center pixel in a neighborhood with the floating-point minimum value in that neighborhood for each 5x5 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

\[
dst[x][y][0] = \text{MIN}( \text{src}[p][q][0], \\
\text{\(x-2 \leq p \leq x+2; y-2 \leq q \leq y+2\) } 
\]

where \(x = 2, \ldots, w - 3\); \(y = 2, \ldots, h - 3\).

### Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`
- `mlib_ImageMedianFilter5x5(3MLIB)`, `mlib_ImageMedianFilter5x5_US(3MLIB)`
- `mlib_ImageMedianFilter5x5_Fp(3MLIB)`, `mlib_ImageMedianFilter5x5_US(3MLIB)`
- `mlib_ImageMedianFilter7x7(3MLIB)`, `mlib_ImageMedianFilter7x7_Fp(3MLIB)`
- `mlib_ImageMedianFilter7x7_US(3MLIB)`, `mlib_ImageMedianFilterMxN_US(3MLIB)`
- `mlib_ImageMedianFilterMxN_Fp(3MLIB)`, `mlib_ImageMedianFilterMxN_US(3MLIB)`
- `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`
- `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter5x5_Fp(3MLIB)`
- `mlib_ImageMinFilter7x7(3MLIB)`, `mlib_ImageMinFilter7x7_Fp(3MLIB)`
- `mlib_ImageMinFilter7x7_US(3MLIB)`, `mlib_ImageMaxFilterMxN(3MLIB)`
- `mlib_ImageMinFilterMxN_Fp(3MLIB)`, `mlib_ImageMinFilterMxN_US(3MLIB)`
- `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`
- `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter7x7(3MLIB)`

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mlib_ImageMinFilter5x5_Fp(3MLIB)

mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageMinFilter7x7(3MLIB)

Name
mlib_ImageMinFilter7x7 – 7x7 Min Filter

Synopsis
cc { flag... } file... -lmlib { library... }
#include <mlib.h>

mlib_status mlib_ImageMinFilter7x7(mlib_image *dst, const mlib_image *src);

Description
The mlib_ImageMinFilter7x7() function replaces the center pixel in a neighborhood with
the minimum value in that neighborhood for each 7x7 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

dst[x][y][0] = MIN{ src[p][q][0],
x-3 ≤ p ≤ x+3; y-3 ≤ q ≤ y+3 }

where x = 3, ..., w - 4; y = 3, ..., h - 4.

Parameters
The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
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mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB),
mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB),
mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageMinFilter7x7(3MLIB)

mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageMinFilter7x7_Fp (3MLIB)

Name
mlib_ImageMinFilter7x7_Fp – 7x7 Min Filter, floating point

Synopsis
cc [-flag...] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMinFilter7x7_Fp(mlib_image *dst,
          const mlib_image *src);

Description
The mlib_ImageMinFilter7x7_Fp() function replaces the center pixel in a neighborhood with the floating-point minimum value in that neighborhood for each 7x7 neighborhood in the image.

The source and destination images must be single-channel images.

It uses the following equation:

dst[x][y][0] = MIN{ src[p][q][0],
                    x-3 ≤ p ≤ x+3; y-3 ≤ q ≤ y+3 }

where x = 3, ..., w - 4; y = 3, ..., h - 4.

Parameters
The function takes the following arguments:

dst Pointer to destination image.

src Pointer to source image.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib的形象MaxFilter3x3(3MLIB), mlib_imageMaxFilter3x3_Fp(3MLIB),
mlib_imageMaxFilter5x5(3MLIB), mlib_imageMaxFilter5x5_Fp(3MLIB),
mlib_imageMaxFilter7x7(3MLIB), mlib_imageMaxFilter7x7_Fp(3MLIB),
mlib_imageMedianFilter3x3(3MLIB), mlib_imageMedianFilter3x3_Fp(3MLIB),
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mlib_ImageMinFilter7x7_Fp(3MLIB)

mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter3x3_US(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageMin_Fp()` function accepts input from the two floating-point source images and writes the minimum to the destination image on a pixel-by-pixel basis. It uses the following equation:

\[
\text{dst}[x][y][i] = \text{MIN}\{ \text{src1}[x][y][i], \text{src2}[x][y][i] \}
\]

**Parameters**

- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**

- `mlib_ImageMin(3MLIB)`, `mlib_ImageMin_Fp_Inp(3MLIB)`, `mlib_ImageMin_Inp(3MLIB)`, `attributes(5)`
Name  

mlib_ImageMin_Fp_Inp – two-image minimum

Synopsis  

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMin_Fp_Inp(mlib_image *src1dst,
    const mlib_image *src2);

Description  

The mlib_ImageMin_Fp_Inp() function accepts input from the two source images and writes the minimum in place on a pixel-by-pixel basis.

It uses the following equation:

src1dst[x][y][i] = MIN{ src1dst[x][y][i], src2[x][y][i] }

Parameters  

The function takes the following arguments:

src1dst  Pointer to source and destination image.
src2  Pointer to second source image.

Return Values  

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  

See attributes(5) for descriptions of the following attributes:

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</table>

See Also  

mlib_ImageMin(3MLIB), mlib_ImageMin_Fp(3MLIB), mlib_ImageMin_Inp(3MLIB), attributes(5)
The `mlib_ImageMinimum()` function determines the minimum value for each channel in an image.

It uses the following equation:

\[
\text{min}[i] = \text{MIN}\{ \text{img}[x][y][i]; \ 0 \leq x < w, \ 0 \leq y < h \}
\]

**Parameters**

- **min** Pointer to minimum vector, where length is the number of channels in the image. 
  \( \text{min}[i] \) contains the minimum of channel \( i \).
- **img** Pointer to a source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

`mlib_ImageMaximum(3MLIB), mlib_ImageMaximum_Fp(3MLIB), mlib_ImageMinimum_Fp(3MLIB), attributes(5)`
The `mlib_ImageMinimum_Fp()` function determines the minimum value for each channel in a floating-point image.

It uses the following equation:

\[
\text{min}[i] = \text{MIN}\{ \text{img}[x][y][i]; \ 0 \leq x < w, \ 0 \leq y < h \}
\]

### Parameters
- **min** Pointer to minimum vector, where length is the number of channels in the image. \text{min}[i] contains the minimum of channel \(i\).
- **img** Pointer to a source image.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_ImageMaximum(3MLIB)`, `mlib_ImageMaximum_Fp(3MLIB)`, `mlib_ImageMinimum(3MLIB)`, attributes(5)
mlib_ImageMin_Inp(3MLIB)

Name  mlib_ImageMin_Inp – two-image minimum

Synopsis  cc { flag... } file... -lm { library... }
          #include <mlib.h>

mlib_status mlib_ImageMin_Inp(mlib_image *src1dst,
                           const mlib_image *src2);

Description  The mlib_ImageMin_Inp() function accepts input from the two source images and writes the
minimum in place on a pixel-by-pixel basis.

It uses the following equation:

src1dst[x][y][i] = MIN{ src1dst[x][y][i], src2[x][y][i] }

Parameters  The function takes the following arguments:

src1dst  Pointer to source and destination image.

src2  Pointer to second source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageMin(3MLIB), mlib_ImageMin_Fp(3MLIB), mlib_ImageMin_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageMoment2()` function computes the second moment of each channel in an image.

It uses the following equation:

\[
\text{moment}[i] = \frac{1}{w \times h} \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img}[x][y][i] \times \text{img}[x][y][i]
\]

The function takes the following arguments:

- `moment`: Pointer to moment array, where length is the number of channels in the image.
- `img`: Pointer to an image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageMoment2_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageMoment2_Fp()` function computes the second moment of each channel in a floating-point image. It uses the following equation:

\[
\text{moment}[i] = \frac{1}{w \times h} \times \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img}[x][y][i]^2
\]

The function takes the following arguments:

- `moment` : Pointer to moment array, where length is the number of channels in the image.
- `img` : Pointer to an image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageMoment2(3MLIB)`
The `mlib_ImageMulAlpha()` function multiplies color channels by the alpha channel on a pixel by pixel basis.

For the `MLIB_BYTE` image, it uses the following equation:
\[
dst[x][y][c] = src[x][y][c] \times src[x][y][a] \times 2^{-8}
\]

For the `MLIB_SHORT` image, it uses the following equation:
\[
dst[x][y][c] = src[x][y][c] \times src[x][y][a] \times 2^{-15}
\]

For the `MLIB_USHORT` image, it uses the following equation:
\[
dst[x][y][c] = src[x][y][c] \times src[x][y][a] \times 2^{-16}
\]

For the `MLIB_INT` image, it uses the following equation:
\[
dst[x][y][c] = src[x][y][c] \times src[x][y][a] \times 2^{-31}
\]

where \( c \) and \( a \) are the indices for the color channels and the alpha channel, respectively, so \( c \neq a \).

### Parameters
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `cmask` Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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See Also  mlib_ImaegMulAlpha_Inp(3MLIB), mlib_ImaegMulAlpha_Fp(3MLIB),
mlib_ImaegMulAlpha_Fp_Inp(3MLIB), attributes(5)
# mlib_ImageMulAlpha_Fp

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageMulAlpha_Fp(mlib_image *dst, const mlib_image *src, mlib_s32 cmask);
```

## Description

The `mlib_ImageMulAlpha_Fp()` function multiplies floating-point color channels by the alpha channel on a pixel by pixel basis. It uses the following equation:

\[
\text{dst}[x][y][c] = \text{src}[x][y][c] \times \text{src}[x][y][a]
\]

where \( c \) and \( a \) are the indices for the color channels and the alpha channel, respectively, so \( c \neq a \).

## Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `cmask` Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_ImageMulAlpha(3MLIB)`, `mlib_ImageMulAlpha_Inp(3MLIB)`, `mlib_ImageMulAlpha_Fp_Inp(3MLIB)`, `attributes(5)`
# mlib_ImageMulAlpha_Fp_Inp

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageMulAlpha_Fp_Inp(mlib_image *srcdst, mlib_s32 cmask);
```

## Description

The `mlib_ImageMulAlpha_Fp_Inp()` function multiplies floating-point color channels by the alpha channel on a pixel by pixel basis, in place.

It uses the following equation:

\[
\text{srcdst}[x][y][c] = \text{srcdst}[x][y][c] \times \text{srcdst}[x][y][a]
\]

where \(c\) and \(a\) are the indices for the color channels and the alpha channel, respectively, so \(c \neq a\).

## Parameters

- **srcdst**: Pointer to source and destination image.
- **cmask**: Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_ImageMulAlpha(3MLIB)`, `mlib_ImageMulAlpha_Inp(3MLIB)`, `mlib_ImageMulAlpha_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageMulAlpha_Inp()` function multiplies color channels by the alpha channel on a pixel by pixel basis, in place.

For the `MLIB_BYTE` image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \text{srcdst}[x][y][c] \times \text{srcdst}[x][y][a] \times 2^{(-8)}
\]

For the `MLIB_SHORT` image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \text{srcdst}[x][y][c] \times \text{srcdst}[x][y][a] \times 2^{(-15)}
\]

For the `MLIB_USHORT` image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \text{srcdst}[x][y][c] \times \text{srcdst}[x][y][a] \times 2^{(-16)}
\]

For the `MLIB_INT` image, it uses the following equation:

\[
\text{srcdst}[x][y][c] = \text{srcdst}[x][y][c] \times \text{srcdst}[x][y][a] \times 2^{(-31)}
\]

where \(c\) and \(a\) are the indices for the color channels and the alpha channel, respectively, so \(c \neq a\).

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `cmask` Channel mask to indicate the alpha channel. Each bit of the mask represents a channel in the image. The channel corresponding to the 1 bit of `cmask` is the alpha channel.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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<tbody>
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</tbody>
</table>

See Also

`mlib_ImageMulAlpha(3MLIB)`, `mlib_ImageMulAlpha_Fp(3MLIB)`, `mlib_ImageMulAlpha_Fp_Inp(3MLIB)`, attributes(5)
mlib_ImageMul_Fp() computes the multiplication of two images on a pixel-by-pixel basis. It uses the following equation:

\[ \text{dst}[x][y][i] = \text{src1}[x][y][i] \times \text{src2}[x][y][i] \]

The function takes the following arguments:
- **dst**: Pointer to destination image.
- **src1**: Pointer to first source image.
- **src2**: Pointer to second source image.

The function returns **MLIB_SUCCESS** if successful. Otherwise, it returns **MLIB_FAILURE**.

The function returns **MLIB_SUCCESS** if successful. Otherwise, it returns **MLIB_FAILURE**.

### Attributes

See **attributes(5)** for descriptions of the following attributes:

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</table>

### See Also

- **mlib_ImageMul_Fp_Inp(3MLIB)**
- **attributes(5)**
mlib_ImageMul_Fp_Inp – computes the multiplication of two images on a pixel-by-pixel basis

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageMul_Fp_Inp(mlib_image *src1dst,
                                 const mlib_image *src2);
```

Description

The `mlib_ImageMul_Fp_Inp()` function computes the multiplication of two floating-point images on a pixel-by-pixel basis, in place.

It uses the following equation:

```
src1dst[x][y][i] = src1dst[x][y][i] * src2[x][y][i]
```

Parameters

The function takes the following arguments:

- `src1dst` Pointer to source and destination image.
- `src2` Pointer to second source image.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`mlib_ImageMul_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageMulShift()` function multiplies the pixel values of the two source images. It scales the result by a right shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

\[
dst[x][y][i] = src1[x][y][i] \times src2[x][y][i] \times 2^{-shift}
\]

**Parameters**

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.
- `shift` Right shifting factor. 0 ≤ shift ≤ 31.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**

`mlib_ImageMulShift_Inp(3MLIB), attributes(5)`
The `mlib_ImageMulShift_Inp()` function multiplies the pixel values of the two source images in place. It scales the result by a right shift and writes the result to the destination image on a pixel-by-pixel basis.

It uses the following equation:

```
src1dst[x][y][i] = src1dst[x][y][i] * src2[x][y][i] * 2**(-shift)
```

**Parameters**
The function takes the following arguments:

- `src1dst` Pointer to source and destination image.
- `src2` Pointer to second source image.
- `shift` Right shifting factor. $0 \leq shift \leq 31$.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_ImageMulShift(3MLIB), attributes(5)
The `mlib_ImageNormCrossCorrel()` function computes the normalized cross-correlation coefficients between a pair of images, on a per-channel basis.

It uses the following equations:

\[
\text{correl}[i] = \frac{\sum_{x=0}^{w-1} \sum_{y=0}^{h-1} (d1[x][y][i] \times d2[x][y][i])}{\text{s1}[i] \times \text{s2}[i]}
\]

where \(w\) and \(h\) are the width and height of the images, respectively; \(m1\) and \(m2\) are the mean arrays of the first and second images, respectively; \(s1\) and \(s2\) are the un-normalized standard deviation arrays of the first and second images, respectively.

In usual cases, the normalized cross-correlation coefficient is in the range of \([-1.0, 1.0]\). In the case of \((s1[i] == 0)\) or \((s2[i] == 0)\), where a constant image channel is involved, the normalized cross-correlation coefficient is defined as follows:

\[
\text{signof}(x) = ((x > 0) \ ? 1 : ((x < 0) \ ? -1 : 0))
\]
if ((s1[i] == 0.) || (s2[i] == 0.)) {
    if ((s1[i] == 0.) && (s2[i] == 0.)) {
        if (signof(m1[i]) == signof(m2[i])) {
            correl[i] = 1.0;
        } else {
            correl[i] = -1.0;
        }
    } else {
        correl[i] = -1.0;
    }
} else {
    correl[i] = -1.0;
}

The two images must have the same type, the same size, and the same number of channels. They can have 1, 2, 3 or 4 channels. They can be of type MLIB_BYTE, MLIB_SHORT, MLIB_USHORT or MLIB_INT.

If (mean2 == NULL) or (sdev2 == NULL), then m2 and s2 are calculated in this function according to the formulas shown above. Otherwise, they are calculated as follows:

\[
m2[i] = mean2[i];
\]
\[
s2[i] = sdev2[i] * \sqrt{w*h};
\]

where mean2 and sdev2 can be the output of mlib_ImageMean() and mlib_ImageStdDev(), respectively.

**Parameters**  The function takes the following arguments:

- **correl** Pointer to normalized cross correlation array on a channel basis. The array must be the size of channels in the images. `correl[i]` contains the cross-correlation of channel i.
- **img1** Pointer to first image.
- **img2** Pointer to second image.
- **mean2** Pointer to the mean array of the second image.
- **sdev2** Pointer to the standard deviation array of the second image.

**Return Values**  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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</table>
See Also

- `mlib_ImageAutoCorrel(3MLIB)`, `mlib_ImageAutoCorrel_Fp(3MLIB)`,
- `mlib_ImageCrossCorrel(3MLIB)`, `mlib_ImageCrossCorrel_Fp(3MLIB)`,
- `mlib_ImageNormCrossCorrel_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageNormCrossCorrel_Fp()` function computes the normalized cross-correlation coefficients between a pair of floating-point images, on a per-channel basis.

It uses the following equations:

\[
\text{correl}[i] = \frac{\sum_{x=0}^{w-1} \sum_{y=0}^{h-1} (d1[x][y][i] \ast d2[x][y][i])}{s1[i] \ast s2[i]}
\]

\[
d1[x][y][i] = \text{img1}[x][y][i] - m1[i]
\]

\[
d2[x][y][i] = \text{img2}[x][y][i] - m2[i]
\]

\[
m1[i] = \frac{1}{w \ast h} \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img1}[x][y][i]
\]

\[
m2[i] = \frac{1}{w \ast h} \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img2}[x][y][i]
\]

\[
s1[i] = \sqrt{\sum_{x=0}^{w-1} \sum_{y=0}^{h-1} (\text{img1}[x][y][i] - m1[i])^2}
\]

\[
s2[i] = \sqrt{\sum_{x=0}^{w-1} \sum_{y=0}^{h-1} (\text{img2}[x][y][i] - m2[i])^2}
\]

where \(w\) and \(h\) are the width and height of the images, respectively; \(m1\) and \(m2\) are the mean arrays of the first and second images, respectively; \(s1\) and \(s2\) are the un-normalized standard deviation arrays of the first and second images, respectively.

In usual cases, the normalized cross-correlation coefficient is in the range of \([-1.0, 1.0]\). In the case of \((s1[i] == 0)\) or \((s2[i] == 0)\), where a constant image channel is involved, the normalized cross-correlation coefficient is defined as follows:

\[
\#define \text{signof}(x) ((x > 0) ? 1 : ((x < 0) ? -1 : 0))
\]
if ((s1[i] == 0.) || (s2[i] == 0.)) {
    if ((s1[i] == 0.) && (s2[i] == 0.)) {
        if (signof(m1[i]) == signof(m2[i])) {
            correl[i] = 1.0;
        } else {
            correl[i] = -1.0;
        }
    } else {
        correl[i] = -1.0;
    }
}
}

The two images must have the same type, the same size, and the same number of channels. They can have 1, 2, 3 or 4 channels. They can be of type MLIB_FLOAT or MLIB_DOUBLE.

If (mean2 == NULL) or (sdev2 == NULL), then m2 and s2 are calculated in this function according to the formulas shown above. Otherwise, they are calculated as follows:

\[
\begin{align*}
    m2[i] &= \text{mean2}[i]; \\
    s2[i] &= \text{sdev2}[i] \times \sqrt{w \times h};
\end{align*}
\]

where mean2 and sdev2 can be the output of \text{mlib\_ImageMean()} and \text{mlib\_ImageStdDev()}, respectively.

In some cases, the resulting coefficients of this function could be NaN, Inf, or -Inf.

**Parameters**
The function takes the following arguments:

- \textit{correl} Pointer to normalized cross correlation array on a channel basis. The array must be the size of channels in the images. \textit{correl[i]} contains the cross-correlation of channel \(i\).
- \textit{img1} Pointer to first image.
- \textit{img2} Pointer to second image.
- \textit{mean2} Pointer to the mean array of the second image.
- \textit{sdev2} Pointer to the standard deviation array of the second image.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageAutoCorrel(3MLIB), mlib_ImageAutoCorrel_Fp(3MLIB),
mlib_ImageCrossCorrel(3MLIB), mlib_ImageCrossCorrel_Fp(3MLIB),
mlib_ImageNormCrossCorrel(3MLIB), attributes(5)
The `mlib_ImageNot()` function computes the logical Not of each pixel in the source image. It uses the following equation:

```
mlib_status mlib_ImageNot(mlib_image *dst, const mlib_image *src);
```

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes for descriptions of the following attributes:

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</table>

See Also `mlib_ImageNot_Inp(3MLIB), attributes(5)`
mlib_ImageNotAnd (3MLIB)

Name  mlib_ImageNotAnd NOT And

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageNotAnd(mlib_image *dst, const mlib_image *src1,
               const mlib_image *src2);

Description  The mlib_ImageNotAnd() function computes the logical And of the first source image with
the second source image and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

\[ \text{dst}[x][y][i] = \neg (\text{src1}[x][y][i] \& (\text{src2}[x][y][i])) \]

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or
MLIB_INT.

Parameters  The function takes the following arguments:

dst  Pointer to destination image.
src1  Pointer to first source image.
src2  Pointer to second source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageNotAnd_Inp(3MLIB), attributes(5)
The `mlib_ImageNotAnd_Inp()` function computes the logical And of the first source image with the second source images and then takes the logical Not of that result on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{src1dst}[x][y][i] = \neg(\text{src1dst}[x][y][i] \& \text{src2}[x][y][i]) \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageNotAnd(3MLIB), attributes(5)`
The `mlib_ImageNot_Inp()` function computes the logical Not of each pixel in the source image, in place.

It uses the following equation:

\[ \text{srcdst}[x][y][i] = \neg \text{srcdst}[x][y][i] \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_ImageNot(3MLIB), attributes(5)`
#include <mlib.h>

mlib_status mlib_ImageNotOr(mlib_image *dst, const mlib_image *src1, const mlib_image *src2);

The mlib_ImageNotOr() function computes the logical Or of the first and second source images and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

dst[x][y][i] = ~(src1[x][y][i] | (src2[x][y][i])

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

The function takes the following arguments:

dst Pointer to destination image.
src1 Pointer to first source image.
src2 Pointer to second source image.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See also mlib_ImageNotOr_Inp(3MLIB), attributes(5)
The `mlib_ImageNotOr_Inp()` function computes the logical Or of the first and second source images and then takes the logical Not of that result on a pixel-by-pixel basis, in place. It uses the following equation:

\[
\text{src1dst}[x][y][i] = \neg (\text{src1dst}[x][y][i] \mid \text{src2}[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageNotOr(3MLIB), attributes(5)`.
mlib_ImageNotXor (3MLIB)

**Name**
mlib_ImageNotXor - NotXor

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageNotXor(mlib_image *dst, const mlib_image *src1, const mlib_image *src2);

**Description**
The `mlib_ImageNotXor()` function computes the logical exclusive Or of the first and second source images and then takes the logical Not of that result on a pixel-by-pixel basis.

It uses the following equation:

```
dst[x][y][i] = ~(src1[x][y][i] ^ (src2[x][y][i])
```

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageNotXor_Inp(3MLIB)`, attributes(5)
The `mlib_ImageNotXor_Inp()` function computes the logical exclusive Or of the first and second source images and then takes the logical Not of that result on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
\text{src1dst}[x][y][i] = \neg (\text{src1dst}[x][y][i] \oplus \text{src2}[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageNotXor(3MLIB), attributes(5)`
Name  mlib_ImageOr – Or

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageOr(mlib_image *dst, const mlib_image *src1,
const mlib_image *src2);

Description  The mlib_ImageOr() function computes the logical Or of the first source image with the
second source image on a pixel-by-pixel basis.

It uses the following equation:

dst[x][y][i] = src1[x][y][i] | src2[x][y][i]

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or
MLIB_INT.

Parameters  The function takes the following arguments:

dst    Pointer to destination image.
src1   Pointer to first source image.
src2   Pointer to second source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageOr_Inp(3MLIB), attributes(5)
**mlib_ImageOr_Inp**

**Name**
mlib_ImageOr_Inp – Or, in place

**Synopsis**
```c
#include <mlib.h>

mlib_status mlib_ImageOr_Inp(mlib_image *src1dst, const mlib_image *src2);
```

**Description**
The `mlib_ImageOr_Inp()` function computes the logical Or of the first source image with the second source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
srcldst[x][y][i] = srcldst[x][y][i] | src2[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
The function takes the following arguments:
- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
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**See Also**
`mlib_ImageOr(3MLIB)`, `attributes(5)`
mlib_ImageOrNot1_Inp

**Name**
mlib_ImageOrNot1_Inp – OrNot, in place

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageOrNot1_Inp(mlib_image *src1dst,
    const mlib_image *src2);
```

**Description**
The `mlib_ImageOrNot1_Inp()` function computes the logical Not of the second source image and then takes the logical Or of that result with the first source image on a pixel-by-pixel basis, in place.

It uses the following equation:

```
src1dst[x][y][i] = src1dst[x][y][i] | (~src2[x][y][i])
```

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_ImageOrNot(3MLIB), mlib_ImageOrNot2_Inp(3MLIB), attributes(5)
The `mlib_ImageOrNot2_Inp()` function computes the logical Not of the second source image and then takes the logical Or of that result with the first source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
src2dst[x][y][i] = src1[x][y][i] \lor \neg src2dst[x][y][i]
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `src2dst` Pointer to second source and destination image.
- `src1` Pointer to first source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**

- `mlib_ImageOrNot(3MLIB)`, `mlib_ImageOrNot1_Inp(3MLIB)`, attributes(5)
# mlib_ImageOrNot(3MLIB)

## Name
mlib_ImageOrNot – OrNot

## Synopsis
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageOrNot(mlib_image *dst, const mlib_image *src1,
const mlib_image *src2);
```

## Description
The `mlib_ImageOrNot()` function computes the logical Not of the second source image and then takes the logical Or of that result with the first source image on a pixel-by-pixel basis.

It uses the following equation:

\[
\text{dst}[x][y][i] = \text{src1}[x][y][i] \lor (~\text{src2}[x][y][i])
\]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

## Parameters
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src1` Pointer to first source image.
- `src2` Pointer to second source image.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

## See Also
- `mlib_ImageOrNot1_Inp(3MLIB)`, `mlib_ImageOrNot2_Inp(3MLIB)`, attributes(5)
Name  mlib_ImagePolynomialWarp – polynomial-based image warp

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImagePolynomialWarp(mlib_image *dst,
const mlib_image *src, const mlib_d64 *xCoeffs,
const mlib_d64 *yCoeffs, mlib_s32 n, mlib_d64 preShiftX,
mlib_d64 preShiftY, mlib_d64 postShiftX, mlib_d64 postShiftY,
mlib_d64 preScaleX, mlib_d64 preScaleY, mlib_d64 postScaleX,
mlib_d64 postScaleY, mlib_filter filter, mlib_edge edge);

Description  The mlib_ImagePolynomialWarp() function performs a polynomial-based image warp.

The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT. The source and destination images may have different sizes.

The xCoeffs and yCoeffs parameters must contain the same number of coefficients of the form (n + 1)(n + 2)/2 for some n, where n is the degree power of the polynomial. The coefficients, in order, are associated with the terms:

1, x, y, x*y, x**2, y**2, ...

x**n, x**(n-1)*y, ..., x*y**(n-1), y**n

and coefficients of value 0 cannot be omitted.

The image pixels are assumed to be centered at .5 coordinate points. In other words, the upper-left corner pixel of an image is located at (0.5, 0.5).

For each pixel in the destination image, its center point D is backward mapped to a point S in the source image. Then the source pixels with their centers surrounding point S are selected to do one of the interpolations specified by the filter parameter to generate the pixel value for point D.

The mapping is defined by the two bivariate polynomial functions X(x, y) and Y(x, y) that map destination (x, y) coordinates to source X and Y positions respectively.

The functions X(x, y) and Y(x, y) are:

preX = (x + preShiftX)*preScaleX
preY = (y + preShiftY)*preScaleY

\[ \text{warpedX} = \sum_{i=0}^{n} \sum_{j=0}^{i} \{ \text{xCoeffs}_{ij} \cdot \text{preX}^{(i-j)} \cdot \text{preY}^{j} \} \]

\[ \text{warpedY} = \sum_{i=0}^{n} \sum_{j=0}^{i} \{ \text{yCoeffs}_{ij} \cdot \text{preX}^{(i-j)} \cdot \text{preY}^{j} \} \]
\[ X(x, y) = \text{warpedX} \times \text{postScaleX} - \text{postShiftX} \]

\[ Y(x, y) = \text{warpedY} \times \text{postScaleY} - \text{postShiftY} \]

The destination \((x, y)\) coordinates are pre-shifted by \((\text{preShiftX}, \text{preShiftY})\) and pre-scaled by the factors \(\text{preScaleX}\) and \(\text{preScaleY}\) prior to the evaluation of the polynomial. The results of the polynomial evaluations are scaled by \(\text{postScaleX}\) and \(\text{postScaleY}\), and then shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates. This process allows for better precision of the results and supports tiled images.

**Parameters**

The function takes the following arguments:

- \(\text{dst}\) Pointer to destination image.
- \(\text{src}\) Pointer to source image.
- \(x\text{Coeffs}\) Destination to source transform coefficients for the X coordinate.
- \(y\text{Coeffs}\) Destination to source transform coefficients for the Y coordinate.
- \(n\) Degree power of the polynomial.
- \(\text{preShiftX}\) Displacement to apply to destination X positions.
- \(\text{preShiftY}\) Displacement to apply to destination Y positions.
- \(\text{postShiftX}\) Displacement to apply to source X positions.
- \(\text{postShiftY}\) Displacement to apply to source Y positions.
- \(\text{preScaleX}\) Scale factor to apply to destination X positions.
- \(\text{preScaleY}\) Scale factor to apply to destination Y positions.
- \(\text{postScaleX}\) Scale factor to apply to source X positions.
- \(\text{postScaleY}\) Scale factor to apply to source Y positions.
- \(\text{filter}\) Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- \(\text{edge}\) Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_SRC_PADDED
mlib_ImagePolynomialWarp(3MLIB)

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImagePolynomialWarp_Fp(3MLIB), mlib_ImagePolynomialWarpTable(3MLIB), mlib_ImagePolynomialWarpTable_Fp(3MLIB), attributes(5)
The `mlib_ImagePolynomialWarp_Fp()` function performs a polynomial-based image warp on a floating-point image.

The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`. The source and destination images may have different sizes.

The `xCoeffs` and `yCoeffs` parameters must contain the same number of coefficients of the form \((n + 1)(n + 2)/2\) for some \(n\), where \(n\) is the degree power of the polynomial. The coefficients, in order, are associated with the terms:

\[
1, x, y, x^2, y^2, \ldots,
\]

\[
x^n, x^{n-1}y, \ldots, x^2y^{n-1}, y^n
\]

and coefficients of value 0 cannot be omitted.

The image pixels are assumed to be centered at .5 coordinate points. In other words, the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

For each pixel in the destination image, its center point \(D\) is backward mapped to a point \(S\) in the source image. Then the source pixels with their centers surrounding point \(S\) are selected to do one of the interpolations specified by the `filter` parameter to generate the pixel value for point \(D\).

The mapping is defined by the two bivariate polynomial functions \(X(x, y)\) and \(Y(x, y)\) that map destination \((x, y)\) coordinates to source \(X\) and \(Y\) positions respectively.

The functions \(X(x, y)\) and \(Y(x, y)\) are:

\[
\text{preX} = (x + \text{preShiftX})*\text{preScaleX}
\]

\[
\text{preY} = (y + \text{preShiftY})*\text{preScaleY}
\]

\[
\text{warpedX} = \sum \sum \{\text{xCoeffs}_{ij} * \text{preX}^{(i-j)} * \text{preY}^{(j)}\}
\]

\[
i=0 \quad j=0
\]
\[ \text{warpedY} = \sum_{i=0}^{n} \sum_{j=0}^{i} \{y_{\text{Coeffs}}_{ij} \times x^{i-j} \times y^{j}\} \]

\[ X(x, y) = \text{warpedX} \times \text{postScaleX} - \text{postShiftX} \]

\[ Y(x, y) = \text{warpedY} \times \text{postScaleY} - \text{postShiftY} \]

The destination \((x, y)\) coordinates are pre-shifted by \((\text{preShiftX}, \text{preShiftY})\) and pre-scaled by the factors \(\text{preScaleX}\) and \(\text{preScaleY}\) prior to the evaluation of the polynomial. The results of the polynomial evaluations are scaled by \(\text{postScaleX}\) and \(\text{postScaleY}\), and then shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates. This process allows for better precision of the results and supports tiled images.

**Parameters**

The function takes the following arguments:

- **\text{dst}** Pointer to destination image.
- **\text{src}** Pointer to source image.
- **\text{xCoeffs}** Destination to source transform coefficients for the X coordinate.
- **\text{yCoeffs}** Destination to source transform coefficients for the Y coordinate.
- **n** Degree power of the polynomial.
- **\text{preShiftX}** Displacement to apply to destination X positions.
- **\text{preShiftY}** Displacement to apply to destination Y positions.
- **\text{postShiftX}** Displacement to apply to source X positions.
- **\text{postShiftY}** Displacement to apply to source Y positions.
- **\text{preScaleX}** Scale factor to apply to destination X positions.
- **\text{preScaleY}** Scale factor to apply to destination Y positions.
- **\text{postScaleX}** Scale factor to apply to source X positions.
- **\text{postScaleY}** Scale factor to apply to source Y positions.
- **\text{filter}** Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **\text{edge}** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_SRC_PADDED
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**

mlib_ImagePolynomialWarp(3MLIB), mlib_ImagePolynomialWarpTable(3MLIB), mlib_ImagePolynomialWarpTable_Fp(3MLIB), attributes(5)
mlib_ImagePolynomialWarpTable–polynomial-based imagewarp with table-driven interpolation

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImagePolynomialWarpTable(mlib_image *dst,
const mlib_image *src, const mlib_d64 *xCoeffs,
const mlib_d64 *yCoeffs, mlib_s32 n, mlib_d64 preShiftX,
mlib_d64 preShiftY, mlib_d64 postShiftX, mlib_d64 postShiftY,
mlib_d64 preScaleX, mlib_d64 preScaleY, mlib_d64 postScaleX,
mlib_d64 postScaleY, const void *interp_table, mlib_edge edge);

The mlib_ImagePolynomialWarpTable() function performs a polynomial-based image warp with table-driven interpolation.

The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT. The source and destination images may have different sizes.

The xCoeffs and yCoeffs parameters must contain the same number of coefficients of the form \((n + 1)(n + 2)/2\) for some \(n\), where \(n\) is the degree power of the polynomial. The coefficients, in order, are associated with the terms:

\[1, x, y, x^2, x*y, y^2, \ldots, x^n, x^{(n-1)}y, \ldots, x*y^{(n-1)}, y^n\]

and coefficients of value 0 cannot be omitted.

The image pixels are assumed to be centered at .5 coordinate points. In other words, the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

For each pixel in the destination image, its center point \(D\) is backward mapped to a point \(S\) in the source image. Then the source pixels with their centers surrounding point \(S\) are selected to do the interpolation specified by interp_table to generate the pixel value for point \(D\).

The mapping is defined by the two bivariate polynomial functions \(X(x, y)\) and \(Y(x, y)\) that map destination \((x, y)\) coordinates to source \(X\) and \(Y\) positions respectively.

The functions \(X(x, y)\) and \(Y(x, y)\) are:

\[\text{preX} = (x + \text{preShiftX})*\text{preScaleX}\]
\[\text{preY} = (y + \text{preShiftY})*\text{preScaleY}\]

\[\text{warpedX} = \sum_{i=0}^{n} \left( \sum_{j=0}^{i} \text{xCoeffs}_{ij} * \text{preX}^{(i-j)} * \text{preY}^{j} \right)\]
warpedY = \sum_{i=0}^{n} \sum_{j=0}^{i} \{ yCoeffs_{ij} \ast \text{preX}^{(i-j)} \ast \text{preY}^{j} \} \\
X(x, y) = \text{warpedX} \ast \text{postScaleX} - \text{postShiftX} \\
Y(x, y) = \text{warpedY} \ast \text{postScaleY} - \text{postShiftY} \\

The destination \((x, y)\) coordinates are pre-shifted by \((\text{preShiftX}, \text{preShiftY})\) and pre-scaled by the factors \(\text{preScaleX}\) and \(\text{preScaleY}\) prior to the evaluation of the polynomial. The results of the polynomial evaluations are scaled by \(\text{postScaleX}\) and \(\text{postScaleY}\), and then shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates. This process allows for better precision of the results and supports tiled images.

**Parameters**  
The function takes the following arguments:

- \(\text{dst}\) Pointer to destination image.
- \(\text{src}\) Pointer to source image.
- \(\text{xCoeffs}\) Destination to source transform coefficients for the X coordinate.
- \(\text{yCoeffs}\) Destination to source transform coefficients for the Y coordinate.
- \(n\) Degree power of the polynomial.
- \(\text{preShiftX}\) Displacement to apply to destination X positions.
- \(\text{preShiftY}\) Displacement to apply to destination Y positions.
- \(\text{postShiftX}\) Displacement to apply to source X positions.
- \(\text{postShiftY}\) Displacement to apply to source Y positions.
- \(\text{preScaleX}\) Scale factor to apply to destination X positions.
- \(\text{preScaleY}\) Scale factor to apply to destination Y positions.
- \(\text{postScaleX}\) Scale factor to apply to source X positions.
- \(\text{postScaleY}\) Scale factor to apply to source Y positions.
- \(\text{interp_table}\) Pointer to an interpolation table. The table is created by the \text{mlib_ImgInterpTableCreate()} function.
- \(\text{edge}\) Type of edge condition. It can be one of the following:
  - \text{MLIB_EDGE_DST_NO_WRITE}
  - \text{MLIB_EDGE_SRC_PADDED}

**Return Values**  
The function returns \text{MLIB_SUCCESS} if successful. Otherwise it returns \text{MLIB_FAILURE}.
Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageInterpTableCreate(3MLIB), mlib_ImageInterpTableDelete(3MLIB), mlib_ImagePolynomialWarpTable_Fp(3MLIB), mlib_ImagePolynomialWarp(3MLIB), mlib_ImagePolynomialWarp_Fp(3MLIB), attributes(5)
Name: mlib_ImagePolynomialWarpTable_Fp - polynomial-based image warp with table-driven interpolation

Synopsis: cc [ flag... ] file... -lmilib [ library... ]
#include <mlib.h>

#include <mlib.h>

mlib_status mlib_ImagePolynomialWarpTable_Fp(mlib_image *dst, 
const mlib_image *src, const mlib_d64 *xCoeffs, 
const mlib_d64 *yCoeffs, mlib_s32 n, mlib_d64 preShiftX, 
mlib_d64 preShiftY, mlib_d64 postShiftX, mlib_d64 postShiftY, 
mlib_d64 preScaleX, mlib_d64 preScaleY, mlib_d64 postScaleX, 
mlib_d64 postScaleY, const void *interp_table, mlib_edge edge);

Description

The mlib_ImagePolynomialWarpTable_Fp() function performs a polynomial-based image warp on a floating-point image with table-driven interpolation.

The images must have the same type, and the same number of channels. The images can have 1, 2, 3, or 4 channels. The data type of the images can be MLIB_FLOAT or MLIB_DOUBLE. The source and destination images may have different sizes.

The xCoeffs and yCoeffs parameters must contain the same number of coefficients of the form \((n + 1) (n + 2)/2\) for some \(n\), where \(n\) is the degree power of the polynomial. The coefficients, in order, are associated with the terms:

\[1, x, y, x^2, x^2y, y^2, \ldots, x^n, x^n(y-1), y^n\]

and coefficients of value 0 cannot be omitted.

The image pixels are assumed to be centered at .5 coordinate points. In other words, the upper-left corner pixel of an image is located at (.5, .5).

For each pixel in the destination image, its center point is backward mapped to a point in the source image. Then the source pixels with their centers surrounding point are selected to do the interpolation specified by interp_table to generate the pixel value for point.

The mapping is defined by the two bivariate polynomial functions \(X(x, y)\) and \(Y(x, y)\) that map destination \((x, y)\) coordinates to source \(X\) and \(Y\) positions respectively.

The functions \(X(x, y)\) and \(Y(x, y)\) are:

\[preX = (x + preShiftX) \times preScaleX\]

\[preY = (y + preShiftY) \times preScaleY\]

\[warpedX = \sum_{i=0}^{n} \sum_{j=0}^{i} \{xCoeffs_{ij} \times preX^{(i-j)} \times preY^{(n-j)}\}\]
\[
\text{warpedY} = \sum_{i=0}^{n} \left( \sum_{j=0}^{i} (y\text{Coeffs}_{ij} \times \text{preX}^{i-j} \times \text{preY}^{j}) \right)
\]

\[
X(x, y) = \text{warpedX} \times \text{postScaleX} - \text{postShiftX}
\]

\[
Y(x, y) = \text{warpedY} \times \text{postScaleY} - \text{postShiftY}
\]

The destination \((x, y)\) coordinates are pre-shifted by \((\text{preShiftX}, \text{preShiftY})\) and pre-scaled by the factors \(	ext{preScaleX}\) and \(	ext{preScaleY}\) prior to the evaluation of the polynomial. The results of the polynomial evaluations are scaled by \(	ext{postScaleX}\) and \(	ext{postScaleY}\), and then shifted by \((-\text{postShiftX}, -\text{postShiftY})\) to produce the source pixel coordinates. This process allows for better precision of the results and supports tiled images.

**Parameters**

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **xCoeffs** Destination to source transform coefficients for the X coordinate.
- **yCoeffs** Destination to source transform coefficients for the Y coordinate.
- **n** Degree power of the polynomial.
- **preShiftX** Displacement to apply to destination X positions.
- **preShiftY** Displacement to apply to destination Y positions.
- **postShiftX** Displacement to apply to source X positions.
- **postShiftY** Displacement to apply to source Y positions.
- **preScaleX** Scale factor to apply to destination X positions.
- **preScaleY** Scale factor to apply to destination Y positions.
- **postScaleX** Scale factor to apply to source X positions.
- **postScaleY** Scale factor to apply to source Y positions.
- **interp_table** Pointer to an interpolation table. The table is created by the \text{mlib\_Image\_Interp\_Table\_Create()} function.
- **edge** Type of edge condition. It can be one of the following:
  - MLIB\_EDGE\_DST\_NO\_WRITE
  - MLIB\_EDGE\_SRC\_PADDED

**Return Values**

The function returns MLIB\_SUCCESS if successful. Otherwise it returns MLIB\_FAILURE.
Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageInterpTableCreate(3MLIB), mlib_ImageInterpTableDelete(3MLIB),
mlib_ImagePolynomialWarpTable(3MLIB), mlib_ImagePolynomialWarp(3MLIB),
mlib_ImagePolynomialWarp_Fp(3MLIB), attributes(5)
The `mlib_ImageRankFilter3x3()` function performs 3x3 rank filtering on an image. Each pixel of the destination image is the pixel with the user-specified rank in the filter window. The source and destination images must be single-channel images.

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `rank` The rank of the destination pixel. The pixel with minimum value is designated rank 0.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMedianFilter5x5(3MLIB)`, `mlib_ImageMedianFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMedianFilter5x5_US(3MLIB)`, `mlib_ImageMedianFilter5x5_US_Fp(3MLIB)`,
- `mlib_ImageMedianFilter7x7(3MLIB)`, `mlib_ImageMedianFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilterMxN(3MLIB)`, `mlib_ImageMedianFilterMxN_Fp(3MLIB)`,
- `mlib_ImageMedianFilterMxN_US(3MLIB)`, `mlib_ImageMedianFilterMxN_US_Fp(3MLIB)`,
- `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMinFilter7x7(3MLIB)`, `mlib_ImageMinFilter7x7_Fp(3MLIB)`,
- `mlib_ImageRankFilter3x3(3MLIB)`, `mlib_ImageRankFilter3x3_Fp(3MLIB)`,
- `mlib_ImageRankFilter5x5(3MLIB)`, `mlib_ImageRankFilter5x5_Fp(3MLIB)`,
- `mlib_ImageRankFilter5x5_US(3MLIB)`, `mlib_ImageRankFilter5x5_US_Fp(3MLIB)`,
- `mlib_ImageRankFilter7x7(3MLIB)`, `mlib_ImageRankFilter7x7_Fp(3MLIB)`,
- `mlib_ImageRankFilter7x7_US(3MLIB)`, `mlib_ImageRankFilter7x7_US_Fp(3MLIB)`,
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name
mlib_ImageRankFilter3x3_Fp – 3x3 rank filter

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRankFilter3x3_Fp(mlib_image *dst,
const mlib_image *src, mlib_s32 rank);

Description
The mlib_ImageRankFilter3x3_Fp() function performs floating-point 3x3 rank filtering on
an image. Each pixel of the destination image is the pixel with the user-specified rank in the
filter window.

The source and destination images must be single-channel images.

Parameters
The function takes the following arguments:

- **dst**  Pointer to destination image.
- **src**  Pointer to source image.
- **rank** The rank of the destination pixel. The pixel with minimum value is designated rank
  0.

Return Values
The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB),
mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB),
mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMedianFilterMxN_US(3MLIB),
mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB),
mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB),
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mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB), mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB), mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageRankFilter3x3_US(3MLIB)

Name
mlib_ImageRankFilter3x3_US – 3x3 rank filter, unsigned

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRankFilter3x3_US(mlib_image *dst,
const mlib_image *src, mlib_s32 rank, mlib_s32 bits);

Description
The mlib_ImageRankFilter3x3_US() function performs 3x3 rank filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with the user-specified rank in the filter window.

The source and destination images must be single-channel images.

Parameters
The function takes the following arguments:

dst Pointer to destination image.

src Pointer to source image.

rank The rank of the destination pixel. The pixel with minimum value is designated rank 0.

bits The number of unsigned bits for pixel dynamic range. 9 ≤ bits ≤ 15.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
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mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_US(3MLIB),
mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB),
mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB),
mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_US(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
mlib_ImageRankFilter5x5(3MLIB)

Name mlib_ImageRankFilter5x5 – 5x5 rank filter

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRankFilter5x5(mlib_image *dst, const mlib_image *src,
        mlib_s32  rank);

Description The mlib_ImageRankFilter5x5() function performs 5x5 rank filtering on an image. Each pixel of the destination image is the pixel with the user-specified rank in the filter window. The source and destination images must be single-channel images.

Parameters The function takes the following arguments:

dst Pointer to destination image.

src Pointer to source image.

rank The rank of the destination pixel. The pixel with minimum value is designated rank 0.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB),
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mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMedianFilterMxN_US(3MLIB),
mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB),
mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB),
mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB),
mlib_ImageRankFilter3x3_US(3MLIB), mlib_ImageRankFilter3x3_US_Fp(3MLIB),
mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB),
mlib_ImageRankFilter5x5_US(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageRankFilter5x5_Fp()` function performs floating-point 5x5 rank filtering on an image. Each pixel of the destination image is the pixel with the user-specified rank in the filter window.

The source and destination images must be single-channel images.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `rank` The rank of the destination pixel. The pixel with minimum value is designated rank 0.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB),
mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
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mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter7x7_US(3MLIB)`
mlib_ImageRankFilter5x5_Fp(3MLIB)

mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
**Name**  
mlib/ImageRankFilter5x5_US – 5x5 rank filter, unsigned

**Synopsis**  
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_ImageRankFilter5x5_US(mlib_image *dst,
                                      const mlib_image *src, mlib_s32 rank, mlib_s32 bits);
```

**Description**  
The `mlib_ImageRankFilter5x5_US()` function performs 5x5 rank filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with the user-specified rank in the filter window.

The source and destination images must be single-channel images.

**Parameters**  
The function takes the following arguments:

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **rank**  
  The rank of the destination pixel. The pixel with minimum value is designated rank 0.

- **bits**  
  The number of unsigned bits for pixel dynamic range. $9 \leq \text{bits} \leq 15$.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  
mlib/ImageMaxFilter3x3(3MLIB), mlib/ImageMaxFilter3x3_fp(3MLIB),  
mlib/ImageMaxFilter5x5(3MLIB), mlib/ImageMaxFilter5x5_fp(3MLIB),  
mlib/ImageMaxFilter7x7(3MLIB), mlib/ImageMaxFilter7x7_fp(3MLIB),  
mlib/ImageMedianFilter3x3(3MLIB), mlib/ImageMedianFilter3x3_fp(3MLIB),  
mlib/ImageMedianFilter5x5_US(3MLIB), mlib/ImageMedianFilter5x5_US_fp(3MLIB),  
mlib/ImageMedianFilter7x7_US(3MLIB), mlib/ImageMedianFilter7x7_US_fp(3MLIB),  
mlib/ImageMedianFilterMxN(3MLIB), mlib/ImageMedianFilterMxN_US(3MLIB),  
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mlib/ImageMinFilter5x5(3MLIB), mlib/ImageMinFilter5x5_fp(3MLIB),  
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mlib/ImageRankFilter5x5_US_US_fp(3MLIB), mlib/ImageRankFilter5x5_US_US_US(3MLIB),  
mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter7x7(3MLIB),
mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilter7x7_US(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
# mlib_ImageRankFilter7x7

The `mlib_ImageRankFilter7x7()` function performs a 7x7 rank filter on an image. Each pixel of the destination image is the pixel with the user-specified rank in the filter window. The source and destination images must be single-channel images.

## Parameters

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **rank**: The rank of the destination pixel. The pixel with minimum value is designated rank 0.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise, it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`, `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`, `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`, `mlib_ImageMaxFilterMxN(3MLIB)`, `mlib_ImageMaxFilterMxN_Fp(3MLIB)`, `mlib_ImageMaxFilterMxN_US(3MLIB)`, `mlib_ImageMaxFilterMxN_US_Fp(3MLIB)`, `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`, `mlib_ImageMedianFilter5x5(3MLIB)`, `mlib_ImageMedianFilter5x5_Fp(3MLIB)`, `mlib_ImageMedianFilter5x5_US(3MLIB)`, `mlib_ImageMedianFilter5x5_US_Fp(3MLIB)`, `mlib_ImageMedianFilter7x7(3MLIB)`, `mlib_ImageMedianFilter7x7_Fp(3MLIB)`, `mlib_ImageMedianFilter7x7_US(3MLIB)`, `mlib_ImageMedianFilter7x7_US_Fp(3MLIB)`, `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`, `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter5x5_Fp(3MLIB)`, `mlib_ImageMinFilter7x7(3MLIB)`, `mlib_ImageMinFilter7x7_Fp(3MLIB)`, `mlib_ImageMinFilterMxN(3MLIB)`, `mlib_ImageMinFilterMxN_Fp(3MLIB)`, `mlib_ImageMinFilterMxN_US(3MLIB)`, `mlib_ImageMinFilterMxN_US_Fp(3MLIB)`, `mlib_ImageRankFilter3x3(3MLIB)`, `mlib_ImageRankFilter3x3_Fp(3MLIB)`, `mlib_ImageRankFilter3x3_US(3MLIB)`, `mlib_ImageRankFilter3x3_US_Fp(3MLIB)`, `mlib_ImageRankFilter5x5(3MLIB)`, `mlib_ImageRankFilter5x5_Fp(3MLIB)`, `mlib_ImageRankFilter5x5_US(3MLIB)`, `mlib_ImageRankFilter5x5_US_Fp(3MLIB)`, `mlib_ImageRankFilter7x7(3MLIB)`, `mlib_ImageRankFilter7x7_Fp(3MLIB)`, `mlib_ImageRankFilter7x7_US(3MLIB)`, `mlib_ImageRankFilter7x7_US_Fp(3MLIB)`
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
Name
mlib_ImageRankFilter7x7_Fp - 7x7 rank filter

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRankFilter7x7_Fp(mlib_image *dst,
const mlib_image *src, mlib_s32 rank);

Description
The mlib_ImageRankFilter7x7_Fp() function performs floating-point 7x7 rank filtering on
an image. Each pixel of the destination image is the pixel with the user-specified rank in the
filter window.

The source and destination images must be single-channel images.

Parameters
The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.
rank The rank of the destination pixel. The pixel with minimum value is designated rank 0.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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See Also
mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB),
mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB),
mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB),
mlib_ImageMedianFilter3x3_US(3MLIB), mlib_ImageMedianFilter5x5(3MLIB),
mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB),
mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB),
mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB),
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mlib_ImageRankFilterMxN(3MLIB),
mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageRankFilter7x7_US()` function performs 7x7 rank filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with the user-specified rank in the filter window.

The source and destination images must be single-channel images.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `rank` The rank of the destination pixel. The pixel with minimum value is designated rank 0.
- `bits` The number of unsigned bits for pixel dynamic range. \(9 \leq \text{bits} \leq 15\).

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMinFilter5x5_US(3MLIB)`, `mlib_ImageMinFilter5x5_US_5Fp(3MLIB)`,
mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter5x5_US(3MLIB),
mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
**mlib_ImageRankFilterMxN**

### Summary

`mlib_ImageRankFilterMxN` filters an image with a user-specified rank in a specified window. Each pixel of the destination image is the pixel with the specified rank in the filter window. The source and destination images must be single-channel images.

### Parameters

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `m` Width of the filter window. Must be an odd number greater than 1.
- `n` Height of the filter window. Must be an odd number greater than 1.
- `rank` The rank of the destination pixel. The pixel with minimum value is designated rank 0.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise, it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`
- `mlib_ImageMedianFilter5x5(3MLIB)`, `mlib_ImageMedianFilter5x5_Fp(3MLIB)`
- `mlib_ImageMedianFilter7x7(3MLIB)`
- `mlib_ImageMedianFilterMxN(3MLIB)`
- `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`
- `mlib_ImageMinFilter5x5(3MLIB)`, `mlib_ImageMinFilter5x5_Fp(3MLIB)`
- `mlib_ImageMinFilter7x7(3MLIB)`, `mlib_ImageMinFilter7x7_Fp(3MLIB)`
- `mlib_ImageRankFilter3x3(3MLIB)`
- `mlib_ImageRankFilter3x3_Fp(3MLIB)`
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- `mlib_ImageRankFilterMxN(3MLIB)`
- `mlib_ImageRankFilterMxN_Fp(3MLIB)`
- `mlib_ImageRankFilterMxN_US(3MLIB)`
- `mlib_ImageMinFilter3x3(3MLIB)`
- `mlib_ImageMinFilter3x3_Fp(3MLIB)`
- `mlib_ImageMinFilter5x5(3MLIB)`
- `mlib_ImageMinFilter5x5_Fp(3MLIB)`
- `mlib_ImageMinFilter7x7(3MLIB)`
- `mlib_ImageMinFilter7x7_Fp(3MLIB)`
- `mlib_ImageRankFilter3x3(3MLIB)`
- `mlib_ImageRankFilter3x3_Fp(3MLIB)`
- `mlib_ImageRankFilter5x5(3MLIB)`
- `mlib_ImageRankFilter5x5_Fp(3MLIB)`
mlib_ImageRankFilterMxN(3MLIB)

mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter5x5_US(3MLIB),
mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter7x7_US(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB),
mlib_ImageRankFilterMxN_US(3MLIB), attributes(5)
The `mlib_ImageRankFilterMxN_Fp()` function performs floating-point MxN rank filtering on an image. Each pixel of the destination image is the pixel with the user-specified rank in the filter window.

The source and destination images must be single-channel images.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `m` Width of the filter window. `m` must be odd number greater than 1.
- `n` Height of the filter window. `n` must be odd number greater than 1.
- `rank` The rank of the destination pixel. The pixel with minimum value is designated rank 0.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB)`.

**Attributes**

See [attributes(5)] for descriptions of the following attributes:

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**See Also**

- `mlib_ImageMaxFilter3x3(3MLIB), mlib_ImageMaxFilter3x3_Fp(3MLIB), mlib_ImageMaxFilter5x5(3MLIB), mlib_ImageMaxFilter5x5_Fp(3MLIB), mlib_ImageMaxFilter7x7(3MLIB), mlib_ImageMaxFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter3x3(3MLIB), mlib_ImageMedianFilter3x3_Fp(3MLIB), mlib_ImageMedianFilter5x5(3MLIB), mlib_ImageMedianFilter5x5_Fp(3MLIB), mlib_ImageMedianFilter5x5_US(3MLIB), mlib_ImageMedianFilter7x7(3MLIB), mlib_ImageMedianFilter7x7_Fp(3MLIB), mlib_ImageMedianFilter7x7_US(3MLIB), mlib_ImageMedianFilterMxN(3MLIB), mlib_ImageMedianFilterMxN_Fp(3MLIB), mlib_ImageMinFilter3x3(3MLIB), mlib_ImageMinFilter3x3_Fp(3MLIB), mlib_ImageMinFilter5x5(3MLIB), mlib_ImageMinFilter5x5_Fp(3MLIB), mlib_ImageMinFilter7x7(3MLIB), mlib_ImageMinFilter7x7_Fp(3MLIB), mlib_ImageRankFilter3x3(3MLIB), mlib_ImageRankFilter3x3_Fp(3MLIB), mlib_ImageRankFilter5x5(3MLIB), mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB), mlib_ImageRankFilterMxN(3MLIB), mlib_ImageRankFilterMxN_Fp(3MLIB)`.
mlib_ImageRankFilter3x3_US(3MLIB), mlib_ImageRankFilter5x5(3MLIB),
mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter5x5_US(3MLIB),
mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter7x7_US(3MLIB), mlib_ImageRankFilterMxN(3MLIB),
mlib_ImageRankFilterMxN_Fp(3MLIB), attributes(5)
The `mlib_ImageRankFilterMxN_US()` function performs MxN rank filtering on an MLIB_SHORT type of image that contains unsigned data. Each pixel of the destination image is the pixel with the user-specified rank in the filter window.

The source and destination images must be single-channel images.

### Parameters
The function takes the following arguments:
- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `m` Width of the filter window. `m` must be odd number greater than 1.
- `n` Height of the filter window. `n` must be odd number greater than 1.
- `rank` The rank of the destination pixel. The pixel with minimum value is designated rank 0.
- `bits` The number of unsigned bits for pixel dynamic range. 9 ≤ `bits` ≤ 15.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
- `mlib_ImageMaxFilter3x3(3MLIB)`, `mlib_ImageMaxFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMaxFilter5x5(3MLIB)`, `mlib_ImageMaxFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMaxFilter7x7(3MLIB)`, `mlib_ImageMaxFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilter3x3(3MLIB)`, `mlib_ImageMedianFilter3x3_Fp(3MLIB)`,
- `mlib_ImageMedianFilter5x5(3MLIB)`, `mlib_ImageMedianFilter5x5_Fp(3MLIB)`,
- `mlib_ImageMedianFilter5x5_US(3MLIB)`, `mlib_ImageMedianFilter5x5_US_Fp(3MLIB)`,
- `mlib_ImageMedianFilter7x7(3MLIB)`, `mlib_ImageMedianFilter7x7_Fp(3MLIB)`,
- `mlib_ImageMedianFilter7x7_US(3MLIB)`, `mlib_ImageMedianFilter7x7_US_Fp(3MLIB)`,
- `mlib_ImageMedianFilterMxN(3MLIB)`, `mlib_ImageMedianFilterMxN_US(3MLIB)`,
- `mlib_ImageMinFilter3x3(3MLIB)`, `mlib_ImageMinFilter3x3_Fp(3MLIB)`,
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mlib_ImageRankFilter5x5_Fp(3MLIB), mlib_ImageRankFilter5x5_US(3MLIB),
mlib_ImageRankFilter7x7(3MLIB), mlib_ImageRankFilter7x7_Fp(3MLIB),
mlib_ImageRankFilter7x7_US(3MLIB), mlib_ImageRankFilterMxN(3MLIB),
mlib_ImageRankFilterMxN_Fp(3MLIB), attributes(5)
mlib_ImageReformat – image data buffer reformat

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageReformat(void **dstData, const void **srcData, mlib_s32 numBands, mlib_s32 xSize, mlib_s32 ySize, mlib_type dstDataType, const mlib_s32 *dstBandoffsets, mlib_s32 dstScanlinestride, mlib_s32 dstPixelstride, mlib_type srcDataType, const mlib_s32 *srcBandoffsets, mlib_s32 srcScanlinestride, mlib_s32 srcPixelstride);

Description

The mlib_ImageReformat() function copies and casts, if needed, an image from one buffer to another. The formats and data types of the two buffers may be different.

dstPixel[x][y][i] = (dstDataType) srcPixel[x][y][i]

where the values of a pixel at position (x, y) and in channel i are:

srcPixel[x][y][i] = srcData[i][srcBandoffsets[i] + srcScanlinestride*y + srcPixelstride*x]

dstPixel[x][y][i] = dstData[i][dstBandoffsets[i] + dstScanlinestride*y + dstPixelstride*x]

It is the user’s responsibility to make sure that the data buffers supplied are suitable for this operation. The srcData and dstData can have 1, 2, 3, or 4 channels, and they must have the same number of channels. The srcDataType and dstDataType can be MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

The conversions between different data types are implemented as described in the following table:

<table>
<thead>
<tr>
<th>Source Type</th>
<th>Dest. Type</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_BYTE</td>
<td>(mlib_u8)clamp(x, 0, 255)</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_BYTE</td>
<td>(mlib_u8)clamp(x, 0, 255)</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_BYTE</td>
<td>(mlib_u8)clamp(x, 0, 255)</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_BYTE</td>
<td>(mlib_u8)clamp(x, 0, 255)</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_BYTE</td>
<td>(mlib_u8)clamp(x, 0, 255)</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_SHORT</td>
<td>(mlib_s16)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_SHORT</td>
<td>(mlib_s16)clamp(x, -32768, 32767)</td>
</tr>
<tr>
<td>Source Type</td>
<td>Dest. Type</td>
<td>Action</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_SHORT</td>
<td>(mlib_s16)clamp(x, -32768, 32767)</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_SHORT</td>
<td>(mlib_s16)clamp(x, -32768, 32767)</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_SHORT</td>
<td>(mlib_s16)clamp(x, -32768, 32767)</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_USHORT</td>
<td>(mlib_u16)clamp(x, 0, 65535)</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_INT</td>
<td>(mlib_s32)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_INT</td>
<td>(mlib_s32)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_INT</td>
<td>(mlib_s32)x</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_INT</td>
<td>(mlib_s32)clamp(x, -2147483647, 2147483647)</td>
</tr>
<tr>
<td>MLIB_DOUBLE</td>
<td>MLIB_INT</td>
<td>(mlib_s32)clamp(x, -2147483647, 2147483647)</td>
</tr>
<tr>
<td>MLIB_BYTE</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_SHORT</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_FLOAT</td>
<td>(mlib_f32)x</td>
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<td>MLIB_DOUBLE</td>
<td>MLIB_FLOAT</td>
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<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_USHORT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_INT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
<tr>
<td>MLIB_FLOAT</td>
<td>MLIB_DOUBLE</td>
<td>(mlib_d64)x</td>
</tr>
</tbody>
</table>

The actions are defined in C-style pseudo-code. All type casts follow the rules of standard C. `clamp()` can be defined as a macro: 

```c
#define clamp(x, low, high) (((x) < (low)) ? (low) : (((x) > (high)) ? (high) : (x)))
```
The function takes the following arguments:

- **dstData**: The pointer to the destination image data buffer.
- **srcData**: The pointer to the source image data buffer.
- **numBands**: The number of channels of the image data buffers.
- **xSize**: The width of the image.
- **ySize**: The height of the image.
- **dstDataType**: The data type of the *dstData* buffer.
- **dstBandoffsets**: The initial pixel’s offsets in the *dstData* buffer in terms of destination data buffer elements.
- **dstScanlinestride**: The scanline stride of the *dstData* buffer in terms of destination data buffer elements.
- **dstPixelstride**: The pixel stride of the *dstData* buffer in terms of destination data buffer elements.
- **srcDataType**: The data type of the *srcData* buffer.
- **srcBandoffsets**: The initial pixel’s offsets in the *srcData* buffer in terms of source data buffer elements.
- **srcScanlinestride**: The scanline stride of the *srcData* buffer in terms of source data buffer elements.
- **srcPixelstride**: The pixel stride of the *srcData* buffer in terms of source data buffer elements.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
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<td>MT-Safe</td>
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</tbody>
</table>

**See Also**

mlib_ImageDataTypeConvert(3MLIB), attributes(5)
mlib_ImageReplaceColor(3MLIB)

Name  mlib_ImageReplaceColor – replace a color in an image

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageReplaceColor(mlib_image *dst, const mlib_image *src,  
        const mlib_s32 *color1, const mlib_s32 *color2);

Description  The mlib_ImageReplaceColor() function copies the source image to the destination image and replaces the pixels having a value of color1 with color2.

It uses the following equation:

\[
\text{dst}[x][y] = \text{color2} \quad \text{if src}[x][y] == \text{color1} \\
\text{dst}[x][y] = \text{src}[x][y] \quad \text{if src}[x][y] != \text{color1}
\]

Parameters  The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.
color1 Array of color components to be replaced.
color2 Array of color components to replace color1.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<tr>
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</tr>
</tbody>
</table>

See Also  mlib_ImageReplaceColor_Inp(3MLIB), mlib_ImageReplaceColor_Fp(3MLIB),  
mlib_ImageReplaceColor_Fp_Inp(3MLIB), mlib_ImageThresh5(3MLIB),  
mlib_ImageThresh5_Inp(3MLIB), mlib_ImageThresh5_Fp(3MLIB),  
mlib_ImageThresh5_Fp_Inp(3MLIB), attributes(5)
mlib_ImageReplaceColor_Fp

**Name**
mlib_ImageReplaceColor_Fp – replace a color in an image

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageReplaceColor_Fp(mlib_image *dst, 
    const mlib_image *src, const mlib_d64 *color1, const mlib_d64 *color2);

**Description**
The `mlib_ImageReplaceColor_Fp()` function copies the source image to the destination image and replaces the pixels having a value of `color1` with `color2`. It uses the following equation:

\[
dst[x][y] = color2 \quad \text{if} \ src[x][y] == color1 \\
dst[x][y] = src[x][y] \quad \text{if} \ src[x][y] != color1
\]

**Parameters**
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **color1** Array of color components to be replaced.
- **color2** Array of color components to replace `color1`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_ImageReplaceColor(3MLIB), mlib_ImageReplaceColor_Inp(3MLIB), mlib_ImageReplaceColor_Fp_Inp(3MLIB), mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Inp(3MLIB), mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageReplaceColor_Fp_Inp()` function scans the image for all pixels with color value equal to `color1` and replaces these pixels with `color2`.

It uses the following equation:

```
srcdst[x][y] = color2  if srcdst[x][y] == color1
```

The function takes the following arguments:

- `srcdst`  Pointer to the source and destination image.
- `color1`  Array of color components to be replaced.
- `color2`  Array of color components to replace `color1`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageReplaceColor(3MLIB), mlib_ImageReplaceColor_Inp(3MLIB), mlib_ImageReplaceColor_Fp(3MLIB), mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Inp(3MLIB), mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB), attributes(5)`. 

Multimedia Library Functions - Part 3 591
mlib_ImageReplaceColor_Inp(3MLIB)

Name  mlib_ImageReplaceColor_Inp – replace a color in an image, in place

Synopsis  
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
```

mlib_status mlib_ImageReplaceColor_Inp(mlib_image *srcdst,
    const mlib_s32 *color1, const mlib_s32 *color2);

Description  The mlib_ImageReplaceColor_Inp() function scans the image for all pixels with color value equal to color1 and replaces these pixels with color2.

It uses the following equation:

\[
\text{srcdst}[x][y] = \text{color2} \quad \text{if} \quad \text{srcdst}[x][y] == \text{color1}
\]

Parameters  The function takes the following arguments:

- **srcdst**  Pointer to the source and destination image.
- **color1**  Array of color components to be replaced.
- **color2**  Array of color components to replace color1.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageReplaceColor(3MLIB), mlib_ImageReplaceColor_Fp(3MLIB),
mlib_ImageReplaceColor_Fp_Inp(3MLIB), mlib_ImageThresh5(3MLIB),
mlib_ImageThresh5_Inp(3MLIB), mlib_ImageThresh5_Fp(3MLIB),
mlib_ImageThresh5_Fp_Inp(3MLIB), attributes(5)
mlib_ImageResetStruct

**Name**
mlib_ImageResetStruct – reset image data structure

**Synopsis**
```c
#include <mlib.h>

mlib_status mlib_ImageResetStruct(mlib_image *image, mlib_type type,
    mlib_s32 channels, mlib_s32 width, mlib_s32 height, mlib_s32 stride,
    const void *datbuf);
```

**Description**
The `mlib_ImageResetStruct()` function resets a mediaLib image data structure using parameters supplied by the user.

The `mlib_ImageResetStruct()` function returns `MLIB_FAILURE` if the supplied parameters do not pass the following sanity checks:

- `image` should not be `NULL`
- `type` should be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`
- `channels` should be between 1 and 4
- `width` should be greater than 0
- `height` should be greater than 0
- `stride` should be no less than `width * channels * (size of type in bytes)`

Whenever `MLIB_FAILURE` is returned, the original image data structure is not changed.

When `datbuf` is `NULL`, the original data buffer is reused. If `mlib_ImageIsUserAllocated(image)==0`, such as the case the image data structure was created by `mlib_ImageCreate()`, and the data buffer size required by the parameters supplied is larger than the original, `MLIB_FAILURE` is returned.

When `datbuf` is not `NULL`, if `mlib_ImageIsUserAllocated(image)==0`, the original data buffer is freed, otherwise the original data buffer is not freed. If `datbuf` points to the original data buffer, it is not freed.

**Parameters**
The function takes the following arguments:

- `image` Pointer to the image data structure.
- `type` Image data type. It can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, `MLIB_INT`, `MLIB_FLOAT`, or `MLIB_DOUBLE`.
- `channels` Number of channels in the image.
- `width` Width of image in pixels.
- `height` Height of image in pixels.
- `stride` Stride of each row of the data space in bytes.
- `datbuf` Pointer to the image data buffer.
MLIB_SUCCESS is returned if the image data structure is reset successfully. MMLIB_FAILURE is returned when the image data structure cannot be reset according to the parameters supplied.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_ImageCreate(3MLIB), mlib_ImageCreateSubimage(3MLIB), mlib_ImageCreateStruct(3MLIB), mlib_ImageSetStruct(3MLIB), mlib_ImageDelete(3MLIB), mlib_ImageSetFormat(3MLIB), mlib_ImageSetPaddings(3MLIB), attributes(5)
The `mlib_ImageResetSubimageStruct()` function resets a sub-image's data structure using parameters supplied by the user.

The `mlib_ImageResetSubimageStruct()` function returns `MLIB_FAILURE` if the supplied parameters do not pass the following sanity checks:

- `subimg != NULL`
- `img != NULL`
- `0 < w ≤ mlib_Imagewidth(img)`
- `0 < h ≤ mlib_ImageHeight(img)`
- `0 ≤ x ≤ (mlib_Imagewidth(img) - w)`
- `0 ≤ y ≤ (mlib_ImageHeight(img) - h)`

Whenever `MLIB_FAILURE` is returned, the original image data structure is not changed.

If `mlib_ImageIsUserAllocated(subimg)==0`, the original data buffer is freed, otherwise the original data buffer is not freed.

The function takes the following arguments:

- `subimg` Pointer to the sub-image data structure.
- `img` Pointer to the source image data structure.
- `x` X coordinate of the left border in the source image.
- `y` Y coordinate of the top border in the source image.
- `w` Width of the sub-image.
- `h` Height of the sub-image.

`MLIB_SUCCESS` is returned if the image data structure is reset successfully. `MLIB_FAILURE` is returned when the image data structure cannot be reset according to the parameters supplied.

See attributes(5) for descriptions of the following attributes:

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</table>
See Also  
mlib_ImageCreate(3MLIB), mlib_ImageCreateSubimage(3MLIB),
mlib_ImageCreateStruct(3MLIB), mlib_ImageSetStruct(3MLIB),
mlib_ImageResetStruct(3MLIB), mlib_ImageSetSubimageStruct(3MLIB),
mlib_ImageDelete(3MLIB), mlib_ImageSetFormat(3MLIB),
mlib_ImageSetPaddings(3MLIB), attributes(5)
mlib_ImageRotate180—rotate an image by 180 degrees

Synopsis

cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRotate180(mlib_image *dst, const mlib_image *src);

Description

Rotate an image 180 degrees.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

Parameters

The function takes the following arguments:

- **dst**  Pointer to destination image.
- **src**  Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB),
mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB),
mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180_Fp(3MLIB),
mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)
mlib_ImageRotate180_Fp(3MLIB)

Name  mlib_ImageRotate180_Fp – rotate an image by 180 degrees

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
           #include <mlib.h>

           mlib_status mlib_ImageRotate180_Fp(mlib_image *dst, const mlib_image *src);

Description  Rotate a floating-point image 180 degrees.

The width and height of the destination image can be different from the width and height of
the source image. The center of the source image is mapped to the center of the destination
image.

Parameters  The function takes the following arguments:

   dst  Pointer to destination image.

   src  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
           mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
           mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB),
           mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB),
           mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180(3MLIB),
           mlib_ImageRotate180_Fp(3MLIB), attributes(5)
mlib_ImageRotate270 – rotate an image by 270 degrees

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRotate270(mlib_image *dst, const mlib_image *src);

Description

Rotate an image 270 degrees clockwise.

The width and height of the destination image can be different from the width and height of
the source image. The center of the source image is mapped to the center of the destination
image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or
MLIB_INT.

Parameters

The function takes the following arguments:

dst Pointer to destination image.

src Pointer to source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB),
mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB),
mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180(3MLIB),
mlib_ImageRotate180_Fp(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)
Name  
mlib_ImageRotate270_Fp – rotate an image by 270 degrees

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

#include <mlib.h>

mlib_status mlib_ImageRotate270_Fp(mlib_image *dst, const mlib_image *src);

Description  
Rotate a floating-point image 270 degrees clockwise.

The width and height of the destination image can be different from the width and height of
the source image. The center of the source image is mapped to the center of the destination
image.

Parameters  
The function takes the following arguments:

dst  
Pointer to destination image.

src  
Pointer to source image.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB),
mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB),
mlib_ImageRotate90_Fp(3MLIB), mlib_ImageRotate180(3MLIB),
mlib_ImageRotate180_Fp(3MLIB), mlib_ImageRotate270(3MLIB), attributes(5)
# Name
mlib_ImageRotate – rotate image

# Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRotate(mlib_image *dst, const mlib_image *src,
                              mlib_d64 angle, mlib_d64 xcenter, mlib_d64 ycenter, mlib_filter filter,
                              mlib_edge edge);

# Description
The mlib_ImageRotate() function rotates a source image around a user-defined rotation center in the user-defined radians.

The width and height of the destination image can be different from the width and height of the source image. The (xcenter, ycenter) point of the source image is mapped to the center of the destination image. You should ensure that the destination buffer is large enough to hold the resulting bounding box to avoid clipping part of the image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or MLIB_INT.

The center of the upper-left corner pixel of an image is located at (0.5, 0.5).

# Parameters
The function takes the following arguments:

**dst** Pointer to destination image.

**src** Pointer to source image.

**angle** Angle of rotation. The angle is measured in radians clockwise.

**xcenter** X coordinate of rotation center in the source image.

**ycenter** Y coordinate of rotation center in the source image.

**filter** Type of resampling filter. It can be one of the following:

- MLIB_NEAREST
- MLIB_BILINEAR
- MLIB_BICUBIC
- MLIB_BICUBIC2

**edge** Type of edge condition. It can be one of the following:

- MLIB_EDGE_DST_NO_WRITE
- MLIB_EDGE_DST_FILL_ZERO
- MLIB_EDGE_OP_NEAREST
- MLIB_EDGE_SRC_EXTEND
- MLIB_EDGE_SRC_PADDED
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** mlib_ImageRotate_Fp(3MLIB), mlib_ImageRotateIndex(3MLIB), attributes(5)
Name  mlib_ImageRotate90 – rotate an image by 90 degrees

Synopsis  cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_ImageRotate90(mlib_image *dst, const mlib_image *src);

Description  Rotate an image 90 degrees clockwise.

The width and height of the destination image can be different from the width and height of
the source image. The center of the source image is mapped to the center of the destination
image.

The data type of the images can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, or
MLIB_INT.

Parameters  The function takes the following arguments:

   dst  Pointer to destination image.

   src  Pointer to source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB),
mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90_Fp(3MLIB),
mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB),
mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)
mlib_ImageRotate90_Fp – rotate an image by 90 degrees

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageRotate90_Fp(mlib_image *dst, const mlib_image *src);
```

Description

Rotate a floating-point image 90 degrees clockwise.

The width and height of the destination image can be different from the width and height of the source image. The center of the source image is mapped to the center of the destination image.

Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`mlib_ImageFlipAntiDiag(3MLIB), mlib_ImageFlipAntiDiag_Fp(3MLIB),
mlib_ImageFlipMainDiag(3MLIB), mlib_ImageFlipMainDiag_Fp(3MLIB),
mlib_ImageFlipX(3MLIB), mlib_ImageFlipX_Fp(3MLIB), mlib_ImageFlipY(3MLIB),
mlib_ImageFlipY_Fp(3MLIB), mlib_ImageRotate90(3MLIB),
mlib_ImageRotate180(3MLIB), mlib_ImageRotate180_Fp(3MLIB),
mlib_ImageRotate270(3MLIB), mlib_ImageRotate270_Fp(3MLIB), attributes(5)}`
The `mlib_ImageRotate_Fp()` function rotates a floating-point source image around a user-defined rotation center in the user-defined radians.

The width and height of the destination image can be different from the width and height of the source image. The \((xcenter, ycenter)\) point of the source image is mapped to the center of the destination image. You should ensure that the destination buffer is large enough to hold the resulting bounding box to avoid clipping part of the image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `angle` Angle of rotation. The angle is measured in radians clockwise.
- `xcenter` X coordinate of rotation center in the source image.
- `ycenter` Y coordinate of rotation center in the source image.
- `filter` Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- `edge` Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:
mlib_ImageRotate_Fp(3MLIB)

<table>
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See Also  mlib_ImageRotate(3MLIB), mlib_ImageRotateIndex(3MLIB), attributes(5)
mlib_ImageRotateIndex(3MLIB)

**Name**
mlib_ImageRotateIndex – rotate color-indexed image

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageRotateIndex(mlib_image *dst, const mlib_image *src, mlib_d64 angle, mlib_d64 xcenter, mlib_d64 ycenter, mlib_filter filter, mlib_edge edge, const void *colormap);
```

**Description**
The `mlib_ImageRotateIndex()` function rotates the source image about a user-defined rotation center in user-defined radians.

The width and height of the destination image can be different from the width and height of the source image. The \((x\text{center}, y\text{center})\) point of the source image is mapped to the center of the destination image. You should ensure that the destination buffer is large enough to hold the resulting bounding box to avoid clipping part of the image.

The source and destination images must be single-channel images.

The image data type must be `MLIB_BYTE` or `MLIB_SHORT`.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

**Parameters**
The function takes the following arguments:

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **angle**  
  Angle of rotation. The angle is measured in radians clockwise.

- **xcenter**  
  X coordinate of rotation center in the source image.

- **ycenter**  
  Y coordinate of rotation center in the source image.

- **filter**  
  Type of resampling filter. It can be one of the following:

  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`

- **edge**  
  Type of edge condition. It can be one of the following:

  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`

- **colormap**  
  Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
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</tr>
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<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  `mlib_ImageRotate(3MLIB), mlib_ImageRotate_Fp(3MLIB), attributes(5)`
The `mlib_ImageScalarBlend()` function blends the first and second source images by adding each of their scaled pixels. The first source image is scaled by the scalar \( a \), and the second source image is inverse scaled by \((1 - a)\).

It uses the following equation:

\[
dst[x][y][i] = a[i]*src1[x][y][i] + (1 - a[i])*src2[x][y][i]
\]

The function takes the following arguments:

- **\textit{dst}**: Pointer to destination image.
- **\textit{src1}**: Pointer to first source image.
- **\textit{src2}**: Pointer to second source image.
- **\textit{alpha}**: Scalar blending factor. The \( a \) value equals \((\text{alpha} \times 2^{(-31)})\). \text{alpha}[i] contains the blending factor for channel \( i \).

The function returns \text{MLIB_SUCCESS} if successful. Otherwise it returns \text{MLIB_FAILURE}.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**

`mlib_ImageScalarBlend_Fp(3MLIB)`, `mlib_ImageScalarBlend_Fp_Inp(3MLIB)`, `mlib_ImageScalarBlend_Inp(3MLIB)`, attributes(5)
The `mlib_ImageScalarBlend_Fp()` function blends the first and second floating-point source images by adding each of their scaled pixels. The first source image is scaled by the scalar \(a\), and the second source image is inverse scaled by \((1 - a)\).

It uses the following equation:
\[
dst[x][y][i] = a[i]*src1[x][y][i] + (1 - a[i])*src2[x][y][i]
\]

### Parameters
- **dst**: Pointer to destination image.
- **src1**: Pointer to first source image.
- **src2**: Pointer to second source image.
- **alpha**: Scalar blending factor. The \(a\) value equals `alpha` which should be in the \([0.0, 1.0]\) range. `alpha[i]` contains the blending factor for channel \(i\).

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
- `mlib_ImageBlend(3MLIB)`
- `mlib_ImageBlend_Fp_Inp(3MLIB)`
- `mlib_ImageBlend_Inp(3MLIB)`
- attributes(5)
Name  
mlib_ImageScalarBlend_Fp_Inp – image blending with scalar

Synopsis  
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageScalarBlend_Fp_Inp(mlib_image *src1dst,
                                           const mlib_image *src2, const mlib_d64 *alpha);

Description  
The mlib_ImageScalarBlend_Fp_Inp() function blends the first and second floating-point
source images by adding each of their scaled pixels in place. The first source image is scaled by
the scalar \( a \), and the second source image is inverse scaled by \( (1 - a) \).

It uses the following equation:

\[
src1dst[x][y][i] = a[i] * src1dst[x][y][i] + (1 - a[i]) * src2[x][y][i]
\]

Parameters  
The function takes the following arguments:

- \( src1dst \)  
  Pointer to first source and destination image.

- \( src2 \)  
  Pointer to second source image.

- \( alpha \)  
  Scalar blending factor. The \( a \) value equals \( alpha \) which should be in the \([0.0, 1.0]\) range. \( alpha[i] \) contains the blending factor for channel \( i \).

Return Values  
The function returns \( \text{MLIB_SUCCESS} \) if successful. Otherwise it returns \( \text{MLIB_FAILURE} \).

Attributes  
See attributes(5) for descriptions of the following attributes:

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</thead>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
mlib_ImageScalarBlend(3MLIB), mlib_ImageScalarBlend_Fp(3MLIB), mlib_ImageScalarBlend_Inp(3MLIB), attributes(5)
The `mlib_ImageScalarBlend_Inp()` function blends the first and second source images by adding each of their scaled pixels in place. The first source image is scaled by the scalar \( a \), and the second source image is inverse scaled by \((1 - a)\).

It uses the following equation:

\[
src1dst[x][y][i] = a[i]*src1dst[x][y][i] + (1 - a[i])*src2[x][y][i]
\]

### Parameters

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.
- `alpha` Scalar blending factor. The \( a \) value equals \((alpha * 2**(-31))\). \( alpha[i] \) contains the blending factor for channel \( i \).

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_ImageScalarBlend(3MLIB)`, `mlib_ImageScalarBlend_Fp(3MLIB)`, `mlib_ImageScalarBlend_Fp_Inp(3MLIB)`, attributes(5)
The `mlib_ImageScale2()` function performs a linear scaling on the pixels of the source image by multiplying the data by a scale factor and then adding an offset. Images must have the same size, and number of channels. They can have 1, 2, 3, or 4 channels.

The following equation is used:

\[ \text{dst}[x][y][i] = \text{src}[x][y][i] \times \text{alpha}[i] + \text{beta}[i] \]

If the result of the operation underflows/overflows the minimum/maximum value supported by the destination image, then it will be clamped to the minimum/maximum value respectively.

See the following table for available variations of this linear scaling function.

<table>
<thead>
<tr>
<th>Type[*]</th>
<th>BYTE</th>
<th>SHORT</th>
<th>USHORT</th>
<th>INT</th>
<th>FLOAT</th>
<th>DOUBLE</th>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MLIB_INT</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `alpha` Scaling factor. `alpha[i]` contains the scaling factor for channel `i`.
- `beta` Offset value. `beta[i]` contains the offset for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:
See Also

- mlib_ImageScale(3MLIB), mlib_ImageScale_Fp(3MLIB),
- mlib_ImageScale_Fp_Inp(3MLIB), mlib_ImageScale_Inp(3MLIB),
- mlib_ImageScale2_Inp(3MLIB), attributes(5)
# Name
mlib_ImageScale2_Inp – linear scaling, in place

## Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageScale2_Inp(mlib_image *srcdst,
                               const mlib_d64 *alpha,
                               const mlib_d64 *beta);
```

## Description

The `mlib_ImageScale2_Inp()` function performs an in-place linear scaling on the pixels of the source image by multiplying the data by a scale factor and then adding an offset. Images can have 1, 2, 3, or 4 channels.

The following equation is used:

$$srcdst[x][y][i] = srcdst[x][y][i] \times \alpha[i] + \beta[i]$$

If the result of the operation underflows/overflows the minimum/maximum value supported by the destination image, then it will be clamped to the minimum/maximum value respectively.

The image can be of type `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT` or `MLIB_INT`.

## Parameters

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `alpha` Scaling factor. `alpha[i]` contains the scaling factor for channel `i`.
- `beta` Offset value. `beta[i]` contains the offset for channel `i`.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

## See Also

- `mlib_ImageScale(3MLIB)`, `mlib_ImageScale_Fp(3MLIB)`,
- `mlib_ImageScale_Fp_Inp(3MLIB)`, `mlib_ImageScale_Inp(3MLIB)`,
- `mlib_ImageScale2(3MLIB)`, attributes(5)
mlib_ImageScale() function performs a linear scaling on the pixels of the source image by multiplying the data by a scale factor, shifting, and then adding an offset.

The following equation is used:

\[
dst[x][y][i] = src[x][y][i] \times alpha[i] \times 2^(-shift) + beta[i]
\]

If the result of the operation underflows/overflows the minimum/maximum value supported by the destination image, then it will be clamped to the minimum/maximum value respectively.

See the following table for available variations of this linear scaling function.

<table>
<thead>
<tr>
<th>Type [*]</th>
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<th>SHORT</th>
<th>USHORT</th>
<th>INT</th>
<th>FLOAT</th>
<th>DOUBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLIB_BYTE</td>
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<td>MLIB_SHORT</td>
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<td>MLIB_INT</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

**Parameters**

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **alpha** Scaling factor. alpha[i] contains the scaling factor for channel i.
- **beta** Offset value. beta[i] contains the offset for channel i.
- **shift** Right shifting factor.

**Return Values**

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_ImageScale_Fp(3MLIB)`
- `mlib_ImageScale_Fp_Inp(3MLIB)`
- `mlib_ImageScale_Inp(3MLIB)`
- `mlib_ImageScale2(3MLIB)`
- `mlib_ImageScale2_Inp(3MLIB)`
- attributes(5)
The `mlib_ImageScale_Fp()` function performs a floating-point linear scaling on the pixels of the source image by multiplying the data by a scale factor, shifting, and then adding an offset.

The following equation is used:

\[
\text{dst}[x][y][i] = \text{src}[x][y][i] \times \text{alpha}[i] + \text{beta}[i]
\]

If the result of the operation underflows/overflows the minimum/maximum value supported by the destination image, then it will be clamped to the minimum/maximum value respectively.

See the following table for available variations of this linear scaling function.

<table>
<thead>
<tr>
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<th>INT</th>
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<tr>
<td>MLIB_DOUBLE</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

### Parameters

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `alpha` Scaling factor. `alpha[i]` contains the scaling factor for channel `i`.
- `beta` Offset value. `beta[i]` contains the offset for channel `i`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

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</table>
See Also  mlib_ImageScale(3MLIB), mlib_ImageScale_Fp(3MLIB),
         mlib_ImageScale_Inp(3MLIB), mlib_ImageScale2(3MLIB),
         mlib_ImageScale2_Inp(3MLIB), attributes(5)
The `mlib_ImageScale_Fp_Inp()` function performs a floating-point, in-place linear scaling on the pixels of the source image by multiplying the data by a scale factor, shifting, and then adding an offset.

The following equation is used:

\[ \text{srcdst}[x][y][i] = \text{srcdst}[x][y][i] \times \text{alpha}[i] + \text{beta}[i] \]

If the result of the operation underflows/overflows the minimum/maximum value supported by the destination image, then it will be clamped to the minimum/maximum value respectively.

The image can be of type `MLIB_FLOAT` or `MLIB_DOUBLE`.

### Parameters

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `alpha` Scaling factor. `alpha[i]` contains the scaling factor for channel `i`.
- `beta` Offset value. `beta[i]` contains the offset for channel `i`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

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### See Also

`mlib_ImageScale(3MLIB), mlib_ImageScale_Fp(3MLIB), mlib_ImageScale_Inp(3MLIB), mlib_ImageScale2(3MLIB), mlib_ImageScale2_Inp(3MLIB), attributes(5)`
mlib_ImageScale_Inp – linear scaling, in place

Synopsis

cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageScale_Inp(mlib_image *srcdst, const mlib_s32 *alpha,
    const mlib_s32 *beta, mlib_s32 shift);

Description

The mlib_ImageScale_Inp() function performs an in-place linear scaling on the pixels of the source image by multiplying the data by a scale factor, shifting, and then adding an offset.

The following equation is used:

\[
srcdst[x][y][i] = srcdst[x][y][i] \times \alpha[i] \times 2^{(-\text{shift})} + \beta[i]
\]

If the result of the operation underflows/overflows the minimum/maximum value supported by the destination image, then it will be clamped to the minimum/maximum value respectively.

The image can be of type MLIB_BYTE, MLIB_SHORT, MLIB_USHORT or MLIB_INT.

Parameters

The function takes the following arguments:

- srcdst: Pointer to source and destination image.
- alpha: Scaling factor. alpha[i] contains the scaling factor for channel i.
- beta: Offset value. beta[i] contains the offset for channel i.
- shift: Right shifting factor.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageScale(3MLIB), mlib_ImageScale_Fp(3MLIB),
mlib_ImageScale_Fp_Inp(3MLIB), mlib_ImageScale2(3MLIB),
mlib_ImageScale2_Inp(3MLIB), attributes(5)
# mlib_ImageSConv3x3

**Synopsis**

```c
#include <mlib.h>

mlib_status mlib_ImageSConv3x3(mlib_image *dst, const mlib_image *src, const mlib_s32 *hkernel, const mlib_s32 *vkernel, mlib_s32 scale, mlib_s32 cmask, mlib_edge edge);
```

**Description**

The `mlib_ImageSConv3x3()` function performs a separable 3x3 convolution on the source image by using the user-supplied kernel.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1-dm} \sum_{q=-dn}^{n-1-dn} src[x+p][y+q][i] * h[p] * v[q] * 2^{-2 * scale}
\]

where \( m = 3 \), \( n = 3 \), \( dm = (m - 1) / 2 = 1 \), \( dn = (n - 1) / 2 = 1 \).

**Parameters**

The function takes the following arguments:

- **dst**
  - Pointer to destination image.
- **src**
  - Pointer to source image.
- **hkernel**
  - Pointer to the horizontal kernel.
- **vkernel**
  - Pointer to the vertical kernel.
- **scale**
  - Scaling factor.
- **cmask**
  - Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to one bits are to be processed. For a single-channel image, the channel mask is ignored.
- **edge**
  - Type of edge condition. It can be one of the following:
    - `MLIB_EDGE_DST_NO_WRITE`
    - `MLIB_EDGE_DST_FILL_ZERO`
    - `MLIB_EDGE_DST_COPY_SRC`
    - `MLIB_EDGE_SRC_EXTEND`

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),  
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),  
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),  
mlib_ImageConv5x5(3MLIB), mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),  
mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),  
mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),  
mlib_ImageConvolveMxN(3MLIB), mlib_ImageConvolveMxN_Fp(3MLIB),  
mlib_ImageConvolveMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB),  
mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),  
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),  
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),  
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageSConv3x3_Fp()` function performs a separable 3x3 convolution on the source image by using the user-supplied kernel. It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{-(m-1)} \sum_{q=-dn}^{-(n-1)} \text{src}[x+p][y+q][i] \times h[p] \times v[q]
\]

where \( m = 3, n = 3, dm = (m - 1)/2 = 1, dn = (n - 1)/2 = 1 \).

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `hkernel` Pointer to the horizontal kernel.
- `vkernel` Pointer to the vertical kernel.
- `cmask` Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to one bits are those to be processed. For a single-channel image, the channel mask is ignored.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),
mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),
mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB),
mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB),
mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)

See Also
The `mlib_ImageSConv5x5()` function performs a separable 5x5 convolution on the source image by using the user-supplied kernel.

It uses the following equation:

\[
\text{dst}[[x][y][i]] = \sum \sum \text{src}[[x+p][y+q][i]*h[p]*v[q]*2^{-2*\text{scale}}]
\]

where \(m = 5, n = 5, dm = (m - 1)/2 = 2, dn = (n - 1)/2 = 2\).

**Parameters**

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `hkernel` Pointer to the horizontal kernel.
- `vkernel` Pointer to the vertical kernel.
- `scale` Scaling factor.
- `cmask` Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to one bits are those to be processed. For a single-channel image, the channel mask is ignored.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See [attributes(5)] for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
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</table>
See Also

mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),
mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),
mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB),
mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB),
mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB),
mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB),
mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB),
mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
The `mlib_ImageSConv5x5_Fp()` function performs a separable 5x5 convolution on the source image by using the user-supplied kernel.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum \sum \text{src}[x+p][y+q][i] * \text{h}[p] * \text{v}[q]
\]

where \( m = 5 \), \( n = 5 \), \( dm = (m - 1)/2 = 2 \), \( dn = (n - 1)/2 = 2 \).

### Parameters

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **hkernel**: Pointer to the horizontal kernel.
- **vkernel**: Pointer to the vertical kernel.
- **cmask**: Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to one bits are those to be processed. For a single-channel image, the channel mask is ignored.
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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</table>
See Also

- `mlib_ImageConv2x2(3MLIB)`, `mlib_ImageConv2x2_Fp(3MLIB)`
- `mlib_ImageConv2x2Index(3MLIB)`, `mlib_ImageConv3x3(3MLIB)`
- `mlib_ImageConv3x3_Fp(3MLIB)`, `mlib_ImageConv3x3Index(3MLIB)`
- `mlib_ImageConv4x4(3MLIB)`, `mlib_ImageConv4x4_Fp(3MLIB)`
- `mlib_ImageConv4x4Index(3MLIB)`, `mlib_ImageConv5x5(3MLIB)`
- `mlib_ImageConv5x5_Fp(3MLIB)`, `mlib_ImageConv5x5Index(3MLIB)`
- `mlib_ImageConv7x7(3MLIB)`, `mlib_ImageConv7x7_Fp(3MLIB)`
- `mlib_ImageConv7x7Index(3MLIB)`, `mlib_ImageConvKernelConvert(3MLIB)`
- `mlib_ImageConvMxN(3MLIB)`, `mlib_ImageConvMxN_Fp(3MLIB)`
- `mlib_ImageConvMxNIndex(3MLIB)`, `mlib_ImageConvolveMxN(3MLIB)`
- `mlib_ImageConvolveMxN_Fp(3MLIB)`, `mlib_ImageSConv3x3(3MLIB)`
- `mlib_ImageSConv3x3_Fp(3MLIB)`, `mlib_ImageSConv3x3_Fp(3MLIB)`
- `mlib_ImageSConvKernelConvert(3MLIB)`, `attributes(5)`
The `mlib_ImageSConv7x7` function performs a separable 7x7 convolution on the source image by using the user-supplied kernel.

It uses the following equation:

\[
\text{dst}[x][y][i] = \sum_{p=-dm}^{dm} \sum_{q=-dn}^{dn} \text{src}[x+p][y+q][i] \times h[p] \times v[q] \times 2^{(-2 \times \text{scale})}
\]

where \( m = 7 \), \( n = 7 \), \( dm = (m - 1) / 2 = 3 \), \( dn = (n - 1) / 2 = 3 \).

### Parameters

- **`dst`** Pointer to destination image.
- **`src`** Pointer to source image.
- **`hkernel`** Pointer to the horizontal kernel.
- **`vkernel`** Pointer to the vertical kernel.
- **`scale`** Scaling factor.
- **`cmask`** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single-channel image, the channel mask is ignored.
- **`edge`** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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</table>
See Also

*mlib_ImageConv2x2*(3MLIB), *mlib_ImageConv2x2_Fp*(3MLIB),
*mlib_ImageConv2x2Index*(3MLIB), *mlib_ImageConv3x3*(3MLIB),
*mlib_ImageConv3x3_Fp*(3MLIB), *mlib_ImageConv3x3Index*(3MLIB),
*mlib_ImageConv4x4*(3MLIB), *mlib_ImageConv4x4_Fp*(3MLIB),
*mlib_ImageConv4x4Index*(3MLIB), *mlib_ImageConv5x5*(3MLIB),
*mlib_ImageConv5x5_Fp*(3MLIB), *mlib_ImageConv5x5Index*(3MLIB),
*mlib_ImageConv7x7*(3MLIB), *mlib_ImageConv7x7_Fp*(3MLIB),
*mlib_ImageConv7x7Index*(3MLIB), *mlib_ImageConvKernelConvert*(3MLIB),
*mlib_ImageConvMxN*(3MLIB), *mlib_ImageConvMxN_Fp*(3MLIB),
*mlib_ImageConvMxNIndex*(3MLIB), *mlib_ImageConvolveMxN*(3MLIB),
*mlib_ImageConvolveMxN_Fp*(3MLIB), *mlib_ImageSConv3x3*(3MLIB),
*mlib_ImageSConv3x3_Fp*(3MLIB), *mlib_ImageSConv5x5*(3MLIB),
*mlib_ImageSConv5x5_Fp*(3MLIB), *mlib_ImageSConv7x7*(3MLIB),
*mlib_ImageSConvKernelConvert*(3MLIB), attributes(5)
The `mlib_ImageSConv7x7_Fp()` function performs a separable 7x7 convolution on the source image by using the user-supplied kernel.

It uses the following equation:

\[
dst[x][y][i] = \sum_{p=-dm}^{m-1} \sum_{q=-dn}^{n-1} src[x+p][y+q][i]*h[p]*v[q]
\]

where \( m = 7 \), \( n = 7 \), \( dm = (m-1)/2 = 3 \), \( dn = (n-1)/2 = 3 \).

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **hkernel** Pointer to the horizontal kernel.
- **vkernel** Pointer to the vertical kernel.
- **cmask** Channel mask to indicate the channels to be convolved, each bit of which represents a channel in the image. The channels corresponding to 1 bits are those to be processed. For a single-channel image, the channel mask is ignored.
- **edge** Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_DST_COPY_SRC`
  - `MLIB_EDGE_SRC_EXTEND`

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also

mlib_ImageConv2x2(3MLIB), mlib_ImageConv2x2_Fp(3MLIB),
mlib_ImageConv2x2Index(3MLIB), mlib_ImageConv3x3(3MLIB),
mlib_ImageConv3x3_Fp(3MLIB), mlib_ImageConv3x3Index(3MLIB),
mlib_ImageConv4x4(3MLIB), mlib_ImageConv4x4_Fp(3MLIB),
mlib_ImageConv4x4Index(3MLIB), mlib_ImageConv5x5(3MLIB),
mlib_ImageConv5x5_Fp(3MLIB), mlib_ImageConv5x5Index(3MLIB),
mlib_ImageConv7x7(3MLIB), mlib_ImageConv7x7_Fp(3MLIB),
mlib_ImageConv7x7Index(3MLIB), mlib_ImageConvKernelConvert(3MLIB),
mlib_ImageConvMxN(3MLIB), mlib_ImageConvMxN_Fp(3MLIB),
mlib_ImageConvMxNIndex(3MLIB), mlib_ImageConvolveMxN(3MLIB),
mlib_ImageConvolveMxN_Fp(3MLIB), mlib_ImageSConv3x3(3MLIB),
mlib_ImageSConv3x3_Fp(3MLIB), mlib_ImageSConv5x5(3MLIB),
mlib_ImageSConv5x5_Fp(3MLIB), mlib_ImageSConv7x7(3MLIB),
mlib_ImageSConvKernelConvert(3MLIB), attributes(5)
mlib_ImageSConvKernelConvert – kernel conversion for separable convolution

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSConvKernelConvert(mlib_s32 *ihkernel,
                        mlib_s32 *ivkernel, mlib_s32 *iscale,
                        const mlib_d64 *fhkernel,
                        const mlib_d64 *fvkernel, mlib_s32 m, mlib_s32 n, mlib_type type);

Description

The mlib_ImageSConvKernelConvert() function converts a floating-point separable convolution kernel to an integer kernel with its scaling factor, which is suitable to be used in separable convolution functions.

Parameters

The function takes the following arguments:

- ihkernel: Pointer to integer horizontal kernel.
- ivkernel: Pointer to integer vertical kernel.
- iscale: Scaling factor of the integer convolution kernel.
- fhkernel: Pointer to floating-point horizontal kernel.
- fvkernel: Pointer to floating-point vertical kernel.
- m: Width of the convolution kernel. m must be an odd number larger than 1.
- n: Height of the convolution kernel. n must be an odd number larger than 1.
- type: The image type.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageSConv3x3(3MLIB), mlib_ImageSConv3x3_Fp(3MLIB),
mlib_ImageSConv5x5(3MLIB), mlib_ImageSConv5x5_Fp(3MLIB),
mlib_ImageSConv7x7(3MLIB), mlib_ImageSConv7x7_Fp(3MLIB),
mlib_ImageConvKernelConvert(3MLIB), attributes(5)
mlib_ImageSetFormat() function sets a new value for the format field of a mlib_image structure.

The data type of the image can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.

Parameters

- **img**: Pointer to a mediaLib image structure.
- **format**: Image pixel format. It can be one of the following:
  - MLIB_FORMAT_UNKNOWN
  - MLIB_FORMAT_INDEXED
  - MLIB_FORMAT_GRAYSCALE
  - MLIB_FORMAT_RGB
  - MLIB_FORMAT_BGR
  - MLIB_FORMAT_ARGB
  - MLIB_FORMAT_ABGR
  - MLIB_FORMAT_PACKED_ARGB
  - MLIB_FORMAT_PACKED_ABGR
  - MLIB_FORMAT_GRAYSCALE_ALPHA
  - MLIB_FORMAT_RGBA

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageGetFormat(3MLIB), mlib_ImageCreate(3MLIB), mlib_ImageCreateStruct(3MLIB), mlib_ImageCreateSubimage(3MLIB), attributes(5)
mlib_ImageSetPaddings — set paddings

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSetPaddings(mlib_image *img, mlib_u8 left,
                                 mlib_u8 top, mlib_u8 right, mlib_u8 bottom);
```

Description

The `mlib_ImageSetPaddings()` function sets new values for the paddings field of the `mlib_image` structure as follows:

```
img->paddings[0] = left;
img->paddings[1] = top;
img->paddings[2] = right;
img->paddings[3] = bottom;
```

By default, an image structure creation function, such as `mlib_ImageCreate()`, `mlib_ImageCreateStruct()`, or `mlib_ImageCreateSubimage()`, sets the paddings field of the `mlib_image` structure as follows:

```
img->paddings[0] = 0;
img->paddings[1] = 0;
img->paddings[2] = 0;
img->paddings[3] = 0;
```

Note that this function is needed only when the edge condition `MLIB_EDGE_SRC_PADDED` is used.

The `mlib_image->paddings` field denotes the amount of paddings on each side of an image, from which the real image border can be seen. When `MLIB_EDGE_SRC_PADDED` is specified as the edge condition, a geometric function uses the "real" source image border for clipping the destination image.

Parameters

The function takes the following arguments:

- `img` Pointer to image data structure.
- `left` Number of columns padded on the left side.
- `top` Number of rows padded on the top.
- `right` Number of columns padded on the right side.
- `bottom` Number of rows padded at the bottom.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:
### mlib_ImageSetPaddings(3MLIB)

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**See Also**  
mlib_ImageGetPaddings(3MLIB), mlib_ImageCreate(3MLIB),  
mlib_ImageCreateStruct(3MLIB), mlib_ImageCreateSubimage(3MLIB),  
mlib_ImageAffine(3MLIB), attributes(5)
mlib_ImageSetStruct() – set image data structure

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSetStruct(mlib_image *image, mlib_type type,
mlib_s32 channels, mlib_s32 width, mlib_s32 height, mlib_s32 stride,
const void *datbuf);

Description

The mlib_ImageSetStruct() function sets a mediaLib image data structure using parameters supplied by the user.

The mlib_ImageSetStruct() function returns MLIB_FAILURE if the supplied parameters do not pass the following sanity checks:

- `image` should not be NULL
- `type` should be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE
- `channels` should be between 1 and 4
- `width` should be greater than 0
- `height` should be greater than 0
- `stride` should be no less than `width * channels * (size of type in bytes)`
- `datbuf` should not be NULL

Whenever MLIB_FAILURE is returned, the original image data structure is not changed.

If the data buffer in the image data structure is not NULL, it is the user’s responsibility to free it if necessary.

Parameters

The function takes the following arguments:

- `image` Pointer to the image data structure.
- `type` Image data type. It can be MLIB_BIT, MLIB_BYTE, MLIB_SHORT, MLIB_USHORT, MLIB_INT, MLIB_FLOAT, or MLIB_DOUBLE.
- `channels` Number of channels in the image.
- `width` Width of image in pixels.
- `height` Height of image in pixels.
- `stride` Stride of each row of the data space in bytes.
- `datbuf` Pointer to the image data buffer.
MLIB_SUCCESS is returned if the image data structure is set successfully. MLI_FAILURE is returned when the image data structure cannot be set according to the parameters supplied.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

mlib_ImageCreate(3MLIB), mlib_ImageCreateSubimage(3MLIB), mlib_ImageCreateStruct(3MLIB), mlib_ImageResetStruct(3MLIB), mlib_ImageDelete(3MLIB), mlib_ImageSetFormat(3MLIB), mlib_ImageSetPaddings(3MLIB), attributes(5)
mlib_ImageSetSubimageStruct — set sub-image data structure

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSetSubimageStruct(mlib_image *subimg,   
    const mlib_image *img, mlib_s32 x, mlib_s32 y,  
    mlib_s32 w, mlib_s32 h);
```

Description

The `mlib_ImageSetSubimageStruct()` function sets a sub-image's data structure using parameters supplied by the user.

The `mlib_ImageSetSubimageStruct()` function returns `MLIB_FAILURE` if the supplied parameters do not pass the following sanity checks:

- `subimg` != NULL
- `img` != NULL
- `0 < w ≤ mlib_ImageGetWidth(img)`
- `0 < h ≤ mlib_ImageGetHeight(img)`
- `0 ≤ x ≤ (mlib_ImageGetWidth(img) - w)`
- `0 ≤ y ≤ (mlib_ImageGetHeight(img) - h)`

Whenever `MLIB_FAILURE` is returned, the original image data structure is not changed.

Parameters

The function takes the following arguments:

- `subimg` Pointer to the sub-image data structure.
- `img` Pointer to the source image data structure.
- `x` X coordinate of the left border in the source image.
- `y` Y coordinate of the top border in the source image.
- `w` Width of the sub-image.
- `h` Height of the sub-image.

Return Values

`MLIB_SUCCESS` is returned if the image data structure is set successfully. `MLIB_FAILURE` is returned when the image data structure can not be set according to the parameters supplied.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageCreate(3MLIB), mlib_ImageCreateSubimage(3MLIB),
mlib_ImageCreateStruct(3MLIB), mlib_ImageSetStruct(3MLIB),
mlib_ImageResetStruct(3MLIB), mlib_ImageResetSubimageStruct(3MLIB),
mlib_ImageDelete(3MLIB), mlib_ImageSetFormat(3MLIB),
mlib_ImageSetPaddings(3MLIB), attributes(5)
mlib_ImageSobel(3MLIB)

Name  mlib_ImageSobel, mlib_ImageSobel_Fp – Sobel filter

Synopsis  cc [... file... -lmlib [...]
  #include <mlib.h>

  mlib_status mlib_ImageSobel(mlib_image *dst, const mlib_image *src, 
  mlib_s32 cmask, mlib_edge edge);

  mlib_status mlib_ImageSobel_Fp(mlib_image *dst, const mlib_image *src, 
  mlib_s32 cmask, mlib_edge edge);

Description  Each function is a special case of the gradient filter, which is an edge detector which computes
the magnitude of the image gradient vector in two orthogonal directions. In this case, the
gradient filter uses specific horizontal and vertical masks.

The Sobel filter is one of the special cases of gradient filter using the following horizontal and
vertical masks:

  hmask = { -1.0, 0.0, 1.0, 
          -2.0, 0.0, 2.0, 
          -1.0, 0.0, 1.0 }

  vmask = { -1.0, -2.0, -1.0, 
         0.0, 0.0, 0.0, 
         1.0, 2.0, 1.0 }

Parameters  Each function takes the following arguments:

  dst   Pointer to destination image.

  src   Pointer to source image.

  cmask  Channel mask to indicate the channels to be processed, each bit of which represents
         a channel in the image. The channels corresponding to 1 bits are those to be
         processed. For a single channel image, the channel mask is ignored.

  edge   Type of edge condition. It can be one of the following:
         MLIB_EDGE_DST_NO_WRITE
         MLIB_EDGE_DS_FILL_ZERO
         MLIB_EDGE_DST_COPY_SRC
         MLIB_EDGE_SR_EXTEND

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_ImageGradient3x3(3MLIB), mlib_ImageGradient3x3_Fp(3MLIB), attributes(5)
The `mlib_ImageSqr_Fp()` function computes the floating-point square of each pixel in the source image.

It uses the following equation:

\[
dst[x][y][i] = src[x][y][i] * src[x][y][i]
\]

**Parameters**
- `dst` Pointer to destination image.
- `src` Pointer to source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
- `mlib_ImageSqr_Fp_Inp(3MLIB)`, `attributes(5)`
The `mlib_ImageSqr_Fp_Inp()` function computes the floating-point square of each pixel in the source image.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = \text{srcdst}[x][y][i] \times \text{srcdst}[x][y][i]
\]

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

```
<table>
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</tbody>
</table>
```

See Also `mlib_ImageSqr_Fp(3MLIB), attributes(5)`
The `mlib_ImageSqrShift()` function computes the square of each pixel in the source image and scales the result by the shift factor.

It uses the following equation:

$$\text{dst}[x][y][i] = \text{src}[x][y][i] \times \text{src}[x][y][i] \times 2^{(-\text{shift})}$$

**Parameters**

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **shift** Right shifting factor. $0 \leq \text{shift} \leq 31$.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**

`mlib_ImageSqrShift_Inp(3MLIB)`, attributes(5)
Name  mlib_ImageSqrShift_Inp – square with shifting, in place

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSqrShift_Inp(mlib_image *srcdst, mlib_s32 shift);

Description  The mlib_ImageSqrShift_Inp() function computes the square of each pixel in the source image and scales the result by the shift factor, in place.

It uses the following equation:
srcdst[x][y][i] = srcdst[x][y][i] * srcdst[x][y][i] * 2**(-shift)

Parameters  The function takes the following arguments:
srcdst  Pointer to source and destination image.
shift  Right shifting factor. 0 ≤ shift ≤ 31.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_ImageSqrShift(3MLIB), attributes(5)
The `mlib_ImageStdDev()` function computes the standard deviation for each channel in the source image. It uses the following equation:

\[
\text{sdev}[i] = \left( \frac{1}{\text{w} \times \text{h}} \sum_{x=0}^{\text{w}-1} \sum_{y=0}^{\text{h}-1} (\text{img}[x][y][i] - \text{mean}[i])^2 \right)^{0.5}
\]

where, in the case of `mean == NULL`,

\[
\text{mean}[i] = \left( \frac{1}{\text{w} \times \text{h}} \sum_{x=0}^{\text{w}-1} \sum_{y=0}^{\text{h}-1} \text{img}[x][y][i] \right)
\]

The function takes the following arguments:

- `sdev`: Pointer to standard deviation array, whose size is the number of channels in the source image. `sdev[i]` contains the standard deviation of channel `i`.
- `img`: Pointer to input image.
- `mean`: Pointer to pre-computed mean array for each channel. (If `NULL`, it will be computed.) `mean[i]` contains the mean of channel `i`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_ImageMean(3MLIB), mlib_ImageMean_Fp(3MLIB), mlib_ImageStdDev_Fp(3MLIB), attributes(5)`
### Name
mlib_ImageStdDev_Fp – image standard deviation

### Synopsis
c c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageStdDev_Fp(mlib_d64 *sdev, const mlib_image *img,
const mlib_d64 *mean);

### Description
The mlib_ImageStdDev_Fp() function computes the standard deviation for each channel in the floating-point source image.

It uses the following equation:

\[
\text{sdev}[i] = \frac{1}{w-1 \times h-1} \times \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} (\text{img}[x][y][i] - \text{mean}[i])^2 \times 0.5
\]

where, in the case of mean == NULL,

\[
\text{mean}[i] = \frac{1}{w-1 \times h-1} \times \sum_{x=0}^{w-1} \sum_{y=0}^{h-1} \text{img}[x][y][i]
\]

### Parameters
The function takes the following arguments:

\[sdev\]
Pointer to standard deviation array, whose size is the number of channels in the source image. \text{sdev}[i] contains the standard deviation of channel \(i\).

\[img\]
Pointer to input image.

\[mean\]
Pointer to pre-computed mean array for each channel. (If NULL, it will be computed.) \text{mean}[i] contains the mean of channel \(i\).

### Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
mlib_ImageMean(3MLIB), mlib_ImageMean_Fp(3MLIB), mlib_ImageStdDev(3MLIB), attributes(5)
The `mlib_ImageSub1_Fp_Inp()` function subtracts the second floating-point source image from the first floating-point source image on a pixel-by-pixel basis, in place. It uses the following equation:

\[
src1dst[x][y][i] = src1dst[x][y][i] - src2[x][y][i]
\]

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also

- `mlib_ImageSub(3MLIB), mlib_ImageSub_Fp(3MLIB), mlib_ImageSub1_Inp(3MLIB), mlib_ImageSub2_Fp_Inp(3MLIB), mlib_ImageSub2_Inp(3MLIB), attributes(5)`
The `mlib_ImageSub1_Inp()` function subtracts the second source image from the first source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[
src1dst[x][y][i] = src1dst[x][y][i] - src2[x][y][i]
\]

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageSub(3MLIB), mlib_ImageSub_Fp(3MLIB), mlib_ImageSub1_Fp_Inp(3MLIB), mlib_ImageSub2_Fp_Inp(3MLIB), mlib_ImageSub2_Inp(3MLIB), attributes(5)`
The `mlib_ImageSub2_Fp_Inp()` function subtracts the second floating-point source image from the first floating-point source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{src2dst}[x][y][i] = \text{src1}[x][y][i] - \text{src2dst}[x][y][i] \]

**Parameters**
- `src2dst` Pointer to second source and destination image.
- `src1` Pointer to first source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageSub(3MLIB), mlib_ImageSub_Fp(3MLIB), mlib_ImageSub1_Fp_Inp(3MLIB), mlib_ImageSub1_Inp(3MLIB), mlib_ImageSub2_Inp(3MLIB), attributes(5)`
# mlib_ImageSub2_Inp

**mlib_ImageSub2_Inp** – subtraction, in place

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSub2_Inp(mlib_image *src2dst,
                               const mlib_image *src1);
```

**Description**
The `mlib_ImageSub2_Inp()` function subtracts the second source image from the first source image on a pixel-by-pixel basis, in place.

It uses the following equation:

```
src2dst[x][y][i] = src1[x][y][i] - src2dst[x][y][i]
```

**Parameters**
The function takes the following arguments:

- `src2dst` Pointer to second source and destination image.
- `src1` Pointer to first source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_ImageSub(3MLIB)`, `mlib_ImageSub_Fp(3MLIB)`, `mlib_ImageSub1_Fp_Inp(3MLIB)`, `mlib_ImageSub1_Inp(3MLIB)`, `mlib_ImageSub2_Fp_Inp(3MLIB)`, attributes(5)
The mlib_ImageSub() function subtracts the second source image from the first source image on a pixel-by-pixel basis.

It uses the following equation:

\[
dst[x][y][i] = src1[x][y][i] - src2[x][y][i]
\]

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src1**: Pointer to first source image.
- **src2**: Pointer to second source image.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See [attributes(5)] for descriptions of the following attributes:

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**See Also**

mlib_ImageSub_Fp(3MLIB), mlib_ImageSub1_Fp_Inp(3MLIB),
mlib_ImageSub1_Inp(3MLIB), mlib_ImageSub2_Fp_Inp(3MLIB),
mlib_ImageSub2_Inp(3MLIB), attributes(5)
mlib_ImageSub_Fp

Name mlib_ImageSub_Fp – subtraction

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageSub_Fp(mlib_image *dst, const mlib_image *src1,
const mlib_image *src2);

Description The mlib_ImageSub_Fp() function subtracts the second floating-point source image from the
first floating-point source image on a pixel-by-pixel basis.

It uses the following equation:

dst[x][y][i] = src1[x][y][i] - src2[x][y][i]

Parameters The function takes the following arguments:

dst Pointer to destination image.
src1 Pointer to first source image.
src2 Pointer to second source image.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageSub(3MLIB), mlib_ImageSub1_Fp_Inp(3MLIB), mlib_ImageSub1_Inp(3MLIB),
mlib_ImageSub2_Fp_Inp(3MLIB), mlib_ImageSub2_Inp(3MLIB), attributes(5)
mlib_ImageSubsampleAverage, mlib_ImageSubsampleAverage_Fp – subsamples an image with a box filter

Synopsis

```c
#include <mlib.h>

mlib_status mlib_ImageSubsampleAverage(mlib_image *dst,
                                           const mlib_image *src, mlib_d64 xscale, mlib_d64 yscale);

mlib_status mlib_ImageSubsampleAverage_Fp(mlib_image *dst,
                                          const mlib_image *src, mlib_d64 xscale, mlib_d64 yscale);
```

Description

Each function scales an image down with an adaptive box filter.

The subsampling algorithm performs the scaling operation by averaging all the pixel values from a block in the source image that correspond to the destination pixel.

The width and height of the source block for a destination pixel are computed as:

```c
blockX = (int)ceil(1.0/xscale);
blockY = (int)ceil(1.0/yscale);
```

If we denote a pixel’s location in an image by its column number and row number (both counted from 0), the destination pixel at \((i, j)\) is backward mapped to the source block whose upper-left corner pixel is at \((xValues[i], yValues[j])\), where

```c
xValues[i] = (int)(i/xscale + 0.5);
yValues[j] = (int)(j/yscale + 0.5);
```

The width and height of the filled area in the destination are restricted by

```c
dstW = (int)(srcWidth * xscale);
daSH = (int)(srcHeight * yscale);
```

where \(srcWidth\) and \(srcHeight\) are width and height of the source image.

Since the block size in source is defined from scale factors with roundup, some blocks (the rightmost and the bottommost blocks) may overrun the border of the source image by 1 pixel. In this case, such blocks are moved by 1 pixel to left/up direction in order to be inside of the source image.

Parameters

The function takes the following arguments:

- \(dst\) Pointer to destination image.
- \(src\) Pointer to source image.
- \(xscale\) X scale factor. \(0.0 < xscale \leq 1.0\).
- \(yscale\) Y scale factor. \(0.0 < yscale \leq 1.0\).
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also mlib_ImageSubsampleAverage(3MLIB), mlib_ImageFilteredSubsample(3MLIB), mlib_ImageZoomTranslate(3MLIB), mlib_ImageZoomTranslate_Fp(3MLIB), attributes(5)
Name  
mlib_ImageSubsampleBinaryToGray – subsamples a binary image and converts it to a grayscale image

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_ImageSubsampleBinaryToGray(mlib_image *dst,  
    const mlib_image *src, mlib_d64 xscale, mlib_d64 yscale,  
    const mlib_u8 *lutGray);

Description  
The mlib_ImageSubsampleBinaryToGray() function subsamples a binary (MLIB_BIT) image and converts it to a grayscale (MLIB_BYTE) image.

The subsampling algorithm performs the scaling operation by accumulating all the bits in the source image that correspond to the destination pixel and, based on the x and y scaling factors, reserving consecutive indexes in the colormap for the maximum number of gray levels possible in the destination image. The destination image pixel values of this function are either gray levels or indexes (if lutGray==NULL).

For representing the source block of pixels that is used to determine destination pixel values, the index 0 represents a block with no 1's (all 0's), the index 1 represents a block with a single 1, and so on. If the scaling factors require a fractional block of source pixels to determine a destination pixel value, the block size is rounded up. For example, if a 2.2-by-2.2 block of source pixels would be required to determine destination pixel values, a 3-by-3 block is used, resulting in 10 possible gray levels and therefore 10 colormap indexes, whose values are 0 through 9.

The width and height of the source block for a destination pixel are computed as:

\[
\text{blockX} = \left(\frac{1.0}{\text{xscale}}\right);
\]

\[
\text{blockY} = \left(\frac{1.0}{\text{yscale}}\right);
\]

If we denote a pixel's location in an image by its column number and row number (both counted from 0), the destination pixel at \((i, j)\) is backward mapped to the source block whose upper-left corner pixel is at \((xValues[i], yValues[j])\), where

\[
xValues[i] = \left(\frac{i}{\text{xscale}} + 0.5\right);
\]

\[
yValues[j] = \left(\frac{j}{\text{yscale}} + 0.5\right);
\]

The width and height of the filled area in the destination are restricted by

\[
\text{dstW} = \left(\frac{\text{srcWidth} \times \text{xscale}}{\text{yscale}}\right);
\]

\[
\text{dstH} = \left(\frac{\text{srcHeight} \times \text{yscale}}{\text{xscale}}\right);
\]

where srcWidth and srcHeight are width and height of the source image.

Since the block size in source is defined from scale factors with roundup, some blocks (the rightmost and the bottommost blocks) may overrun the border of the source image by 1 pixel. In this case, such blocks are moved by 1 pixel to left/up direction in order to be inside of the source image.
The function takes the following arguments:

- `dst` Pointer to destination image. It must be of type `MLIB_BYTE` and have just one channel.
- `src` Pointer to source image. It must be of type `MLIB_BIT` and have just one channel.
- `xscale` X scale factor. \(0.0 < xscale \leq 1.0\).
- `yscale` Y scale factor. \(0.0 < yscale \leq 1.0\).
- `lutGray` Pointer to a grayscale lookup-table.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See Also

- `mlib_ImageZoomTranslateToGray(3MLIB)`, `mlib_ImageSubsampleAverage(3MLIB)`, `attributes(5)`
The `mlib_ImageTestFlags()` function tests the flags for a combination of the following predefined characteristics. Note that the result of zero means the conditions are satisfied.

- `MLIB_IMAGE_ALIGNED64` /* data address is 64-byte aligned */
- `MLIB_IMAGE_ALIGNED8` /* data address is 8-byte aligned */
- `MLIB_IMAGE_ALIGNED4` /* data address is 4-byte aligned */
- `MLIB_IMAGE_ALIGNED2` /* data address is 2-byte aligned */
- `MLIB_IMAGE_WIDTH8X` /* width is multiple of 8 */
- `MLIB_IMAGE_WIDTH4X` /* width is multiple of 4 */
- `MLIB_IMAGE_WIDTH2X` /* width is multiple of 2 */
- `MLIB_IMAGE_HEIGHT8X` /* height is multiple of 8 */
- `MLIB_IMAGE_HEIGHT4X` /* height is multiple of 4 */
- `MLIB_IMAGE_HEIGHT2X` /* height is multiple of 2 */
- `MLIB_IMAGE_STRIDE8X` /* stride is multiple of 8 */
- `MLIB_IMAGE_ONEVERYVECTOR` /* stride is equal to width in bytes */
- `MLIB_IMAGE_USERALLOCATED` /* data space has been allocated by user */
- `MLIB_IMAGE_ATTRIBUTESET` /* image attribute flags have been set */

The function takes the following arguments:

- `img` Pointer to a mediaLib image structure.
- `flags` Combination of a set of characteristics to be tested. It is formed by logically Oring one or more individual predefined characteristics.

The function returns an integer value containing results of test. Condition = 0 if satisfied; otherwise, Condition != 0.

### Attributes

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_ImageGetFlags(3MLIB), attributes(5)`
# mlib_ImageThresh1

**Name**  
mlib_ImageThresh1 – image thresholding

**Synopsis**  
`cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>`

```c
mlib_status mlib_ImageThresh1(mlib_image *dst, const mlib_image *src,  
    const mlib_s32 *thresh, const mlib_s32 *ghigh, const mlib_s32 *glow);
```

**Description**  
The `mlib_ImageThresh1()` function compares each pixel in the source image to a threshold value. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

The data type of the destination image can be `MLIB_BIT` or can be the same as the data type of the source image.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][i] &= \text{glow}[i] \quad \text{if} \; \text{src}[x][y][i] \leq \text{thresh}[i] \\
\text{dst}[x][y][i] &= \text{ghigh}[i] \quad \text{if} \; \text{src}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

**Parameters**  
The function takes the following arguments:

- `dst`  
  Pointer to destination image.
- `src`  
  Pointer to source image.
- `thresh`  
  Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `ghigh`  
  High output level. `ghigh[i]` contains the high output level for channel `i`.
- `glow`  
  Low output level. `glow[i]` contains the low output level for channel `i`.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

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</tbody>
</table>

**See Also**  
`mlib_ImageThresh1_Fp(3MLIB), mlib_ImageThresh1_Fp_Inp(3MLIB),  
mlib_ImageThresh1_Inp(3MLIB), mlib_ImageThresh2(3MLIB),  
mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB),  
mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh3(3MLIB),  
mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB),  
mlib_ImageThresh3_Inp(3MLIB), mlib_ImageThresh4(3MLIB),  
mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Fp_Inp(3MLIB),  
mlib_ImageThresh4_Inp(3MLIB) |
mlib_ImageThresh1(3MLIB)

mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB),
mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB),
mlib_ImageThresh5_Inp(3MLIB), attributes(5)
Name  mlib_ImageThresh1_Fp - image thresholding

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
            #include <mlib.h>

            mlib_status mlib_ImageThresh1_Fp(mlib_image *dst, const mlib_image *src,
               const mlib_d64 *thresh, const mlib_d64 *ghigh, const mlib_d64 *glow);

Description  The mlib_ImageThresh1_Fp() function compares each pixel in the floating-point source image to a threshold value. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

The data type of the destination image can be MLIB_BIT or can be the same as the data type of the source image.

It uses the following equation:

\[
\begin{align*}
  & \text{dst}[x][y][i] = \text{glow}[i] \quad \text{if} \quad \text{src}[x][y][i] \leq \text{thresh}[i] \\
  & \text{dst}[x][y][i] = \text{ghigh}[i] \quad \text{if} \quad \text{src}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

Parameters  The function takes the following arguments:

- \( dst \)  Pointer to destination image.
- \( src \)  Pointer to source image.
- \( thresh \)  Threshold value. \( thresh[i] \) contains the threshold for channel \( i \).
- \( ghigh \)  High output level. \( ghigh[i] \) contains the high output level for channel \( i \).
- \( glow \)  Low output level. \( glow[i] \) contains the low output level for channel \( i \).

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp_Inp(3MLIB),
mlib_ImageThresh1_Inp(3MLIB), mlib_ImageThresh2(3MLIB),
mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB),
mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh3(3MLIB),
mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB),
mlib_ImageThresh3_Inp(3MLIB), mlib_ImageThresh4(3MLIB),
mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Fp_Inp(3MLIB),
mlib_ImageThresh4_Inp(3MLIB),
mlib_ImageThresh1_Fp(3MLIB)

mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB),
mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB),
mlib_ImageThresh5_Inp(3MLIB), attributes(5)
The `mlib_ImageThresh1_Fp_Inp()` function compares each pixel in the floating-point source image to a threshold value, in place. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

It uses the following equation:

\[
\begin{align*}
&\text{srcdst}[x][y][i] = \text{glow}[i] \quad \text{if} \quad \text{srcdst}[x][y][i] \leq \text{thresh}[i] \\
&\text{srcdst}[x][y][i] = \text{ghigh}[i] \quad \text{if} \quad \text{srcdst}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

### Parameters
The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `thresh` Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `ghigh` High output level. `ghigh[i]` contains the high output level for channel `i`.
- `glow` Low output level. `glow[i]` contains the low output level for channel `i`.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB), mlib_ImageThresh1_Inp(3MLIB), mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Inp(3MLIB), mlib_ImageThresh4(3MLIB), mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Inp(3MLIB), attributes(5)`
mlib_ImageThresh1_Inp(3MLIB)

Name  mlib_ImageThresh1_Inp – image thresholding

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageThresh1_Inp(mlib_image *srcdst,
const mlib_s32 *thresh, const mlib_s32 *ghigh, const mlib_s32 *glow);

Description  The mlib_ImageThresh1_Inp() function compares each pixel in the image to a threshold value on a per-channel basis. If the pixel is less than or equal to the threshold value, then it is reset to the low output level. If the pixel is greater than the threshold value, then it is reset to the high output level.

It uses the following equation:

\[
\begin{align*}
\text{srcdst}[x][y][i] &= \text{glow}[i] & \text{if } \text{srcdst}[x][y][i] \leq \text{thresh}[i] \\
\text{srcdst}[x][y][i] &= \text{ghigh}[i] & \text{if } \text{srcdst}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

Parameters  The function takes the following arguments:

- srcdst  Pointer to source and destination image.
- thresh  Threshold value. thresh[i] contains the threshold for channel i.
- ghigh  High output level. ghigh[i] contains the high output level for channel i.
- glow  Low output level. glow[i] contains the low output level for channel i.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),
mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh2(3MLIB),
mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB),
mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh3(3MLIB),
mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB),
mlib_ImageThresh3_Inp(3MLIB), mlib_ImageThresh4(3MLIB),
mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Fp_Inp(3MLIB),
mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB),
mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB),
mlib_ImageThresh5_Inp(3MLIB), attributes(5)
# mlib_ImageThresh2

The `mlib_ImageThresh2()` function compares each pixel in the source image to a threshold value. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][i] &= \text{glow}[i] & \text{if } \text{src}[x][y][i] \leq \text{thresh}[i] \\
\text{dst}[x][y][i] &= \text{src}[x][y][i] & \text{if } \text{src}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

### Parameters

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **thresh**: Threshold value. `thresh[i]` contains the threshold for channel `i`.
- **glow**: Low output level. `glow[i]` contains the low output level for channel `i`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_ImageThresh1(3MLIB)`, `mlib_ImageThresh1_Fp(3MLIB)`,
- `mlib_ImageThresh1_Fp_Inp(3MLIB)`, `mlib_ImageThresh1_Inp(3MLIB)`,
- `mlib_ImageThresh2_Fp(3MLIB)`, `mlib_ImageThresh2_Fp_Inp(3MLIB)`,
- `mlib_ImageThresh2_Inp(3MLIB)`, `mlib_ImageThresh3(3MLIB)`,
- `mlib_ImageThresh3_Fp(3MLIB)`, `mlib_ImageThresh3_Inp(3MLIB)`,
- `mlib_ImageThresh3_Inp(3MLIB)`, `mlib_ImageThresh4(3MLIB)`,
- `mlib_ImageThresh4_Fp(3MLIB)`, `mlib_ImageThresh4_Inp(3MLIB)`,
- `mlib_ImageThresh4_Inp(3MLIB)`, `mlib_ImageThresh5(3MLIB)`,
- `mlib_ImageThresh5_Fp(3MLIB)`, `mlib_ImageThresh5_Fp_Inp(3MLIB)`,
- `mlib_ImageThresh5_Inp(3MLIB)`, `attributes(5)`
The `mlib_ImageThresh2_Fp()` function compares each pixel in the floating-point source image to a threshold value. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
\text{dst}[x][y][i] = \text{glow}[i] \quad \text{if} \quad \text{src}[x][y][i] \leq \text{thresh}[i] \\
\text{dst}[x][y][i] = \text{src}[x][y][i] \quad \text{if} \quad \text{src}[x][y][i] > \text{thresh}[i]
\]

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

- `mlib_ImageThresh1(3MLIB)`, `mlib_ImageThresh1_Fp(3MLIB)`, `mlib_ImageThresh1_Fp_Inp(3MLIB)`, `mlib_ImageThresh1_Inp(3MLIB)`, `mlib_ImageThresh2(3MLIB)`, `mlib_ImageThresh2_Fp_Inp(3MLIB)`, `mlib_ImageThresh2_Inp(3MLIB)`, `mlib_ImageThresh3(3MLIB)`, `mlib_ImageThresh3_Fp(3MLIB)`, `mlib_ImageThresh3_Fp_Inp(3MLIB)`, `mlib_ImageThresh3_Inp(3MLIB)`, `mlib_ImageThresh4(3MLIB)`, `mlib_ImageThresh4_Fp_Inp(3MLIB)`, `mlib_ImageThresh4_Inp(3MLIB)`, `mlib_ImageThresh5(3MLIB)`, `mlib_ImageThresh5_Fp(3MLIB)`, `mlib_ImageThresh5_Fp_Inp(3MLIB)`, `mlib_ImageThresh5_Inp(3MLIB)`
The `mlib_ImageThresh2_Fp_Inp()` function compares each pixel in the floating-point source image to a threshold value, in place. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
srcdst[x][y][i] = \text{glow}[i] \text{ if } srcdst[x][y][i] \leq \text{thresh}[i]
\]

**Parameters**
- `srcdst` Pointer to source and destination image.
- `thresh` Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `glow` Low output level. `glow[i]` contains the low output level for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- `mlib_ImageThresh1(3MLIB)`, `mlib_ImageThresh1_Fp(3MLIB)`, `mlib_ImageThresh1_Inp(3MLIB)`, `mlib_ImageThresh2(3MLIB)`, `mlib_ImageThresh2_Fp(3MLIB)`, `mlib_ImageThresh2_Inp(3MLIB)`, `mlib_ImageThresh3(3MLIB)`, `mlib_ImageThresh3_Fp(3MLIB)`, `mlib_ImageThresh3_Inp(3MLIB)`, `mlib_ImageThresh4(3MLIB)`, `mlib_ImageThresh4_Fp(3MLIB)`, `mlib_ImageThresh4_Inp(3MLIB)`, `mlib_ImageThresh5(3MLIB)`, `mlib_ImageThresh5_Fp(3MLIB)`, `mlib_ImageThresh5_Inp(3MLIB)`, attributes(5)
The `mlib_ImageThresh2_Inp()` function compares each pixel in the source image to a threshold value, in place. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the low output level. If the pixel is greater than the threshold value, then the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
srcdst[x][y][i] = glow[i] \text{ if } srcdst[x][y][i] \leq \text{thresh}[i]
\]

**Parameters**

The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `thresh` Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `glow` Low output level. `glow[i]` contains the low output level for channel `i`.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_ImageThresh1(3MLIB)`, `mlib_ImageThresh1_Fp(3MLIB)`, `mlib_ImageThresh1_Fp_Inp(3MLIB)`, `mlib_ImageThresh1_Inp(3MLIB)`
- `mlib_ImageThresh2(3MLIB)`, `mlib_ImageThresh2_Fp(3MLIB)`, `mlib_ImageThresh2_Fp_Inp(3MLIB)`, `mlib_ImageThresh2_Inp(3MLIB)`
- `mlib_ImageThresh3(3MLIB)`, `mlib_ImageThresh3_Fp(3MLIB)`, `mlib_ImageThresh3_Fp_Inp(3MLIB)`, `mlib_ImageThresh3_Inp(3MLIB)`
- `mlib_ImageThresh4(3MLIB)`, `mlib_ImageThresh4_Fp(3MLIB)`, `mlib_ImageThresh4_Fp_Inp(3MLIB)`, `mlib_ImageThresh4_Inp(3MLIB)`
- `mlib_ImageThresh5(3MLIB)`, `mlib_ImageThresh5_Fp(3MLIB)`, `mlib_ImageThresh5_Fp_Inp(3MLIB)`, `mlib_ImageThresh5_Inp(3MLIB)`
- attributes(5)
**Name**  
`mlib_ImageThresh3` – image thresholding

**Synopsis**  
`cc [ flag... ] file... -lmlib [ library... ]`  
`#include <mlib.h>`

```c
mlib_status mlib_ImageThresh3(mlib_image *dst, const mlib_image *src,
const mlib_s32 *thresh, const mlib_s32 *ghigh);
```

**Description**  
The `mlib_ImageThresh3()` function compares each pixel in the source image to a threshold value. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the value of the source pixel. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

It uses the following equation:

\[
\text{dst}[x][y][i] = \begin{cases} 
\text{src}[x][y][i] & \text{if src}[x][y][i] \leq \text{thresh}[i] \\
\text{ghigh}[i] & \text{if src}[x][y][i] > \text{thresh}[i]
\end{cases}
\]

**Parameters**  
The function takes the following arguments:

- `dst`  
  Pointer to destination image.
- `src`  
  Pointer to source image.
- `thresh`  
  Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `ghigh`  
  High output level. `ghigh[i]` contains the high output level for channel `i`.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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**See Also**  
`mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB), mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB), mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB), mlib_ImageThresh4(3MLIB), mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Fp_Inp(3MLIB), mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB), mlib_ImageThresh5_Inp(3MLIB), attributes(5)`
The `mlib_ImageThresh3_Fp` function compares each pixel in the floating-point source image to a threshold value. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the value of the source pixel. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][i] &= \text{src}[x][y][i] & \text{if } \text{src}[x][y][i] \leq \text{thresh}[i] \\
\text{dst}[x][y][i] &= \text{ghigh}[i] & \text{if } \text{src}[x][y][i] > \text{thresh}[i]
\end{align*}
\]

### Parameters
The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `thresh` Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `ghigh` High output level. `ghigh[i]` contains the high output level for channel `i`.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
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### See Also
- `mlib_ImageThresh1(3MLIB)`, `mlib_ImageThresh1_Fp(3MLIB)`, `mlib_ImageThresh1_Fp_Inp(3MLIB)`, `mlib_ImageThresh1_Inp(3MLIB)`, `mlib_ImageThresh2(3MLIB)`, `mlib_ImageThresh2_Fp(3MLIB)`, `mlib_ImageThresh2_Fp_Inp(3MLIB)`, `mlib_ImageThresh2_Inp(3MLIB)`, `mlib_ImageThresh3(3MLIB)`, `mlib_ImageThresh3_Fp(3MLIB)`, `mlib_ImageThresh3_Fp_Inp(3MLIB)`, `mlib_ImageThresh3_Inp(3MLIB)`, `mlib_ImageThresh4_Fp(3MLIB)`, `mlib_ImageThresh4_Fp_Inp(3MLIB)`, `mlib_ImageThresh4_Inp(3MLIB)`, `mlib_ImageThresh5_Fp(3MLIB)`, `mlib_ImageThresh5_Fp_Inp(3MLIB)`, `mlib_ImageThresh5_Inp(3MLIB)`, attributes(5)
Name  
mlib_ImageThresh3_Fp_Inp – image thresholding

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageThresh3_Fp_Inp(mlib_image *srcdst,
    const mlib_d64 *thresh, const mlib_d64 *ghigh);

Description  
The mlib_ImageThresh3_Fp_Inp() function compares each pixel in the floating-point source image to a threshold value, in place. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the value of the source pixel. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

It uses the following equation:

srcdst[x][y][i] = ghigh[i]  if srcdst[x][y][i] > thresh[i]

Parameters  
The function takes the following arguments:

srcdst  
Pointer to source and destination image.

thresh  
Threshold value. thresh[i] contains the threshold for channel i.

ghigh  
High output level. ghigh[i] contains the high output level for channel i.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),
mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB),
mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB),
mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB),
mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB),
mlib_ImageThresh3_Inp(3MLIB), mlib_ImageThresh4(3MLIB),
mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Fp_Inp(3MLIB),
mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB),
mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB),
mlib_ImageThresh5_Inp(3MLIB), attributes(5)
mlib_ImageThresh3_Inp

**Name**
mlib_ImageThresh3_Inp – image thresholding

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_ImageThresh3_Inp(mlib_image *srcdst,
       const mlib_s32 *thresh, const mlib_s32 *ghigh);
```

**Description**
The `mlib_ImageThresh3_Inp()` function compares each pixel in the source image to a threshold value, in place. If the pixel is less than or equal to the threshold value, then the destination pixel is set to the value of the source pixel. If the pixel is greater than the threshold value, then the destination pixel is set to the high output level.

It uses the following equation:

```
srcdst[x][y][i] = ghigh[i] if srcdst[x][y][i] > thresh[i]
```

**Parameters**
The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `thresh` Threshold value. `thresh[i]` contains the threshold for channel `i`.
- `ghigh` High output level. `ghigh[i]` contains the high output level for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
- `mlib_ImageThresh1(3MLIB)`, `mlib_ImageThresh1_Fp(3MLIB)`,
- `mlib_ImageThresh1_Fp_Inp(3MLIB)`, `mlib_ImageThresh1_Inp(3MLIB)`,
- `mlib_ImageThresh2(3MLIB)`, `mlib_ImageThresh2_Fp(3MLIB)`,
- `mlib_ImageThresh2_Fp_Inp(3MLIB)`, `mlib_ImageThresh2_Inp(3MLIB)`,
- `mlib_ImageThresh3(3MLIB)`, `mlib_ImageThresh3_Fp(3MLIB)`,
- `mlib_ImageThresh3_Fp_Inp(3MLIB)`, `mlib_ImageThresh3_Inp(3MLIB)`,
- `mlib_ImageThresh4(3MLIB)`, `mlib_ImageThresh4_Fp(3MLIB)`,
- `mlib_ImageThresh4_Fp_Inp(3MLIB)`, `mlib_ImageThresh4_Inp(3MLIB)`,
- `mlib_ImageThresh5(3MLIB)`, `mlib_ImageThresh5_Fp(3MLIB)`,
- `mlib_ImageThresh5_Fp_Inp(3MLIB)`, `mlib_ImageThresh5_Inp(3MLIB)`,
**Name**
mlib_ImageThresh4 – image thresholding

**Synopsis**
```
c c [flag...] file... -lmlib [library...]
#include <mlib.h>

mlib_status mlib_ImageThresh4(mlib_image *dst, const mlib_image *src,
                          const mlib_s32 *thigh, const mlib_s32 *tlow, const mlib_s32 *ghigh,
                          const mlib_s32 *glow);
```

**Description**
The `mlib_ImageThresh4()` function compares each pixel in the source image to two threshold values, `tlow` and `thigh`. If the pixel is less than the lower threshold value, `tlow`, then the destination pixel is set to the lower output level, `glow`. If the pixel is greater than the higher threshold value, `thigh`, then the destination pixel is set to the higher output level, `ghigh`. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Destination Pixel Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>src[x][y][i] &lt; tlow[i]</code></td>
<td><code>glow[i]</code></td>
</tr>
<tr>
<td><code>tlow[i] ≤ src[x][y][i] ≤ thigh[i]</code></td>
<td><code>src[x][y][i]</code></td>
</tr>
<tr>
<td><code>src[x][y][i] &gt; thigh[i]</code></td>
<td><code>ghigh[i]</code></td>
</tr>
</tbody>
</table>

**Parameters**
The function takes the following arguments:

- `dst`  Pointer to destination image.
- `src`  Pointer to source image.
- `thigh`  High threshold value. `thigh[i]` holds the high threshold for channel `i`.
- `tlow`  Low threshold value. `tlow[i]` holds the low threshold for channel `i`.
- `ghigh`  High output grayscale level. `ghigh[i]` holds the high output grayscale level for channel `i`.
- `glow`  Low output grayscale level. `glow[i]` holds the low output grayscale level for channel `i`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),
mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB),
mlib_ImageThresh2(3MLIB), mlib_ImageThresh1_Inp(3MLIB),
mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB),
mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB),
mlib_ImageThresh4(3MLIB)

mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB),
mlib_ImageThresh4_Fp(3MLIB), mlib_ImageThresh4_Fp_Inp(3MLIB), mlib_ImageThresh4_Inp(3MLIB), mlib_ImageThresh5(3MLIB),
mlib_ImageThresh5_Fp(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB), mlib_ImageThresh5_Inp(3MLIB), attributes(5)
The `mlib_ImageThresh4_Fp()` function compares each pixel in the source image to two threshold values, `tlow` and `thigh`. If the pixel is less than the lower threshold value, `tlow`, then the destination pixel is set to the lower output level, `glow`. If the pixel is greater than the higher threshold value, `thigh`, then the destination pixel is set to the higher output level, `ghigh`. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
\begin{align*}
    \text{dst}[x][y][i] &= \text{glow}[i] & \text{if src}[x][y][i] < \text{tlow}[i] \\
    \text{dst}[x][y][i] &= \text{src}[x][y][i] & \text{if tlow}[i] \leq \text{src}[x][y][i] \leq \text{thigh}[i] \\
    \text{dst}[x][y][i] &= \text{ghigh}[i] & \text{if src}[x][y][i] > \text{thigh}[i]
\end{align*}
\]

### Parameters

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **thigh**  
  High threshold value. `thigh[i]` holds the high threshold for channel `i`.

- **tlow**  
  Low threshold value. `tlow[i]` holds the low threshold for channel `i`.

- **ghigh**  
  High output grayscale level. `ghigh[i]` holds the high output grayscale level for channel `i`.

- **glow**  
  Low output grayscale level. `glow[i]` holds the low output grayscale level for channel `i`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See [attributes(5)] for descriptions of the following attributes:

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</tbody>
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### See Also

- `mlib_ImageThresh1(3MLIB)`
- `mlib_ImageThresh1_Fp(3MLIB)`
- `mlib_ImageThresh1_Fp_Inp(3MLIB)`
- `mlib_ImageThresh2(3MLIB)`
- `mlib_ImageThresh2_Fp(3MLIB)`
- `mlib_ImageThresh2_Fp_Inp(3MLIB)`
- `mlib_ImageThresh3(3MLIB)`
- `mlib_ImageThresh3_Fp(3MLIB)`
- `mlib_ImageThresh3_Fp_Inp(3MLIB)`
- `mlib_ImageThresh4(3MLIB)`
- `mlib_ImageThresh4_Fp(3MLIB)`
- `mlib_ImageThresh4_Fp_Inp(3MLIB)`

```c
#include <mlib.h>

mlib_status mlib_ImageThresh4_Fp(mlib_image *dst, const mlib_image *src,
    const mlib_d64 *thigh, const mlib_d64 *tlow, const mlib_d64 *ghigh,
    const mlib_d64 *glow);
```
mlib_ImageThresh4_Fp(3LIB)

mlib_ImageThresh3(3LIB), mlib_ImageThresh3_Fp(3LIB),
mlib_ImageThresh3_Fp_Inp(3LIB), mlib_ImageThresh3_Inp(3LIB),
mlib_ImageThresh4(3LIB), mlib_ImageThresh4_Fp_Inp(3LIB),
mlib_ImageThresh4_Inp(3LIB), mlib_ImageThresh5(3LIB),
mlib_ImageThresh5_Fp(3LIB), mlib_ImageThresh5_Fp_Inp(3LIB),
mlib_ImageThresh5_Inp(3LIB), attributes(5)
### Name
mlib_ImageThresh4_Fp_Inp – image thresholding

### Synopsis
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageThresh4_Fp_Inp(mlib_image *srcdst,
    const mlib_d64 *thigh, const mlib_d64 *tlow, const mlib_d64 *ghigh,
    const mlib_d64 *glow);
```

### Description
The `mlib_ImageThresh4_Fp_Inp()` function compares each pixel in the source image to two threshold values, `tlow` and `thigh`. If the pixel is less than the lower threshold value, `tlow`, then the destination pixel is set to the lower output level, `glow`. If the pixel is greater than the higher threshold value, `thigh`, then the destination pixel is set to the higher output level, `ghigh`. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

```
srcdst[x][y][i] = glow[i] if srcdst[x][y][i] < tlow[i]
srcdst[x][y][i] = ghigh[i] if srcdst[x][y][i] > thigh[i]
```

### Parameters
The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `thigh` High threshold value. `thigh[i]` holds the high threshold for channel `i`.
- `tlow` Low threshold value. `tlow[i]` holds the low threshold for channel `i`.
- `ghigh` High output grayscale level. `ghigh[i]` holds the high output grayscale level for channel `i`.
- `glow` Low output grayscale level. `glow[i]` holds the low output grayscale level for channel `i`.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

### See Also
`mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB), mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB)`
mlib_IMAGE_THRESH4_Fp_Inp(3MLIB)

mlib_IMAGE_THRESH4(3MLIB), mlib_IMAGE_THRESH4_Fp(3MLIB),
mlib_IMAGE_THRESH4_Inp(3MLIB), mlib_IMAGE_THRESH5(3MLIB),
mlib_IMAGE_THRESH5_Fp(3MLIB), mlib_IMAGE_THRESH5_Fp_Inp(3MLIB),
mlib_IMAGE_THRESH5_Inp(3MLIB), attributes(5)
Name: mlib_ImageThresh4_Inp – image thresholding

Synopsis: cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageThresh4_Inp(mlib_image *srcdst,
   const mlib_s32 *thigh, const mlib_s32 *tlow, const mlib_s32 *ghigh,
   const mlib_s32 *glow);

Description: The mlib_ImageThresh4_Inp() function compares each pixel in the source image to two threshold values, tlow and thigh. If the pixel is less than the lower threshold value, tlow, then the destination pixel is set to the lower output level, glow. If the pixel is greater than the higher threshold value, thigh, then the destination pixel is set to the higher output level, ghigh. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = \text{glow}[i] \quad \text{if} \quad \text{srcdst}[x][y][i] < \text{tlow}[i] \\
\text{srcdst}[x][y][i] = \text{ghigh}[i] \quad \text{if} \quad \text{srcdst}[x][y][i] > \text{thigh}[i]
\]

Parameters: The function takes the following arguments:

- srcdst: Pointer to source and destination image.
- thigh: High threshold value. thigh[i] holds the high threshold for channel i.
- tlow: Low threshold value. tlow[i] holds the low threshold for channel i.
- ghigh: High output grayscale level. ghigh[i] holds the high output grayscale level for channel i.
- glow: Low output grayscale level. glow[i] holds the low output grayscale level for channel i.

Return Values: The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes: See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also: mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB), mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB), mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB), mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB), mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB), mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB),
mlib_ImageThresh5 – image thresholding

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageThresh5(mlib_image *dst, const mlib_image *src,
const mlib_s32 *thigh, const mlib_s32 *tlow, const mlib_s32 *gray);

Description
The mlib_ImageThresh5() function compares each pixel in the source image to two
threshold values, tlow and thigh. If the pixel is in between the lower threshold value, tlow, and
the higher threshold value, thigh, (inclusive on both sides), then the destination pixel is set to
the value gray. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

dst[x][y][i] = src[x][y][i] if src[x][y][i] < tlow[i]
dst[x][y][i] = gray[i] if tlow[i] ≤ src[x][y][i] ≤ thigh[i]
dst[x][y][i] = src[x][y][i] if src[x][y][i] > thigh[i]

Parameters
The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.

thigh High threshold value. thigh[i] holds the high threshold for channel i.
tlow Low threshold value. tlow[i] holds the low threshold for channel i.
gray Output grayscale level. gray[i] holds the output grayscale level for channel i.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<tbody>
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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),
mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB),
mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB),
mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB),
mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB),
mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB),
mlib_ImageThresh4(3MLIB), mlib_ImageThresh4_Fp(3MLIB),
mlib_ImageThresh4_Fp_Inp(3MLIB), mlib_ImageThresh4_Inp(3MLIB),
mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Fp(3MLIB),
mlib_ImageThresh5_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageThresh5_Fp()` function compares each pixel in the source image to two threshold values, `tlow` and `thigh`. If the pixel is in between the lower threshold value, `tlow`, and the higher threshold value, `thigh`, (inclusive on both sides), then the destination pixel is set to the value `gray`. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
\begin{align*}
\text{dst}[x][y][i] &= \text{src}[x][y][i] \quad \text{if} \quad \text{src}[x][y][i] < \text{tlow}[i] \\
\text{dst}[x][y][i] &= \text{gray}[i] \quad \text{if} \quad \text{tlow}[i] \leq \text{src}[x][y][i] \leq \text{thigh}[i] \\
\text{dst}[x][y][i] &= \text{src}[x][y][i] \quad \text{if} \quad \text{src}[x][y][i] > \text{thigh}[i]
\end{align*}
\]

Parameters

The function takes the following arguments:

- `dst`: Pointer to destination image.
- `src`: Pointer to source image.
- `thigh`: High threshold value. `thigh[i]` holds the high threshold for channel `i`.
- `tlow`: Low threshold value. `tlow[i]` holds the low threshold for channel `i`.
- `gray`: Output grayscale level. `gray[i]` holds the output grayscale level for channel `i`.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),
mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB),
mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB),
mlib_ImageThresh4(3MLIB), mlib_ImageThresh4_Fp(3MLIB),
mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Fp_Inp(3MLIB),
mlib_ImageThresh5_Inp(3MLIB), attributes(5)`
**Name**  
mlib_ImageThresh5_Fp_Inp – image thresholding

**Synopsis**  
```c
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_ImageThresh5_Fp_Inp(mlib_image *srcdst,  
const mlib_d64 *thigh, const mlib_d64 *tlow, const mlib_d64 *gray);
```

**Description**  
The `mlib_ImageThresh5_Fp_Inp()` function compares each pixel in the source image to two threshold values, `tlow` and `thigh`. If the pixel is in between the lower threshold value, `tlow`, and the higher threshold value, `thigh`, (inclusive on both sides), then the destination pixel is set to the value `gray`. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
srcdst[x][y][i] = gray[i] \text{ if } tlow[i] \leq srcdst[x][y][i] \leq thigh[i]
\]

**Parameters**  
The function takes the following arguments:

- `srcdst` Pointer to source and destination image.
- `thigh` High threshold value. `thigh[i]` holds the high threshold for channel `i`.
- `tlow` Low threshold value. `tlow[i]` holds the low threshold for channel `i`.
- `gray` Output grayscale level. `gray[i]` holds the output grayscale level for channel `i`.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

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**See Also**  
mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),  
mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB),  
mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB),  
mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB),  
mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB),  
mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB),  
mlib_ImageThresh4(3MLIB), mlib_ImageThresh4_Fp(3MLIB),  
mlib_ImageThresh4_Fp_Inp(3MLIB), mlib_ImageThresh4_Inp(3MLIB),  
mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Fp(3MLIB),  
mlib_ImageThresh5_Inp(3MLIB), attributes(5)
mlib_ImageThresh5_Inp(3MLIB)

**Name**  
mlib_ImageThresh5_Inp – image thresholding

**Synopsis**  
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageThresh5_Inp(mlib_image *srcdst,
                                 const mlib_s32 *thigh,
                                 const mlib_s32 *tlow,
                                 const mlib_s32 *gray);
```

**Description**  
The `mlib_ImageThresh5_Inp()` function compares each pixel in the source image to two threshold values, `tlow` and `thigh`. If the pixel is in between the lower threshold value, `tlow`, and the higher threshold value, `thigh`, (inclusive on both sides), then the destination pixel is set to the value `gray`. Otherwise, the destination pixel is set to the value of the source pixel.

It uses the following equation:

\[
\text{srcdst}[x][y][i] = \text{gray}[i] \text{ if } \text{tlow}[i] \leq \text{srcdst}[x][y][i] \leq \text{thigh}[i]
\]

**Parameters**  
The function takes the following arguments:

- `srcdst`  
  Pointer to source and destination image.
- `thigh`  
  High threshold value. `thigh[i]` holds the high threshold for channel `i`.
- `tlow`  
  Low threshold value. `tlow[i]` holds the low threshold for channel `i`.
- `gray`  
  Output grayscale level. `gray[i]` holds the output grayscale level for channel `i`.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
mlib_ImageThresh1(3MLIB), mlib_ImageThresh1_Fp(3MLIB),  
mlib_ImageThresh1_Fp_Inp(3MLIB), mlib_ImageThresh1_Inp(3MLIB),  
mlib_ImageThresh2(3MLIB), mlib_ImageThresh2_Fp(3MLIB),  
mlib_ImageThresh2_Fp_Inp(3MLIB), mlib_ImageThresh2_Inp(3MLIB),  
mlib_ImageThresh3(3MLIB), mlib_ImageThresh3_Fp(3MLIB),  
mlib_ImageThresh3_Fp_Inp(3MLIB), mlib_ImageThresh3_Inp(3MLIB),  
mlib_ImageThresh4(3MLIB), mlib_ImageThresh4_Fp(3MLIB),  
mlib_ImageThresh4_Fp_Inp(3MLIB), mlib_ImageThresh4_Inp(3MLIB),  
mlib_ImageThresh5(3MLIB), mlib_ImageThresh5_Fp(3MLIB),  
mlib_ImageThresh5_Fp_Inp(3MLIB), attributes(5)
The `mlib_ImageXor()` function computes the exclusive Or of the first source image with the second source image on a pixel-by-pixel basis.

It uses the following equation:

\[ \text{dst}[x][y][i] = \text{src1}[x][y][i] \oplus \text{src2}[x][y][i] \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

**Parameters**
- `dst`  Pointer to destination image.
- `src1`  Pointer to first source image.
- `src2`  Pointer to second source image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
`mlib_ImageXor_Inp(3MLIB)`, attributes(5)
The `mlib_ImageXor_Inp()` function computes the exclusive Or of the first source image with the second source image on a pixel-by-pixel basis, in place.

It uses the following equation:

\[ \text{src1dst}[x][y][i] = \text{src1dst}[x][y][i] \oplus \text{src2}[x][y][i] \]

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The function takes the following arguments:

- `src1dst` Pointer to first source and destination image.
- `src2` Pointer to second source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_ImageXor(3MLIB), attributes(5)`
The `mlib_ImageXProj()` function computes the sum of the pixels in each column of the source image.

The image must be a single-channel image.

It uses the following equation:

\[
xproj[x] = \sum_{y=0}^{h-1} img[x][y][0]
\]

where \( x = 0, 1, \ldots, w - 1 \).

**Parameters**

The function takes the following arguments:

- `xproj` Pointer to X-projection vector, where length is equal to the number of columns in the source image (in other words, the image width).
- `img` Pointer to an input image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**

`mlib_ImageXProj_fp(3MLIB)`, `mlib_ImageYProj(3MLIB)`, `mlib_ImageYProj_fp(3MLIB)`, `attributes(5)`
The `mlib_ImageXProj_Fp()` function computes the sum of the pixels in each column of the floating-point source image.

The image must be a single-channel image.

It uses the following equation:

\[
xproj[x] = \sum_{y=0}^{h-1} img[x][y][0]
\]

where \( x = 0, 1, \ldots, w - 1 \).

**Parameters**
The function takes the following arguments:

- `xproj` Pointer to X-projection vector, where length is equal to the number of columns in the source image (in other words, the image width).
- `img` Pointer to an input image.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
`mlib_ImageXProj(3MLIB), mlib_ImageYProj(3MLIB), mlib_ImageYProj_Fp(3MLIB), attributes(5)`, `manpages section 3: Multimedia Library Functions • Last Revised 2 Mar 2007`
The `mlib_ImageYProj()` function computes the sum of the pixels in each row of the source image.

The image must be a single-channel image.

It uses the following equation:

\[ y_{proj}[y] = \sum_{x=0}^{w-1} \text{img}[x][y][0] \]

where \( y = 0, 1, \ldots, h - 1 \).

**Parameters**

- `yproj` Pointer to Y-projection vector, where length is equal to the number of rows in the source image (in other words, the image height).
- `img` Pointer to an input image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

`mlib_ImageXProj(3MLIB)`, `mlib_ImageXProj_Fp(3MLIB)`, `mlib_ImageYProj_Fp(3MLIB)`, `attributes(5)`
The `mlib_ImageYProj_Fp()` function computes the sum of the pixels in each row of the floating-point source image.

The image must be a single-channel image.

It uses the following equation:

\[ w-1 \]
\[ yproj[y] = \sum_{x=0}^{w-1} img[x][y][0] \]

where \( y = 0, 1, \ldots, h - 1 \).

### Parameters

- `yproj` Pointer to Y-projection vector, where length is equal to the number of rows in the source image (in other words, the image height).
- `img` Pointer to an input image.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

`mlib_ImageXProj(3MLIB), mlib_ImageXProj_Fp(3MLIB), mlib_ImageYProj(3MLIB), attributes(5)`
# Name
mlib_ImageZoom – zoom

## Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageZoom(mlib_image *dst, const mlib_image *src,
mlib_d64 zoomx, mlib_d64 zoomy, mlib_filter filter, mlib_edge edge);

## Description
The `mlib_ImageZoom()` function will enlarge or minify the source image by the X and Y zoom factors. It uses the interpolation method as described by the resampling filter.

The data type of the images can be `MLIB_BIT`, `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

## Parameters
The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **zoomx**: X zoom factor. `zoomx > 0.0`.
- **zoomy**: Y zoom factor. `zoomy > 0.0`.
- **filter**: Type of resampling filter. It can be one of the following:
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_EXTEND_INDEF`
  - `MLIB_EDGE_SRC_PADDED`

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See `attributes(5)` for descriptions of the following attributes:
mlib_ImageZoom(3MLIB)

<table>
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See Also
mlib_ImageZoom_Fp(3MLIB), mlib_ImageZoomIn2X(3MLIB),
mlib_ImageZoomIn2X_Fp(3MLIB), mlib_ImageZoomIn2XIndex(3MLIB),
mlib_ImageZoomIndex(3MLIB), mlib_ImageZoomOut2X(3MLIB),
mlib_ImageZoomOut2X_Fp(3MLIB), mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
**Name**  
mlib\_ImageZoomBlend – image scaling with alpha blending

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib\_status mlib\_ImageZoomBlend(mlib\_image *dst, const mlib\_image *src,
mlib\_d64 zoomx, mlib\_d64 zoomy, mlib\_filter filter, mlib\_edge edge,
mlib\_blend blend, mlib\_s32 alpha, mlib\_s32 cmask);

**Description**  
The mlib\_ImageZoomBlend() function will enlarge or minify the source image by the X and Y zoom factors and blend it with the destination image.

This function is a special case of mlib\_ImageZoomTranslateBlend() with the center of the source image being mapped to the center of the destination image.

The center of the upper-left corner pixel of an image is considered to be located at (0.5, 0.5).

Both src and dst must be of type MLIB\_BYTE. They can have either 3 or 4 channels.

The src image cannot have width or height larger than 32767.

**Parameters**  
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to first source image.
- **zoomx** X zoom factor. zoomx > 0.0.
- **zoomy** Y zoom factor. zoomy > 0.0.
- **filter** Type of resampling filter. It can be one of the following:
  - MLIB\_NEAREST
  - MLIB\_BILINEAR
  - MLIB\_BICUBIC
  - MLIB\_BICUBIC2
- **edge** Type of edge condition. It can be one of the following:
  - MLIB\_EDGE\_DST\_NO\_WRITE
  - MLIB\_EDGE\_DST\_FILL\_ZERO
  - MLIB\_EDGE\_OP\_NEAREST
  - MLIB\_EDGE\_SRC\_EXTEND
  - MLIB\_EDGE\_SRC\_EXTEND\_INDEF
  - MLIB\_EDGE\_SRC\_PADD ED
- **blend** Type of alpha blending. It can be one of the following:
  - MLIB\_BLEND\_GTK\_SRC
  - MLIB\_BLEND\_GTK\_SRC\_OVER
  - MLIB\_BLEND\_GTK\_SRC\_OVER2
- **alpha** Overall alpha for blending.
cmask Channel mask to indicate the alpha channel.

**Return Values** The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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<tr>
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</tbody>
</table>

**See Also** mlib_ImageZoomTranslateBlend(3MLIB), mlib_ImageZoomTranslateTableBlend(3MLIB), attributes(5)
The `mlib_ImageZoom_Fp()` function will enlarge or minify the floating-point source image by the X and Y zoom factors. It uses the interpolation method as described by the resampling filter.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **zoomx** X zoom factor. `zoomx > 0.0`.
- **zoomy** Y zoom factor. `zoomy > 0.0`.
- **filter** Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_EXTEND_INDEF
  - MLIB_EDGE_SRC_PADDED

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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mlib_ImageZoom_Fp(3MLIB)

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See Also  
mlib_ImageZoom(3MLIB), mlib_ImageZoomIn2X(3MLIB), mlib_ImageZoomIn2X_Fp(3MLIB),  
mlib_ImageZoomIn2XIndex(3MLIB), mlib_ImageZoomIndex(3MLIB),  
mlib_ImageZoomOut2X(3MLIB), mlib_ImageZoomOut2X_Fp(3MLIB),  
mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
mlib_ImageZoomIn2X(3MLIB)

Name

mlib_ImageZoomIn2X – 2X zoom

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageZoomIn2X(mlib_image *dst, const mlib_image *src, 
    mlib_filter filter, mlib_edge edge);

Description

The mlib_ImageZoomIn2X() function enlarges the source image by a factor of two. It uses the
interpolation method as described by the resampling filter.

The center of the upper-left corner pixel of an image is located at (0.5, 0.5).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

Parameters

The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **filter** Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_ImageZoom(3MLIB), mlib_ImageZoom_Fp(3MLIB), mlib_ImageZoomIn2X_Fp(3MLIB),
mlib_ImageZoomIn2XIndex(3MLIB), mlib_ImageZoomIndex(3MLIB),
mlib_ImageZoomOut2X(3MLIB), mlib_ImageZoomOut2X_Fp(3MLIB),
mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
mlib_ImageZoomIn2X_Fp

Name

mlib_ImageZoomIn2X_Fp – 2X zoom

Synopsis

c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageZoomIn2X_Fp(mlib_image *dst, const mlib_image *src, mlib_filter filter, mlib_edge edge);

Description

The mlib_ImageZoomIn2X_Fp() function enlarges the floating-point source image by a factor of two. It uses the interpolation method as described by the resampling filter.

The center of the upper-left corner pixel of an image is located at (0.5, 0.5).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

Parameters

The function takes the following arguments:

dst Pointer to destination image.
src Pointer to source image.
filter Type of resampling filter. It can be one of the following:
MLIB_NEAREST
MLIB_BILINEAR
MLIB_BICUBIC
MLIB_BICUBIC2
edge Type of edge condition. It can be one of the following:
MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_OP_NEAREST
MLIB_EDGE_SRC_EXTEND
MLIB_EDGE_SRC_PADDED

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_ImageZoom(3MLIB), mlib_ImageZoom_Fp(3MLIB), mlib_ImageZoomIn2X(3MLIB),
mlib_ImageZoomIn2XIndex(3MLIB), mlib_ImageZoomIndex(3MLIB),
mlib_ImageZoomOut2X(3MLIB), mlib_ImageZoomOut2X_Fp(3MLIB),
mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
The `mlib_ImageZoomIn2XIndex()` function enlarges the source image by a factor of two. It uses the interpolation method as described by the resampling filter.

The image data type must be `MLIB_BYTE` or `MLIB_SHORT`.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **filter**: Type of resampling filter. It can be one of the following:
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`
- **colormap**: Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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mlib_ImageZoomIn2XIndex(3MLIB)

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See Also mlib_ImageZoom(3MLIB), mlib_ImageZoom_Fp(3MLIB), mlib_ImageZoomIn2X(3MLIB), mlib_ImageZoomIn2X_Fp(3MLIB), mlib_ImageZoomIndex(3MLIB), mlib_ImageZoomOut2X(3MLIB), mlib_ImageZoomOut2X_Fp(3MLIB), mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
**Name**  
mlib_ImageZoomIndex – zoom on color-indexed image

**Synopsis**  
cc { flag... } file... -mlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_ImageZoomIndex(mlib_image *dst, const mlib_image *src,  
mlib_d64 zoomx, mlib_d64 zoomy, mlib_filter filter, mlib_edge edge,  
const void *colormap);
```

**Description**  
The `mlib_ImageZoomIndex()` function will enlarge or minify the source image by the X and Y zoom factors. It uses the interpolation method as described by the resampling filter.

The image data type must be `MLIB_BYTE` or `MLIB_SHORT`.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

**Parameters**  
The function takes the following arguments:

- `dst`  
  Pointer to destination image.

- `src`  
  Pointer to source image.

- `zoomx`  
  X zoom factor. `zoomx > 0.0`.

- `zoomy`  
  Y zoom factor. `zoomy > 0.0`.

- `filter`  
  Type of resampling filter. It can be one of the following:
  
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`

- `edge`  
  Type of edge condition. It can be one of the following:
  
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`

- `colormap`  
  Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`. 
Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_ImageZoom(3MLIB), mlib_ImageZoom_Fp(3MLIB), mlib_ImageZoomIn2X(3MLIB), mlib_ImageZoomIn2X_Fp(3MLIB), mlib_ImageZoomIn2XIndex(3MLIB), mlib_ImageZoomOut2X(3MLIB), mlib_ImageZoomOut2X_Fp(3MLIB), mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
mlib_ImageZoomOut2X(3MLIB)

**Name**
mlib_ImageZoomOut2X – 0.5X zoom

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageZoomOut2X(mlib_image *dst, const mlib_image *src,
   mlib_filter filter, mlib_edge edge);

**Description**
The `mlib_ImageZoomOut2X()` function minifies the source image by a factor of two. It uses the interpolation method as described by the resampling filter.
The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).
The width and height of the destination image can be different from those of the source image.
The center of the source image is mapped onto the center of the destination image.

**Parameters**
The function takes the following arguments:

- **dst** Pointer to destination image.
- **src** Pointer to source image.
- **filter** Type of resampling filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC
  - MLIB_BICUBIC2
- **edge** Type of edge condition. It can be one of the following:
  - MLIB_EDGE_DST_NO_WRITE
  - MLIB_EDGE_DST_FILL_ZERO
  - MLIB_EDGE_OP_NEAREST
  - MLIB_EDGE_SRC_EXTEND
  - MLIB_EDGE_SRC_PADDED

**Return Values**
The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
mlib_ImageZoom(3MLIB), mlib_ImageZoom_Fp(3MLIB), mlib_ImageZoomIn2X(3MLIB),
mlib_ImageZoomIn2X_Fp(3MLIB), mlib_ImageZoomIn2XIndex(3MLIB),
mlib_ImageZoomIndex(3MLIB), mlib_ImageZoomOut2X_Fp(3MLIB),
mlib_ImageZoomOut2XIndex(3MLIB), attributes(5)
The `mlib_ImageZoomOut2X_Fp()` function magnifies the floating-point source image by a factor of two. It uses the interpolation method as described by the resampling filter.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

### Parameters
The function takes the following arguments:

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to source image.

- **filter**  
  Type of resampling filter. It can be one of the following:
  
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`

- **edge**  
  Type of edge condition. It can be one of the following:
  
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

### See Also
- `mlib_ImageZoom(3MLIB)`
- `mlib_ImageZoom_Fp(3MLIB)`
- `mlib_ImageZoomIn2X(3MLIB)`
- `mlib_ImageZoomIn2X_Fp(3MLIB)`
- `mlib_ImageZoomOut2X(3MLIB)`
- `mlib_ImageZoomOut2X_Fp(3MLIB)`
- `attributes(5)`
The `mlib_ImageZoomOut2XIndex()` function minimizes the source image by a factor of two. It uses the interpolation method as described by the resampling filter.

The image data type must be `MLIB_BYTE` or `MLIB_SHORT`.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The width and height of the destination image can be different from those of the source image.

The center of the source image is mapped onto the center of the destination image.

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `filter` Type of resampling filter. It can be one of the following:
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`
- `colormap` Internal data structure for inverse color mapping. This data structure is generated by the `mlib_ImageColorTrue2IndexInit()` function.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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</table>
mlib_ImageZoomOut2XIndex(3MLIB)

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</table>

See Also  
*mlib_ImageZoom(3MLIB)*, *mlib_ImageZoom_Fp(3MLIB)*, *mlib_ImageZoomIn2X(3MLIB)*,  
*mlib_ImageZoomIn2X_Fp(3MLIB)*, *mlib_ImageZoomIn2XIndex(3MLIB)*,  
*mlib_ImageZoomIndex(3MLIB)*, *mlib_ImageZoomOut2X(3MLIB)*,  
*mlib_ImageZoomOut2X_Fp(3MLIB)*, *attributes(5)*
mlib_ImageZoomTranslate—zoom, with translation

Synopsis

\texttt{cc \{ flag... \} file... \-mlib \{ library... \}}
\#include <mlib.h>

\begin{verbatim}
mlib_status mlib_ImageZoomTranslate(mlib_image *dst,
        const mlib_image *src, mlib_d64 zoomx, mlib_d64 zoomy,
        mlib_d64 tx, mlib_d64 ty, mlib_filter filter,
        mlib_edge edge);
\end{verbatim}

Description

The \texttt{mlib\_ImageZoomTranslate()} function will enlarge or minify the source image by the X and Y zoom factors, with translation. It uses the interpolation method as described by the resampling filter.

It uses the following equation for coordinate mapping:
\begin{align*}
xd &= \text{zoomx} \times xs + tx \\
yd &= \text{zoomy} \times ys + ty
\end{align*}

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be \texttt{MLIB\_BIT}, \texttt{MLIB\_BYTE}, \texttt{MLIB\_SHORT}, \texttt{MLIB\_USHORT}, or \texttt{MLIB\_INT}.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

Parameters

The function takes the following arguments:

- \texttt{dst} \hspace{1cm} Pointer to destination image.
- \texttt{src} \hspace{1cm} Pointer to source image.
- \texttt{zoomx} \hspace{1cm} X zoom factor. \texttt{zoomx} \textgreater{} 0.
- \texttt{zoomy} \hspace{1cm} Y zoom factor. \texttt{zoomy} \textgreater{} 0.
- \texttt{tx} \hspace{1cm} X translation.
- \texttt{ty} \hspace{1cm} Y translation.
- \texttt{filter} \hspace{1cm} Type of resampling filter. It can be one of the following:
  \begin{verbatim}
  MLIB\_NEAREST
  MLIB\_BILINEAR
  MLIB\_BICUBIC
  MLIB\_BICUBIC2
  \end{verbatim}
- \texttt{edge} \hspace{1cm} Type of edge condition. It can be one of the following:
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageZoomTranslate_Fp(3MLIB), mlib_ImageAffine(3MLIB), mlib_ImageAffine_Fp(3MLIB), attributes(5)
The `mlib_ImageZoomTranslateBlend()` function will enlarge or minify the source image by the X and Y zoom factors, with translation, and blend it with the destination image.

It uses the following equation for coordinate mapping:

\[
xd = zoomx \times xs + tx \\
yd = zoomy \times ys + ty
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The alpha blending is closely combined with the interpolation to achieve better performance. Part of alpha blending has to be performed before or together with the interpolation if the source image has an alpha channel. In that case, the color components of each neighboring source pixel which participates in the interpolation \((src_r \text{ and etc.)}\) have to be pre-multiplied by the alpha component of the same source pixel \((src_a)\). After the interpolation, the overall alpha \((alpha)\), the interpolated source alpha \((interp_a)\) and the destination pixel’s original alpha \((dst_a, \text{if any})\) are used to blend the interpolated source pixel (with components \(interp_r \text{ and etc.) with the destination pixel (with components dst_r \text{ and etc.})}\).

The `MLIB_BLEND_GTK_SRC` blending is similar to the SRC rule of the Porter-Duff rules for image compositing. It is defined by

\[
C_d = C_s \\
A_d = A_s
\]

in general, and by the following formula for this function:

```c
if (interp_a != 0.0) {
  if (dst_has_alpha) {
    dst_r = interp_r / interp_a;
    dst_g = interp_g / interp_a;
    dst_b = interp_b / interp_a;
    dst_a = interp_a;
  } else {
    dst_r = interp_r;
    dst_g = interp_g;
    dst_b = interp_b;
  }
}
```
The MLIB_BLEND_GTK_SRC_OVER or MLIB_BLEND_GTK_SRC_OVER2 blending is similar to the SRC_OVER rule of the Porter-Duff rules for image compositing. It is defined by

$$Cd = Cs + Cd*(1 - As)$$
$$Ad = As + Ad*(1 - As)$$

in general, and by the following formula for this function:

$$w = \alpha*interp_a + (1 - \alpha*interp_a)*dst_a;$$
if ($w \neq 0.0$) {
    $$dst_r = (\alpha*interp_r + (1 - \alpha*interp_a)*dst_a*dst_r)/w;$$
    $$dst_g = (\alpha*interp_g + (1 - \alpha*interp_a)*dst_a*dst_g)/w;$$
    $$dst_b = (\alpha*interp_b + (1 - \alpha*interp_a)*dst_a*dst_b)/w;$$
    $$dst_a = w;$$
} else if (MLIB_BLEND_GTK_SRC_OVER) {
    $$dst_r = 0;$$
    $$dst_g = 0;$$
    $$dst_b = 0;$$
    $$dst_a = 0;$$
}

where $\alpha$, $src_a$, $interp_a$ and $dst_a$ are assumed to be in the range of $[0.0, 1.0]$.

For an image with 4 channels, the first or the fourth channel is considered the alpha channel if $cmask$ equals 8 or 1, respectively. An image with 3 channels is considered to have no alpha channel, which is equivalent to having an alpha channel filled with all $1.0$, or $0xff$ in case of MLIB_BYTE, if the general formulas for blending shown above are used.

Both $src$ and $dst$ must be of type MLIB_BYTE. They can have either 3 or 4 channels.

The $src$ image cannot have width or height larger than 32767.

**Parameters** The function takes the following arguments:

- $dst$ Pointer to destination image.
- $src$ Pointer to first source image.
- $zoomx$ X zoom factor. $zoomx > 0.0$. 

```c
mlib_ImageZoomTranslateBlend(3MLIB)
```
zoomy  Y zoom factor. zoomy > 0.0.
tx      X translation.
ty      Y translation.
filter  Type of resampling filter. It can be one of the following:
        MLIB_NEAREST
        MLIB_BILINEAR
        MLIB_BICUBIC
        MLIB_BICUBIC2
edge    Type of edge condition. It can be one of the following:
        MLIB_EDGE_DST_NO_WRITE
        MLIB_EDGE_DST_FILL_ZERO
        MLIB_EDGE_OP_NEAREST
        MLIB_EDGE_SRC_EXTEND
        MLIB_EDGE_SRC_EXTEND_INDEF
        MLIB_EDGE_SRC_PADDED
blend   Type of alpha blending. It can be one of the following:
        MLIB_BLEND_GTK_SRC
        MLIB_BLEND_GTK_SRC_OVER
        MLIB_BLEND_GTK_SRC_OVER2
alpha   Overall alpha for blending.
cmask   Channel mask to indicate the alpha channel.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_ImageZoomBlend(3MLIB), mlib_ImageZoomTranslateTableBlend(3MLIB), attributes(5)
The `mlib_ImageZoomTranslate_Fp()` function will enlarge or minify the floating-point source image by the X and Y zoom factors, with translation. It uses the interpolation method as described by the resampling filter.

It uses the following equation for coordinate mapping:

\[
xd = \text{zoomx}*xs + tx \\
yd = \text{zoomy}*ys + ty
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `zoomx` X zoom factor. \(\text{zoomx} > 0\).
- `zoomy` Y zoom factor. \(\text{zoomy} > 0\).
- `tx` X translation.
- `ty` Y translation.
- `filter` Type of resampling filter. It can be one of the following:
  - `MLIB_NEAREST`
  - `MLIB_BILINEAR`
  - `MLIB_BICUBIC`
  - `MLIB_BICUBIC2`
- `edge` Type of edge condition. It can be one of the following:
MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_OP_NEAREST
MLIB_EDGE_SRC_EXTEND
MLIB_EDGE_SRC_EXTEND_INDEF
MLIB_EDGE_SRC_PADDED

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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See Also
mlib_ImageZoomTranslate(3MLIB), mlib_ImageAffine(3MLIB),
mlib_ImageAffine_Fp(3MLIB), attributes(5)
The `mlib_ImageZoomTranslateTable()` function will enlarge or minify the source image by the X and Y zoom factors, with translation. It uses a table, `interp_table`, to do interpolation.

It uses the following equation for coordinate mapping:

\[
\begin{align*}
xd &= \text{zoomx} \times xs + tx \\
yd &= \text{zoomy} \times ys + ty
\end{align*}
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be `MLIB_BYTE`, `MLIB_SHORT`, `MLIB_USHORT`, or `MLIB_INT`.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

The function takes the following arguments:

- `dst` Pointer to destination image.
- `src` Pointer to source image.
- `zoomx` X zoom factor. \(zoomx > 0\).
- `zoomy` Y zoom factor. \(zoomy > 0\).
- `tx` X translation.
- `ty` Y translation.
- `interp_table` Pointer to an interpolation table. The table is created by the `mlib_ImageInterpTableCreate()` function.
- `edge` Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_EXTEND_INDEF`
  - `MLIB_EDGE_SRC_PADDED`
Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_ImageInterpTableCreate(3MLIB), mlib_ImageInterpTableDelete(3MLIB),
mlib_ImageZoomTranslateTable_Fp(3MLIB), mlib_ImageZoomTranslate(3MLIB),
mlib_ImageZoomTranslate_Fp(3MLIB), attributes(5)
The `mlib_ImageZoomTranslateTableBlend()` function will enlarge or minify the source image by the X and Y zoom factors, with translation, and blend it with the destination image.

It uses the following equation for coordinate mapping:

\[
\begin{align*}
\text{xd} &= \text{zoomx}*\text{xs} + \text{tx} \\
\text{yd} &= \text{zoomy}^*\text{ys} + \text{ty}
\end{align*}
\]

where a point with coordinates \((\text{xs}, \text{ys})\) in the source image is mapped to a point with coordinates \((\text{xd}, \text{yd})\) in the destination image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

It is assumed that the overall alpha for controlling the blending between the source image and the destination image has been pre-multiplied to the interpolation table for better performance.

The alpha blending is closely combined with the interpolation to achieve better performance. Part of alpha blending has to be performed before or together with the interpolation if the source image has an alpha channel. In that case, the color components of each neighboring source pixel which participates in the interpolation (\(\text{src}_r\) and etc.) have to be pre-multiplied by the alpha component of the same source pixel (\(\text{src}_a\)). After the interpolation, the interpolated alpha (\(\text{interp}_a\), which has been multiplied by the overall alpha because of the pre-multiplied interpolation table) and the destination pixel's original alpha (\(\text{dst}_a\), if any) are used to blend the interpolated source pixel (with components \(\text{interp}_r\) and etc.) with the destination pixel (with components \(\text{dst}_r\) and etc.).

The `MLIB_BLEND_GTK_SRC` blending is similar to the SRC rule of the Porter-Duff rules for image compositing. It is defined by

\[
\begin{align*}
\text{Cd} &= \text{Cs} \\
\text{Ad} &= \text{As}
\end{align*}
\]

in general, and by the following formula for this function:

```c
if (interp_a != 0.0) {
    if (dst_has_alpha) {
        dst_r = interp_r/interp_a;
        dst_g = interp_g/interp_a;
    }
```
The `MLIB_BLEND_GTK_SRC_OVER` or `MLIB_BLEND_GTK_SRC_OVER2` blending is similar to the `SRC_OVER` rule of the Porter-Duff rules for image compositing. It is defined by:

\[
\begin{align*}
Cd &= Cs + Cd*(1 - As) \\
Ad &= As + Ad*(1 - As)
\end{align*}
\]

in general, and by the following formula for this function:

\[
\begin{align*}
w &= interp_a + (1 - interp_a)*dst_a; \\
if (w != 0.0) \\
\begin{align*}
dst_r &= (interp_r + (1 - interp_a)*dst_a*dst_r)/w; \\
dst_g &= (interp_g + (1 - interp_a)*dst_a*dst_g)/w; \\
dst_b &= (interp_b + (1 - interp_a)*dst_a*dst_b)/w; \\
dst_a &= w;
\end{align*}
\end{align*}
\]

where `src_a`, `interp_a` and `dst_a` are assumed to be in the range of \([0, 1.0]\).

For an image with 4 channels, the first or the fourth channel is considered the alpha channel if `cmask` equals 8 or 1, respectively. An image with 3 channels is considered to have no alpha channel, which is equivalent to having an alpha channel filled with all 1.0, or 0xff in case of `MLIB_BYTE`, if the general formulas for blending shown above are used.

Both `src` and `dst` must be of type `MLIB_BYTE`. They can have either 3 or 4 channels.

The `src` image cannot have width or height larger than 32767.
The function takes the following arguments:

dst    Pointer to destination image.
src    Pointer to first source image.
zoomx  X zoom factor. \( zoomx > 0.0 \).
zoomy  Y zoom factor. \( zoomy > 0.0 \).

tx     X translation.

ty     Y translation.

table  Pointer to interpolation table structure.

dst    Pointer to destination image.
src    Pointer to first source image.

edge   Type of edge condition. It can be one of the following:

MLIB_EDGE_DST_NO_WRITE
MLIB_EDGE_DST_FILL_ZERO
MLIB_EDGE_OP_NEAREST
MLIB_EDGE_SRC_EXTEND
MLIB_EDGE_SRC_EXTEND_INDEF
MLIB_EDGE_SRC_PADDDED

blend  Type of alpha blending. It can be one of the following:

MLIB_BLEND_GTK_SRC
MLIB_BLEND_GTK_SRC_OVER
MLIB_BLEND_GTK_SRC_OVER2

cmask  Channel mask to indicate the alpha channel.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_ImageZoomBlend(3MLIB), mlib_ImageZoomTranslateBlend(3MLIB), mlib_ImageInterpTableCreate(3MLIB), attributes(5)
The `mlib_ImageZoomTranslateTable_Fp()` function will enlarge or minify the floating-point source image by the X and Y zoom factors, with translation. It uses a table, `interp_table`, to do interpolation.

It uses the following equation for coordinate mapping:

\[
xd = zoomx * xs + tx \\
yd = zoomy * ys + ty
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The data type of the images can be `MLIB_FLOAT` or `MLIB_DOUBLE`.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

### Parameters

The function takes the following arguments:

- **dst**: Pointer to destination image.
- **src**: Pointer to source image.
- **zoomx**: X zoom factor. \(zoomx > 0\).
- **zoomy**: Y zoom factor. \(zoomy > 0\).
- **tx**: X translation.
- **ty**: Y translation.
- **interp_table**: Pointer to an interpolation table. The table is created by the `mlib_ImageInterpTableCreate()` function.
- **edge**: Type of edge condition. It can be one of the following:
  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTETYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  `mlib_ImageInterpTableCreate(3MLIB)`, `mlib_ImageInterpTableDelete(3MLIB)`, `mlib_ImageZoomTranslateTable(3MLIB)`, `mlib_ImageZoomTranslate(3MLIB)`, `mlib_ImageZoomTranslate_Fp(3MLIB)`, attributes(5)
### Name
mlib_ImageZoomTranslateToGray – zoom, with translation, and convert to grayscale

### Synopsis
```
cs [ fag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_ImageZoomTranslateToGray(mlib_image *dst,
    const mlib_image *src, mlib_d64 zoomx, mlib_d64 zoomy,
    mlib_d64 tx, mlib_d64 ty, mlib_filter filter, mlib_edge edge,
    const mlib_s32 *ghigh, const mlib_s32 *glow);
```

### Description
The `mlib_ImageZoomTranslateToGray()` function will enlarge or minify the source binary image by the X and Y zoom factors, with translation, and convert the resulting image into a grayscale image.

It uses the following equation for coordinate mapping:

\[
xd = zoomx \times xs + tx \\
yd = zoomy \times ys + ty
\]

where a point with coordinates \((xs, ys)\) in the source image is mapped to a point with coordinates \((xd, yd)\) in the destination image.

The width and height of the destination image can be different from the width and height of the source image.

The center of the upper-left corner pixel of an image is located at \((0.5, 0.5)\).

### Parameters
The function takes the following arguments:

- **dst**  
  Pointer to destination image. It must be of type `MLIB_BYTE` and have just one channel.

- **src**  
  Pointer to source image. It must be of type `MLIB_BIT` and have just one channel.

- **zoomx**  
  X zoom factor. `zoomx > 0`.

- **zoomy**  
  Y zoom factor. `zoomy > 0`.

- **tx**  
  X translation.

- **ty**  
  Y translation.

- **filter**  
  Type of resampling filter. It must be `MLIB_NEAREST`.

- **edge**  
  Type of edge condition. It can be one of the following:

  - `MLIB_EDGE_DST_NO_WRITE`
  - `MLIB_EDGE_DST_FILL_ZERO`
  - `MLIB_EDGE_OP_NEAREST`
  - `MLIB_EDGE_SRC_EXTEND`
  - `MLIB_EDGE_SRC_PADDED`

- **ghigh**  
  Pointer to value for ‘1’ pixels in source image.
glow       Pointer to value for '0' pixels in source image.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

See Also  mlib_ImageSubsampleBinaryToGray(3MLIB), attributes(5)
**Name**
mlib_malloc – allocate a block of bytes

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
void *mlib_malloc(size_t size);
```

**Description**
The `mlib_malloc()` function allocates `size` bytes on a 16-byte aligned boundary and returns a pointer to the allocated block.

This function is equivalent to `memalign(16, size)`.

**Parameters**
The function takes the following arguments:

- `size` Size of the block in bytes.

**Return Values**
The function returns a pointer to the allocated block if successful. Otherwise it returns a null pointer.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</tbody>
</table>

**See Also**
`mlib_free(3MLIB), mlib_realloc(3MLIB), malloc(3C), attributes(5)`
Name
mlib_MatrixAddS_U8_Mod, mlib_MatrixAddS_U8_Sat, mlib_MatrixAddS_U8C_Mod,
mlib_MatrixAddS_U8C_Sat, mlib_MatrixAddS_S8_Mod, mlib_MatrixAddS_S8_Sat,
mlib_MatrixAddS_S8C_Mod, mlib_MatrixAddS_S8C_Sat, mlib_MatrixAddS_S16_Mod,
mlib_MatrixAddS_S16_Sat, mlib_MatrixAddS_S16C_Mod, mlib_MatrixAddS_S16C_Sat,
mlib_MatrixAddS_S32_Mod, mlib_MatrixAddS_S32_Sat, mlib_MatrixAddS_S32C_Mod,
mlib_MatrixAddS_S32C_Sat – matrix addition to scalar, in place

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixAddS_U8_Mod(mlib_u8 *xz, const mlib_u8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_U8_Sat(mlib_u8 *xz, const mlib_u8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_U8C_Mod(mlib_u8 *xz, const mlib_u8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_U8C_Sat(mlib_u8 *xz, const mlib_u8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S8_Mod(mlib_s8 *xz, const mlib_s8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S8_Sat(mlib_s8 *xz, const mlib_s8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S8C_Mod(mlib_s8 *xz, const mlib_s8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S8C_Sat(mlib_s8 *xz, const mlib_s8 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S16_Mod(mlib_s16 *xz, const mlib_s16 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S16_Sat(mlib_s16 *xz, const mlib_s16 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S16C_Mod(mlib_s16 *xz, const mlib_s16 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S16C_Sat(mlib_s16 *xz, const mlib_s16 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S32_Mod(mlib_s32 *xz, const mlib_s32 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S32_Sat(mlib_s32 *xz, const mlib_s32 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S32C_Mod(mlib_s32 *xz, const mlib_s32 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c,
mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAddS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c,
        mlib_s32 m, mlib_s32 n);

**Description** Each of these functions performs an in-place addition of a scalar value to a matrix.

For real data, the following equation is used:

\[ xz[i] = c[0] + xz[i] \]

where \( i = 0, 1, \ldots, (m\times n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\end{align*}
\]

where \( i = 0, 1, \ldots, (m\times n - 1) \).

**Parameters** Each of the functions takes the following arguments:

- \( xz \) Pointer to the source and the destination matrix.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( m \) Number of rows in the matrices.
- \( n \) Number of columns in the matrices.

**Return Values** Each of the functions returns
MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also** mlib_MatrixAddS_U8_U8_Mod(3MLIB), attributes(5)
Name  
mlib_MatrixAddS_U8_U8_Mod, mlib_MatrixAddS_U8_U8_Sat,
mlib_MatrixAddS_U8C_U8C_Mod, mlib_MatrixAddS_U8C_U8C_Sat,
mlib_MatrixAddS_S8_S8_Mod, mlib_MatrixAddS_S8_S8_Sat,
mlib_MatrixAddS_S8C_S8C_Mod, mlib_MatrixAddS_S8C_S8C_Sat,
mlib_MatrixAddS_S16_U8_Mod, mlib_MatrixAddS_S16_U8_Sat,
mlib_MatrixAddS_S16_S8_Mod, mlib_MatrixAddS_S16_S8_Sat,
mlib_MatrixAddS_S16_S16_Mod, mlib_MatrixAddS_S16_S16_Sat,
mlib_MatrixAddS_S16C_S16C_Mod, mlib_MatrixAddS_S16C_S16C_Sat,
mlib_MatrixAddS_S32_S16_Mod, mlib_MatrixAddS_S32_S16_Sat,
mlib_MatrixAddS_S32_S32_Mod, mlib_MatrixAddS_S32_S32_Sat,
mlib_MatrixAddS_S32C_S32C_Mod, mlib_MatrixAddS_S32C_S32C_Sat – matrix addition
to scalar

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mllib_status mlib_MatrixAddS_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
                                       const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
                                       const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
                                       const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
                                       const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
                                       const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
                                       const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
                                       const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
                                       const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
                                       const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x,
                                       const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
                                       const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
                                       const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
                                       const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
                                       const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x,
                                       const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x,
                                       const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
                                       const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
                                       const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
                                       const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
                                       const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x,
                                       const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
mllib_status mlib_MatrixAddS_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x,
                                       const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
Each of these functions adds a scalar value to a matrix.

For real data, the following equation is used:
\[ z[i] = c[0] + x[i] \]
where \( i = 0, 1, \ldots, (m*n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
    z[2*i] &= c[0] + x[2*i] \\
\end{align*}
\]

where \( i = 0, 1, \ldots, (m*n - 1) \).

**Parameters** Each of the functions takes the following arguments:

- **z** Pointer to the destination matrix.
- **x** Pointer to the source matrix.
- **c** Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- **m** Number of rows in the matrices.
- **n** Number of columns in the matrices.

**Return Values** Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See [attributes(5)](attributes(5)) for descriptions of the following attributes:

<table>
<thead>
<tr>
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</tr>
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</table>

**See Also** [mlib_MatrixAddS_U8_U8_Mod(3MLIB)](mlib_MatrixAddS_U8_U8_Mod(3MLIB)), [attributes(5)](attributes(5))
Name
mlib_MatrixAdd_U8_Mod, mlib_MatrixAdd_U8_Sat, mlib_MatrixAdd_U8C_Mod,
mlib_MatrixAdd_U8C_Sat, mlib_MatrixAdd_S8_Mod, mlib_MatrixAdd_S8_Sat,
mlib_MatrixAdd_S8C_Mod, mlib_MatrixAdd_S8C_Sat, mlib_MatrixAdd_S16_Mod,
mlib_MatrixAdd_S16_Sat, mlib_MatrixAdd_S16C_Mod, mlib_MatrixAdd_S16C_Sat,
mlib_MatrixAdd_S32_Mod, mlib_MatrixAdd_S32_Sat, mlib_MatrixAdd_S32C_Mod,
mlib_MatrixAdd_S32C_Sat – matrix addition, in place

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixAdd_U8_Mod(mlib_u8 *xz,
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_U8_Sat(mlib_u8 *xz,
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_U8C_Mod(mlib_u8 *xz,
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_U8C_Sat(mlib_u8 *xz,
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S8_Mod(mlib_s8 *xz,
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S8_Sat(mlib_s8 *xz,
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S8C_Mod(mlib_s8 *xz,
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S8C_Sat(mlib_s8 *xz,
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S16_Mod(mlib_s16 *xz,
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S16_Sat(mlib_s16 *xz,
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S16C_Mod(mlib_s16 *xz,
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S16C_Sat(mlib_s16 *xz,
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S32_Mod(mlib_s32 *xz,
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S32_Sat(mlib_s32 *xz,
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S32C_Mod(mlib_s32 *xz,
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixAdd_S32C_Sat(mlib_s32 *xz,
   const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

**Description**  Each of these functions performs an in-place addition of the second source matrix to the first source matrix.

It uses the following equation:

\[ xz[i] = xz[i] + y[i] \]

where \( i = 0, 1, \ldots, (m\times n - 1) \) for real data; \( i = 0, 1, \ldots, (m\times n\times 2 - 1) \) for complex data.

**Parameters**  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the first source and destination matrix.
- \( y \)  Pointer to the second source matrix.
- \( m \)  Number of rows in the matrices.
- \( n \)  Number of columns in the matrices.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**  mlib_MatrixAdd_U8_U8_Mod(3MLIB), attributes(5)
Name

mlib_MatrixAdd_U8_U8_Mod, mlib_MatrixAdd_U8_U8_Sat,
mlib_MatrixAdd_U8C_U8C_Mod, mlib_MatrixAdd_U8C_U8C_Sat,
mlib_MatrixAdd_S8_S8_Mod, mlib_MatrixAdd_S8_S8_Sat,
mlib_MatrixAdd_S8C_S8C_Mod, mlib_MatrixAdd_S8C_S8C_Sat,
mlib_MatrixAdd_S16_U8_Mod, mlib_MatrixAdd_S16_U8_Sat,
mlib_MatrixAdd_S16_S8_Mod, mlib_MatrixAdd_S16_S8_Sat,
mlib_MatrixAdd_S16C_S16C_Mod, mlib_MatrixAdd_S16C_S16C_Sat,
mlib_MatrixAdd_S16C_U8C_Mod, mlib_MatrixAdd_S16C_U8C_Sat,
mlib_MatrixAdd_S16C_S8C_Mod, mlib_MatrixAdd_S16C_S8C_Sat,
mlib_MatrixAdd_S32_S16_Mod, mlib_MatrixAdd_S32_S16_Sat,
mlib_MatrixAdd_S32_S32_Mod, mlib_MatrixAdd_S32_S32_Sat,
mlib_MatrixAdd_S32C_S16C_Mod, mlib_MatrixAdd_S32C_S16C_Sat,
mlib_MatrixAdd_S32C_S32C_Mod, mlib_MatrixAdd_S32C_S32C_Sat – matrix addition

Synopsis

cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_MatrixAdd_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixAdd_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
Each of these functions adds the first source matrix to the second source matrix and writes the output to the destination matrix.

It uses the following equation:

\[ z[i] = x[i] + y[i] \]
where \( i = 0, 1, \ldots, (m \cdot n - 1) \) for real data; \( i = 0, 1, \ldots, (m \cdot n \cdot 2 - 1) \) for complex data.

**Parameters**

Each of the functions takes the following arguments:

- \( z \): Pointer to the destination matrix.
- \( x \): Pointer to the first source matrix.
- \( y \): Pointer to the second source matrix.
- \( m \): Number of rows in the matrices.
- \( n \): Number of columns in the matrices.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
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</tr>
</tbody>
</table>

**See Also**

`mlib_MatrixAdd_U8_U8_Mod(3MLIB)`, attributes(5)
mlib_MatrixAve_U8(3MLIB)

Name  mlib_MatrixAve_U8, mlib_MatrixAve_U8C, mlib_MatrixAve_S8, mlib_MatrixAve_S8C,
       mlib_MatrixAve_S16, mlib_MatrixAve_S16C, mlib_MatrixAve_S32, mlib_MatrixAve_S32C

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
       #include <mlib.h>

       mlib_status mlib_MatrixAve_U8(mlib_u8 *xz,
                  const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_U8C(mlib_u8 *xz,
                  const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_S8(mlib_s8 *xz,
                  const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_S8C(mlib_s8 *xz,
                  const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_S16(mlib_s16 *xz,
                  const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_S16C(mlib_s16 *xz,
                  const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_S32(mlib_s32 *xz,
                  const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
       mlib_status mlib_MatrixAve_S32C(mlib_s32 *xz,
                  const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

Description  Each of these functions performs an in-place averaging of two matrices.

   It uses the following equation:

   \[ \text{avg}[i] = (\text{prev}[i] + \text{next}[i] + 1) / 2 \]

   where \( i = 0, 1, \ldots, (m\times n - 1) \) for real data; \( i = 0, 1, \ldots, (m\times n^2 - 1) \) for complex data.

Parameters  Each of the functions takes the following arguments:

   \( xz \)  Pointer to the first source and destination matrix.

   \( y \)  Pointer to the second source matrix.

   \( m \)  Number of rows in the matrices.

   \( n \)  Number of columns in the matrices.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
Attributes  See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also  mlib_MatrixAve_U8_U8(3MLIB), attributes(5)
Each of these functions computes the average of the first source matrix and the second source matrix and writes the output to the destination matrix.

It uses the following equation:
\[ z[i] = (x[i] + y[i] + 1) / 2 \]

where \( i = 0, 1, \ldots, (m*n - 1) \) for real data; \( i = 0, 1, \ldots, (m*n*2 - 1) \) for complex data.

**Parameters**  
Each of the functions takes the following arguments:
- \( z \)  
  Pointer to the destination matrix.
- \( x \)  
  Pointer to the first source matrix.
- \( y \)  
  Pointer to the second source matrix.
- \( m \)  
  Number of rows in the matrices.
- \( n \)  
  Number of columns in the matrices.

**Return Values**  
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  
`mlib_MatrixAve_U8_U8(3MLIB)`, attributes(5)
mlib_MatrixMaximumMag_U8C, mlib_MatrixMaximumMag_S8C, mlib_MatrixMaximumMag_S16C, mlib_MatrixMaximumMag_S32C, mlib_MatrixMaximumMag_F32C, mlib_MatrixMaximumMag_D64C – find the first element with the maximum magnitude in a matrix

### Synopsis

```c
#include <mlib.h>

mlib_status mlib_MatrixMaximumMag_U8C(mlib_u8 *max, const mlib_u8 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximumMag_S8C(mlib_s8 *max, const mlib_s8 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximumMag_S16C(mlib_s16 *max, const mlib_s16 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximumMag_S32C(mlib_s32 *max, const mlib_s32 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximumMag_F32C(mlib_f32 *max, const mlib_f32 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximumMag_D64C(mlib_d64 *max, const mlib_d64 *x, mlib_s32 m, mlib_s32 n);
```

### Description

Each of these functions finds the first element with the maximum magnitude in a complex matrix, then puts the real and imaginary parts of it into `max[0]` and `max[1]`, respectively.

### Parameters

Each of the functions takes the following arguments:

- `max` Pointer to the first element with the maximum magnitude
- `x` Pointer to the first element of the source matrix.
- `m` Number of rows in the source matrix
- `n` Number of columns in the source matrix

### Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

- `mlib_MatrixMinimumMag_U8C(3MLIB)`, `mlib_VectorMaximumMag_U8C(3MLIB)`, `mlib_VectorMinimumMag_U8C(3MLIB)`
mlib_MatrixMaximum_U8,mlib_MatrixMaximum_S8,mlib_MatrixMaximum_S16,mlib_MatrixMaximum_S32,mlib_MatrixMaximum_F32,mlib_MatrixMaximum_D64 – find the maximum value in a matrix

Synopsis
cc [ flag ... ] file ... -lmlib [ library ... ]
#include <mlib.h>
mlib_status mlib_MatrixMaximum_U8(mlib_u8 *max, const mlib_u8 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximum_S8(mlib_s8 *max, const mlib_s8 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximum_S16(mlib_s16 *max, const mlib_s16 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximum_S32(mlib_s32 *max, const mlib_s32 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximum_F32(mlib_f32 *max, const mlib_f32 *x, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMaximum_D64(mlib_d64 *max, const mlib_d64 *x, mlib_s32 m, mlib_s32 n);

Description
Each of these functions finds the maximum value of all elements in a matrix. It uses the following equation:
max[0] = MAX{ x[i]  i = 0, 1, ..., (m*n - 1) }

Parameters
Each of the functions takes the following arguments:

max  Pointer to the maximum value.

x  Pointer to the first element of the source matrix.

m  Number of rows in the source matrix.

n  Number of columns in the source matrix.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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</table>
See Also  

mlib_MatrixMinimum_U8(3MLIB), mlib_VectorMaximum_U8(3MLIB),
mlib_VectorMinimum_U8(3MLIB), attributes(5)
Each of these functions finds the first element with the minimum magnitude in a complex
matrix, then puts the real and imaginary parts of it into \texttt{min[0]} and \texttt{min[1]}, respectively.

Each of the functions takes the following arguments:

- \textit{min} Pointer to the first element with the minimum magnitude.
- \textit{x} Pointer to the first element of the source matrix.
- \textit{m} Number of rows in the source matrix.
- \textit{n} Number of columns in the source matrix.

Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

See also \texttt{mlib_MatrixMaximumMag_U8C(3MLIB)}, \texttt{mlib_VectorMaximumMag_U8C(3MLIB)},
\texttt{mlib_VectorMinimumMag_U8C(3MLIB)}, \texttt{attributes(5)}
Each of these functions finds the minimum value of all elements in a matrix. It uses the following equation:
\[
\text{min}[0] = \text{MIN}\{ x[i] \mid i = 0, 1, \ldots, (m*n - 1) \}
\]

**Parameters**
Each of the functions takes the following arguments:

- **min** Pointer to the minimum value.
- **x** Pointer to the first element of the source matrix.
- **m** Number of rows in the source matrix.
- **n** Number of columns in the source matrix.

**Return Values**
Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also  mlib_MatrixMaximum_U8(3MLIB), mlib_VectorMaximum_U8(3MLIB),
        mlib_VectorMinimum_U8(3MLIB), attributes(5)
Each of these functions performs a multiplication of two matrices and shifts the result.

For real data, the following equation is used:

\[
\begin{align*}
    z[i*n + j] &= \{\text{SUM}_{k=0}^{m-1} (x[i*l + k] \times y[k*n + j])\} \times 2^{-\text{shift}} \\
    \text{where } i &= 0, 1, ..., (m - 1); j = 0, 1, ..., (n - 1).
\end{align*}
\]

For complex data, the following equation is used:

\[
\begin{align*}
    z[2*(i*n + j)] &= \{\text{SUM}_{k=0}^{m-1} (xR*yR - xI*yI)\} \times 2^{-\text{shift}} \\
    z[2*(i*n + j) + 1] &= \{\text{SUM}_{k=0}^{m-1} (xR*yI + xI*yR)\} \times 2^{-\text{shift}} \\
    \text{where } xR &= x[2*(i*l + k)] \\
    xI &= x[2*(i*l + k) + 1] \\
    yR &= y[2*(k*n + j)] \\
    yI &= y[2*(k*n + j) + 1] \\
    i &= 0, 1, ..., (m - 1) \\
    j &= 0, 1, ..., (n - 1)
\end{align*}
\]

### Parameters

Each of the functions takes the following arguments:
z Pointer to the first element of the result matrix, in row major order.
x Pointer to the first element of the first matrix, in row major order.
y Pointer to the first element of the second matrix, in row major order.
m Number of rows in the first matrix. \( m > 0 \).
l Number of columns in the first matrix, and the number of rows in the second matrix. \( l > 0 \).
n Number of columns in the second matrix. \( n > 0 \).
shift Right shifting factor. \( 1 \leq \text{shift} \leq 16 \).

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_MatrixMulShift_S16_S16_Mod(3MLIB), attributes(5)
REFERENCE

Multimedia Library Functions - Part 4
mlib_MatrixMulSShift_U8_Mod, mlib_MatrixMulSShift_U8_Sat,
mlib_MatrixMulSShift_U8C_Mod, mlib_MatrixMulSShift_U8C_Sat,
mlib_MatrixMulSShift_S8_Mod, mlib_MatrixMulSShift_S8_Sat,
mlib_MatrixMulSShift_S8C_Mod, mlib_MatrixMulSShift_S8C_Sat,
mlib_MatrixMulSShift_S16_Mod, mlib_MatrixMulSShift_S16_Sat,
mlib_MatrixMulSShift_S16C_Mod, mlib_MatrixMulSShift_S16C_Sat,
mlib_MatrixMulSShift_S32_Mod, mlib_MatrixMulSShift_S32_Sat – matrix
multiplication by scalar plus shifting, in place

Synopsis
c c [ flag... ] file... -lmlib [ library... ]
#include "mlib.h"

mlib_status mlib_MatrixMulSShift_U8_Mod(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_U8_Sat(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_U8C_Mod(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_U8C_Sat(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S8_Mod(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S8_Sat(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S8C_Mod(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S8C_Sat(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S16_Mod(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S16_Sat(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S16C_Mod(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S16C_Sat(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S32_Mod(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S32_Sat(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 m, mlib_s32 n, mlib_s32 shift);
Each of these functions performs an in-place multiplication of a matrix with a scalar and shifts the result.

For real data, the following equation is used:
\[ xz[i] = c[0] \times xz[i] \times 2^{-shift} \]
where \( i = 0, 1, \ldots, (m \times n - 1) \).

For complex data, the following equation is used:
\[
\begin{align*}
\text{tmp} &= xz[2i] \\
xz[2i] &= (c[0] \times \text{tmp} - c[1] \times xz[2i + 1]) \times 2^{-shift} \\
xz[2i + 1] &= (c[1] \times \text{tmp} + c[0] \times xz[2i + 1]) \times 2^{-shift}
\end{align*}
\]
where \( i = 0, 1, \ldots, (m \times n - 1) \).

The ranges of valid shift are:
\[ 1 \leq \text{shift} \leq 8 \quad \text{for U8, S8, U8C, S8C types} \\
1 \leq \text{shift} \leq 16 \quad \text{for S16, S16C types} \\
1 \leq \text{shift} \leq 31 \quad \text{for S32, S32C types} \]

Each of the functions takes the following arguments:
- \( xz \) Pointer to the source and destination matrix.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( m \) Number of rows in each matrix.
- \( n \) Number of columns in each matrix.
- \( \text{shift} \) Right shifting factor.

Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

See attributes\(^{(5)}\) for descriptions of the following attributes:

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</table>
See Also mlib_MatrixMulSShift_U8_U8_Mod(3MLIB), attributes(5)
Name  
mlib_MatrixMulSShift_U8_U8_Mod, mlib_MatrixMulSShift_U8_U8_Sat,
mlib_MatrixMulSShift_U8C_U8C_Mod, mlib_MatrixMulSShift_U8C_U8C_Sat,
mlib_MatrixMulSShift_S8_S8_Mod, mlib_MatrixMulSShift_S8_S8_Sat,
mlib_MatrixMulSShift_S8C_S8C_Mod, mlib_MatrixMulSShift_S8C_S8C_Sat,
mlib_MatrixMulSShift_S16_S16_Mod, mlib_MatrixMulSShift_S16_S16_Sat,
mlib_MatrixMulSShift_S16C_S16C_Mod, mlib_MatrixMulSShift_S16C_S16C_Sat,
mlib_MatrixMulSShift_S32_S32_Mod, mlib_MatrixMulSShift_S32_S32_Sat,
mlib_MatrixMulSShift_S32C_S32C_Mod, mlib_MatrixMulSShift_S32C_S32C_Sat – matrix
multiplication by scalar plus shifting

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixMulSShift_U8_U8_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_U8_U8_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_U8C_U8C_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_U8C_U8C_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S8_S8_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S8_S8_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S8C_S8C_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S16_S16_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S16_S16_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S16C_S16C_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S16C_S16C_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32_S32_Mod(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32_S32_Sat(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32C_S32C_Mod(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32C_S32C_Sat(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,
mlib_s32 shift);
mlib_status mlib_MatrixMulSShift_S16C_S16C_Mod(mlib_s16 *z,  
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n,  
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S16C_S16C_Sat(mlib_s16 *z,  
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n,  
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32_S32_Mod(mlib_s32 *z,  
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,  
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32_S32_Sat(mlib_s32 *z,  
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,  
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32C_S32C_Mod(mlib_s32 *z,  
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,  
mlib_s32 shift);

mlib_status mlib_MatrixMulSShift_S32C_S32C_Sat(mlib_s32 *z,  
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n,  
mlib_s32 shift);

Description Each of these functions performs a multiplication of a matrix with a scalar and shifts the result.

For real data, the following equation is used:

\[ z[i] = c[0] \times x[i] \times 2^{-\text{shift}} \]

where \( i = 0, 1, \ldots, (m \times n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
  z[2i] &= (c[0] \times x[2i] - c[1] \times x[2i + 1]) \times 2^{-\text{shift}} \\
  z[2i + 1] &= (c[1] \times x[2i] + c[0] \times x[2i + 1]) \times 2^{-\text{shift}}
\end{align*}
\]

where \( i = 0, 1, \ldots, (m \times n - 1) \).

The ranges of valid shift are:

1 \leq \text{shift} \leq 8 \quad \text{for U8, S8, U8C, S8C types}
1 \leq \text{shift} \leq 16 \quad \text{for S16, S16C types}
1 \leq \text{shift} \leq 31 \quad \text{for S32, S32C types}

Parameters Each of the functions takes the following arguments:

- \( z \) Pointer to the destination matrix.
- \( x \) Pointer to the source matrix.
c  Pointer to the source scalar. When the function is used with complex data types, c[0] contains the scalar for the real part, and c[1] contains the scalar for the imaginary part.

m  Number of rows in each matrix.

n  Number of columns in each matrix.

shift  Right shifting factor.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_MatrixMulSShift_U8_U8_Mod(3MLIB), attributes(5)
Name
mlib_MatrixMulS_U8_Mod, mlib_MatrixMulS_U8_Sat, mlib_MatrixMulS_U8C_Mod,
mlib_MatrixMulS_U8C_Sat, mlib_MatrixMulS_S8_Mod, mlib_MatrixMulS_S8_Sat,
mlib_MatrixMulS_S8C_Mod, mlib_MatrixMulS_S8C_Sat, mlib_MatrixMulS_S16_Mod,
mlib_MatrixMulS_S16_Sat, mlib_MatrixMulS_S16C_Mod, mlib_MatrixMulS_S16C_Sat,
mlib_MatrixMulS_S32_Mod, mlib_MatrixMulS_S32_Sat, mlib_MatrixMulS_S32C_Mod,
mlib_MatrixMulS_S32C_Sat – matrix multiplication by scalar, in place

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixMulS_U8_Mod(mlib_u8 *xz, const mlib_u8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_U8_Sat(mlib_u8 *xz, const mlib_u8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_U8C_Mod(mlib_u8 *xz, const mlib_u8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_U8C_Sat(mlib_u8 *xz, const mlib_u8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8_Mod(mlib_s8 *xz, const mlib_s8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8_Sat(mlib_s8 *xz, const mlib_s8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8C_Mod(mlib_s8 *xz, const mlib_s8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8C_Sat(mlib_s8 *xz, const mlib_s8 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_Mod(mlib_s16 *xz, const mlib_s16 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_Sat(mlib_s16 *xz, const mlib_s16 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_Mod(mlib_s16 *xz, const mlib_s16 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_Sat(mlib_s16 *xz, const mlib_s16 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32_Mod(mlib_s32 *xz, const mlib_s32 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32_Sat(mlib_s32 *xz, const mlib_s32 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32C_Mod(mlib_s32 *xz, const mlib_s32 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c,
   mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c,
         mlib_s32 m, mlib_s32 n);

Description  Each of these functions performs an in-place multiplication of a scalar to a matrix.

For real data, the following equation is used:

\[ xz[i] = c[0]\times xz[i] \]

where \( i = 0, 1, \ldots, (m\times n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\text{tmp} & = xz[2*i] \\
xz[2*i] & = c[0]\times \text{tmp} - c[1]\times xz[2*i + 1] \\
xz[2*i + 1] & = c[1]\times \text{tmp} + c[0]\times xz[2*i + 1]
\end{align*}
\]

where \( i = 0, 1, \ldots, (m\times n - 1) \).

Parameters  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the source and destination matrix.
- \( c \)  Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( m \)  Number of rows in each matrix.
- \( n \)  Number of columns in each matrix.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<tbody>
<tr>
<td>Interface Stability</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_MatrixMulS_U8_U8_Mod(3MLIB), attributes(5)
mlib_MatrixMulS_U8_U8_Mod, mlib_MatrixMulS_U8_U8_Sat, mlib_MatrixMulS_S8_S8_Mod, mlib_MatrixMulS_S8_S8_Sat, mlib_MatrixMulS_S8C_S8C_Mod, mlib_MatrixMulS_S8C_S8C_Sat, mlib_MatrixMulS_S16_U8_Mod, mlib_MatrixMulS_S16_U8_Sat, mlib_MatrixMulS_S16_S8_Mod, mlib_MatrixMulS_S16_S8_Sat, mlib_MatrixMulS_S16_S16_Mod, mlib_MatrixMulS_S16_S16_Sat, mlib_MatrixMulS_S16C_U8C_Mod, mlib_MatrixMulS_S16C_U8C_Sat, mlib_MatrixMulS_S16C_S8C_Mod, mlib_MatrixMulS_S16C_S8C_Sat, mlib_MatrixMulS_S16C_S16C_Mod, mlib_MatrixMulS_S16C_S16C_Sat, mlib_MatrixMulS_S32_S16_Mod, mlib_MatrixMulS_S32_S16_Sat, mlib_MatrixMulS_S32_S32_Mod, mlib_MatrixMulS_S32_S32_Sat – matrix multiplication by scalar

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include "mlib.h"

mlib_status mlib_MatrixMulS_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_U8C_Mod(mlib_s16c *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_U8C_Sat(mlib_s16c *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_S8C_Mod(mlib_s16c *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_S8C_Sat(mlib_s16c *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_S16C_Mod(mlib_s16c *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16C_S16C_Sat(mlib_s16c *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixMulS_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixMulS_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);

Description Each of these functions multiplies a matrix by a scalar.

For real data, the following equation is used:

\[ z[i] = c[0] \times x[i] \]
where $i = 0, 1, \ldots, (mn - 1)$.

For complex data, the following equation is used:

$$
\begin{align*}
    z[2i] &= c[0]*x[2i] - c[1]*x[2i + 1] \\
    z[2i + 1] &= c[1]*x[2i] + c[0]*x[2i + 1]
\end{align*}
$$

where $i = 0, 1, \ldots, (mn - 1)$.

**Parameters**

Each of the functions takes the following arguments:

- $z$ Pointer to the destination matrix.
- $x$ Pointer to the source matrix.
- $c$ Pointer to the source scalar. When the function is used with complex data types, $c[0]$ contains the scalar for the real part, and $c[1]$ contains the scalar for the imaginary part.
- $m$ Number of rows in each matrix.
- $n$ Number of columns in each matrix.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

`mlib_MatrixMulS_U8_U8_Mod(3MLIB)`, attributes(5)
Name mlib_MatrixMul_U8_U8_Mod, mlib_MatrixMul_U8_U8_Sat, mlib_MatrixMul_U8C_U8C_Mod, mlib_MatrixMul_U8C_U8C_Sat, mlib_MatrixMul_S8_S8_Mod, mlib_MatrixMul_S8_S8_Sat, mlib_MatrixMul_S8C_S8C_Mod, mlib_MatrixMul_S8C_S8C_Sat, mlib_MatrixMul_S16_U8_Mod, mlib_MatrixMul_S16_U8_Sat, mlib_MatrixMul_S16_S8_Mod, mlib_MatrixMul_S16_S8_Sat, mlib_MatrixMul_S16_S16_Mod, mlib_MatrixMul_S16_S16_Sat, mlib_MatrixMul_S16C_U8C_Mod, mlib_MatrixMul_S16C_U8C_Sat, mlib_MatrixMul_S16C_S8C_Mod, mlib_MatrixMul_S16C_S8C_Sat, mlib_MatrixMul_S32_S16_Mod, mlib_MatrixMul_S32_S16_Sat, mlib_MatrixMul_S32_S32_Mod, mlib_MatrixMul_S32_S32_Sat – matrix multiplication

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixMul_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16C_U8C_Mod(mlib_s16C *z, const mlib_u8C *x,
const mlib_u8C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16C_U8C_Sat(mlib_s16C *z, const mlib_u8C *x,
const mlib_u8C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16C_S8C_Mod(mlib_s16C *z, const mlib_s8C *x,
const mlib_s8C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16C_S8C_Sat(mlib_s16C *z, const mlib_s8C *x,
const mlib_s8C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16C_S16C_Mod(mlib_s16C *z, const mlib_s16C *x,
const mlib_s16C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16C_S16C_Sat(mlib_s16C *z, const mlib_s16C *x,
const mlib_s16C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S16C_Mod(mlib_s32C *z, const mlib_s16C *x,
const mlib_s16C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S16C_Sat(mlib_s32C *z, const mlib_s16C *x,
const mlib_s16C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S32C_Mod(mlib_s32C *z, const mlib_s32C *x,
const mlib_s32C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S32C_Sat(mlib_s32C *z, const mlib_s32C *x,
const mlib_s32C *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
Each of these functions performs matrix multiplication of the first matrix to the second matrix or the first complex matrix to the second complex matrix.

For real data, the following equation is used:

Description

mlib_status mlib_MatrixMul_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
mlib_status mlib_MatrixMul_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 l, mlib_s32 n);
\[ z[i*n + j] = \sum_{k=0}^{l-1} (x[i*l + k] * y[k*n + j]) \]

where \( i = 0, 1, \ldots, (m - 1); \quad j = 0, 1, \ldots, (n - 1). \)

For complex data, the following equation is used:

\[
\begin{align*}
  z[2*(i*n + j)] &= \sum_{k=0}^{l-1} (xR*yR - xI*yI) \\
  z[2*(i*n + j) + 1] &= \sum_{k=0}^{l-1} (xR*yI + xI*yR)
\end{align*}
\]

where

\[
\begin{align*}
  xR &= x[2*(i*l + k)] \\
  xI &= x[2*(i*l + k) + 1] \\
  yR &= y[2*(k*n + j)] \\
  yI &= y[2*(k*n + j) + 1] \\
  i &= 0, 1, \ldots, (m - 1) \\
  j &= 0, 1, \ldots, (n - 1)
\end{align*}
\]

**Parameters**

Each of the functions takes the following arguments:

- \( z \) Pointer to the destination matrix.
- \( x \) Pointer to the first source matrix.
- \( y \) Pointer to the second source matrix.
- \( m \) Number of rows in the first matrix.
- \( l \) Number of columns in the first matrix, and number of rows in the second matrix.
- \( n \) Number of columns in the second matrix.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also  mlib_MatrixMulShift_S16_S16_Mod(3MLIB), attributes(5)
Name mlib_MatrixScale_U8_Mod, mlib_MatrixScale_U8_Sat, mlib_MatrixScale_U8C_Mod, 
mlib_MatrixScale_U8C_Sat, mlib_MatrixScale_S8_Mod, mlib_MatrixScale_S8_Sat, 
mlib_MatrixScale_S8C_Mod, mlib_MatrixScale_S8C_Sat, mlib_MatrixScale_S16_Mod, 
mlib_MatrixScale_S16_Sat, mlib_MatrixScale_S16C_Mod, mlib_MatrixScale_S16C_Sat, 
mlib_MatrixScale_S32_Mod, mlib_MatrixScale_S32_Sat, mlib_MatrixScale_S32C_Mod, 
mlib_MatrixScale_S32C_Sat - matrix linear scaling, in place

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixScale_U8_Mod(mlib_u8 *xz, const mlib_u8 *a,
const mlib_u8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_U8_Sat(mlib_u8 *xz, const mlib_u8 *a,
const mlib_u8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_U8C_Mod(mlib_u8 *xz, const mlib_u8 *a,
const mlib_u8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_U8C_Sat(mlib_u8 *xz, const mlib_u8 *a,
const mlib_u8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S8_Mod(mlib_s8 *xz, const mlib_s8 *a,
const mlib_s8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S8_Sat(mlib_s8 *xz, const mlib_s8 *a,
const mlib_s8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S8C_Mod(mlib_s8 *xz, const mlib_s8 *a,
const mlib_s8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S8C_Sat(mlib_s8 *xz, const mlib_s8 *a,
const mlib_s8 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S16_Mod(mlib_s16 *xz, const mlib_s16 *a,
const mlib_s16 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S16_Sat(mlib_s16 *xz, const mlib_s16 *a,
const mlib_s16 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S16C_Mod(mlib_s16 *xz, const mlib_s16 *a,
const mlib_s16 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S16C_Sat(mlib_s16 *xz, const mlib_s16 *a,
const mlib_s16 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S32_Mod(mlib_s32 *xz, const mlib_s32 *a,
const mlib_s32 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S32_Sat(mlib_s32 *xz, const mlib_s32 *a,
const mlib_s32 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S32C_Mod(mlib_s32 *xz, const mlib_s32 *a,
const mlib_s32 *b, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixScale_S32C_Sat(mlib_s32 *xz, const mlib_s32 *a, const mlib_s32 *b, mlib_s32 m, mlib_s32 n);

Description Each of these functions performs an in-place multiplication of a matrix by a scalar and then adds an offset.

For real data, the following equation is used:

\[ xz[i] = a[0] \times xz[i] + b[0] \]

where \( i = 0, 1, \ldots, (m \times n - 1) \).

For complex data, the following equation is used:

\[

tmp = xz[2*i] \\
xz[2*i] = a[0] \times tmp - a[1] \times xz[2*i + 1] + b[0] \\
xz[2*i + 1] = a[1] \times tmp + a[0] \times xz[2*i + 1] + b[1]
\]

where \( i = 0, 1, \ldots, (m \times n - 1) \).

Parameters Each of the functions takes the following arguments:

- \( xz \): Pointer to the source and destination matrix.
- \( a \): Pointer to the source scaling factor. When the function is used with complex data types, \( a[0] \) contains the scalar for the real part, and \( a[1] \) contains the scalar for the imaginary part.
- \( b \): Pointer to the source offset. When the function is used with complex data types, \( b[0] \) contains the offset for the real part, and \( b[1] \) contains the offset for the imaginary part.
- \( m \): Number of rows in the matrix.
- \( n \): Number of columns in the matrix.

Return Values Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_MatrixScale_U8_U8_Mod(3MLIB), attributes(5)
Name

mlib_MatrixScale_U8_U8_Mod, mlib_MatrixScale_U8_U8_Sat,
mlib_MatrixScale_U8C_U8C_Mod, mlib_MatrixScale_U8C_U8C_Sat,
mlib_MatrixScale_S8_S8_Mod, mlib_MatrixScale_S8_S8_Sat,
mlib_MatrixScale_S8C_S8C_Mod, mlib_MatrixScale_S8C_S8C_Sat,
mlib_MatrixScale_S16_U8_Mod, mlib_MatrixScale_S16_U8_Sat,
mlib_MatrixScale_S16_S8_Mod, mlib_MatrixScale_S16_S8_Sat,
mlib_MatrixScale_S16_S16_Mod, mlib_MatrixScale_S16_S16_Sat,
mlib_MatrixScale_S16C_U8C_Mod, mlib_MatrixScale_S16C_U8C_Sat,
mlib_MatrixScale_S16C_S8C_Mod, mlib_MatrixScale_S16C_S8C_Sat,
mlib_MatrixScale_S16C_S16C_Mod, mlib_MatrixScale_S16C_S16C_Sat,
mlib_MatrixScale_S32_S16_Mod, mlib_MatrixScale_S32_S16_Sat,
mlib_MatrixScale_S32_S32_Mod, mlib_MatrixScale_S32_S32_Sat
– matrix linear scaling

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixScale_U8_U8_Mod(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_U8_U8_Sat(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_U8C_U8C_Mod(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_U8C_U8C_Sat(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S8_S8_Mod(mlib_s8 *z,
            const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S8_S8_Sat(mlib_s8 *z,
            const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S8C_S8C_Mod(mlib_s8 *z,
            const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S8C_S8C_Sat(mlib_s8 *z,
            const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_S16_Mod(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_S16_Sat(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S32_S32_Mod(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S32_S32_Sat(mlib_u8 *z,
            const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b,
            mlib_s32 m, mlib_s32 n);

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mlib_status mlib_MatrixScale_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *a, const mlib_s16 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *a, const mlib_s16 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *a, const mlib_u8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *a, const mlib_s8 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *a, const mlib_s16 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *a, const mlib_s16 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *a, const mlib_s16 *b, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixScale_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *a, const mlib_s16 *b, mlib_s32 m, mlib_s32 n);
Each of these functions multiplies a matrix by a scalar and then adds an offset.

For real data, the following equation is used:

\[ z[i] = a[0] \times x[i] + b[0] \]

where \( i = 0, 1, \ldots, (m \times n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
z[2i] & = a[0] \times x[2i] - a[1] \times x[2i + 1] + b[0] \\
z[2i + 1] & = a[1] \times x[2i] + a[0] \times x[2i + 1] + b[1]
\end{align*}
\]

where \( i = 0, 1, \ldots, (m \times n - 1) \).

**Parameters**

Each of the functions takes the following arguments:

- \( z \) Pointer to the destination matrix.
- \( x \) Pointer to the source matrix.
- \( a \) Pointer to the source scaling factor. When the function is used with complex data types, \( a[0] \) contains the scalar for the real part, and \( a[1] \) contains the scalar for the imaginary part.
- \( b \) Pointer to the source offset. When the function is used with complex data types, \( b[0] \) contains the offset for the real part, and \( b[1] \) contains the offset for the imaginary part.
- \( m \) Number of rows in each matrix.
- \( n \) Number of columns in each matrix.
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
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<tr>
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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_MatrixScale_U8_U8_Mod(3MLIB), attributes(5)
Name  
mlib_MatrixSubS_U8_Mod, mlib_MatrixSubS_U8_Sat, mlib_MatrixSubS_U8C_Mod,  
mlib_MatrixSubS_U8C_Sat, mlib_MatrixSubS_S8_Mod, mlib_MatrixSubS_S8_Sat,  
mlib_MatrixSubS_S8C_Mod, mlib_MatrixSubS_S8C_Sat, mlib_MatrixSubS_S16_Mod,  
mlib_MatrixSubS_S16_Sat, mlib_MatrixSubS_S16C_Mod, mlib_MatrixSubS_S16C_Sat,  
mlib_MatrixSubS_S32_Mod, mlib_MatrixSubS_S32_Sat, mlib_MatrixSubS_S32C_Mod,  
mlib_MatrixSubS_S32C_Sat – matrix subtraction from scalar, in place

Synopsis  
cc [ flag... ] file... -o file -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_MatrixSubS_U8_Mod(mlib_u8 *xz, const mlib_u8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_U8_Sat(mlib_u8 *xz, const mlib_u8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_U8C_Mod(mlib_u8 *xz, const mlib_u8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_U8C_Sat(mlib_u8 *xz, const mlib_u8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S8_Mod(mlib_s8 *xz, const mlib_s8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S8_Sat(mlib_s8 *xz, const mlib_s8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S8C_Mod(mlib_s8 *xz, const mlib_s8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S8C_Sat(mlib_s8 *xz, const mlib_s8 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S16_Mod(mlib_s16 *xz, const mlib_s16 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S16_Sat(mlib_s16 *xz, const mlib_s16 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S16C_Mod(mlib_s16 *xz, const mlib_s16 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S16C_Sat(mlib_s16 *xz, const mlib_s16 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S32_Mod(mlib_s32 *xz, const mlib_s32 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S32_Sat(mlib_s32 *xz, const mlib_s32 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S32C_Mod(mlib_s32 *xz, const mlib_s32 *c,  
  mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSubS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c, mlib_s32 m, mlib_s32 n);

Description  Each of these functions performs an in-place subtraction of a matrix from a scalar.

For real data, the following equation is used:

\[ xz[i] = c[0] - xz[i] \]

where \( i = 0, 1, \ldots, (m*n - 1) \).

For complex data, the following equation is used:

\[ xz[2*i] = c[0] - xz[2*i] \]

where \( i = 0, 1, \ldots, (m*n - 1) \).

Parameters  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the source and destination matrix.
- \( c \)  Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( m \)  Number of rows in the matrices.
- \( n \)  Number of columns in the matrices.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_MatrixSubS_U8_U8_Mod(3MLIB), attributes(5)
Name

mlib_MatrixSubS_U8_U8_Mod, mlib_MatrixSubS_U8_U8_Sat,
mlib_MatrixSubS_U8C_U8C_Mod, mlib_MatrixSubS_U8C_U8C_Sat,
mlib_MatrixSubS_S8_S8_Mod, mlib_MatrixSubS_S8_S8_Sat,
mlib_MatrixSubS_S8C_S8C_Mod, mlib_MatrixSubS_S8C_S8C_Sat,
mlib_MatrixSubS_S16_U8_Mod, mlib_MatrixSubS_S16_U8_Sat,
mlib_MatrixSubS_S16_S8_Mod, mlib_MatrixSubS_S16_S8_Sat,
mlib_MatrixSubS_S16_S16_Mod, mlib_MatrixSubS_S16_S16_Sat,
mlib_MatrixSubS_S16C_U8C_Mod, mlib_MatrixSubS_S16C_U8C_Sat,
mlib_MatrixSubS_S16C_S8C_Mod, mlib_MatrixSubS_S16C_S8C_Sat,
mlib_MatrixSubS_S16C_S16C_Mod, mlib_MatrixSubS_S16C_S16C_Sat,
mlib_MatrixSubS_S32_S16_Mod, mlib_MatrixSubS_S32_S16_Sat,
mlib_MatrixSubS_S32_S32_Mod, mlib_MatrixSubS_S32_S32_Sat – matrix
subtraction from scalar

Synopsis

cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_MatrixSubS_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x,
    const mlib_u8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
    const mlib_s8 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16c *x,
    const mlib_s16c *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16c *x,
    const mlib_s16c *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
    const mlib_s16 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
    const mlib_s32 *c, mlib_s32 m, mlib_s32 n);

mlib_status mlib_MatrixSubS_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
    const mlib_s32 *c, mlib_s32 m, mlib_s32 n);
Each of these functions subtracts a matrix from a scalar.

For real data, the following equation is used:

\[ z[i] = c[0] - x[i] \]
where \( i = 0, 1, \ldots, (m\times n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
z[2i] & = c[0] - x[2i] \\
z[2i + 1] & = c[1] - x[2i + 1]
\end{align*}
\]

where \( i = 0, 1, \ldots, (m\times n - 1) \).

**Parameters**
Each of the functions takes the following arguments:

- \( z \) Pointer to the destination matrix.
- \( x \) Pointer to the source matrix.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( m \) Number of rows in the matrices.
- \( n \) Number of columns in the matrices.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_MatrixSubS_U8_U8_Mod(3MLIB), attributes(5)
Name  
mlib_MatrixSub_U8_Mod, mlib_MatrixSub_U8_Sat, mlib_MatrixSub_U8C_Mod,  
mlib_MatrixSub_U8C_Sat, mlib_MatrixSub_S8_Mod, mlib_MatrixSub_S8_Sat,  
mlib_MatrixSub_S8C_Mod, mlib_MatrixSub_S8C_Sat, mlib_MatrixSub_S16_Mod,  
mlib_MatrixSub_S16_Sat, mlib_MatrixSub_S16C_Mod, mlib_MatrixSub_S16C_Sat,  
mlib_MatrixSub_S32_Mod, mlib_MatrixSub_S32_Sat, mlib_MatrixSub_S32C_Mod,  
mlib_MatrixSub_S32C_Sat – matrix subtraction, in place 

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h> 
mlib_status mlib_MatrixSub_U8_Mod(mlib_u8 *xz,  
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_U8_Sat(mlib_u8 *xz,  
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_U8C_Mod(mlib_u8 *xz,  
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_U8C_Sat(mlib_u8 *xz,  
    const mlib_u8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S8_Mod(mlib_s8 *xz,  
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S8_Sat(mlib_s8 *xz,  
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S8C_Mod(mlib_s8 *xz,  
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S8C_Sat(mlib_s8 *xz,  
    const mlib_s8 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S16_Mod(mlib_s16 *xz,  
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S16_Sat(mlib_s16 *xz,  
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S16C_Mod(mlib_s16 *xz,  
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S16C_Sat(mlib_s16 *xz,  
    const mlib_s16 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S32_Mod(mlib_s32 *xz,  
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S32_Sat(mlib_s32 *xz,  
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S32C_Mod(mlib_s32 *xz,  
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);  
mlib_status mlib_MatrixSub_S32C_Sat(mlib_s32 *xz,  
    const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32C_Sat(mlib_s32 *xz,
        const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

**Description**  Each of these functions performs an in-place subtraction of the second matrix from the first matrix.

It uses the following equation:

\[ xz[i] = xz[i] - y[i] \]

where \( i = 0, 1, \ldots, (m*n - 1) \) for real data; \( i = 0, 1, \ldots, (m*n*2 - 1) \) for complex data.

**Parameters**  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the first source and destination matrix.
- \( y \)  Pointer to the second source matrix.
- \( m \)  Number of rows in the matrices.
- \( n \)  Number of columns in the matrices.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
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</tr>
</tbody>
</table>

**See Also**  mlib_MatrixSub_U8_U8_Mod(3MLIB), attributes(5)
Name  mlib_MatrixSub_U8_U8_Mod, mlib_MatrixSub_U8_U8_Sat,
       mlib_MatrixSub_U8C_U8C_Mod, mlib_MatrixSub_U8C_U8C_Sat,
       mlib_MatrixSub_S8_S8_Mod, mlib_MatrixSub_S8_S8_Sat,
       mlib_MatrixSub_S8C_S8C_Mod, mlib_MatrixSub_S8C_S8C_Sat,
       mlib_MatrixSub_S16_U8_Mod, mlib_MatrixSub_S16_U8_Sat,
       mlib_MatrixSub_S16_S8_Mod, mlib_MatrixSub_S16_S8_Sat,
       mlib_MatrixSub_S16_S16_Mod, mlib_MatrixSub_S16_S16_Sat,
       mlib_MatrixSub_S16C_S16C_Mod, mlib_MatrixSub_S16C_S16C_Sat,
       mlib_MatrixSub_S32_S16_Mod, mlib_MatrixSub_S32_S16_Sat,
       mlib_MatrixSub_S32_S32_Mod, mlib_MatrixSub_S32_S32_Sat,
       mlib_MatrixSub_S32C_S32C_Mod, mlib_MatrixSub_S32C_S32C_Sat – matrix subtraction

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_MatrixSub_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
           const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
           const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
           const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
           const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
           const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
           const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
           const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
           const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
           const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
           const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x,
           const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x,
           const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
           const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
           const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);
mlib_status mlib_MatrixSub_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 m, mlib_s32 n);

**Description**

Each of these functions subtracts the second matrix from the first matrix.

It uses the following equation:

\[ z[i] = x[i] - y[i] \]

where \( i = 0, 1, \ldots, (m\times n - 1) \) for real data; \( i = 0, 1, \ldots, (m\times n\times 2 - 1) \) for complex data.
Each of the functions takes the following arguments:

- **z**: Pointer to the destination matrix.
- **x**: Pointer to the first source matrix.
- **y**: Pointer to the second source matrix.
- **m**: Number of rows in the matrices.
- **n**: Number of columns in the matrices.

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also **mlib_MatrixSub_U8_Mod(3MLIB)**, attributes(5)
Each of these functions performs an in-place transpose of a square matrix.

For real data, the following pseudo code applies:

```c
for (i = 1; i < mn; i++) {
    for (j = 0; j < i; j++) {
        tmp = xz[i*mn + j];
        xz[i*mn + j] = xz[j*mn + i];
        xz[j*mn + i] = tmp;
    }
}
```

For complex data, the following pseudo code applies:

```c
for (i = 1; i < mn; i++) {
    for (j = 0; j < i; j++) {
        tmp0 = xz[2*(i*mn + j)];
        tmp1 = xz[2*(i*mn + j) + 1];
        xz[2*(i*mn + j)] = xz[2*(j*mn + i)];
        xz[2*(i*mn + j) + 1] = xz[2*(j*mn + i) + 1];
        xz[2*(j*mn + i)] = tmp0;
        xz[2*(j*mn + i) + 1] = tmp1;
    }
}
```

Each of the functions takes the following arguments:

- `xz`  Pointer to the source and destination matrix.
- `mn`  Number of rows and columns in the matrix.
Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_MatrixTranspose_U8(3MLIB), attributes(5)
Each of these functions computes the transpose of the input matrix.

For real data, the following equation is used:

\[ z[j \cdot m + i] = x[i \cdot n + j] \]

where \( i = 0, 1, \ldots, (m - 1) \); \( j = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[ z[2 \cdot (j \cdot m + i)] = x[2 \cdot (i \cdot n + j)] \]
\[ z[2 \cdot (j \cdot m + i) + 1] = x[2 \cdot (i \cdot n + j) + 1] \]

where \( i = 0, 1, \ldots, (m - 1) \); \( j = 0, 1, \ldots, (n - 1) \).

Parameters

- \( z \)   Pointer to the destination matrix. The output data type must be the same as the input data type.
- \( x \)   Pointer to the source matrix.
- \( m \)   Number of rows in the source matrix.
\textbf{n} Number of columns in the source matrix.

\textbf{Return Values} Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

\textbf{Attributes} See \texttt{attributes(5)} for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

\textbf{See Also} \texttt{mlib\_MatrixTranspose\_U8(3MLIB)}, \texttt{attributes(5)}
mlib_MatrixUnit_U8(3MLIB)

Name  mlib_MatrixUnit_U8, mlib_MatrixUnit_U8C, mlib_MatrixUnit_S8, mlib_MatrixUnit_S8C,
       mlib_MatrixUnit_S16, mlib_MatrixUnit_S16C, mlib_MatrixUnit_S32,
       mlib_MatrixUnit_S32C – Unit matrix generation

Synopsis  cc [ flag... ] file... -lmllib [ library... ]
          #include <mlib.h>

          mlib_status mlib_MatrixUnit_U8(mlib_u8 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_U8C(mlib_u8 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_S8(mlib_s8 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_S8C(mlib_s8 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_S16(mlib_s16 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_S16C(mlib_s16 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_S32(mlib_s32 *z, mlib_s32 n);
          mlib_status mlib_MatrixUnit_S32C(mlib_s32 *z, mlib_s32 n);

Description  Each of these functions sets the values for a unit matrix.

For real data, the following equation is used:

\[ z[i*n + j] = 1 \text{ if } i == j \]
\[ z[i*n + j] = 0 \text{ if } i != j \]

where \( i = 0, 1, \ldots, (n - 1) \); \( j = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[ z[2*(i*n + j)] = 1 \text{ if } i == j \]
\[ z[2*(i*n + j)] = 0 \text{ if } i != j \]
\[ z[2*(i*n + j) + 1] = 0 \]

where \( i = 0, 1, \ldots, (n - 1) \); \( j = 0, 1, \ldots, (n - 1) \).

Parameters  Each of the functions takes the following arguments:

\( z \)  Pointer to the destination matrix.
\( n \)  Number of rows and columns in the matrix.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
</tbody>
</table>
### mlib_MatrixUnit_U8(3MLIB)

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
attributes(5)
mlib_memcpy(3MLIB)

Name
mlib_memcpy — copy a block of bytes

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void *mlib_memcpy(void *dst, const void *src, size_t n);

Description
The mlib_memcpy() function copies n bytes from memory area src to dst. It returns dst. The memory areas may not overlap. Use mlib_memmove() if the memory areas do overlap.

This function is a wrapper of the standard C function memcpy().

Parameters
The function takes the following arguments:

dst  Pointer to the destination.
src  Pointer to the source.
n  Number of bytes to be copied.

Return Values
The function returns a pointer to the destination.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_memmove(3MLIB), mlib_memset(3MLIB), memory(3C), attributes(5)
### mlib_memmove(3MLIB)

**Name**    
mlib_memmove – copy a block of bytes

**Synopsis**  
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void *mlib_memmove(void *dst, const void *src, size_t n);
```

**Description**  
The `mlib_memmove()` function copies `n` bytes from memory area `src` to `dst`. Copying between objects that overlap will take place correctly. It returns `dst`.

This function is a wrapper of the standard C function `memmove()`.

**Parameters**  
The function takes the following arguments:
- `dst`  
  Pointer to the destination.
- `src`  
  Pointer to the source.
- `n`  
  Number of bytes to be copied.

**Return Values**  
The function returns a pointer to the destination.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
`mlib_memcpy(3MLIB)`, `mlib_memset(3MLIB)`, `memory(3C)`, `attributes(5)`
The `mlib_memset()` function sets the first `n` bytes in memory area `s` to the value of `c` (converted to an unsigned char). It returns `s`.

This function is a wrapper of the standard C function `memset()`.

**Parameters**

The function takes the following arguments:

- `s`  Pointer to the destination.
- `c`  Value to set.
- `n`  Number of bytes to be set.

**Return Values**

The function returns a pointer to the destination.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also `mlib_memcpy(3MLIB), mlib_memmove(3MLIB), memory(3C), attributes(5)`
### mlib_realloc(3MLIB)

**Name**  
mlib_realloc — reallocate a block of bytes

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
void *mlib_realloc(void *ptr, size_t size);
```

**Description**  
The `mlib_realloc()` function changes the size of the block pointed to by `ptr` to `size` bytes and returns a pointer to the (possibly moved) block.

This function is a wrapper of the standard C function `realloc()`.

**Parameters**  
The function takes the following arguments:

- `size`  
  New size of the block in bytes.

- `ptr`  
  Pointer to a block.

**Return Values**  
The function returns a pointer to the reallocated block if successful. Otherwise it returns a null pointer.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
mlib_free(3MLIB), mlib_malloc(3MLIB), malloc(3C), attributes(5)
mlib_SignalADPCM2Bits2Linear – adaptive differential pulse code modulation (ADPCM)

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalADPCM2Bits2Linear(mlib_s16 *pcm,
    const mlib_u8 *adpcm, void *state, mlib_s32 n);

The **mlib_SignalADPCM2Bits2Linear**() function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from G.723 or G.726 16kbps 2-bit ADPCM to 16-bit linear PCM format.

**Parameters**

- *pcm* Linear PCM sample array.
- *adpcm* ADPCM code array.
- *state* Internal structure of the codec.
- *n* Number of samples in the source array.

**Return Values**

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

- mlib_SignalADPCM3Bits2Linear(3MLIB)
- mlib_SignalADPCM4Bits2Linear(3MLIB)
- mlib_SignalADPCM5Bits2Linear(3MLIB)
- mlib_SignalADPCMFree(3MLIB)
- mlib_SignalADPCMInit(3MLIB)
- mlib_SignalLinear2ADPCM2Bits(3MLIB)
- mlib_SignalLinear2ADPCM3Bits(3MLIB)
- mlib_SignalLinear2ADPCM4Bits(3MLIB)
- mlib_SignalLinear2ADPCM5Bits(3MLIB)
- attributes(5)
The `mlib_SignalADPCM3Bits2Linear()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from G.723 or G.726 24kbps 3-bit ADPCM to 16-bit linear PCM format.

### Parameters

- **pcm**: Linear PCM sample array.
- **adpcm**: ADPCM code array.
- **state**: Internal structure of the codec.
- **n**: Number of samples in the source array.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_SignalADPCM2Bits2Linear(3MLIB)`, `mlib_SignalADPCM4Bits2Linear(3MLIB)`, `mlib_SignalADPCM5Bits2Linear(3MLIB)`, `mlib_SignalADPCMFree(3MLIB)`, `mlib_SignalADPCMInit(3MLIB)`, `mlib_SignalLinear2ADPCM2Bits(3MLIB)`, `mlib_SignalLinear2ADPCM3Bits(3MLIB)`, `mlib_SignalLinear2ADPCM4Bits(3MLIB)`,
### mlib_SignalADPCM4Bits2Linear

**Name**
mlib_SignalADPCM4Bits2Linear – adaptive differential pulse code modulation (ADPCM)

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalADPCM4Bits2Linear(mlib_s16 *pcm,
                         const mlib_u8 *adpcm, void *state, mlib_s32 n);
```

**Description**
The `mlib_SignalADPCM4Bits2Linear()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from G.721 or G.726 32kbps 4-bit ADPCM to 16-bit linear PCM format.

**Parameters**
The function takes the following arguments:
- `pcm` Linear PCM sample array.
- `adpcm` ADPCM code array.
- `state` Internal structure of the codec.
- `n` Number of samples in the source array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_SignalADPCM2Bits2Linear(3MLIB), mlib_SignalADPCM3Bits2Linear(3MLIB), mlib_SignalADPCM5Bits2Linear(3MLIB), mlib_SignalADPCMFree(3MLIB), mlib_SignalADPCMInit(3MLIB), mlib_SignalLinear2ADPCM2Bits(3MLIB), mlib_SignalLinear2ADPCM3Bits(3MLIB), mlib_SignalLinear2ADPCM4Bits(3MLIB), mlib_SignalLinear2ADPCM5Bits(3MLIB), attributes(5)
The `mlib_SignalADPCM5Bits2Linear()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from G.723 or G.726 40kbps 5-bit ADPCM to 16-bit linear PCM format.

The function takes the following arguments:

- `pcm` Linear PCM sample array.
- `adpcm` ADPCM code array.
- `state` Internal structure of the codec.
- `n` Number of samples in the source array.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_SignalADPCM2Bits2Linear(3MLIB), mlib_SignalADPCM3Bits2Linear(3MLIB), mlib_SignalADPCM4Bits2Linear(3MLIB), mlib_SignalADPCMFree(3MLIB), mlib_SignalADPCMInit(3MLIB), mlib_SignalLinear2ADPCM2Bits(3MLIB), mlib_SignalLinear2ADPCM3Bits(3MLIB), mlib_SignalLinear2ADPCM4Bits(3MLIB), mlib_SignalLinear2ADPCM5Bits(3MLIB), attributes(5)`
**Name**
mplib\_Signal\_ADPCM\_Free – adaptive differential pulse code modulation (ADPCM)

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib\_Signal\_ADPCM\_Free(void *state);
```

**Description**
The `mlib\_Signal\_ADPCM\_Free()` function frees the internal structure for the codec for functions that perform adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications.

**Parameters**
The function takes the following arguments:
- `state` Internal structure of the codec.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib\_Signal\_ADPCM\_2\_Bits\_2\_Linear(3MLIB), mlib\_Signal\_ADPCM\_3\_Bits\_2\_Linear(3MLIB), mlib\_Signal\_ADPCM\_4\_Bits\_2\_Linear(3MLIB), mlib\_Signal\_ADPCM\_5\_Bits\_2\_Linear(3MLIB), mlib\_Signal\_ADPCM\_Init(3MLIB), mlib\_Signal\_Linear\_2\_ADPCM\_2\_Bits(3MLIB), mlib\_Signal\_Linear\_2\_ADPCM\_3\_Bits(3MLIB), mlib\_Signal\_Linear\_2\_ADPCM\_4\_Bits(3MLIB), mlib\_Signal\_Linear\_2\_ADPCM\_5\_Bits(3MLIB), attributes(5)
mlib_SignalADPCMInit() function creates the internal structure for the codec for functions that perform adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications.

The function takes the following arguments:

*state* Internal structure of the codec.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalADPCMInit(void **state);
```

**Description**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

*mlib_SignalADPCM2Bits2Linear(3MLIB)*, *mlib_SignalADPCM3Bits2Linear(3MLIB)*, *mlib_SignalADPCM4Bits2Linear(3MLIB)*, *mlib_SignalADPCM5Bits2Linear(3MLIB)*, *mlib_SignalADPCMFree(3MLIB)*, *mlib_SignalLinear2ADPCM2Bits(3MLIB)*, *mlib_SignalLinear2ADPCM3Bits(3MLIB)*, *mlib_SignalLinear2ADPCM4Bits(3MLIB)*, *mlib_SignalLinear2ADPCM5Bits(3MLIB)*, attributes(5)
The `mlib_SignalALaw2Linear()` function performs ITU G.711 m-law and A-law compression and decompression in compliance with the ITU (Former CCITT) G.711 specification.

**Parameters**
The function takes the following arguments:

- `pcm` Linear PCM sample array.
- `acode` A-law code array.
- `n` Number of samples in the source array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
- `mlib_SignalALaw2uLaw(3MLIB)`, `mlib_Signal2uLaw2ALaw(3MLIB)`,
- `mlib_SignalLinear2uLaw(3MLIB)`, `mlib_SignaluLaw2ALaw(3MLIB)`,
- `mlib_SignaluLaw2Linear(3MLIB)`, attributes(5)
The `mlib_SignalALaw2uLaw()` function performs ITU G.711 m-law and A-law compression and decompression in compliance with the ITU (Former CCITT) G.711 specification.

**Parameters**
The function takes the following arguments:

- `ucode` m-law code array.
- `acode` A-law code array.
- `n` Number of samples in the source array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
`mlib_SignalALaw2Linear(3MLIB), mlib_SignalLinear2ALaw(3MLIB), mlib_SignalLinear2uLaw(3MLIB), mlib_SignaluLaw2ALaw(3MLIB), mlib_SignaluLaw2Linear(3MLIB), attributes(5)`
Each of these functions performs auto-correlation.

For monaural signals, the following equation is used:

\[
\text{correl}[0] = \frac{1}{n-d-1} \sum_{i=0}^{n-d} (\text{src}[i] * \text{src}[i + d])
\]

For stereo signals, the following equation is used:

\[
\text{correl}[0] = \frac{1}{n-d-1} \sum_{i=0}^{n-d} (\text{src}[2*i] * \text{src}[2*(i + d)])
\]
\[
\text{correl}[1] = \frac{1}{n-d-1} \sum_{i=0}^{n-d} (\text{src}[2*i + 1] * \text{src}[2*(i + d) + 1])
\]

where \(d = \text{disp}\).

Parameters

- \(\text{correl}\) Pointer to the auto-correlation array. In the stereo version, \(\text{correl}[0]\) contains the auto-correlation of channel 0, and \(\text{correl}[1]\) contains the auto-correlation of channel 1.
- \(\text{src}\) Source signal array.
- \(\text{disp}\) Displacement. \(0 \leq \text{disp} < n\).
- \(n\) Number of samples in the source signal array.
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTETYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalCrossCorrel_S16(3MLIB), attributes(5)
The `mlib_SignalCepstral_F32()` function performs cepstral analysis.

The basic operations to compute the cepstrum is shown below.

<table>
<thead>
<tr>
<th>Fourier</th>
<th></th>
<th></th>
<th></th>
<th>Inverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>-----&gt;</td>
<td></td>
<td>-----</td>
<td></td>
<td>Fourier</td>
</tr>
<tr>
<td>x(n)</td>
<td>Transform</td>
<td>X(k)</td>
<td></td>
<td>X'(k)</td>
</tr>
</tbody>
</table>

where \( x(n) \) is the input signal and \( c(n) \) is its cepstrum. In mathematics, they are

\[
X(k) = \sum_{n=0}^{N-1} x(n) \cdot \exp\left(-j\frac{2\pi k n}{N}\right)
\]

\[
X'(k) = \log|X(k)|
\]

\[
c(n) = \sum_{n=0}^{N-1} X'(k) \cdot \exp\left(j\frac{2\pi k n}{N}\right)
\]

Since \( X'(k) \) is real and even (symmetric), i.e.

\[
X'(k) = X'(N - k)
\]

the \( c(n) \) is real and the equation becomes Cosine transform.

\[
c(n) = \sum_{n=0}^{N-1} X'(k) \cdot \cos\left(\frac{2\pi k n}{N}\right)
\]

The cepstral coefficients in LPC is a special case of the above.


Parameters
The function takes the following arguments:

- `cepst` The cepstral coefficients.
- `signal` The input signal vector.
- `state` Pointer to the internal state structure.

Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_SignalCepstralInit_F32(3MLIB), mlib_SignalCepstralFree_F32(3MLIB), attributes(5)
mlib_SignalCepstralFree_S16, mlib_SignalCepstralFree_F32 – clean up for cepstral analysis

Synopsis

cc { flag... } file... -lmlib [ library... ]

#include <mlib.h>

void mlib_SignalCepstralFree_S16(void *state);
void mlib_SignalCepstralFree_F32(void *state);

Description

Each of these functions frees the internal state structure for cepstral analysis.

This function cleans up the internal state structure and releases all memory buffers.

Parameters

Each of the functions takes the following arguments:

- state Pointer to the internal state structure.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

mlib_SignalCepstral_S16(3MLIB), mlib_SignalCepstral_F32(3MLIB),
mlib_SignalCepstral_S16_Adp(3MLIB), mlib_SignalCepstralInit_S16(3MLIB),
mlib_SignalCepstralInit_F32(3MLIB), attributes(5)
Name  
mlib_SignalCepstralInit_S16, mlib_SignalCepstralInit_F32 – initialization for cepstral analysis

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalCepstralInit_S16(void *state, mlib_s32 order);
mlib_status mlib_SignalCepstralInit_F32(void *state, mlib_s32 order);

Description  
Each of these functions initializes the internal state structure for cepstral analysis.

The init function performs internal state structure allocation and global initialization. Per function call initialization is done in each function, so the same internal state structure can be reused for multiple function calls.

Parameters  
Each of the functions takes the following arguments:

order  
The order of the input signal vector and the cepstral coefficients, where \( \text{length} = 2^{\text{order}}. \)

state  
Pointer to the internal state structure.

Return Values  
Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

Attributes  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
mlib_SignalCepstral_S16(3MLIB), mlib_SignalCepstral_S16_Adp(3MLIB),
mlib_SignalCepstral_F32(3MLIB), mlib_SignalCepstralFree_S16(3MLIB),
mlib_SignalCepstralFree_F32(3MLIB), attributes(5)
The `mlib_SignalCepstral_S16()` function performs cepstral analysis. The user supplied scaling factor will be used and the output will be saturated if necessary.

The basic operations to compute the cepstrum is shown below.

```
+-----------+ +--------+ +-----------+
| Fourier   | | Inverse |
-----|------|---|------|
-+++++|---| log*|---| Fourier|
-+++++|---|-------|
```

where \( x(n) \) is the input signal and \( c(n) \) is its cepstrum. In mathematics, they are

\[
X(k) = \sum_{n=0}^{N-1} x(n) \cdot \exp(-j\cdot\frac{2\pi k n}{N})
\]

\[
X'(k) = \log|X(k)|
\]

\[
c(n) = -\sum_{n=0}^{N-1} X'(k) \cdot \exp(j\cdot\frac{2\pi k n}{N})
\]

Since \( X'(k) \) is real and even (symmetric), i.e.

\[
X'(k) = X'(N - k)
\]

the \( c(n) \) is real and the equation becomes Cosine transform.

\[
c(n) = -\sum_{n=0}^{N-1} X'(k) \cdot \cos(\frac{2\pi k n}{N})
\]

The cepstral coefficients in LPC is a special case of the above.


The function takes the following arguments:

- **cepst**  The cepstral coefficients.
- **cscale** The scaling factor of cepstral coefficients, where \( \text{actual\_data} = \text{output\_data} \times 2^{-(\cdot \text{scaling\_factor})} \).
- **signal**  The input signal vector, the signal samples are in Q15 format.
- **state**  Pointer to the internal state structure.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
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<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  mlib_SignalCepstralInit_S16(3MLIB), mlib_SignalCepstral_S16_Adp(3MLIB), mlib_SignalCepstralFree_S16(3MLIB), attributes(5)
### mlib_SignalCepstral_S16_Adp(3MLIB)

**Name**  
mlib_SignalCepstral_S16_Adp – perform cepstral analysis

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_SignalCepstral_S16_Adp(mlib_s16 *cepst,
    mlib_s32 *cscale, const mlib_s16 *signal, void *state);
```

**Description**  
The `mlib_SignalCepstral_S16_Adp()` function performs cepstral analysis. The scaling factor of the output data will be calculated based on the actual data.

The basic operations to compute the cepstrum is shown below.

```
+-----------+ +--------+ +-----------+
| Fourier | | | | Inverse |
----->| |----->| log|*| |------>| Fourier |----->
x(n) | Transform | X(k) | | X'(k) | Transform | c(n)
+-----------+ +--------+ +-----------+
```

Where `x(n)` is the input signal and `c(n)` is its cepstrum. In mathematics, they are

\[
X(k) = \sum_{n=0}^{N-1} x(n) \cdot \exp(-j \cdot 2\pi k n / N) \\
X'(k) = \log|X(k)| \\
c(n) = \sum_{n=0}^{N-1} X'(k) \cdot \exp(j \cdot 2\pi k n / N)
\]

Since `X'(k)` is real and even (symmetric), i.e.

\[
X'(k) = X'(N - k)
\]

the `c(n)` is real and the equation becomes Cosine transform.

\[
c(n) = \sum_{n=0}^{N-1} X'(k) \cdot \cos(2\pi k n / N)
\]

The cepstral coefficients in LPC is a special case of the above.


The function takes the following arguments:

- `cepst`  The cepstral coefficients.
- `cscale`  The scaling factor of cepstral coefficients, where `actual_data = output_data * 2**(-scaling_factor)`.
- `signal`  The input signal vector, the signal samples are in Q15 format.
- `state`   Pointer to the internal state structure.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
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<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  `mlib_SignalCepstralInit_S16(3MLIB)`, `mlib_SignalCepstral_S16(3MLIB)`, `mlib_SignalCepstralFree_S16(3MLIB)`, attributes(5)
Name mlib_SignalConvertShift_F32_U8, mlib_SignalConvertShift_F32_S8, mlib_SignalConvertShift_F32_S16, mlib_SignalConvertShift_F32_S32, mlib_SignalConvertShift_F32S_U8S, mlib_SignalConvertShift_F32S_S8S, mlib_SignalConvertShift_F32S_S16S, mlib_SignalConvertShift_F32S_S32S – data type convert with shifting

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalConvertShift_F32_U8(mlib_f32 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32_S8(mlib_f32 *dst, const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32_S16(mlib_f32 *dst, const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32_S32(mlib_f32 *dst, const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32S_U8S(mlib_f32 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32S_S8S(mlib_f32 *dst, const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32S_S16S(mlib_f32 *dst, const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_F32S_S32S(mlib_f32 *dst, const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);

Description Each of these functions performs data type convert with shifting.

The following equation is used:
\[ \text{dst}[i] = \text{src}[i] \cdot 2^{\text{shift}} \]

See the following table for available variations of this group of data type convert functions.

<table>
<thead>
<tr>
<th>Type[*]</th>
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<th>F32S</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>S8</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>S16</td>
<td>Y</td>
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<td>S32</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>U8S</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>
mlib_SignalConvertShift_F32_U8(3MLIB)

<table>
<thead>
<tr>
<th>Type [*]</th>
<th>F32</th>
<th>F32S</th>
</tr>
</thead>
<tbody>
<tr>
<td>S8S</td>
<td></td>
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<tr>
<td>S16S</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>S32S</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

**Parameters**
Each of the functions takes the following arguments:
- dst  Destination signal array.
- src  Source signal array.
- shift  Left shifting factor.
- n  Number of samples in the source signal arrays.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
mlib_SignalConvertShift_U8_S8_Sat(3MLIB), attributes(5)
Name

mlib_SignalConvertShift_U8_S8_Sat, mlib_SignalConvertShift_U8_S16_Sat,
mlib_SignalConvertShift_U8_S32_Sat, mlib_SignalConvertShift_U8_F32_Sat,
mlib_SignalConvertShift_U8S_S8S_Sat, mlib_SignalConvertShift_U8S_S16S_Sat,
mlib_SignalConvertShift_U8S_S32S_Sat, mlib_SignalConvertShift_U8S_F32S_Sat,
mlib_SignalConvertShift_S8_U8_Sat, mlib_SignalConvertShift_S8_S16_Sat,
mlib_SignalConvertShift_S8_S32_Sat, mlib_SignalConvertShift_S8_S16_Sat,
mlib_SignalConvertShift_S8S_S8S_Sat, mlib_SignalConvertShift_S8S_S16S_Sat,
mlib_SignalConvertShift_S8S_S32S_Sat, mlib_SignalConvertShift_S8S_F32S_Sat,
mlib_SignalConvertShift_S16_U8_Sat, mlib_SignalConvertShift_S16_S8_Sat,
mlib_SignalConvertShift_S16_S32_Sat, mlib_SignalConvertShift_S16_S16_Sat,
mlib_SignalConvertShift_S16S_S8S_Sat, mlib_SignalConvertShift_S16S_S16S_Sat,
mlib_SignalConvertShift_S16S_S32S_Sat, mlib_SignalConvertShift_S16S_F32S_Sat,
mlib_SignalConvertShift_S32_U8_Sat, mlib_SignalConvertShift_S32_S8_Sat,
mlib_SignalConvertShift_S32_S16_Sat, mlib_SignalConvertShift_S32_S32_Sat,
mlib_SignalConvertShift_S32S_U8S_Sat, mlib_SignalConvertShift_S32S_S8S_Sat,
mlib_SignalConvertShift_S32S_S16S_Sat, mlib_SignalConvertShift_S32S_F32S_Sat – data

type convert with shifting

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalConvertShift_U8_S8_Sat(mlib_u8 *dst,
    const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8_S16_Sat(mlib_u8 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8_S32_Sat(mlib_u8 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8_F32_Sat(mlib_u8 *dst,
    const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8S_S8S_Sat(mlib_u8 *dst,
    const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8S_S16S_Sat(mlib_u8 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8S_S32S_Sat(mlib_u8 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_U8S_F32S_Sat(mlib_u8 *dst,
    const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8_S8_Sat(mlib_s8 *dst,
    const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8_S16_Sat(mlib_s8 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8_S32_Sat(mlib_s8 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8_S16_Sat (mlib_s8 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_S8S_Sat (mlib_s8 *dst,
    const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_S16S_Sat (mlib_s8 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_S32S_Sat (mlib_s8 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_F32S_Sat (mlib_s8 *dst,
    const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_S8_Sat (mlib_s16 *dst,
    const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_S16_Sat (mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_S32_Sat (mlib_s16 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_S16_Sat (mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_S8S_Sat (mlib_s16 *dst,
    const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_S16S_Sat (mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_S32S_Sat (mlib_s16 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_F32S_Sat (mlib_s16 *dst,
    const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_S8_Sat (mlib_s32 *dst,
    const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_S16_Sat (mlib_s32 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_S32_Sat (mlib_s32 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_S16_Sat (mlib_s32 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32S_S8S_Sat (mlib_s32 *dst,
    const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32S_S16S_Sat (mlib_s32 *dst,
    const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32S_S32S_Sat (mlib_s32 *dst,
    const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32S_F32S_Sat (mlib_s32 *dst,
    const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8_S32_Sat(mlib_s8 *dst, const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8_F32_Sat(mlib_s8 *dst, const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_U8S_Sat(mlib_s8 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_S16S_Sat(mlib_s8 *dst, const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_S32S_Sat(mlib_s8 *dst, const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S8S_F32S_Sat(mlib_s8 *dst, const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_U8_Sat(mlib_s16 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_S8_Sat(mlib_s16 *dst, const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_S32_Sat(mlib_s16 *dst, const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16_F32_Sat(mlib_s16 *dst, const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_U8S_Sat(mlib_s16 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_S8S_Sat(mlib_s16 *dst, const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_S32S_Sat(mlib_s16 *dst, const mlib_s32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S16S_F32S_Sat(mlib_s16 *dst, const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_U8_Sat(mlib_s32 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_S8_Sat(mlib_s32 *dst, const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_S16_Sat(mlib_s32 *dst, const mlib_s16 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32_F32_Sat(mlib_s32 *dst, const mlib_f32 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32S_U8S_Sat(mlib_s32 *dst, const mlib_u8 *src, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalConvertShift_S32S_S8S_Sat(mlib_s32 *dst, const mlib_s8 *src, mlib_s32 shift, mlib_s32 n);
Each of these functions performs data type convert with shifting.

The following equation is used:

\[ \text{dst}[i] = \text{saturate}(\text{src}[i] \times 2^{\text{shift}}) \]

See the following tables for available variations of this group of data type convert functions.

<table>
<thead>
<tr>
<th>Type[*]</th>
<th>U8</th>
<th>S8</th>
<th>S16</th>
<th>S32</th>
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<table>
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<td>Y</td>
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<tr>
<td>F32S</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[*] Each row represents a source data type. Each column represents a destination data type.

**Parameters**

Each of the functions takes the following arguments:

- \( dst \) Destination signal array.
- \( src \) Source signal array.
- \( shift \) Left shifting factor.
- \( n \) Number of samples in the source signal arrays.
Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalConvertShift_F32_U8(3MLIB), attributes(5)
Name

mlib_SignalConv_S16_S16_Sat, mlib_SignalConv_S16S_S16S_Sat,
mlib_SignalConv_F32_F32, mlib_SignalConv_F32S_F32S – signal convolution

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalConv_S16_S16_Sat(mlib_s16 *dst,
const mlib_s16 *src1, const mlib_s16 *src2, mlib_s32 m,
mlib_s32 n);

mlib_status mlib_SignalConv_S16S_S16S_Sat(mlib_s16 *dst,
const mlib_s16 *src1, const mlib_s16 *src2, mlib_s32 m,
mlib_s32 n);

mlib_status mlib_SignalConv_F32_F32(mlib_f32 *dst,
const mlib_f32 *src1, const mlib_f32 *src2, mlib_s32 m,
mlib_s32 n);

mlib_status mlib_SignalConv_F32S_F32S(mlib_f32 *dst,
const mlib_f32 *src1, const mlib_f32 *src2, mlib_s32 m,
mlib_s32 n);

Description

Each of these functions performs convolution.

For monaural signals, the following equation is used:

\[
\begin{align*}
\text{dst}[i] &= \sum_{j=0}^{m-1} (\text{src1}[j] \times \text{src2}[i - j]) & \text{if } m \leq n \\
\text{dst}[i] &= \sum_{j=0}^{n-1} (\text{src2}[j] \times \text{src1}[i - j]) & \text{if } m > n
\end{align*}
\]

where \( i = 0, 1, \ldots, (m+n-2) \).

For stereo signals, the following equation is used:

\[
\begin{align*}
\text{dst}[2\times i] &= \sum_{j=0}^{m-1} (\text{src1}[2\times j] \times \text{src2}[2\times(i - j)]) \\
\text{dst}[2\times i + 1] &= \sum_{j=0}^{m-1} (\text{src1}[2\times j + 1] \times \text{src2}[2\times(i - j) + 1]) \\
\text{if } m \leq n, & \text{ or } \\
\text{dst}[2\times i] &= \sum_{j=0}^{n-1} (\text{src2}[2\times j] \times \text{src1}[2\times(i - j)])
\end{align*}
\]
\[
\text{dst}[2i + 1] = \sum_{j=0}^{n-1} (\text{src2}[2j + 1] \times \text{src1}[2(i - j) + 1])
\]
if \(m > n\); where \(i = 0, 1, \ldots, (m + n - 2)\).

**Parameters**
Each of the functions takes the following arguments:

- \(dst\) Destination signal array.
- \(src1\) First source signal array.
- \(src2\) Second source signal array.
- \(m\) Number of samples in the first source signal array.
- \(n\) Number of samples in the second source signal arrays.

**Return Values**
Each of the functions returns \(\text{MLIB\_SUCCESS}\) if successful. Otherwise it returns \(\text{MLIB\_FAILURE}\).

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** attributes(5)
mlib_SignalCrossCorrel_S16, mlib_SignalCrossCorrel_S16S, mlib_SignalCrossCorrel_F32,
mlib_SignalCrossCorrel_F32S – signal cross correlation

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalCrossCorrel_S16(mlib_d64 *correl,
    const mlib_s16 *src1, const mlib_s16 *src2, mlib_s32 n);
mlib_status mlib_SignalCrossCorrel_S16S(mlib_d64 *correl,
    const mlib_s16 *src1, const mlib_s16 *src2, mlib_s32 n);
mlib_status mlib_SignalCrossCorrel_F32(mlib_d64 *correl,
    const mlib_f32 *src1, const mlib_f32 *src2, mlib_s32 n);
mlib_status mlib_SignalCrossCorrel_F32S(mlib_d64 *correl,
    const mlib_f32 *src1, const mlib_f32 *src2, mlib_s32 n);

Description
Each of these functions performs cross correlation.

For monaural signals, the following equation is used:

\[
\text{correl}[0] = \frac{1}{n} \sum_{i=0}^{n-1} (\text{src1}[i] \times \text{src2}[i])
\]

For stereo signals, the following equation is used:

\[
\text{correl}[0] = \frac{1}{n} \sum_{i=0}^{n-1} (\text{src1}[2i] \times \text{src2}[2i])
\]
\[
\text{correl}[1] = \frac{1}{n} \sum_{i=0}^{n-1} (\text{src1}[2i+1] \times \text{src2}[2i+1])
\]

Parameters
Each of the functions takes the following arguments:

correl Pointer to the cross correlation array. In the stereo version, correl[0] contains the
cross correlation of channel 0, and correl[1] contains the cross correlation of
cchannel 1.

src1 First source signal array.

src2 Second source signal array.

n Number of samples in the source signal arrays.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.
Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalAutoCorrel_S16(3MLIB), attributes(5)
mlib_SignalDownSample_S16_S16, mlib_SignalDownSample_S16S_S16S, mlib_SignalDownSample_F32_F32, mlib_SignalDownSample_F32S_F32S – signal downsampling

Synopsis

cc [-f] [ flag... ] file... -lmllib [library...]
#include <mlib.h>

mlib_status mlib_SignalDownSample_S16_S16(mlib_s16 *dst, 
    const mlib_s16 *src, mlib_s32 factor, mlib_s32 phase, 
    mlib_s32 n);

mlib_status mlib_SignalDownSample_S16S_S16S(mlib_s16 *dst, 
    const mlib_s16 *src, mlib_s32 factor, mlib_s32 phase, 
    mlib_s32 n);

mlib_status mlib_SignalDownSample_F32_F32(mlib_f32 *dst, 
    const mlib_f32 *src, mlib_s32 factor, mlib_s32 phase, 
    mlib_s32 n);

mlib_status mlib_SignalDownSample_F32S_F32S(mlib_f32 *dst, 
    const mlib_f32 *src, mlib_s32 factor, mlib_s32 phase, 
    mlib_s32 n);

Description

Each of these functions performs downsampling.

For monaural signals, the following equation is used:

dst[i] = src[i*factor + phase]

where i = 0, 1, ..., (n - 1 - phase)/factor.

For stereo signals, the following equation is used:

dst[2*i] = src[2*(i*factor + phase)]  
dst[2*i + 1] = src[2*(i*factor + phase) + 1]

where i = 0, 1, ..., (n - 1 - phase)/factor.

Parameters

Each of the functions takes the following arguments:

dst        Output signal array.
src        Input signal array.
factor     Factor by which to downsample. factor ≥ 1.
phase      Parameter that determines relative position of an output value, within the input signal. 0 ≤ phase < factor.
n          Number of samples in the input signal array.
Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalUpSample_S16_S16(3MLIB), attributes(5)
The `mlib_SignalDTWKScalar_F32()` function performs dynamic time warping for K-best paths on scalar data. Assume the reference data are

\[ r(y), \ y = 1, 2, \ldots, N \]

and the observed data are

\[ o(x), \ x = 1, 2, \ldots, M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = (px(i), py(i)), \ i = 1, 2, \ldots, Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[ \text{dist} = \sum_{i=1}^{Q} d(r(py(i)), o(px(i))) \times m(px(i), py(i)) \]

where \( d(r, o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x, y) \) is the path weighting coefficient associated with path point \( (x, y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)

\[ L-1 \quad d(r, o) = \sum_{i=0}^{L-1} |r(i) - o(i)| \]

Using L2 norm (Euclidean distance)

\[ L-1 \quad d(r, o) = \sqrt{ \sum_{i=0}^{L-1} (r(i) - o(i))^2 } \]

where \( L \) is the length of each data vector.

To scalar data where \( L=1 \), the two norms are the same.
\[ d(r,o) = |r - o| = \sqrt{(r - o)^2} \]

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   
   \[ px(1) = 1 \]
   \[ 1 \leq py(1) \leq 1 + \delta \]

   and

   \[ px(Q) = M \]
   \[ N - \delta \leq py(Q) \leq N \]

2. **Monotonicity Conditions**
   
   \[ px(i) \leq px(i+1) \]
   \[ py(i) \leq py(i+1) \]

3. **Local Continuity Constraints**
   
   See Table 4.5 on page 211 in Rabiner and Juang's book.

   **Itakura Type:**

   \[
   \begin{array}{c}
   \text{py} \\
   \text{----} \\
   \text{|} \\
   \text{----} \\
   \text{|} \\
   \text{----} \\
   \text{|} \\
   \text{----} \\
   \text{p4} | p1 | p0 \\
   \text{|} | | \\
   \text{----} \\
   \text{|} | | \\
   \text{----} \\
   \text{|} | | \\
   \text{----} \\
   \text{p2} | \\
   \text{|} | | \\
   \text{----} \\
   \text{|} | | \\
   \text{----} \\
   \text{p3} \\
   \end{array}
   \]

   Allowable paths are

   \[ p_1 \rightarrow p_0 \quad (1, 0) \]
   \[ p_2 \rightarrow p_0 \quad (1, 1) \]
   \[ p_3 \rightarrow p_0 \quad (1, 2) \]

   Consecutive \((1, 0) (1, 0)\) is disallowed. So path \(p_4 \rightarrow p_1 \rightarrow p_0\) is disallowed.

4. **Global Path Constraints**

   Due to local continuity constraints, certain portions of the \((px, py)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**

   See Equation 4.150-3 on page 216 in Rabiner and Juang's book.

   A path in \((px, py)\) plane can be represented in chain code. The value of the chain code is defined as following.
<table>
<thead>
<tr>
<th>shift (x, y)</th>
<th>chain code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, 0)</td>
<td>0</td>
</tr>
<tr>
<td>(0, 1)</td>
<td>1</td>
</tr>
<tr>
<td>(1, 1)</td>
<td>2</td>
</tr>
<tr>
<td>(2, 1)</td>
<td>3</td>
</tr>
<tr>
<td>(1, 2)</td>
<td>4</td>
</tr>
<tr>
<td>(3, 1)</td>
<td>5</td>
</tr>
<tr>
<td>(3, 2)</td>
<td>6</td>
</tr>
<tr>
<td>(1, 3)</td>
<td>7</td>
</tr>
<tr>
<td>(2, 3)</td>
<td>8</td>
</tr>
</tbody>
</table>

where \( x \) marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```
<table>
<thead>
<tr>
<th>py</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 8 7 *</td>
</tr>
<tr>
<td>* 4 * 6</td>
</tr>
<tr>
<td>1 2 3 5</td>
</tr>
<tr>
<td>x--0--*--- px</td>
</tr>
</tbody>
</table>
```

Multimedia Library Functions - Part 4
The chain code that represents the path is

\((2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 2 \ 0 \ 2 \ 0)\)


**Parameters**

The function takes the following arguments:

- \(dist\): The distances of the \(K\)-best paths.
- \(dobs\): The observed data array.
- \(lobs\): The length of the observed data array.
- \(state\): Pointer to the internal state structure.

**Return Values**

The function returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

**Attributes**

See attributes\(\text{(5)}\) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

\texttt{mlib\_SignalDTWKScalar\_Init\_F32(3MLIB)}, \texttt{mlib\_SignalDTWKScalar\_F32(3MLIB)}, \texttt{mlib\_SignalDTWKScalar\_Path\_F32(3MLIB)}, \texttt{mlib\_SignalDTWKScalar\_Free\_F32(3MLIB)}, attributes\(\text{(5)}\)
mlib_SignalDTWKScalarFree_S16, mlib_SignalDTWKScalarFree_F32 – clean up for K-best paths of scalar data

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalDTWKScalarFree_S16(void *state);
void mlib_SignalDTWKScalarFree_F32(void *state);

Description

Each of these functions frees the internal state structure for dynamic time warping (DTW) for K-best paths of scalar data.

This function cleans up the internal state structure and releases all memory buffers.

Parameters

Each of the functions takes the following arguments:

state Pointer to the internal state structure.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

mlib_SignalDTWKScalarInit_S16(3MLIB), mlib_SignalDTWKScalarInit_F32(3MLIB),
mlib_SignalDTWKScalar_S16(3MLIB), mlib_SignalDTWKScalar_F32(3MLIB),
mlib_SignalDTWKScalarPath_S16(3MLIB), mlib_SignalDTWKScalarPath_F32(3MLIB),
attributes(5)
The `mlib_SignalDTWKScalarInit_F32()` function initializes the internal state structure for dynamic time warping (DTW) for K-best paths of scalar data.

The `mlib_SignalDTWKScalarInit_F32()` function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

The function takes the following arguments:

- `dref` The reference data array.
- `lref` The length of the reference data array.
- `kbest` The number of the best paths evaluated.
- `delta` The delta in the endpoint constraints.
- `local` The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- `slope` The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- `state` Pointer to the internal state structure.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
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</thead>
<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
`mlib_SignalDTWKScalarInit_F32(3MLIB)`,
Name  mlib_SignalDTWKScalarInit_S16 – initialization for K-best paths of scalar data

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
           #include <mlib.h>

mlib_status mlib_SignalDTWKScalarInit_S16(void *state,
                                         const mlib_s16 *dref, mlib_s32 lref, mlib_s32 kbest,
                                         mlib_s32 sref, mlib_s32 delta, mlib_s32 local,
                                         mlib_s32 slope);

Description  The mlib_SignalDTWKScalarInit_S16() function initializes the internal state structure for dynamic time warping (DTW) for K-best paths of scalar data.

The init function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

Parameters  The function takes the following arguments:

dref  The reference data array.
lref  The length of the reference data array.
kbest  The number of the best paths evaluated.
sref  The scaling factor of the reference data array, where actual_data = input_data * 2**(scaling_factor).
delta  The delta in the endpoint constraints.
local  The type of the local continuity constraints. MLIB_DTW_ITAKURA for Itakura type constraints.
slope  The type of the slope weighting. MLIB_DTW_NONE for no slope weighting.
state  Pointer to the internal state structure.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalDTWKScalarInit_S16(3MLIB), mlib_SignalDTWKScalar_S16(3MLIB),
          mlib_SignalDTWKScalarPath_S16(3MLIB), mlib_SignalDTWKScalarFree_S16(3MLIB),
          attributes(5)
mlib_SignalDTWKScalarPath_S16, mlib_SignalDTWKScalarPath_F32 – return K-best path on scalar data

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalDTWKScalarPath_S16(mlib_s32 *path,
    mlib_s32 *lpath, mlib_s32 kpath, void *state);
mlib_status mlib_SignalDTWKScalarPath_F32(mlib_s32 *path,
    mlib_s32 *lpath, mlib_s32 kpath, void *state);

Description

Each of these functions returns K-best path on scalar data.

Assume the reference data are

\[ r(y), \ y=1,2,...,N \]

and the observed data are

\[ o(x), \ x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{px(i),py(i)\}, \ i=1,2,...,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
\text{dist} = \sum_{i=1}^{Q} \sum d(r(py(i)),o(px(i))) \times m(px(i),py(i))
\]

where \( d(r,o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x,y) \) is the path weighting coefficient associated with path point \( (x,y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)

\[
L-1 \quad d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)

\[
L-1 \quad d(r,o) = \text{SQRT} \left\{ \sum_{i=0}^{L-1} (r(i) - o(i))^2 \right\}
\]

where \( L \) is the length of each data vector.
To scalar data where $L=1$, the two norms are the same.

$$d(r, o) = |r - o| = \sqrt{(r - o)^2}$$

The constraints of dynamic time warping are:

1. Endpoint constraints
   
   \[ px(1) = 1 \]
   \[ 1 \leq py(1) \leq 1 + \delta \]
   
   and
   
   \[ px(Q) = M \]
   \[ N - \delta \leq py(Q) \leq N \]

2. Monotonicity Conditions
   
   \[ px(i) \leq px(i+1) \]
   \[ py(i) \leq py(i+1) \]

3. Local Continuity Constraints
   
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

Itakura Type:

\[
\begin{array}{c}
| \hline
| & | & | \\
| p_4 & p_1 & p_0 \\
| \hline
| & | & | \\
| & & \\
| \hline
| & & \\
| \hline
\end{array}
\]

Allowable paths are

- $p_1 \rightarrow p_0 \ (1, 0)$
- $p_2 \rightarrow p_0 \ (1, 1)$
- $p_3 \rightarrow p_0 \ (1, 2)$

Consecutive $(1, 0) \ (1, 0)$ is disallowed. So path $p_4 \rightarrow p_1 \rightarrow p_0$ is disallowed.

4. Global Path Constraints

   Due to local continuity constraints, certain portions of the $(px, py)$ plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. Slope Weighting

   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in $(px, py)$ plane can be represented in chain code. The value of the chain code is defined as following.
### shift (x, y) | chain code

| (1, 0) | 0 |
| (0, 1) | 1 |
| (1, 1) | 2 |
| (2, 1) | 3 |
| (1, 2) | 4 |
| (3, 1) | 5 |
| (3, 2) | 6 |
| (1, 3) | 7 |
| (2, 3) | 8 |

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points.

```
py
| * 8 7 *
| * 4 * 6
| 1 2 3 5
| x--0--*--*-- px
```

```
The chain code that represents the path is
\[(2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 2 \ 0 \ 0)\]


**Parameters** Each of the functions takes the following arguments:
- \(path\) The optimal path.
- \(lpath\) The length of the optimal path.
- \(kpath\) The path index, \(0 \leq kpath < kbest\).
- \(state\) Pointer to the internal state structure.

**Return Values** Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

**Attributes** See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
- \texttt{mlib\_SignalDTWKScalarInit\_S16(3MLIB)}, \texttt{mlib\_SignalDTWKScalarInit\_F32(3MLIB)}
- \texttt{mlib\_SignalDTWKScalar\_S16(3MLIB)}, \texttt{mlib\_SignalDTWKScalar\_F32(3MLIB)}
- \texttt{mlib\_SignalDTWKScalarFree\_S16(3MLIB)}, \texttt{mlib\_SignalDTWKScalarFree\_F32(3MLIB)}
The `mlib_SignalDTWKScalar_S16()` function performs dynamic time warping for K-best paths on scalar data.

Assume the reference data are

\[ r(y), \quad y=1,2,\ldots,N \]

and the observed data are

\[ o(x), \quad x=1,2,\ldots,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{px(i), py(i)\}, \quad i=1,2,\ldots,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
\text{dist} = \sum_{i=1}^{Q} d(r(py(i)), o(px(i))) * m(px(i), py(i))
\]

where \( d(r,o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o; m(x,y) \) is the path weighting coefficient associated with path point \( (x,y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)

\[
L-1 \quad d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)

\[
L-1 \quad d(r,o) = \sqrt{ \sum_{i=0}^{L-1} (r(i) - o(i))^2 } \]
To scalar data where \( L = 1 \), the two norms are the same.
\[
d(r, o) = |r - o| = \sqrt{(r - o)^2}
\]

The constraints of dynamic time warping are:

1. **Endpoint Constraints**
   \[
   px(1) = 1
   \]
   \[
   1 \leq py(1) \leq 1 + \text{delta}
   \]
   and
   \[
   px(Q) = M
   \]
   \[
   N - \text{delta} \leq py(Q) \leq N
   \]

2. **Monotonicity Conditions**
   \[
   px(i) \leq px(i+1)
   \]
   \[
   py(i) \leq py(i+1)
   \]

3. **Local Continuity Constraints**
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   **Itakura Type:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

   Allowable paths are
   \[
P1 \to P0 \quad (1, 0)
   \]
   \[
P2 \to P0 \quad (1, 1)
   \]
   \[
P3 \to P0 \quad (1, 2)
   \]

   Consecutive \((1, 0)(1, 0)\) is disallowed. So path \(P4 \to P1 \to P0\) is disallowed.

4. **Global Path Constraints**
   Due to local continuity constraints, certain portions of the \((px, py)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \((px, py)\) plane can be represented in chain code. The value of the chain code is defined as following.
<table>
<thead>
<tr>
<th>shift (x, y)</th>
<th>chain code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, 0)</td>
<td>0</td>
</tr>
<tr>
<td>(0, 1)</td>
<td>1</td>
</tr>
<tr>
<td>(1, 1)</td>
<td>2</td>
</tr>
<tr>
<td>(2, 1)</td>
<td>3</td>
</tr>
<tr>
<td>(1, 2)</td>
<td>4</td>
</tr>
<tr>
<td>(3, 1)</td>
<td>5</td>
</tr>
<tr>
<td>(3, 2)</td>
<td>6</td>
</tr>
<tr>
<td>(1, 3)</td>
<td>7</td>
</tr>
<tr>
<td>(2, 3)</td>
<td>8</td>
</tr>
</tbody>
</table>

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```
py
| 9 | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
|   | * * * * * * * * * * * *.*
|   | /                      
```

mlib_SignalDTWKScalar_S16(3MLIB)
The chain code that represents the path is
\[(2, 2, 2, 1, 2, 0, 2, 2, 0, 2, 0)\]


**Parameters**
The function takes the following arguments:

- `dist` The distances of the K-best paths.
- `dobs` The observed data array.
- `lobs` The length of the observed data array.
- `sobs` The scaling factor of the observed data array, where `actual_data = input_data * 2**(-scaling_factor)`.
- `state` Pointer to the internal state structure.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_SignalDTWKScalarInit_S16(3MLIB), mlib_SignalDTWKScalar_S16(3MLIB), mlib_SignalDTWKScalarPath_S16(3MLIB), mlib_SignalDTWKScalarFree_S16(3MLIB), attributes(5)
The `mlib_SignalDTWKVector_F32()` function performs dynamic time warping for K-best paths on vector data.

Assume the reference data are

\[ r(y), \ y=1,2,...,N \]

and the observed data are

\[ o(x), \ x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{px(i),py(i)\}, \ i=1,2,...,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
\begin{align*}
\text{dist} &= \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) \cdot m(px(i),py(i)) \\
\end{align*}
\]

where \(d(r,o)\) is the dissimilarity between data point/vector \(r\) and data point/vector \(o\); \(m(x,y)\) is the path weighting coefficient associated with path point \((x,y)\); \(N\) is the length of the reference data; \(M\) is the length of the observed data; \(Q\) is the length of the path.

Using L1 norm (sum of absolute differences)

\[ L-1 \]

\[
\begin{align*}
d(r,o) &= \sum_{i=0}^{L-1} |r(i) - o(i)| \\
\end{align*}
\]

Using L2 norm (Euclidean distance)

\[ L-1 \]

\[
\begin{align*}
d(r,o) &= \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2} \\
\end{align*}
\]

where \(L\) is the length of each data vector.

To scalar data where \(L=1\), the two norms are the same.
\[ d(r,o) = |r - o| = \sqrt{(r - o)^2} \]

The constraints of dynamic time warping are:

1. Endpoint constraints
   \[ px(1) = 1 \]
   \[ 1 \leq py(1) \leq 1 + \delta \]
   and
   \[ px(Q) = M \]
   \[ N - \delta \leq py(Q) \leq N \]

2. Monotonicity Conditions
   \[ px(i) \leq px(i+1) \]
   \[ py(i) \leq py(i+1) \]

3. Local Continuity Constraints
   See Table 4.5 on page 211 in Rabiner and Juang’s book.
   Itakura Type:
   
   \[
   \begin{array}{ccc}
   & p_4 & | p_1 & | p_0 \\
   * & | & | & \\
   p_3 & | & | & \quad \quad px
   \end{array}
   \]
   Allowable paths are
   \[ p_1 \rightarrow p_0 \ (1,0) \]
   \[ p_2 \rightarrow p_0 \ (1,1) \]
   \[ p_3 \rightarrow p_0 \ (1,2) \]
   Consecutive (1, 0) (1, 0) is disallowed. So path \( p_4 \rightarrow p_1 \rightarrow p_0 \) is disallowed.

4. Global Path Constraints
   Due to local continuity constraints, certain portions of the \((px, py)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. Slope Weighting
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \((px, py)\) plane can be represented in chain code. The value of the chain code is defined as following.
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</tbody>
</table>

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```
py
|
| * 8 7 * |
| * 4 * 6 |
| 1 2 3 5 |
| x--0--*--*-- px
```
The chain code that represents the path is
\[(2 2 2 1 2 0 2 2 0 2 0)\]


**Parameters**  The function takes the following arguments:
- `dist`  The distances of the K-best paths.
- `dobs`  The observed data array.
- `lobs`  The length of the observed data array.
- `state`  Pointer to the internal state structure.

**Return Values**  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>MT-Level</td>
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</tr>
</tbody>
</table>

**See Also**  `mlib_SignalDTWKVector_Init_F32(3MLIB)`, `mlib_SignalDTWKVector_F32(3MLIB)`, `mlib_SignalDTWKVectorPath_F32(3MLIB)`, `mlib_SignalDTWKVectorFree_F32(3MLIB)`, attributes(5)
mlib_SignalDTWKVectorFree_S16, mlib_SignalDTWKVectorFree_F32 – clean up for K-best paths of vector data

#include <mlib.h>

void mlib_SignalDTWKVectorFree_S16(void *state);
void mlib_SignalDTWKVectorFree_F32(void *state);

Description

Each of these functions frees the internal state structure for dynamic time warping (DTW) for K-best paths of vector data.

This function cleans up the internal state structure and releases all memory buffers.

Parameters

Each of the functions takes the following arguments:

state Pointer to the internal state structure.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
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</tbody>
</table>

See Also

mlib_SignalDTWKScalarInit_S16(3MLIB), mlib_SignalDTWKVectorInit_F32(3MLIB),
mlib_SignalDTWKScalar_S16(3MLIB), mlib_SignalDTWKVector_F32(3MLIB),
mlib_SignalDTWKScalarPath_S16(3MLIB), mlib_SignalDTWKVectorPath_F32(3MLIB),
attributes(5)
mlib_SignalDTWKVectorInit_F32 – initialization for K-best paths of vector data

#include <mlib.h>

mlib_status mlib_SignalDTWKVectorInit_F32(void *state,
    const mlib_f32 **dref, mlib_s32 lref, mlib_s32 ndata,
    mlib_s32 kbest, mlib_s32 dtype, mlib_s32 delta,
    mlib_s32 local, mlib_s32 slope);

The mlib_SignalDTWKVectorInit_F32() function initializes the internal state structure for dynamic time warping (DTW) for K-best paths of vector data.

The init function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

The function takes the following arguments:

- `dref`: The reference data array.
- `lref`: The length of the reference data array.
- `ndata`: The length of each data vector.
- `kbest`: The number of the best paths evaluated.
- `dtype`: The type of distance metric between data vectors. `MLIB_DTW_L1NORM` for L1 norm of difference (sum of absolute difference). `MLIB_DTW_L2NORM` for L2 norm of difference (Euclidean distance).
- `delta`: The delta in the endpoint constraints.
- `local`: The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- `slope`: The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- `state`: Pointer to the internal state structure.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

<table>
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</tr>
</tbody>
</table>
See Also  
mlib_SignalDTWKVectorInit_F32(3MLIB), mlib_SignalDTWKVector_F32(3MLIB),
mlib_SignalDTWKVectorPath_F32(3MLIB), mlib_SignalDTWKVectorFree_F32(3MLIB),
attributes(5)
## mlib_SignalDTWKVectorInit_S16

### Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalDTWKVectorInit_S16(void *state,
const mlib_s16 **dref, mlib_s32 lref, mlib_s32 ndata,
mlib_s32 kbest, mlib_s32 dtype, mlib_s32 sref,
mlib_s32 delta, mlib_s32 local, mlib_s32 slope);
```

### Description

The `mlib_SignalDTWKVectorInit_S16()` function initializes the internal state structure for dynamic time warping (DTW) for K-best paths of vector data.

The `init` function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

### Parameters

The function takes the following arguments:

- **dref**: The reference data array.
- **lref**: The length of the reference data array.
- **ndata**: The length of each data vector.
- **kbest**: The number of the best paths evaluated.
- **dtype**: The type of distance metric between data vectors. `MLIB_DTW_L1NORM` for L1 norm of difference (sum of absolute difference). `MLIB_DTW_L2NORM` for L2 norm of difference (Euclidean distance).
- **sref**: The scaling factor of the reference data array, where `actual_data = input_data * 2**(-scaling_factor)`.
- **delta**: The delta in the endpoint constraints.
- **local**: The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- **slope**: The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- **state**: Pointer to the internal state structure.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<tbody>
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</table>
mib_SignalDTWKVectorInit_S16(3MLIB)

<table>
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<tr>
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<th>ATTRIBUTE VALUE</th>
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</tbody>
</table>

See Also  
mib_SignalDTWKVectorInit_S16(3MLIB), mlib_SignalDTWKVector_S16(3MLIB),  
mib_SignalDTWKVectorPath_S16(3MLIB), mlib_SignalDTWKVectorFree_S16(3MLIB),  
attributes(5)
mlib_SignalDTWKVectorPath_S16, mlib_SignalDTWKVectorPath_F32 – return K-best path on vector data

Synopsis
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalDTWKVectorPath_S16(mlib_s32 *path,
        mlib_s32 *lpath, mlib_s32 kpath, void *state);
mlib_status mlib_SignalDTWKVectorPath_F32(mlib_s32 *path,
        mlib_s32 *lpath, mlib_s32 kpath, void *state);
```

Description
Each of these functions returns K-best path on vector data.

Assume the reference data are
\[ r(y), y=1,2,...,N \]
and the observed data are
\[ o(x), x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)
\[ p(i) = \{px(i),py(i)\}, i=1,2,...,Q \]
with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as
\[
\text{dist} = \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) \cdot m(px(i),py(i))
\]
where \(d(r,o)\) is the dissimilarity between data point/vector \(r\) and data point/vector \(o\); \(m(x,y)\) is the path weighting coefficient associated with path point \((x,y)\); \(N\) is the length of the reference data; \(M\) is the length of the observed data; \(Q\) is the length of the path.

Using L1 norm (sum of absolute differences)
\[
\text{L-1} = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)
\[
\text{L-2} = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2}
\]
where \(L\) is the length of each data vector.

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To scalar data where \( L=1 \), the two norms are the same.

\[
d(r, o) = |r - o| = \sqrt{ (r - o)^2 }
\]

The constraints of dynamic time warping are:

1. Endpoint constraints

\[
   p_x(1) = 1 \\
   1 \leq p_y(1) \leq 1 + \delta
\]

and

\[
   p_x(Q) = M \\
   N - \delta \leq p_y(Q) \leq N
\]

2. Monotonicity Conditions

\[
   p_x(i) \leq p_x(i+1) \\
   p_y(i) \leq p_y(i+1)
\]

3. Local Continuity Constraints

   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   *Itakura Type:*

   \[
   \begin{array}{c|c|c|c}
   p_y & \text{py} & \text{p4} & \text{p1} & \text{p0} \\
   \hline
   \text{*-......*-} & | & | & | \\
   \text{*-......*-} & | & | & | \\
   \text{*-......*-} & | & | & | \\
   \text{*-......*-} & | & | & | \\
   \end{array}
   \]

   *-**-*-- px

   Allowable paths are

   \[
   p_1 \rightarrow p_0 \quad (1, 0) \\
   p_2 \rightarrow p_0 \quad (1, 1) \\
   p_3 \rightarrow p_0 \quad (1, 2)
   \]

   Consecutive \((1, 0)\) \((1, 0)\) is disallowed. So path \(p_4 \rightarrow p_1 \rightarrow p_0\) is disallowed.

4. Global Path Constraints

   Due to local continuity constraints, certain portions of the \((p_x, p_y)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. Slope Weighting

   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

   A path in \((p_x, p_y)\) plane can be represented in chain code. The value of the chain code is defined as following.
where $x$ marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```plaintext
py
|  
| * 8 7 *
|  
| * 4 6
|  
| 1 2 3 5
|  
x--0--*--*-- px
```
The chain code that represents the path is

\((2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 2 \ 0 \ 2 \ 0)\)


**Parameters** Each of the functions takes the following arguments:

- **path** The optimal path.
- **lpath** The length of the optimal path.
- **kpath** The path index, \(0 \leq kpath < k\text{best}\).
- **state** Pointer to the internal state structure.

**Return Values** Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See attributes(5) for descriptions of the following attributes:

<table>
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<tr>
<th>ATTRIBUTE TYPE</th>
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</table>

**See Also**

- mlib_SignalDTWKScalarInit_S16(3MLIB)
- mlib_SignalDTWKVectorInit_F32(3MLIB)
- mlib_SignalDTWKScalar_S16(3MLIB)
- mlib_SignalDTWKVector_F32(3MLIB)
- mlib_SignalDTWKScalarFree_S16(3MLIB)
- mlib_SignalDTWKScalarFree_F32(3MLIB)
- attributes(5)
Name  mlib_SignalDTWKVector_S16 - perform dynamic time warping for K-best paths on vector data

Synopsis  cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalDTWKVector_S16(mlib_d64 *dist,
    const mlib_s16 **dobs, mlib_s32lobs, mlib_s32sobs,
    void *state);

Description  The mlib_SignalDTWKVector_S16() function performs dynamic time warping for K-best paths on vector data.
Assume the reference data are

\[ r(y), y=1,2,...,N \]

and the observed data are

\[ o(x), x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = (px(i),py(i)), i=1,2,...,Q \]

with the minimum distance.
In K-best paths case, K paths with the K minimum distances are searched.
The distance of a path is defined as

\[ \text{dist} = \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) * m(px(i),py(i)) \]

where \( d(r,o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x,y) \)
is the path weighting coefficient associated with path point \( (x,y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.
Using L1 norm (sum of absolute differences)

\[ L-1 \]
\[ d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)| \]

Using L2 norm (Euclidean distance)

\[ L-1 \]
\[ d(r,o) = \sqrt{ \sum_{i=0}^{L-1} (r(i) - o(i))^2 } \]

where \( L \) is the length of each data vector.
To scalar data where $L=1$, the two norms are the same.

$$d(r,o) = |r - o| = \sqrt{(r - o)^2}$$

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   
   $$p_x(1) = 1$$
   $$1 \leq p_y(1) \leq 1 + \delta$$
   
   and
   
   $$p_x(Q) = M$$
   $$N - \delta \leq p_y(Q) \leq N$$

2. **Monotonicity Conditions**

   $$p_x(i) \leq p_x(i+1)$$
   $$p_y(i) \leq p_y(i+1)$$

3. **Local Continuity Constraints**

   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   **Itakura Type:**

   | *----*----* |
   | |p4 |p1 |p0 |
   | | | | |
   | *----*----* |
   | |p2 |
   | | | |
   | *----*----*-- px |
   |
   
   **Allowable paths are**

   $$p_1 \rightarrow p_0 (1,0)$$
   $$p_2 \rightarrow p_0 (1,1)$$
   $$p_3 \rightarrow p_0 (1,2)$$

   Consecutive $(1, 0) (1, 0)$ is disallowed. So path $p_4 \rightarrow p_1 \rightarrow p_0$ is disallowed.

4. **Global Path Constraints**

   Due to local continuity constraints, certain portions of the $(p_x, p_y)$ plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**

   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

   A path in $(p_x, p_y)$ plane can be represented in chain code. The value of the chain code is defined as following.
### Shift Table

<table>
<thead>
<tr>
<th>shift (x, y)</th>
<th>chain code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, 0)</td>
<td>0</td>
</tr>
<tr>
<td>(0, 1)</td>
<td>1</td>
</tr>
<tr>
<td>(1, 1)</td>
<td>2</td>
</tr>
<tr>
<td>(2, 1)</td>
<td>3</td>
</tr>
<tr>
<td>(1, 2)</td>
<td>4</td>
</tr>
<tr>
<td>(3, 1)</td>
<td>5</td>
</tr>
<tr>
<td>(3, 2)</td>
<td>6</td>
</tr>
<tr>
<td>(1, 3)</td>
<td>7</td>
</tr>
<tr>
<td>(2, 3)</td>
<td>8</td>
</tr>
</tbody>
</table>

### Chain Code Example

<table>
<thead>
<tr>
<th>py</th>
</tr>
</thead>
<tbody>
<tr>
<td>*87</td>
</tr>
<tr>
<td>*46</td>
</tr>
<tr>
<td>1235</td>
</tr>
<tr>
<td>x--0--<em>--</em>-- px</td>
</tr>
</tbody>
</table>

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

<table>
<thead>
<tr>
<th>py</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>*  *  *  *  *  *  *  *  *  *</td>
</tr>
<tr>
<td>/</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Multimedia Library Functions - Part 4
The chain code that represents the path is

\[(2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 0 \ 2 \ 0)\]


**Parameters**  The function takes the following arguments:

- **dist**  The distances of the K-best paths.
- **dobs**  The observed data array.
- **lobs**  The length of the observed data array.
- **sobs**  The scaling factor of the observed data array, where actual_data = input_data * 2**(-scaling_factor).
- **state**  Pointer to the internal state structure.

**Return Values**  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalDTWKVectorInit_S16(3MLIB), mlib_SignalDTWKVector_S16(3MLIB),
mlib_SignalDTWKVectorPath_S16(3MLIB), mlib_SignalDTWKVectorFree_S16(3MLIB),
attributes(5)
The `mlib_SignalDTWScalar_F32()` function performs dynamic time warping on scalar data.

Assume the reference data are
\[ r(y), \ y = 1, 2, \ldots, N \]
and the observed data are
\[ o(x), \ x = 1, 2, \ldots, M \]
the dynamic time warping is to find a mapping function (a path)
\[ p(i) = (px(i), py(i)), \ i = 1, 2, \ldots, Q \]
with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as
\[
\text{dist} = \sum_{i=1}^{Q} d(r(py(i)), o(px(i))) \times m(px(i), py(i))
\]
where \( d(r, o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x, y) \)
is the path weighting coefficient associated with path point \( (x, y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)
\[
L-1\ d(r, o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]
Using L2 norm (Euclidean distance)
\[
L-1\ d(r, o) = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2}
\]
where \( L \) is the length of each data vector.

To scalar data where \( L=1 \), the two norms are the same.
\[
d(r, o) = |r - o| = \sqrt{(r - o)^2}
\]
The constraints of dynamic time warping are:

1. Endpoint constraints
   \[ px(1) = 1 \]
   \[ 1 \leq py(1) \leq 1 + \delta \]
   and
   \[ px(Q) = N - \delta \]
   \[ N - \delta \leq py(Q) \leq N \]

2. Monotonicity Conditions
   \[ px(i) \leq px(i+1) \]
   \[ py(i) \leq py(i+1) \]

3. Local Continuity Constraints
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   Itakura Type:
   \[
   \begin{array}{cccc}
   & * & . . . & * \\
   p4 & p1 & p0 & \\
   & | & | & \\
   & * . . . * & \\
   & | & p2 & \\
   & | & | & \\
   & * . . . . . . & px \\
   & | & | & \\
   & p3 & \\
   \end{array}
   \]

   Allowable paths are
   \[
   \begin{array}{c}
   p1 \rightarrow p0 & (1, 0) \\
p2 \rightarrow p0 & (1, 1) \\
p3 \rightarrow p0 & (1, 2) \\
   \end{array}
   \]

   Consecutive \((1, 0)\) is disallowed. So path \(p4 \rightarrow p1 \rightarrow p0\) is disallowed.

4. Global Path Constraints
   Due to local continuity constraints, certain portions of the \((px, py)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. Slope Weighting
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \((px, py)\) plane can be represented in chain code. The value of the chain code is defined as following.

\[
\text{shift} (x, y) | \text{chain code}
\]

\[
\begin{array}{cccc}
\text{shift} & (x, y) & | & \text{chain code} \\
\hline
\end{array}
\]
where \( x \) marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

\[
\begin{array}{c|c}
0 & 1 \\
1 & 0 \\
2 & 1 \\
3 & 1 \\
4 & 2 \\
5 & 3 \\
6 & 3 \\
7 & 1 \\
8 & 2 \\
\end{array}
\]

-----------------------------

\[
\begin{array}{c|c}
1 & 0 \\
2 & 0 \\
3 & 0 \\
4 & 0 \\
5 & 1 \\
6 & 1 \\
7 & 1 \\
8 & 1 \\
0 & 0 \\
\end{array}
\]

-----------------------------
The chain code that represents the path is

\[(2 2 1 2 0 2 2 0 2 0)\]


**Parameters**  The function takes the following arguments:

- `dist`  The distance of the optimal path.
- `dobs`  The observed data array.
- `lobs`  The length of the observed data array.
- `state`  Pointer to the internal state structure.

**Return Values**  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  `mlib_SignalDTWScalarInit_F32(3MLIB)`, `mlib_SignalDTWScalar_F32(3MLIB)`, `mlib_SignalDTWScalarPath_F32(3MLIB)`, `mlib_SignalDTWScalarFree_F32(3MLIB)`, attributes(5)
Name  mlib_SignalDTWScalarFree_S16, mlib_SignalDTWScalarFree_F32 – clean up for scalar data

Synopsis  
```
cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

void mlib_SignalDTWScalarFree_S16(void *state);
void mlib_SignalDTWScalarFree_F32(void *state);
```

Description  Each of these functions frees the internal state structure for dynamic time warping (DTW) of scalar data.

This function cleans up the internal state structure and releases all memory buffers.

Parameters  Each of the functions takes the following arguments:

- `state`  Pointer to the internal state structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalDTWScalarInit_S16(3MLIB), mlib_SignalDTWScalarInit_F32(3MLIB),
mlib_SignalDTWScalar_S16(3MLIB), mlib_SignalDTWScalar_F32(3MLIB),
mlib_SignalDTWScalarPath_S16(3MLIB), mlib_SignalDTWScalarPath_F32(3MLIB),
attributes(5)
The `mlib_SignalDTWScalarInit_F32()` function initializes the internal state structure for dynamic time warping (DTW) of scalar data. The init function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

The function takes the following arguments:

- `dref` The reference data array.
- `lref` The length of the reference data array.
- `delta` The delta in the endpoint constraints.
- `local` The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- `slope` The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- `state` Pointer to the internal state structure.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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<tr>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also `mlib_SignalDTWScalarInit_F32(3MLIB), mlib_SignalDTWScalar_F32(3MLIB), mlib_SignalDTWScalarPath_F32(3MLIB), mlib_SignalDTWScalarFree_F32(3MLIB), attributes(5)`
The `mlib_SignalDTWScalarInit_S16()` function initializes the internal state structure for dynamic time warping (DTW) of scalar data.

The init function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

### Parameters

- `dref` - The reference data array.
- `lref` - The length of the reference data array.
- `sref` - The scaling factor of the reference data array, where `actual_data = input_data * 2**(-scaling_factor)`.
- `delta` - The delta in the endpoint constraints.
- `local` - The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- `slope` - The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- `state` - Pointer to the internal state structure.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
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</thead>
<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_SignalDTWScalarInit_S16(3MLIB)`, `mlib_SignalDTWScalar_S16(3MLIB)`, `mlib_SignalDTWScalarPath_S16(3MLIB)`, `mlib_SignalDTWScalarFree_S16(3MLIB)`
- `attributes(5)`
The `mlib_SignalDTWScalarPath_F32()` function performs dynamic time warping on scalar data. Assume the reference data are

\[ r(y), y=1,2,...,N \]

and the observed data are

\[ o(x), x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{ px(i), py(i) \}, i=1,2,...,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[ \text{dist} = \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) \times m(px(i),py(i)) \]

where \( d(r,o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x,y) \) is the path weighting coefficient associated with path point \( (x,y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)

\[ \sqrt{L-1} \]

\[ d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)| \]

Using L2 norm (Euclidean distance)

\[ \sqrt{L-1} \]

\[ d(r,o) = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2} \]

where \( L \) is the length of each data vector.

To scalar data where \( L=1 \), the two norms are the same.
\[ d(r,o) = |r - o| = \sqrt{(r - o)^2} \]

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   
   \[
   \begin{align*}
   & p_x(1) = 1 \\
   & 1 \leq p_y(1) \leq 1 + \delta \\
   \end{align*}
   \]
   
   and

   \[
   \begin{align*}
   & p_x(Q) = M \\
   & N - \delta \leq p_y(Q) \leq N \\
   \end{align*}
   \]

2. **Monotonicity Conditions**

   \[
   \begin{align*}
   & p_x(i) \leq p_x(i+1) \\
   & p_y(i) \leq p_y(i+1) \\
   \end{align*}
   \]

3. **Local Continuity Constraints**

   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   Itakura Type:

   \[
   \begin{align*}
   & p_x \\
   & \*----*----* \\
   & | \*-----*-----* \\
   & | | \*-----*-----* \\
   & | | | \*-----*----* \\
   & | | | | | \*-----*----* \\
   \end{align*}
   \]

   Allowable paths are

   \[
   \begin{align*}
   & p_1 \rightarrow p_0 \quad (1,0) \\
   & p_2 \rightarrow p_0 \quad (1,1) \\
   & p_3 \rightarrow p_0 \quad (1,2) \\
   \end{align*}
   \]

   Consecutive \((1, 0) (1, 0)\) is disallowed. So path \(p_4 \rightarrow p_1 \rightarrow p_0\) is disallowed.

4. **Global Path Constraints**

   Due to local continuity constraints, certain portions of the \((p_x, p_y)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**

   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \((p_x, p_y)\) plane can be represented in chain code. The value of the chain code is defined as following.
shift (x, y) | chain code
-----------------------------
(1,0)     | 0  
(0,1)     | 1  
(1,1)     | 2  
(2,1)     | 3  
(1,2)     | 4  
(3,1)     | 5  
(3,2)     | 6  
(1,3)     | 7  
(2,3)     | 8  

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

...
The chain code that represents the path is
\[(2 2 2 1 2 0 2 2 0 2 0)\]


**Parameters**
The function takes the following arguments:
- \textit{dist} The distance of the optimal path.
- \textit{path} The optimal path.
- \textit{lpath} The length of the optimal path.
- \textit{dobs} The observed data array.
- \textit{lobs} The length of the observed data array.
- \textit{state} Pointer to the internal state structure.

**Return Values**
The function returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Attributes**
See attributes\(^{(5)}\) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
\texttt{mlib\_SignalDTWScalarInit\_F32(3MLIB)}, \texttt{mlib\_SignalDTWScalar\_F32(3MLIB)},
\texttt{mlib\_SignalDTWScalarPath\_F32(3MLIB)}, \texttt{mlib\_SignalDTWScalarFree\_F32(3MLIB)},
attributes\(^{(5)}\)
mlib_SignalDTWScalarPath_S16 – perform dynamic time warping on scalar data

**Synopsis**

```cpp
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalDTWScalarPath_S16(mlib_d64 *dist, mlib_s32 *path,
                                       mlib_s32 *lpath, const mlib_s16 *dobs,
                                       mlib_s32 lobs, mlib_s32 losb,
                                       void *state);
```

**Description**

The `mlib_SignalDTWScalarPath_S16()` function performs dynamic time warping on scalar data.

Assume the reference data are

\[ r(y), y=1,2,\ldots,N \]

and the observed data are

\[ o(x), x=1,2,\ldots,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = (px(i),py(i)), i=1,2,\ldots,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
\text{dist} = \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) \times m(px(i),py(i))
\]

where \(d(r,o)\) is the dissimilarity between data point/vector \(r\) and data point/vector \(o\); \(m(x,y)\) is the path weighting coefficient associated with path point \((x,y)\); \(N\) is the length of the reference data; \(M\) is the length of the observed data; \(Q\) is the length of the path.

Using L1 norm (sum of absolute differences)

\[
d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)

\[
d(r,o) = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2}
\]

where \(L\) is the length of each data vector.

To scalar data where \(L=1\), the two norms are the same.
\[ d(r,o) = |r - o| = \sqrt{(r - o)^2} \]

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   \[
   \begin{align*}
   p_x(1) &= 1 \\
   1 &\leq p_y(1) \leq 1 + \delta \\
   \text{and} \quad p_x(Q) &= M \\
   M - \delta &\leq p_y(Q) \leq N
   \end{align*}
   \]

2. **Monotonicity Conditions**
   \[
   p_x(i) \leq p_x(i+1) \quad p_y(i) \leq p_y(i+1)
   \]

3. **Local Continuity Constraints**
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   **Itakura Type:**
   
   \[
   \begin{array}{c}
   | \quad | \quad |
   | \quad \star \quad \star \quad \star \quad \star \\
   | p_4 \quad | p_1 \quad | p_0 \\
   | \quad | \quad |
   | \star \quad \star \quad \star \quad \star \\
   | \quad | p_2 \\
   | \quad | \quad |
   \end{array}
   \]

   Allowable paths are
   
   \[
   \begin{align*}
   p_1 \rightarrow p_0 & \quad (1,0) \\
   p_2 \rightarrow p_0 & \quad (1,1) \\
   p_3 \rightarrow p_0 & \quad (1,2)
   \end{align*}
   \]

   Consecutive \( (1,0) (1,0) \) is disallowed. So path \( p_4 \rightarrow p_1 \rightarrow p_0 \) is disallowed.

4. **Global Path Constraints**
   Due to local continuity constraints, certain portions of the \((p_x, p_y)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \((p_x, p_y)\) plane can be represented in chain code. The value of the chain code is defined as following.
<table>
<thead>
<tr>
<th>shift (x, y)</th>
<th>chain code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1,0)</td>
<td>0</td>
</tr>
<tr>
<td>(0,1)</td>
<td>1</td>
</tr>
<tr>
<td>(1,1)</td>
<td>2</td>
</tr>
<tr>
<td>(2,1)</td>
<td>3</td>
</tr>
<tr>
<td>(1,2)</td>
<td>4</td>
</tr>
<tr>
<td>(3,1)</td>
<td>5</td>
</tr>
<tr>
<td>(3,2)</td>
<td>6</td>
</tr>
<tr>
<td>(1,3)</td>
<td>7</td>
</tr>
<tr>
<td>(2,3)</td>
<td>8</td>
</tr>
</tbody>
</table>

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```
py
|
* 8 7 *
|
* 4 * 6
|
1 2 3 5
|
x--0--*--*-- px
```
The chain code that represents the path is
(2 2 2 1 2 0 2 2 0 2 0)


**Parameters**
The function takes the following arguments:
- `dist` The distance of the optimal path.
- `path` The optimal path.
- `lpath` The length of the optimal path.
- `dobs` The observed data array.
- `lobs` The length of the observed data array.
- `sobs` The scaling factor of the observed data array, where `actual_data = input_data * 2**(-scaling_factor)`.
- `state` Pointer to the internal state structure.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_SignalDTWScalarInit_S16(3MLIB), mlib_SignalDTWScalar_S16(3MLIB), mlib_SignalDTWScalarPath_S16(3MLIB), mlib_SignalDTWScalarFree_S16(3MLIB), attributes(5)
mlib_SignalDTWScalar_S16 – perform dynamic time warping on scalar data

Synopsis

```c
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalDTWScalar_S16(mlib_d64 *dist,
    const mlib_s16 *dobs, mlib_s32 lob, mlib_s32 sobs,
    void *state);
```

Description

The `mlib_SignalDTWScalar_S16()` function performs dynamic time warping on scalar data.

Assume the reference data are

\[ r(y), y=1,2,...,N \]

and the observed data are

\[ o(x), x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{px(i),py(i)\}, i=1,2,...,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[ \text{dist} = \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) * m(px(i),py(i)) \]

where \(d(r,o)\) is the dissimilarity between data point/vector \(r\) and data point/vector \(o\); \(m(x,y)\) is the path weighting coefficient associated with path point \((x,y)\); \(N\) is the length of the reference data; \(M\) is the length of the observed data; \(Q\) is the length of the path.

Using L1 norm (sum of absolute differences)

\[ L-1 \]

\[ d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)| \]

Using L2 norm (Euclidean distance)

\[ L-1 \]

\[ d(r,o) = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2} \]

where \(L\) is the length of each data vector.

To scalar data where \(L=1\), the two norms are the same.
\[
d(r,o) = |r - o| = \sqrt{(r - o)^2}
\]

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   
   \[
   px(1) = 1 \\
   1 \leq py(1) \leq 1 + \delta
   \]

   and
   
   \[
   px(Q) = M \\
   N - \delta \leq py(Q) \leq N
   \]

2. **Monotonicity Conditions**
   
   \[
   px(i) \leq px(i+1) \\
   py(i) \leq py(i+1)
   \]

3. **Local Continuity Constraints**
   
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   **Itakura Type:**
   
   \[
   \begin{array}{c}
   \text{py} \\
   o \cdots o \cdots o \\
   p4 \ \ p1 \ \ p0 \\
   o \ \ o \\
   p2 \\
   o \ \ o \\
   \end{array}
   \]

   Allowable paths are
   
   - p1 -> p0 (1, 0)
   - p2 -> p0 (1, 1)
   - p3 -> p0 (1, 2)

   Consecutive (1, 0) (1, 0) is disallowed. So path p4 -> p1 -> p0 is disallowed.

4. **Global Path Constraints**
   
   Due to local continuity constraints, certain portions of the (px, py) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**
   
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

   A path in (px, py) plane can be represented in chain code. The value of the chain code is defined as following.
where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In the following example, the observed data with 11 data points are mapped into the reference data with 9 data points:

```
p y
|   * 8 7 *
|   ** 4 ** 6
| 1 2 3 5
|---0---*--- px
```

```mlib_SignalDTWScalar_S16(3MLIB)
man pages section 3: Multimedia Library Functions • Last Revised 23 May 2007
```
The chain code that represents the path is

\((2 \ 2 \ 2 \ 1 \ 2 \ \ 0 \ 2 \ 2 \ 0 \ 2 \ 0)\)


**Parameters**
The function takes the following arguments:

- `dist` The distance of the optimal path.
- `dobs` The observed data array.
- `lobs` The length of the observed data array.
- `sobs` The scaling factor of the observed data array, where `actual_data = input_data \times 2^{-\text{scaling\_factor}}`.
- `state` Pointer to the internal state structure.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** `mlib_SignalDTWScalar_Init_S16(3MLIB)`, `mlib_SignalDTWScalar_S16(3MLIB)`, `mlib_SignalDTWScalarPath_S16(3MLIB)`, `mlib_SignalDTWScalarFree_S16(3MLIB)`, `attributes(5)`
The `mlib_SignalDTWVector_F32()` function performs dynamic time warping on vector data.

Assume the reference data are

\[ r(y), \ y=1,2,...,N \]

and the observed data are

\[ o(x), \ x=1,2,...,M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{px(i),py(i)\}, \ i=1,2,...,Q \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
\text{dist} = \sum_{i=1}^{Q} d(r(py(i)),o(px(i))) * m(px(i),py(i))
\]

where \(d(r,o)\) is the dissimilarity between data point/vector \(r\) and data point/vector \(o\); \(m(x,y)\) is the path weighting coefficient associated with path point \((x,y)\); \(N\) is the length of the reference data; \(M\) is the length of the observed data; \(Q\) is the length of the path.

Using L1 norm (sum of absolute differences)

\[
L-1 \quad d(r,o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)

\[
L-1 \quad d(r,o) = \sqrt{ \sum_{i=0}^{L-1} (r(i) - o(i))^2 }\]

where \(L\) is the length of each data vector.

To scalar data where \(L=1\), the two norms are the same.

\[
d(r,o) = |r - o| = \sqrt{(r - o)^2}
\]
The constraints of dynamic time warping are:

1. Endpoint constraints
   
   \[ px(1) = 1 \]
   
   \[ 1 \leq py(1) \leq 1 + \delta \]

   and

   \[ px(Q) = M \]
   
   \[ N - \delta \leq py(Q) \leq N \]

2. Monotonicity Conditions
   
   \[ px(i) \leq px(i+1) \]
   
   \[ py(i) \leq py(i+1) \]

3. Local Continuity Constraints
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   Itakura Type:

   \[
   \begin{array}{c|c|c}
   py & p4 & p1 \\
   \hline
   *----*----* & | & |
   | p4 & p1 & p0 \\
   \hline
   \end{array}
   \]

   Allowable paths are

   \[ p1 \rightarrow p0 \quad (1, 0) \]
   
   \[ p2 \rightarrow p0 \quad (1, 1) \]
   
   \[ p3 \rightarrow p0 \quad (1, 2) \]

   Consecutive \((1, 0)\) \((1, 0)\) is disallowed. So path \(p4 \rightarrow p1 \rightarrow p0\) is disallowed.

4. Global Path Constraints
   
   Due to local continuity constraints, certain portions of the \((px, py)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. Slope Weighting
   
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

   A path in \((px, py)\) plane can be represented in chain code. The value of the chain code is defined as following.

   \[
   \begin{array}{l}
   \text{shift} \ (x, y) \ | \ \text{chain code} \\
   \end{array}
   \]
where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In the following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```
py
| 8 7 *
| 4 * 6
| 1 2 3 5
| x-0--*--- px
```

```c
mlib_SignalDTWVector_F32(3MLIB)
```
The chain code that represents the path is
\((2\ 2\ 2\ 1\ 2\ 0\ 2\ 2\ 0\ 2\ 0)\)


**Parameters**  The function takes the following arguments:
- \(\text{dist}\)  The distance of the optimal path.
- \(\text{dobs}\)  The observed data array.
- \(\text{lobs}\)  The length of the observed data array.
- \(\text{state}\)  Pointer to the internal state structure.

**Return Values**  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  `mlib_SignalDTWVectorInit_F32(3MLIB)`, `mlib_SignalDTWVector_F32(3MLIB)`, `mlib_SignalDTWVectorPath_F32(3MLIB)`, `mlib_SignalDTWVectorFree_F32(3MLIB)`, attributes(5)
Name  mlib_SignalDTWVectorFree_S16, mlib_SignalDTWVectorFree_F32 – clean up for vector data

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalDTWVectorFree_S16(void *state);
void mlib_SignalDTWVectorFree_F32(void *state);

Description  Each of these functions frees the internal state structure for dynamic time warping (DTW) of vector data.

This function cleans up the internal state structure and releases all memory buffers.

Parameters  Each of the functions takes the following arguments:

state    Pointer to the internal state structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalDTWVectorInit_S16(3MLIB), mlib_SignalDTWVectorInit_F32(3MLIB),
mlib_SignalDTWVector_S16(3MLIB), mlib_SignalDTWVector_F32(3MLIB),
mlib_SignalDTWVectorPath_S16(3MLIB), mlib_SignalDTWVectorPath_F32(3MLIB),
attributes(5)
mlib_SignalDTWVectorInit_F32 – initialization for vector data

### Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalDTWVectorInit_F32(void *state,
                                          const mlib_f32 **dref, mlib_s32 lref,
                                          mlib_s32 ndata,
                                          mlib_s32 dtype, mlib_s32 delta, mlib_s32 local,
                                          mlib_s32 slope);
```

### Description

The `mlib_SignalDTWVectorInit_F32()` function initializes the internal state structure for dynamic time warping (DTW) of vector data.

The init function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

### Parameters

The function takes the following arguments:

- **dref** The reference data array.
- **lref** The length of the reference data array.
- **ndata** The length of each data vector.
- **dtype** The type of distance metric between data vectors. `MLIB_DTW_L1NORM` for L1 norm of difference (sum of absolute difference). `MLIB_DTW_L2NORM` for L2 norm of difference (Euclidean distance).
- **delta** The delta in the endpoint constraints.
- **local** The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- **slope** The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- **state** Pointer to the internal state structure.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_SignalDTWVectorInit_F32(3MLIB)`, `mlib_SignalDTWVector_F32(3MLIB)`,
- `mlib_SignalDTWVectorPath_F32(3MLIB)`, `mlib_SignalDTWVectorFree_F32(3MLIB)`,
# mlib_SignalDTWVectorInit_S16

The `mlib_SignalDTWVectorInit_S16()` function initializes the internal state structure for dynamic time warping (DTW) of vector data.

The init function performs internal state structure allocation and global initialization. Per DTW function call initialization is done in DTW function, so the same internal state structure can be reused for multiple DTW function calls.

## Parameters

- **dref**: The reference data array.
- **lref**: The length of the reference data array.
- **ndata**: The length of each data vector.
- **dtype**: The type of distance metric between data vectors. `MLIB_DTW_L1NORM` for L1 norm of difference (sum of absolute difference). `MLIB_DTW_L2NORM` for L2 norm of difference (Euclidean distance).
- **sref**: The scaling factor of the reference data array, where `actual_data = input_data * 2 ** (-scaling_factor)`.
- **delta**: The delta in the endpoint constraints.
- **local**: The type of the local continuity constraints. `MLIB_DTW_ITAKURA` for Itakura type constraints.
- **slope**: The type of the slope weighting. `MLIB_DTW_NONE` for no slope weighting.
- **state**: Pointer to the internal state structure.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>
See Also  
mlib_SignalDTWVectorInit_S16(3MLIB), mlib_SignalDTWVector_S16(3MLIB),
mlib_SignalDTWVectorPath_S16(3MLIB), mlib_SignalDTWVectorFree_S16(3MLIB),
attributes(5)
The `mlib_SignalDTWVectorPath_F32()` function performs dynamic time warping on vector data.

Assume the reference data are

\[ r(y), \ y = 1, 2, \ldots, N \]

and the observed data are

\[ o(x), \ x = 1, 2, \ldots, M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{px(i), py(i)\}, \ i = 1, 2, \ldots, 0 \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
\text{dist} = \sum_{i=1}^{Q} d(r(py(i)), o(px(i))) \cdot m(px(i), py(i))
\]

where \( d(r, o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x, y) \) is the path weighting coefficient associated with path point \( (x, y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)

\[
L-1 \quad d(r, o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)

\[
L-1 \quad d(r, o) = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2}
\]

where \( L \) is the length of each data vector.

To scalar data where \( L = 1 \), the two norms are the same.
\[ d(r,o) = |r - o| = \sqrt{(r - o)^2} \]

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   
   \[ px(1) = 1 \]
   \[ 1 \leq py(1) \leq 1 + \delta \]

   and

   \[ px(Q) = M \]
   \[ N - \delta \leq py(Q) \leq N \]

2. **Monotonicity Conditions**

   \[ px(i) \leq px(i+1) \]
   \[ py(i) \leq py(i+1) \]

3. **Local Continuity Constraints**

   See Table 4.5 on page 211 in Rabiner and Juang's book.

   **Itakura Type:**

   \[
   \begin{array}{c}
   \text{py} \\
   | \\
   *-----*-----* \\
   |p4 |p1 |p0 \\
   | | | \\
   *-----*-----* \\
   | |p2 | \\
   | | | \\
   *-----*-----*-- px \\
   \end{array}
   \]

   Allowable paths are

   \[ p1 \rightarrow p0 \quad (1, 0) \]
   \[ p2 \rightarrow p0 \quad (1, 1) \]
   \[ p3 \rightarrow p0 \quad (1, 2) \]

   Consecutive \((1, 0) (1, 0)\) is disallowed. So path \(p4 \rightarrow p1 \rightarrow p0\) is disallowed.

4. **Global Path Constraints**

   Due to local continuity constraints, certain portions of the \((px, py)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**

   See Equation 4.150-3 on page 216 in Rabiner and Juang's book.

   A path in \((px, py)\) plane can be represented in chain code. The value of the chain code is defined as following.
**shift (x, y) | chain code**

<table>
<thead>
<tr>
<th>x, y</th>
<th>Chain code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, 0)</td>
<td>0</td>
</tr>
<tr>
<td>(0, 1)</td>
<td>1</td>
</tr>
<tr>
<td>(1, 1)</td>
<td>2</td>
</tr>
<tr>
<td>(2, 1)</td>
<td>3</td>
</tr>
<tr>
<td>(1, 2)</td>
<td>4</td>
</tr>
<tr>
<td>(3, 1)</td>
<td>5</td>
</tr>
<tr>
<td>(3, 2)</td>
<td>6</td>
</tr>
<tr>
<td>(1, 3)</td>
<td>7</td>
</tr>
<tr>
<td>(2, 3)</td>
<td>8</td>
</tr>
</tbody>
</table>

**py**

```
<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8 7</td>
</tr>
<tr>
<td>4 6</td>
</tr>
<tr>
<td>1 2 3 5</td>
</tr>
<tr>
<td>x--0--<em>--</em>-- px</td>
</tr>
</tbody>
</table>
```

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points

```
9 | **** *** * * * * * * * * * * |
   | /\                          |
   | * * * * * * * * * * * * * |
   | /\                        |
   | * * * * * * * * * * * * * |
   | /\                      |
   | * * * * * * * * * * * * * |
   | /\                  |
   | * * * * * * * * * * * * * |
   | /\              |
   | * * * * * * * * * * * * * |
   | /\          |
   | * * * * * * * * * * * * * |
   | /\      |
   | * * * * * * * * * * * * * |
   | /\   |
   | * * * * * * * * * * * * * |
   | /\ |
   | * * * * * * * * * * * * * |
   | / |
   | * * * * * * * * * * * * * |
```

```
The chain code that represents the path is
\[(2 \ 2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 2 \ 0 \ 2 \ 0)\]


**Parameters**
The function takes the following arguments:
- \textit{dist} The distance of the optimal path.
- \textit{path} The optimal path.
- \textit{lpath} The length of the optimal path.
- \textit{dobs} The observed data array.
- \textit{lobs} The length of the observed data array.
- \textit{state} Pointer to the internal state structure.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
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**See Also**
mlib_SignalDTWVectorInit_F32(3MLIB), mlib_SignalDTWVector_F32(3MLIB),
mlib_SignalDTWVectorPath_F32(3MLIB), mlib_SignalDTWVectorFree_F32(3MLIB),
attributes(5)
The `mlib_SignalDTWVectorPath_S16()` function performs dynamic time warping on vector data.

Assume the reference data are
\[ r(y), \ y=1,2,...,N \]
and the observed data are
\[ o(x), \ x=1,2,...,M \]
the dynamic time warping is to find a mapping function (a path)
\[ p(i) = \{px(i),py(i)\}, \ i=1,2,...,Q \]
with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as
\[
\begin{align*}
\text{dist} & = \sum_{i=1}^{Q} d(r(py(i)), o(px(i))) \cdot m(px(i),py(i)) \\
& \quad + \sum_{i=1}^{Q} \end{align*}
\]
where \( d(r,o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x,y) \) is the path weighting coefficient associated with path point \( (x,y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)
\[
\begin{align*}
d(r,o) & = \sum_{i=0}^{L-1} |r(i) - o(i)| \\
& \quad + \sum_{i=1}^{Q} \end{align*}
\]
Using L2 norm (Euclidean distance)
\[
\begin{align*}
d(r,o) & = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2} \\
& \quad + \sum_{i=1}^{Q} \end{align*}
\]
where \( L \) is the length of each data vector.
To scalar data where \( L=1 \), the two norms are the same.
\[ d(r, o) = |r - o| = \sqrt{(r - o)^2} \]

The constraints of dynamic time warping are:

1. **Endpoint constraints**
   
   \[
   \begin{align*}
   p_x(1) &= 1 \\
   1 &\leq p_y(1) \leq 1 + \delta \\
   
   p_x(Q) &= M \\
   N - \delta &\leq p_y(Q) \leq N
   \end{align*}
   \]

2. **Monotonicity Conditions**
   
   \[
   \begin{align*}
   p_x(i) &\leq p_x(i+1) \\
   p_y(i) &\leq p_y(i+1)
   \end{align*}
   \]

3. **Local Continuity Constraints**
   
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   **Itakura Type:**
   
   \[
   \begin{array}{c|c|c}
   \hline
   & | & \\
   \hline
   p_4 & p_1 & p_0 \\
   \hline
   *----*----* & | & | \\
   \hline
   p_2 & | & | \\
   \hline
   *----*----* & | & | \\
   \hline
   *----*----* & px & \\
   \hline
   p_3 & & \\
   \hline
   \end{array}
   \]

   Allowable paths are
   
   \[
   \begin{align*}
   p_1 &\rightarrow p_0 & (1, 0) \\
   p_2 &\rightarrow p_0 & (1, 1) \\
   p_3 &\rightarrow p_0 & (1, 2)
   \end{align*}
   \]

   Consecutive \((1, 0)\) \((1, 0)\) is disallowed. So path \(p_4 \rightarrow p_1 \rightarrow p_0\) is disallowed.

4. **Global Path Constraints**
   
   Due to local continuity constraints, certain portions of the \((p_x, p_y)\) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. **Slope Weighting**
   
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \((p_x, p_y)\) plane can be represented in chain code. The value of the chain code is defined as following.
### Shift (x, y) | Chain Code

| (1, 0) | 0  
| (0, 1) | 1  
| (1, 1) | 2  
| (2, 1) | 3  
| (1, 2) | 4  
| (3, 1) | 5  
| (3, 2) | 6  
| (1, 3) | 7  
| (2, 3) | 8  

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points:

```
  py
  |
* 8 7 *
|
* 4 * 6
|
1 2 3 5
|
*--0--*--*-- px
```

```python
9 | * * * * * * * _._  
| / 
| * * * * * _._ * _ _  
| / 
| * * * * * * * * *  
| / 
| * * * _._ * * * *  
| / 
| * * * * * * * * *  
| / 
| * * * * * * * * *  
| / 
| * * * * * * * * *  
| / 
| * * * * * * * * *  
| / 
1 | * * * * * * * * *  
```
The chain code that represents the path is

\((2 \ 2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 2 \ 0 \ 2 \ 0)\)


**Parameters**

The function takes the following arguments:

- \(dist\) The distance of the optimal path.
- \(path\) The optimal path.
- \(lpath\) The length of the optimal path.
- \(dobs\) The observed data array.
- \(lobs\) The length of the observed data array.
- \(sobs\) The scaling factor of the observed data array, where \(\text{actual\_data} = \text{input\_data} * 2^{\text{-\_scaling\_factor}}\).
- \(state\) Pointer to the internal state structure.

**Return Values**

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes\(^{(5)}\) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

mlib_SignalDTWVectorInit_S16(3MLIB), mlib_SignalDTWVectorPath_S16(3MLIB), mlib_SignalDTWVectorFree_S16(3MLIB), attributes\(^{(5)}\)
The `mlib_SignalDTWVector_S16()` function performs dynamic time warping on vector data. Assume the reference data are

\[ r(y), \ y = 1, 2, \ldots, N \]

and the observed data are

\[ o(x), \ x = 1, 2, \ldots, M \]

the dynamic time warping is to find a mapping function (a path)

\[ p(i) = \{ px(i), py(i) \}, \ i = 1, 2, \ldots, 0 \]

with the minimum distance.

In K-best paths case, K paths with the K minimum distances are searched.

The distance of a path is defined as

\[
dist = \sum_{i=1}^{Q} \left[ d(\{ py(i) \}, o(\{ px(i) \})) \times m(\{ px(i), py(i) \}) \right]
\]

where \( d(r, o) \) is the dissimilarity between data point/vector \( r \) and data point/vector \( o \); \( m(x, y) \) is the path weighting coefficient associated with path point \( (x, y) \); \( N \) is the length of the reference data; \( M \) is the length of the observed data; \( Q \) is the length of the path.

Using L1 norm (sum of absolute differences)

\[
dl_{1}(r, o) = \sum_{i=0}^{L-1} |r(i) - o(i)|
\]

Using L2 norm (Euclidean distance)

\[
dl_{2}(r, o) = \sqrt{\sum_{i=0}^{L-1} (r(i) - o(i))^2}
\]

where \( L \) is the length of each data vector.

To scalar data where \( L=1 \), the two norms are the same.
The constraint of dynamic time warping are:

1. Endpoint constraints
   
   \[ p_x(1) = 1 \]
   
   \[ 1 \leq p_y(1) \leq 1 + \delta \]

   and

   \[ p_x(Q) = M \]
   
   \[ N - \delta \leq p_y(Q) \leq N \]

2. Monotonicity Conditions
   
   \[ p_x(i) \leq p_x(i+1) \]
   
   \[ p_y(i) \leq p_y(i+1) \]

3. Local Continuity Constraints
   
   See Table 4.5 on page 211 in Rabiner and Juang’s book.

   Itakura Type:

   \[
   \begin{array}{|c|c|c|c|}
   \hline
   & p_4 & p_1 & p_0 \\
   \hline
   p_4 & & & \\
   \hline
   p_3 & & & \\
   \hline
   \end{array}
   \]

   Allowable paths are

   \[ p_1 \rightarrow p_0 \] \hspace{0.5cm} (1,0) \hspace{0.5cm} p_2 \rightarrow p_0 \] \hspace{0.5cm} (1,1) \hspace{0.5cm} p_3 \rightarrow p_0 \] \hspace{0.5cm} (1,2) \hspace{0.5cm}

   Consecutive (1,0) (1,0) is disallowed. So path \( p_4 \rightarrow p_1 \rightarrow p_0 \) is disallowed.

4. Global Path Constraints
   
   Due to local continuity constraints, certain portions of the \( (p_x, p_y) \) plane are excluded from the region the optimal warping path can traverse. This forms global path constraints.

5. Slope Weighting
   
   See Equation 4.150-3 on page 216 in Rabiner and Juang’s book.

A path in \( (p_x, p_y) \) plane can be represented in chain code. The value of the chain code is defined as following.
### Chain Code Table

<table>
<thead>
<tr>
<th>shift (x, y)</th>
<th>chain code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, 0)</td>
<td>0</td>
</tr>
<tr>
<td>(0, 1)</td>
<td>1</td>
</tr>
<tr>
<td>(1, 1)</td>
<td>2</td>
</tr>
<tr>
<td>(2, 1)</td>
<td>3</td>
</tr>
<tr>
<td>(1, 2)</td>
<td>4</td>
</tr>
<tr>
<td>(3, 1)</td>
<td>5</td>
</tr>
<tr>
<td>(3, 2)</td>
<td>6</td>
</tr>
<tr>
<td>(1, 3)</td>
<td>7</td>
</tr>
<tr>
<td>(2, 3)</td>
<td>8</td>
</tr>
</tbody>
</table>

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.

In following example, the observed data with 11 data points are mapped into the reference data with 9 data points:

```
1 0--*--*-- px
```

py
| * 8 7 *
| * 4 * 6
| 1 2 3 5

where x marks the start point of a path segment, the numbers are the values of the chain code for the segment that ends at the point.
The chain code that represents the path is

\[(2 \ 2 \ 2 \ 1 \ 2 \ 0 \ 2 \ 2 \ 0 \ 2 \ 0)\]


**Parameters**  The function takes the following arguments:

- `dist` The distance of the optimal path.
- `dobs` The observed data array.
- `lobs` The length of the observed data array.
- `sobs` The scaling factor of the observed data array, where \( \text{actual\_data} = \text{input\_data} \times 2^{-\text{scaling\_factor}} \).
- `state` Pointer to the internal state structure.

**Return Values**  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
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<tr>
<th>ATTRIBUTE TYPE</th>
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<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  `mlib_SignalDTWVectorInit_S16(3MLIB), mlib_SignalDTWVector_S16(3MLIB), mlib_SignalDTWVectorPath_S16(3MLIB), mlib_SignalDTWVectorFree_S16(3MLIB), attributes(5)`
mlib_SignalEmphasizeFree_S16_S16(3MLIB)

Name  mlib_SignalEmphasizeFree_S16_S16, mlib_SignalEmphasizeFree_S16S_S16S, mlib_SignalEmphasizeFree_F32_F32, mlib_SignalEmphasizeFree_F32S_F32S – clean up for signal pre-emphasizing

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalEmphasizeFree_S16_S16(void *filter);
void mlib_SignalEmphasizeFree_S16S_S16S(void *filter);
void mlib_SignalEmphasizeFree_F32_F32(void *filter);
void mlib_SignalEmphasizeFree_F32S_F32S(void *filter);

Description  Each of these functions releases the memory allocated for the internal state’s structure.

Parameters  Each of the functions takes the following arguments:

  filter  Internal filter structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_SignalEmphasize_S16_S16_Sat(3MLIB),
mlib_SignalEmphasizeInit_S16_S16(3MLIB), attributes(5)
**mlib_SignalEmphasizeInit_S16_S16, mlib_SignalEmphasizeInit_S16S_S16S, mlib_SignalEmphasizeInit_F32_F32, mlib_SignalEmphasizeInit_F32S_F32S** – initialization for signal pre-emphasizing

**Synopsis**

```c
cc [ flag ... ] file ... -lmlib [ library ... ]
#include <mlib.h>

mlib_status mlib_SignalEmphasizeInit_S16_S16(void **filter, mlib_f32 alpha);
mlib_status mlib_SignalEmphasizeInit_S16S_S16S(void **filter, mlib_f32 alpha);
mlib_status mlib_SignalEmphasizeInit_F32_F32(void **filter, mlib_f32 alpha);
mlib_status mlib_SignalEmphasizeInit_F32S_F32S(void **filter, mlib_f32 alpha);
```

**Description**

Each of these functions allocates memory for an internal filter structure and converts the filter coefficients into the internal representation.

**Parameters**

Each of the functions takes the following arguments:

- `filter` Internal filter structure.
- `alpha` Emphasizing coefficient. $0 < \alpha < 1.0$

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
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<tbody>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**

`mlib_SignalEmphasize_S16_S16_Sat(3MLIB),
mlib_SignalEmphasizeFree_S16_S16(3MLIB), attributes(5)`
mlib_SignalEmphasize_S16_S16_Sat, mlib_SignalEmphasize_S16_S16_Sat, mlib_SignalEmphasize_F32_F32, mlib_SignalEmphasize_F32_F32 – signal pre-emphasizing

cc [-flag... ] file... -lmlib [ -library... ]
#include <mlib.h>

mlib_status mlib_SignalEmphasize_S16_S16_Sat(mlib_s16 *dst, const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalEmphasize_S16S_S16S_Sat(mlib_s16 *dst, const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalEmphasize_F32_F32(mlib_f32 *dst, const mlib_f32 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalEmphasize_F32S_F32S(mlib_f32 *dst, const mlib_f32 *src, void *filter, mlib_s32 n);

Each of these functions applies the preemphasizer to one signal packet and updates the filter states.

For monaural signals, the following equation is used:

dst[i] = src[i] - alpha*src[i - 1]

where i = 0, 1, ..., (n - 1); src[-1] = 0.

For stereo signals, the following equation is used:

dst[2*i + 1] = src[2*i + 1] - alpha*src[2*(i - 1) + 1]

where i = 0, 1, ..., (n - 1); src[-2] = src[-1] = 0.

Each of the functions takes the following arguments:

dst Destination signal array.
src Source signal array.
filter Internal filter structure.
n Number of samples in the source signal array.

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
</tbody>
</table>
### mlib_SignalEmphasize_S16_S16_Sat(3MLIB)

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
- mlib_SignalEmphasizeFree_S16_S16(3MLIB),
- mlib_SignalEmphasizeInit_S16_S16(3MLIB), attributes(5)
Name
mlib_SignalFFT_1, mlib_SignalFFT_1_S16_S16_Mod,
mlib_SignalFFT_1_S16C_S16C_Mod, mlib_SignalFFT_1_S16C_S16_Mod,
mlib_SignalFFT_1_S16_Mod, mlib_SignalFFT_1_S16C_Mod, mlib_SignalFFT_1_F32_F32,
mlib_SignalFFT_1_F32C_F32C, mlib_SignalFFT_1_F32C_F32, mlib_SignalFFT_1_F32,
mlib_SignalFFT_1_F32C, mlib_SignalFFT_1_D64_D64, mlib_SignalFFT_1_D64C_D64C,
mlib_SignalFFT_1_D64C_D64, mlib_SignalFFT_1_D64, mlib_SignalFFT_1_D64C – signal
Fast Fourier Transform (FFT)

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFFT_1_S16_S16_Mod(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_S16C_S16C_Mod(mlib_s16 *dstr, mlib_s16 *dstc,
const mlib_s16 *srcc, mlib_s32 order);
mlib_status mlib_SignalFFT_1_S16C_S16_Mod(mlib_s16 *dstr, mlib_s16 *dstc,
const mlib_s16 *srcr, mlib_s32 order);
mlib_status mlib_SignalFFT_1_S16_Mod(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcdstr, mlib_s32 order);
mlib_status mlib_SignalFFT_1_S16C_Mod(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcdstr, mlib_s32 order);
mlib_status mlib_SignalFFT_1_F32_F32(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcc, mlib_f32 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_F32C_F32C(mlib_f32 *dstr, mlib_f32 *dstc,
const mlib_f32 *srcc, mlib_f32 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_F32C_F32(mlib_f32 *dstr, mlib_f32 *dstc,
const mlib_f32 *srcc, mlib_f32 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_F32(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcdstr, mlib_s32 order);
mlib_status mlib_SignalFFT_1_F32C(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcc, mlib_f32 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_D64_D64(mlib_d64 *dstr, mlib_d64 *dsti,
const mlib_d64 *srcdstr, mlib_d64 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_D64C_D64C(mlib_d64 *dstr, mlib_d64 *dstc,
const mlib_d64 *srcc, mlib_d64 *srcci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_D64C_D64(mlib_d64 *dstr, mlib_d64 *dstc,
const mlib_d64 *srcc, mlib_d64 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_1_D64(mlib_d64 *dstr, mlib_d64 *dsti,
const mlib_d64 *srcc, mlib_d64 *srci, mlib_s32 order);
Each of the functions in this group performs Fast Fourier Transform (FFT).

The following equation is used for forward FFT:

$$
dst[k] = \frac{1}{N} \sum_{n=0}^{N-1} \{src[n] \times \exp(-j2\pi n k/N)\} 
$$

and the following equation is used for inverse FFT (IFFT):

$$
dst[n] = \frac{1}{N} \sum_{k=0}^{N-1} \{src[k] \times \exp(j2\pi n k/N)\} 
$$

where

k = 0, 1, ..., (N - 1)
n = 0, 1, ..., (N - 1)
N = 2**order

The signal FFT/IFFT functions can be categorized into four groups according to the scale mode in the function names in the following form:

mlib_Signal[FFT|IFFT]_ScaleMode_OutType_InType_OpMode()
mlib_Signal[FFT|IFFT]_ScaleMode_DataType_OpMode()

The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, C1 = 1 and C2 = 2**order.
- For ScaleMode = 2, C1 = 2**order and C2 = 1.
- For ScaleMode = 3, C1 = C2 = 2**(order/2) when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.
- For ScaleMode = 4, C1 = 2**P and C2 = 2**Q, where P and Q are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

Each function takes some of the following arguments:

- **dstr** Destination signal array that contains the real parts.
- **dsti** Destination signal array that contains the imaginary parts.
- **srcr** Source signal array that contains the real parts.
- **srci** Source signal array that contains the imaginary parts.
**dstc** Complex destination signal array. \( \text{dstc}[2*i] \) contains the real parts, and \( \text{dstc}[2*i+1] \) contains the imaginary parts.

**srcc** Complex source signal array. \( \text{srcc}[2*i] \) contains the real parts, and \( \text{srcc}[2*i+1] \) contains the imaginary parts.

**srcdstr** Source and destination signal array that contains the real parts.

**srcdsti** Source and destination signal array that contains the imaginary parts.

**srcdstc** Complex source and destination signal array. \( \text{srcdstc}[2*i] \) contains the real parts, and \( \text{srcdstc}[2*i+1] \) contains the imaginary parts.

**order** Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values** The function returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Attributes** See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_2(3MLIB), mlib_SignalFFT_3(3MLIB), mlib_SignalFFT_4(3MLIB), mlib_SignalIFFT_1(3MLIB), mlib_SignalIFFT_2(3MLIB), mlib_SignalIFFT_3(3MLIB), mlib_SignalIFFT_4(3MLIB), attributes(5)
Name  
mlib_SignalFFT_2, mlib_SignalFFT_2_S16_S16, mlib_SignalFFT_2_S16C_S16C,
mlib_SignalFFT_2_S16C_S16, mlib_SignalFFT_2_S16, mlib_SignalFFT_2_S16C,
mlib_SignalFFT_2_F32_F32, mlib_SignalFFT_2_F32C_F32C,
mlib_SignalFFT_2_F32C_F32, mlib_SignalFFT_2_F32, mlib_SignalFFT_2_F32C,
mlib_SignalFFT_2_D64_D64, mlib_SignalFFT_2_D64C_D64C,
mlib_SignalFFT_2_D64C_D64, mlib_SignalFFT_2_D64, mlib_SignalFFT_2_D64C

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFFT_2_S16_S16(mlib_s16 *dstr, mlib_s16 *dsti,
        const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_2_S16C_S16C(mlib_s16 *dstc,
        const mlib_s16 *srcc,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_S16C_S16(mlib_s16 *dstc,
        const mlib_s16 *srcr,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_S16(mlib_s16 *srcdstr,
        mlib_s16 *srcdsti,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_S16C(mlib_s16 *srcdstc,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_F32_F32(mlib_f32 *dstr,
        mlib_f32 *dsti, const mlib_f32 *srcc,
        const mlib_f32 *srcr,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_F32C_F32C(mlib_f32 *dstc,
        const mlib_f32 *srcc,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_F32C_F32(mlib_f32 *dstc,
        const mlib_f32 *srcr,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_F32(mlib_f32 *srcdstr,
        mlib_f32 *srcdsti,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_F32C(mlib_f32 *srcdstc,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_D64_D64(mlib_d64 *dstr, mlib_d64 *dsti,
        const mlib_d64 *srcc, const mlib_d64 *srcr, mlib_s32 order);
mlib_status mlib_SignalFFT_2_D64C_D64C(mlib_d64 *dstc,
        const mlib_d64 *srcr, mlib_s32 order);
mlib_status mlib_SignalFFT_2_D64C_D64(mlib_d64 *dstc, const mlib_d64 *srcr,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_D64(mlib_d64 *srcdstr, mlib_d64 *srcdsti,
        mlib_s32 order);
mlib_status mlib_SignalFFT_2_D64C(mlib_d64 *srcdstc, mlib_s32 order);

**Description**  Each of the functions in this group performs Fast Fourier Transform (FFT).

The following equation is used for forward FFT:

\[
1 \quad N-1 \\
\text{dst}[k] = \sum_{n=0}^{N-1} \text{src}[n] \times \exp(-j2\pi n k/N)
\]

\[C1\]

and the following equation is used for inverse FFT (IFFT):

\[
1 \quad N-1 \\
\text{dst}[n] = \sum_{k=0}^{N-1} \text{src}[k] \times \exp(j2\pi n k/N)
\]

\[C2\]

where

- \(k = 0, 1, \ldots, (N - 1)\)
- \(n = 0, 1, \ldots, (N - 1)\)
- \(N = 2^{\text{order}}\)

The signal FFT/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

- \(\text{mlib_SignalFFT|IFFT|ScaleMode|OutType|InType|OpMode}()\)
- \(\text{mlib_SignalFFT|IFFT|ScaleMode|DataType|OpMode}()\)

The scaling factors \(C1\) and \(C2\) used in the equations are defined as follows:

- For ScaleMode = 1, \(C1 = 1\) and \(C2 = 2^{\text{order}}\).
- For ScaleMode = 2, \(C1 = 2^{\text{order}}\) and \(C2 = 1\).
- For ScaleMode = 3, \(C1 = C2 = 2^{\text{order}/2}\) when order is even, or \(C1 = 2^{\text{(order+1)/2}}\) and \(C2 = 2^{\text{(order-1)/2}}\) when order is odd.
- For ScaleMode = 4, \(C1 = 2^{P}\) and \(C2 = 2^{Q}\), where \(P\) and \(Q\) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**  Each function takes some of the following arguments:

- \(\text{dst}r\)  Destination signal array that contains the real parts.
- \(\text{dst}i\)  Destination signal array that contains the imaginary parts.
- \(\text{src}r\)  Source signal array that contains the real parts.
- \(\text{src}i\)  Source signal array that contains the imaginary parts.
Complex destination signal array. \(\text{dstc}[2*i]\) contains the real parts, and \(\text{dstc}[2*i+1]\) contains the imaginary parts.

Complex source signal array. \(\text{srcc}[2*i]\) contains the real parts, and \(\text{srcc}[2*i+1]\) contains the imaginary parts.

Source and destination signal array that contains the real parts.

Source and destination signal array that contains the imaginary parts.

Complex source and destination signal array. \(\text{srcdstc}[2*i]\) contains the real parts, and \(\text{srcdstc}[2*i+1]\) contains the imaginary parts.

Order
Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
<th>Attribute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_3(3MLIB), mlib_SignalFFT_4(3MLIB), mlib_SignalIFFT_1(3MLIB), mlib_SignalIFFT_2(3MLIB), mlib_SignalIFFT_3(3MLIB), mlib_SignalIFFT_4(3MLIB), attributes(5)
Name

mlib_SignalFFT_3, mlib_SignalFFT_3_S16_S16_Mod,
mlib_SignalFFT_3_S16C_S16C_Mod, mlib_SignalFFT_3_S16C_S16_Mod,
mlib_SignalFFT_3_S16_Mod, mlib_SignalFFT_3_S16C_Mod, mlib_SignalFFT_3_F32_F32,
mlib_SignalFFT_3_F32C_F32C, mlib_SignalFFT_3_F32C_F32, mlib_SignalFFT_3_F32,
mlib_SignalFFT_3_F32C, mlib_SignalFFT_3_D64_D64, mlib_SignalFFT_3_D64C_D64C,
mlib_SignalFFT_3_D64C_D64, mlib_SignalFFT_3_D64, mlib_SignalFFT_3_D64C – signal
Fast Fourier Transform (FFT)

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFFT_3_S16_S16_Mod(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_S16C_S16C_Mod(mlib_s16 *dstr,
const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_S16C_S16_Mod(mlib_s16 *dstr,
const mlib_s16 *srcr, mlib_s32 order);

mlib_status mlib_SignalFFT_3_S16_S16_Mod(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_F32_F32(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_F32C_F32(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_F32C_F32C(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_F32C_F32(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_F32C_F32C(mlib_f32 *dstr, mlib_f32 *dsti,
const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_D64_D64(mlib_d64 *dstr, mlib_d64 *dsti,
const mlib_d64 *srcr, const mlib_d64 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_D64C_D64C(mlib_d64 *dstr, mlib_d64 *dsti,
const mlib_d64 *srcr, const mlib_d64 *srci, mlib_s32 order);

mlib_status mlib_SignalFFT_3_D64C_D64(mlib_d64 *dstr, mlib_d64 *dsti,
const mlib_d64 *srcr, const mlib_d64 *srci, mlib_s32 order);
mlib_status mlib_SignalFFT_3_D64C_D64C(mlib_d64 *dstc,
const mlib_d64 *srcc,
   mlib_s32 order);

mlib_status mlib_SignalFFT_3_D64C_D64(mlib_d64 *dstc,
const mlib_d64 *srcr,
   mlib_s32 order);

mlib_status mlib_SignalFFT_3_D64C(mlib_d64 *srcdstc,
   mlib_s32 order);

mlib_status mlib_SignalFFT_3_D64C(mlib_d64 *srcdstc,
   mlib_s32 order);

Description Each of the functions in this group performs Fast Fourier Transform (FFT).

The following equation is used for forward FFT:

\[
\sum_{n=0}^{N-1} \frac{1}{N} \cdot \text{src}[n] \cdot \exp(-j2\pi n k/N)
\]

and the following equation is used for inverse FFT (IFFT):

\[
\sum_{k=0}^{N-1} \frac{1}{N} \cdot \text{src}[k] \cdot \exp(j2\pi n k/N)
\]

where

- \(k = 0, 1, \ldots, (N - 1)\)
- \(n = 0, 1, \ldots, (N - 1)\)
- \(N = 2^{\text{order}}\)

The signal FFT/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

- mlib_SignalFFT[IFFT]_ScaleMode_OutType_InType_OpMode()
- mlib_SignalFFT[IFFT]_ScaleMode_DataType_OpMode()

The scaling factors \(C1\) and \(C2\) used in the equations are defined as follows:

- For ScaleMode = 1, \(C1 = 1\) and \(C2 = 2^{\text{order}}\).
- For ScaleMode = 2, \(C1 = 2^{\text{order}}\) and \(C2 = 1\).
- For ScaleMode = 3, \(C1 = 2^{\text{order}/2}\) when order is even, or \(C1 = 2^{((\text{order}+1)/2)}\) and \(C2 = 2^{((\text{order}-1)/2)}\) when order is odd.
- For ScaleMode = 4, \(C1 = 2^{\text{P}}\) and \(C2 = 2^{\text{Q}}\), where \(\text{P}\) and \(\text{Q}\) are adaptive scaling factors and are generated by the functions.
For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

Parameters
Each function takes some of the following arguments:

dstr Destination signal array that contains the real parts.
dsti Destination signal array that contains the imaginary parts.
srcr Source signal array that contains the real parts.
scri Source signal array that contains the imaginary parts.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also
mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_2(3MLIB), mlib_SignalFFT_4(3MLIB), mlib_SignalIFFT_1(3MLIB), mlib_SignalIFFT_2(3MLIB), mlib_SignalIFFT_3(3MLIB), mlib_SignalIFFT_4(3MLIB), attributes(5)
mlib_SignalFFT_4(3MLIB)

**Name**
mlib_SignalFFT_4, mlib_SignalFFT_4_S16_S16, mlib_SignalFFT_4_S16C_S16C,
mlib_SignalFFT_4_S16C_S16, mlib_SignalFFT_4_S16, mlib_SignalFFT_4_S16C – signal
Fast Fourier Transform (FFT)

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_SignalFFT_4_S16_S16(mlib_s16 *dstr, mlib_s16 *dsti,
        const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order,
        mlib_s32 *scale);
mlib_status mlib_SignalFFT_4_S16C_S16C(mlib_s16 *dstc,
        const mlib_s16 *srcc,
        mlib_s32 order, mlib_s32 *scale);
mlib_status mlib_SignalFFT_4_S16C_S16(mlib_s16 *dstc,
        const mlib_s16 *srcc,
        mlib_s32 order, mlib_s32 *scale);
mlib_status mlib_SignalFFT_4_S16_S16(mlib_s16 *srdstr, mlib_s16 *srddst,
        mlib_s32 order, mlib_s32 *scale);
mlib_status mlib_SignalFFT_4_S16C_S16C(mlib_s16 *srcdstc, mlib_s32 order,
        mlib_s32 *scale);
```

**Description**
Each of the functions in this group performs Fast Fourier Transform (FFT).
The following equation is used for forward FFT:

\[
dst[k] = \frac{1}{N-1} \sum_{n=0}^{N-1} \text{src}[n] \cdot \exp(-j2\pi n k / N)\]

and the following equation is used for inverse FFT (IFFT):

\[
dst[n] = \frac{1}{N-1} \sum_{k=0}^{N-1} \text{src}[k] \cdot \exp(j2\pi n k / N)\]

where

- \( k = 0, 1, \ldots, (N - 1) \)
- \( n = 0, 1, \ldots, (N - 1) \)
- \( N = 2^{\text{order}} \)

The signal FFT/IFFT functions can be categorized into four groups according to the
ScaleMode in the function names in the following form:

- mlib_Signal[FFT|IFFT]_ScaleMode_OutType_InType_OpMode()
- mlib_Signal[FFT|IFFT]_ScaleMode_DataType_OpMode()

The scaling factors \( C_1 \) and \( C_2 \) used in the equations are defined as follows:

- For ScaleMode = 1, \( C_1 = 1 \) and \( C_2 = 2^{\text{order}} \).
For ScaleMode = 2, \( C1 = 2^{\text{order}} \) and \( C2 = 1 \).

For ScaleMode = 3, \( C1 = C2 = 2^{\text{order}/2} \) when order is even, or \( C1 = 2^{((\text{order}+1)/2)} \) and \( C2 = 2^{((\text{order}-1)/2)} \) when order is odd.

For ScaleMode = 4, \( C1 = 2^{\text{P}} \) and \( C2 = 2^{\text{Q}} \), where \( \text{P} \) and \( \text{Q} \) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**
Each function takes some of the following arguments:

- \( dstr \) Destination signal array that contains the real parts.
- \( dsti \) Destination signal array that contains the imaginary parts.
- \( srcr \) Source signal array that contains the real parts.
- \( srci \) Source signal array that contains the imaginary parts.
- \( dstc \) Complex destination signal array. \( \text{dstc}[2*i] \) contains the real parts, and \( \text{dstc}[2*i+1] \) contains the imaginary parts.
- \( src\text{cc} \) Complex source signal array. \( \text{src}\text{cc}[2*i] \) contains the real parts, and \( \text{src}\text{cc}[2*i+1] \) contains the imaginary parts.
- \( src\text{dstr} \) Source and destination signal array that contains the real parts.
- \( src\text{dsti} \) Source and destination signal array that contains the imaginary parts.
- \( src\text{dstc} \) Complex source and destination signal array. \( \text{src}\text{dstc}[2*i] \) contains the real parts, and \( \text{src}\text{dstc}[2*i+1] \) contains the imaginary parts.
- \( \text{order} \) Order of the transformation. The base-2 logarithm of the number of data samples.
- \( \text{scale} \) Adaptive scaling factor.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes\(^{(5)}\) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>
See Also

mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_2(3MLIB), mlib_SignalFFT_3(3MLIB),
mlib_SignalIFFT_1(3MLIB), mlib_SignalIFFT_2(3MLIB), mlib_SignalIFFT_3(3MLIB),
mlib_SignalIFFT_4(3MLIB), attributes(5)
Each of the functions in this group performs Fast Fourier Transform with windowing (FFTW).

The FFTW functions use the following equation:

\[
    \text{dst}[k] = \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \cdot \text{window}[n] \cdot \exp(-j2\pi n k/N)
\]

and the IFFT functions use the following equation:

\[
    \text{src}[n] = \frac{1}{N} \sum_{k=0}^{N-1} \text{dst}[k] \cdot \text{window}[k] \cdot \exp(j2\pi n k/N)
\]
\[ \text{dst}[n] = \sum_{k=0}^{N-1} \text{src}[k] \times \text{window}[k] \times \exp(j2\pi n k / N) \]

where

\[ k = 0, 1, \ldots, (N - 1) \]
\[ n = 0, 1, \ldots, (N - 1) \]
\[ N = 2^{\text{order}} \]

The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

\[
\text{mlib_Signal\{FFTW|IFFTW\}_ScaleMode\_OutType\_InType\_OpMode()}
\]
\[
\text{mlib_Signal\{FFTW|IFFTW\}_ScaleMode\_DataType\_OpMode()}
\]

The scaling factors \( C1 \) and \( C2 \) used in the equations are defined as follows:

- For ScaleMode = 1, \( C1 = 1 \) and \( C2 = 2^{\text{order}} \).
- For ScaleMode = 2, \( C1 = 2^{\text{order}} \) and \( C2 = 1 \).
- For ScaleMode = 3, \( C1 = C2 = 2^{\text{order}/2} \) when order is even, or \( C1 = 2^{(\text{order}+1)/2} \) and \( C2 = 2^{(\text{order}-1)/2} \) when order is odd.
- For ScaleMode = 4, \( C1 = 2^{\text{P}} \) and \( C2 = 2^{\text{Q}} \), where \( \text{P} \) and \( \text{Q} \) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- \( \text{dstr} \): Destination signal array that contains the real parts.
- \( \text{dsti} \): Destination signal array that contains the imaginary parts.
- \( \text{srcr} \): Source signal array that contains the real parts.
- \( \text{srci} \): Source signal array that contains the imaginary parts.
- \( \text{dstc} \): Complex destination signal array. \( \text{dstc}[2*i] \) contains the real parts, and \( \text{dstc}[2*i+1] \) contains the imaginary parts.
- \( \text{srcc} \): Complex source signal array. \( \text{srcc}[2*i] \) contains the real parts, and \( \text{srcc}[2*i+1] \) contains the imaginary parts.
- \( \text{srcdstr} \): Source and destination signal array that contains the real parts.
- \( \text{srcdsti} \): Source and destination signal array that contains the imaginary parts.
- \( \text{srcdstc} \): Complex source and destination signal array. \( \text{srcdstc}[2*i] \) contains the real parts, and \( \text{srcdstc}[2*i+1] \) contains the imaginary parts.
Window coefficient array with $2^\text{order}$ real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.

Order of the transformation. The base-2 logarithm of the number of data samples.

Return Values Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTES TYPE</th>
<th>ATTRIBUTE VALUE</th>
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<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_3(3MLIB), mlib_SignalFFTW_4(3MLIB), mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)
Each of the functions in this group performs Fast Fourier Transform with windowing (FFTW).

The FFTW functions use the following equation:

\[
\text{dst}[k] = \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \times \text{window}[n] \times \exp(-j2\pi n k / N)
\]

and the IFFT functions use the following equation:
\[ \text{dst}[n] = \sum_{k=0}^{N-1} \text{src}[k] \times \text{window}[k] \times \exp(j2\pi n k / N) \]

where

\[ k = 0, 1, \ldots, (N - 1) \]
\[ n = 0, 1, \ldots, (N - 1) \]
\[ N = 2^{\text{order}} \]

The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

\[ \text{mlib_Signal[FFTW|IFFTW]}_\text{ScaleMode}_\text{OutType}_\text{InType}_\text{OpMode}() \]

\[ \text{mlib_Signal[FFTW|IFFTW]}_\text{ScaleMode}_\text{DataType}_\text{OpMode}() \]

The scaling factors \( C_1 \) and \( C_2 \) used in the equations are defined as follows:

- For \( \text{ScaleMode} = 1 \), \( C_1 = 1 \) and \( C_2 = 2^{\text{order}} \).
- For \( \text{ScaleMode} = 2 \), \( C_1 = 2^{\text{order}} \) and \( C_2 = 1 \).
- For \( \text{ScaleMode} = 3 \), \( C_1 = C_2 = 2^{\text{(order/2)}} \) when order is even, or \( C_1 = 2^{\text{((order+1)/2)}} \) and \( C_2 = 2^{\text{((order-1)/2)}} \) when order is odd.
- For \( \text{ScaleMode} = 4 \), \( C_1 = 2^{\text{P}} \) and \( C_2 = 2^{\text{Q}} \), where \( P \) and \( Q \) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- \( \text{dstr} \) Destination signal array that contains the real parts.
- \( \text{dsti} \) Destination signal array that contains the imaginary parts.
- \( \text{srcr} \) Source signal array that contains the real parts.
- \( \text{srci} \) Source signal array that contains the imaginary parts.
- \( \text{dstc} \) Complex destination signal array. \( \text{dstc}[2*i] \) contains the real parts, and \( \text{dstc}[2*i+1] \) contains the imaginary parts.
- \( \text{srcc} \) Complex source signal array. \( \text{srcc}[2*i] \) contains the real parts, and \( \text{srcc}[2*i+1] \) contains the imaginary parts.
- \( \text{srcdstr} \) Source and destination signal array that contains the real parts.
- \( \text{srcdsti} \) Source and destination signal array that contains the imaginary parts.
- \( \text{srcdstc} \) Complex source and destination signal array. \( \text{srcdstc}[2*i] \) contains the real parts, and \( \text{srcdstc}[2*i+1] \) contains the imaginary parts.
Window coefficient array with $2^\text{order}$ real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.

Order of the transformation. The base-2 logarithm of the number of data samples.

Return Values Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_4(3MLIB), mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)
Each of the functions in this group performs Fast Fourier Transform with windowing (FFTW).

The FFTW functions use the following equation:

$$\text{dst}[k] = \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \cdot \text{window}[n] \cdot \exp(-j2\pi n k/N)$$

and the IFFT functions use the following equation:
\[
\text{dst}[n] = \sum_{k=0}^{N-1} \frac{\text{src}[k] \times \text{window}[k] \times \exp(j2\pi n k / N)}{\text{C2}}
\]

where
\[
k = 0, 1, \ldots, (N - 1)
\]
\[
n = 0, 1, \ldots, (N - 1)
\]
\[
N = 2^{\text{order}}
\]

The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

- mlib_Signal[FFTW|IFFTW]_ScaleMode_OutType_InType_OpMode()
- mlib_Signal[FFTW|IFFTW]_ScaleMode_DataType_OpMode()

The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, C1 = 1 and C2 = 2^{\text{order}}.
- For ScaleMode = 2, C1 = 2^{\text{order}} and C2 = 1.
- For ScaleMode = 3, C1 = C2 = 2^{\text{order}/2} when order is even, or C1 = 2^{((\text{order}+1)/2)} and C2 = 2^{((\text{order}-1)/2)} when order is odd.
- For ScaleMode = 4, C1 = 2^{\text{P}} and C2 = 2^{\text{Q}}, where \text{P} and \text{Q} are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- \text{dstr} Destination signal array that contains the real parts.
- \text{dsti} Destination signal array that contains the imaginary parts.
- \text{srcr} Source signal array that contains the real parts.
- \text{srci} Source signal array that contains the imaginary parts.
- \text{dsrc} Complex source signal array. \text{src}[2*i] contains the real parts, and \text{src}[2*i+1] contains the imaginary parts.
- \text{srcs} Complex destination signal array. \text{dstc}[2*i] contains the real parts, and \text{dstc}[2*i+1] contains the imaginary parts.
- \text{srcdstr} Source and destination signal array that contains the real parts.
- \text{srcdsti} Source and destination signal array that contains the imaginary parts.
- \text{srcdstc} Complex source and destination signal array. \text{srcdstc}[2*i] contains the real parts, and \text{srcdstc}[2*i+1] contains the imaginary parts.
Window coefficient array with $2^\text{order}$ real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.

Order of the transformation. The base-2 logarithm of the number of data samples.

Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
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</tr>
</tbody>
</table>

See Also
mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_4(3MLIB),
mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB),
mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)
Name  mlib_SignalFFTW_4, mlib_SignalFFTW_4_S16_S16, mlib_SignalFFTW_4_S16C_S16C, mlib_SignalFFTW_4_S16C_S16, mlib_SignalFFTW_4_S16, mlib_SignalFFTW_4_S16C -
signal Fast Fourier Transform with windowing (FFTW)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFFTW_4_S16_S16(mlib_s16 *dstr, mlib_s16 *dsti,
   const mlib_s16 *srcr, const mlib_s16 *srci, const mlib_s16 *window,
   mlib_s32 order, mlib_s32 *scale);

mlib_status mlib_SignalFFTW_4_S16C_S16C(mlib_s16 *dsrc,
   const mlib_s16 *srcc, const mlib_s16 *window, mlib_s32 order,
   mlib_s32 *scale);

mlib_status mlib_SignalFFTW_4_S16C_S16(mlib_s16 *dsrc,
   const mlib_s16 *srcc, const mlib_s16 *window, mlib_s32 order,
   mlib_s32 *scale);

mlib_status mlib_SignalFFTW_4_S16C(mlib_s16 *srcdstr,
   const mlib_s16 *srcdsti, const mlib_s16 *window, mlib_s32 order,
   mlib_s32 *scale);

mlib_status mlib_SignalFFTW_4_S16C(mlib_s16 *srccdstc,
   const mlib_s16 *window, mlib_s32 order, mlib_s32 *scale);

Description  Each of the functions in this group performs Fast Fourier Transform with windowing
(FFTW).

The FFTW functions use the following equation:

$$ \text{dst}[k] = \frac{1}{N-1} \sum_{n=0}^{N-1} \text{src}[n] \times \text{window}[n] \times \exp(-j2\pi n k/N) $$

and the IFFT functions use the following equation:

$$ \text{dst}[n] = \frac{1}{N-1} \sum_{k=0}^{N-1} \text{src}[k] \times \text{window}[k] \times \exp(j2\pi n k/N) $$

where

- k = 0, 1, ..., (N - 1)
- n = 0, 1, ..., (N - 1)
- N = 2**order

The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

mlib_Signal[FFT|IFFTW]_ScaleMode_OutType_InType_OpMode()
mlib_Signal[FFT|IFFTW]_ScaleMode_DataType_OpMode()
The scaling factors $C_1$ and $C_2$ used in the equations are defined as follows:

- For $ScaleMode = 1$, $C_1 = 1$ and $C_2 = 2^{\text{order}}$.
- For $ScaleMode = 2$, $C_1 = 2^{\text{order}}$ and $C_2 = 1$.
- For $ScaleMode = 3$, $C_1 = C_2 = 2^{\text{order}/2}$ when order is even, or $C_1 = 2^{\text{(order+1)/2}}$ and $C_2 = 2^{\text{(order-1)/2}}$ when order is odd.
- For $ScaleMode = 4$, $C_1 = 2^{\text{P}}$ and $C_2 = 2^{\text{Q}}$, where $P$ and $Q$ are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- $dstr$: Destination signal array that contains the real parts.
- $dsti$: Destination signal array that contains the imaginary parts.
- $srcr$: Source signal array that contains the real parts.
- $srci$: Source signal array that contains the imaginary parts.
- $dstc$: Complex destination signal array. $\text{dstc}[2*i]$ contains the real parts, and $\text{dstc}[2*i+1]$ contains the imaginary parts.
- $srcc$: Complex source signal array. $\text{srcc}[2*i]$ contains the real parts, and $\text{srcc}[2*i+1]$ contains the imaginary parts.
- $srcdstr$: Source and destination signal array that contains the real parts.
- $srcdsti$: Source and destination signal array that contains the imaginary parts.
- $srcdstc$: Complex source and destination signal array. $\text{srcdstc}[2*i]$ contains the real parts, and $\text{srcdstc}[2*i+1]$ contains the imaginary parts.
- $window$: Window coefficient array with $2^{\text{order}}$ real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.
- $order$: Order of the transformation. The base-2 logarithm of the number of data samples.
- $scale$: Adaptive scaling factor.

**Return Values**

Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:
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See Also mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_3(3MLIB), mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)
The \texttt{mlib\_Signal\_FIR\_F32\_F32()} function applies the FIR filter to one signal packet and updates the filter state.

\textbf{Parameters} \hspace{2em} The function takes the following arguments:

- \texttt{dst} \hspace{2em} Output signal array.
- \texttt{src} \hspace{2em} Input signal array.
- \texttt{filter} \hspace{2em} Internal filter structure.
- \texttt{n} \hspace{2em} Number of samples in the input signal array.

\textbf{Return Values} \hspace{2em} The function returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

\textbf{Attributes} \hspace{2em} See \texttt{attributes(5)} for descriptions of the following attributes:

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</table>

\textbf{See Also} \hspace{2em} \texttt{attributes(5)}
Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFIR_F32S_F32S(mlib_f32 *dst, const mlib_f32 *src, 
    void *filter, mlib_s32 n);
```

Description

The `mlib_SignalFIR_F32S_F32S()` function applies the FIR filter to one signal packet and updates the filter state.

Parameters

The function takes the following arguments:

- `dst`  

- `src`  

- `filter`  
  Internal filter structure.

- `n`  
  Number of samples in the input signal array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`attributes(5)`
mlib_SignalFIRFree_F32_F32 – Finite Impulse Response (FIR) filtering

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalFIRFree_F32_F32(void *filter);
```

Description

The `mlib_SignalFIRFree_F32_F32()` function releases the memory allocated for the internal filter structure.

Parameters

The function takes the following arguments:

- `filter` Internal filter structure.

Return Values

None.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`attributes(5)`
The `mlib_SignalFIRFree_F32S_F32S()` function releases the memory allocated for the internal filter structure.

**Parameters**
The function takes the following arguments:
- `filter` Internal filter structure.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also** attributes(5)
mlib_SignalFIRFree_S16_S16, mlib_SignalFIRFree_S16S_S16S – Finite Impulse Response (FIR) filtering

#include <mlib.h>

void mlib_SignalFIRFree_S16_S16(void *filter);
void mlib_SignalFIRFree_S16S_S16S(void *filter);

Each of these functions releases the memory allocated for the internal filter structure.

Parameters
Each of the functions takes the following arguments:

    filter  Internal filter structure.

Return Values
None.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_SignalFIR_S16_S16_Sat(3MLIB), mlib_SignalFIRInit_S16_S16(3MLIB), attributes(5)
# mlib_SignalFIRInit_F32_F32

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalFIRInit_F32_F32(void **filter, const mlib_f32 *flt, mlib_s32 tap);
```

## Description

The `mlib_SignalFIRInit_F32_F32()` function allocates memory for the internal filter structure and converts the filter coefficients to an internal representation.

## Parameters

- `filter`: Internal filter structure.
- `flt`: Filter coefficient array.
- `tap`: Taps of the filter.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

`attributes(5)`
mlib_SignalFIRInit_F32S_F32S() – Finite Impulse Response (FIR) filtering

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_SignalFIRInit_F32S_F32S(void **filter,
const mlib_f32 *flt, mlib_s32 tap);
```

Description

The `mlib_SignalFIRInit_F32S_F32S()` function allocates memory for the internal filter structure and converts the filter coefficients to an internal representation.

Parameters

The function takes the following arguments:

- `filter` Internal filter structure.
- `tap` Taps of the filter.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`attributes(5)`
Name mlib_SignalFIRInit_S16_S16, mlib_SignalFIRInit_S16S_S16S – Finite Impulse Response (FIR) filtering

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFIRInit_S16_S16(void **filter,
    const mlib_f32 *flt, mlib_s32 tap);
mlib_status mlib_SignalFIRInit_S16S_S16S(void **filter,
    const mlib_f32 *flt, mlib_s32 tap);

Description Each of these functions allocates memory for the internal filter structure and converts the filter coefficients to an internal representation.

Parameters Each of the functions takes the following arguments:
- filter Internal filter structure.
- flt Filter coefficient array.
- tap Taps of the filter.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_SignalFIR_S16_S16_Sat(3MLIB), mlib_SignalFIRFree_S16_S16(3MLIB), attributes(5)
mlib_SignalFIR_S16_S16_Sat, mlib_SignalFIR_S16S_S16S_Sat – Finite Impulse Response (FIR) filtering

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalFIR_S16_S16_Sat(mlib_s16 *dst,
const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalFIR_S16S_S16S_Sat(mlib_s16 *dst,
const mlib_s16 *src, void *filter, mlib_s32 n);

Description
Each of these functions applies the FIR filter to one signal packet and updates the filter state.

Parameters
Each of the functions takes the following arguments:

\- \textit{dst} \quad \text{Output signal array.}
\- \textit{src} \quad \text{Input signal array.}
\- \textit{filter} \quad \text{Internal filter structure.}
\- \textit{n} \quad \text{Number of samples in the input signal array.}

Return Values
Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

Attributes
See \texttt{attributes(5)} for descriptions of the following attributes:

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</table>

See Also
\texttt{mlib_SignalFIRFree_S16_S16(3MLIB), mlib_SignalFIRInit_S16_S16(3MLIB), attributes(5)}
The `mlib_SignalGaussNoise_F32()` function generates one packet of Gaussian noise and updates the internal state.

### Parameters

- **gnoise**: Generated Gaussian noise array.
- **state**: Internal state structure.
- **n**: Length of the generated Gaussian wave array in number of samples.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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</table>
mlib_SignalGaussNoiseFree_F32 – Gaussian noise generation

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalGaussNoiseFree_F32(void *state);

Description

The mlib_SignalGaussNoiseFree_F32() function releases the memory allocated for the internal state's structure.

Parameters

The function takes the following arguments:

state Internal state structure.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

attributes(5)
mlib_SignalGaussNoiseFree_S16 – Gaussian noise generation

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalGaussNoiseFree_S16(void *state);

Description

The mlib_SignalGaussNoiseFree_S16() function releases the memory allocated for the internal state's structure.

Parameters

The function takes the following arguments:

state   Internal state structure.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_SignalGaussNoise_S16(3MLIB), mlib_SignalGaussNoiseInit_S16(3MLIB), attributes(5)
Name      mlib_SignalGaussNoiseInit_F32 – Gaussian noise generation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalGaussNoiseInit_F32(void **state, mlib_f32 mag,
                                          mlib_f32 mean, mlib_f32 stddev, mlib_f32 seed);

Description The mlib_SignalGaussNoiseInit_F32() function allocates memory for an internal state
structure and converts the parameters into an internal representation.

Parameters The function takes the following arguments:

- **state**  Internal state structure.
- **mag**    Magnitude of the Gaussian noise to be generated, in Q15 format.
- **mean**   Mean of the Gaussian noise.
- **stddev** Standard deviation of the Gaussian noise.
- **seed**   Seed value for the pseudorandom number generator.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also  attributes(5)
mlib_SignalGaussNoiseInit_S16 – Gaussian noise generation

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalGaussNoiseInit_S16(void **state, mlib_s16 mag,
                               mlib_f32  mean, mlib_f32 stddev, mlib_s16 seed);
```

**Description**
The `mlib_SignalGaussNoiseInit_S16()` function allocates memory for an internal state structure and converts the parameters into an internal representation.

**Parameters**
The function takes the following arguments:
- `state` - Internal state structure.
- `mag` - Magnitude of the Gaussian noise to be generated, in Q15 format.
- `mean` - Mean of the Gaussian noise.
- `stddev` - Standard deviation of the Gaussian noise.
- `seed` - Seed value for the pseudorandom number generator.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_SignalGaussNoise_S16(3MLIB), mlib_SignalGaussNoiseFree_S16(3MLIB), attributes(5)`
The `mlib_SignalGaussNoise_S16()` function generates one packet of Gaussian noise and updates the internal state.

### Parameters
- **gnoise**: Generated Gaussian noise array.
- **state**: Internal state structure.
- **n**: Length of the generated Gaussian wave array in number of samples.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_SignalGaussNoiseFree_S16(3MLIB)`, `mlib_SignalGaussNoiseInit_S16(3MLIB)`, attributes(5)
mlib_SignalGenBartlett_F32 – Bartlett window generation

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalGenBartlett_F32(mlib_f32 *window, mlib_s32 n);
```

Description

The `mlib_SignalGenBartlett_F32()` function generates the normalized coefficients of the Bartlett window.

Parameters

- `window` Generated window coefficient array.
- `n` Length of window array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

attributes(5)
The `mlib_SignalGenBartlett_S16()` function generates the normalized coefficients of the Bartlett window.

**Parameters**
- `window`: Generated window coefficient array. The window coefficients are in Q15 format.
- `n`: Length of window array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also
- `mlib_SignalGenHanning_S16(3MLIB)`, `mlib_SignalGenHamming_S16(3MLIB)`, `mlib_SignalGenBlackman_S16(3MLIB)`, `mlib_SignalGenKaiser_S16(3MLIB)`, attributes(5)
# mlib_SignalGenBlackman_F32

## Name
mlib_SignalGenBlackman_F32 – Blackman window generation

## Synopsis
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalGenBlackman_F32(mlib_f32 *window, mlib_f32 alpha, mlib_s32 n);
```

## Description
The `mlib_SignalGenBlackman_F32()` function generates the normalized coefficients of the Blackman window.

## Parameters
The function takes the following arguments:
- `window` Generated window coefficient array.
- `alpha` Blackman window parameter. `-1 < alpha < 0`.
- `n` Length of window array.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See `attributes(5)` for descriptions of the following attributes:

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</table>

## See Also
`attributes(5)`
The `mlib_SignalGenBlackman_S16()` function generates the normalized coefficients of the Blackman window.

**Parameters**
The function takes the following arguments:
- `window` Generated window coefficient array. The window coefficients are in Q15 format.
- `alpha` Blackman window parameter. \(-1 < \alpha < 0\).
- `n` Length of window array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
- `mlib_SignalGenBartlett_S16(3MLIB)`, `mlib_SignalGenHanning_S16(3MLIB)`, `mlib_SignalGenHamming_S16(3MLIB)`, `mlib_SignalGenKaiser_S16(3MLIB)`, `attributes(5)`
The `mlib_SignalGenHamming_F32()` function generates the normalized coefficients of the Hamming window.

The function takes the following arguments:
- `window` Generated window coefficient array.
- `n` Length of window array.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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</table>
mlib_SignalGenHamming_S16(3MLIB)

**Name**
mlib_SignalGenHamming_S16 – Hamming window generation

**Synopsis**
```
c c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalGenHamming_S16(mlib_s16 *window, mlib_s32 n);
```

**Description**
The mlib_SignalGenHamming_S16() function generates the normalized coefficients of the Hamming window.

**Parameters**
The function takes the following arguments:
- `window` Generated window coefficient array. The window coefficients are in Q15 format.
- `n` Length of window array.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
mlib_SignalGenBartlett_S16(3MLIB), mlib_SignalGenHanning_S16(3MLIB),
mlib_SignalGenBlackman_S16(3MLIB), mlib_SignalGenKaiser_S16(3MLIB),
attributes(5)
The mlib_SignalGenHanning_F32() function generates the normalized coefficients of the Hanning window.

**Parameters**
The function takes the following arguments:
- `window` Generated window coefficient array. The window coefficients are in Q15 format.
- `n` Length of window array.

**Return Values**
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
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**See Also**
attributes(5)
The `mlib_SignalGenHanning_S16` function generates the normalized coefficients of the Hanning window.

**Parameters**
The function takes the following arguments:

- `window`: Generated window coefficient array. The window coefficients are in Q15 format.
- `n`: Length of window array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_SignalGenBartlett_S16(3MLIB)`, `mlib_SignalGenHamming_S16(3MLIB)`, `mlib_SignalGenBlackman_S16(3MLIB)`, `mlib_SignalGenKaiser_S16(3MLIB)`, `attributes(5)`
The `mlib_SignalGenKaiser_F32()` function generates the normalized coefficients of the Kaiser window.

**Parameters**
- `window` Generated window coefficient array. The window coefficients are in Q15 format.
- `beta` Kaiser window parameter.
- `n` Length of window array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`attributes(5)`
Name  mlib_SignalGenKaiser_S16 – Kaiser window generation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

  mlib_status mlib_SignalGenKaiser_S16(mlib_s16 *window, mlib_f32 beta,
  mlib_s32 n);

Description  The mlib_SignalGenKaiser_S16() function generates the normalized coefficients of the Kaiser window.

Parameters  The function takes the following arguments:

  window  Generated window coefficient array. The window coefficients are in Q15 format.
  beta    Kaiser window parameter.
  n       Length of window array.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalGenBartlett_S16(3MLIB), mlib_SignalGenHanning_S16(3MLIB),
mlib_SignalGenHamming_S16(3MLIB), mlib_SignalGenBlackman_S16(3MLIB),
attributes(5)
**Name**

mlib_SignalIFFT_1, mlib_SignalIFFT_1_S16_S16, mlib_SignalIFFT_1_S16C_S16C,
mlib_SignalIFFT_1_S16_S16C, mlib_SignalIFFT_1_S16, mlib_SignalIFFT_1_S16C,
mlib_SignalIFFT_1_F32_F32, mlib_SignalIFFT_1_F32C_F32C,
mlib_SignalIFFT_1_F32_F32C, mlib_SignalIFFT_1_F32, mlib_SignalIFFT_1_F32C,
mlib_SignalIFFT_1_D64_D64, mlib_SignalIFFT_1_D64C_D64C,
mlib_SignalIFFT_1_D64_D64C, mlib_SignalIFFT_1_D64, mlib_SignalIFFT_1_D64C—
signalInverseFastFourierTransform (IFFT)

**Synopsis**

cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_SignalIFFT_1_S16_S16(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);

mlib_status mlib_SignalIFFT_1_S16C_S16C(mlib_s16 *dstr,
const mlib_s16 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_S16_S16C(mlib_s16 *dstr,
const mlib_s16 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_S16(mlib_s16 *srcdstr,
mlib_s16 *srcdsti,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_S16C(mlib_s16 *srcdstc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_F32_F32(mlib_f32 *dstr,
mlib_f32 *dsti, const mlib_f32 *srcr,
const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalIFFT_1_F32C_F32C(mlib_f32 *dstr,
const mlib_f32 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_F32_F32C(mlib_f32 *dstr,
const mlib_f32 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_F32C(mlib_f32 *srcdstr,
mlib_f32 *srcdsti,
mlib_s32 order);

mlib_status mlib_SignalIFFT_1_D64_D64(mlib_d64 *dstr,
mlib_d64 *dsti,
const mlib_d64 *srcr, const mlib_d64 *srci, mlib_s32 order);
```

Multimedia Library Functions - Part 4 945
Each of the functions in this group performs Inverse Fast Fourier Transform (IFFT).

The following equation is used for forward FFT:

\[
1 \quad \frac{1}{N-1} \sum_{n=0}^{N-1} \text{src}[n] \times \exp(-j2\pi n k/N)
\]

and the following equation is used for inverse FFT (IFFT):

\[
1 \quad \frac{1}{N-1} \sum_{k=0}^{N-1} \text{src}[k] \times \exp(j2\pi n k/N)
\]

where

\[ k = 0, 1, \ldots, (N - 1) \]
\[ n = 0, 1, \ldots, (N - 1) \]
\[ N = 2**\text{order} \]

The signal FFT/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

\[
\text{mlib_Signal}\{\text{FFT|IFFT}\}_\text{ScaleMode}_\text{OutType}_\text{InType}_\text{OpMode}()
\]

\[
\text{mlib_Signal}\{\text{FFT|IFFT}\}_\text{ScaleMode}_\text{DataType}_\text{OpMode}()
\]

The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, C1 = 1 and C2 = 2**order.
- For ScaleMode = 2, C1 = 2**order and C2 = 1.
- For ScaleMode = 3, C1 = C2 = 2**(order/2) when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.
- For ScaleMode = 4, C1 = 2**P and C2 = 2**Q, where P and Q are adaptive scaling factors and are generated by the functions.
For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- **dstr**: Destination signal array that contains the real parts.
- **dsti**: Destination signal array that contains the imaginary parts.
- **srcr**: Source signal array that contains the real parts.
- **srci**: Source signal array that contains the imaginary parts.
- **srcdstr**: Source and destination signal array that contains the real parts.
- **srcdsti**: Source and destination signal array that contains the imaginary parts.
- **order**: Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_2(3MLIB), mlib_SignalFFT_3(3MLIB), mlib_SignalFFT_4(3MLIB), mlib_SignalIFFT_2(3MLIB), mlib_SignalIFFT_3(3MLIB), mlib_SignalIFFT_4(3MLIB), attributes(5)`
mlib_SignalIFFT_2(3MLIB)

Name
mlib_SignalIFFT_2, mlib_SignalIFFT_2_S16_S16_Mod,
mlib_SignalIFFT_2_S16C_S16C_Mod, mlib_SignalIFFT_2_S16_S16C_Mod,
mlib_SignalIFFT_2_S16_Mod, mlib_SignalIFFT_2_S16C_Mod,
mlib_SignalIFFT_2_F32_F32, mlib_SignalIFFT_2_F32C_F32C,
mlib_SignalIFFT_2_F32_F32C, mlib_SignalIFFT_2_F32, mlib_SignalIFFT_2_F32C,
mlib_SignalIFFT_2_D64_D64, mlib_SignalIFFT_2_D64C_D64C,
mlib_SignalIFFT_2_D64_D64C, mlib_SignalIFFT_2_D64, mlib_SignalIFFT_2_D64C

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIFFT_2_S16_S16_Mod(mlib_s16 *dstr,
mlib_s16 *dsti,
const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);

mlib_status mlib_SignalIFFT_2_S16C_S16C_Mod(mlib_s16 *dstr,
const mlib_s16 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_2_S16_S16C_Mod(mlib_s16 *dstr,
const mlib_s16 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_2_S16_Mod(mlib_s16 *srcdstr,
mlib_s16 *srcdsti,
mlib_s32 order);

mlib_status mlib_SignalIFFT_2_F32_F32(mlib_f32 *dstr,
mlib_f32 *dsti,
const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalIFFT_2_F32C_F32C(mlib_f32 *dstr,
const mlib_f32 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_2_F32_F32C(mlib_f32 *dstr,
const mlib_f32 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_2_F32_C2F(mlib_f32 *dstr,
mlib_f32 *srcc,
mlib_s32 order);

mlib_status mlib_SignalIFFT_2_D64_D64(mlib_d64 *dstr,
mlib_d64 *dsti,
const mlib_d64 *srcr, const mlib_d64 *srci, mlib_s32 order);
mlib_status mlib_SignalIFFT_2_D64C_D64C(mlib_d64 *dstc,
    const mlib_d64 *srcc,
    mlib_s32 order);

mlib_status mlib_SignalIFFT_2_D64_D64C(mlib_d64 *dstr,
    const mlib_d64 *srcc,
    mlib_s32 order);

mlib_status mlib_SignalIFFT_2_D64D64C(mlib_d64 *srcdstc,
    mlib_s32 order);

mlib_status mlib_SignalIFFT_2_D64C(mlib_d64 *srcdstc,
    mlib_s32 order);

Each of the functions in this group performs Inverse Fast Fourier Transform (IFFT).

The following equation is used for forward FFT:

\[
\text{dst}[k] = \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \cdot \exp(-j2\pi n k/N)
\]

and the following equation is used for inverse FFT (IFFT):

\[
\text{dst}[n] = \frac{1}{N} \sum_{k=0}^{N-1} \text{src}[k] \cdot \exp(j2\pi n k/N)
\]

where

- \( k = 0, 1, \ldots, (N - 1) \)
- \( n = 0, 1, \ldots, (N - 1) \)
- \( N = 2^{\text{order}} \)

The signal FFT/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

mlib_Signal[FFT|IFFT]_ScaleMode_OutType_InType_OpMode()

mlib_Signal[FFT|IFFT]_ScaleMode_DataType_OpMode()

The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, C1 = 1 and C2 = 2**order.
- For ScaleMode = 2, C1 = 2**order and C2 = 1.
- For ScaleMode = 3, C1 = C2 = 2**((order/2) when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.
- For ScaleMode = 4, C1 = 2**P and C2 = 2**Q, where P and Q are adaptive scaling factors and are generated by the functions.
For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters** Each function takes some of the following arguments:

- **dstr** Destination signal array that contains the real parts.
- **dsti** Destination signal array that contains the imaginary parts.
- **srcr** Source signal array that contains the real parts.
- **srci** Source signal array that contains the imaginary parts.
- **dstc** Complex destination signal array. **dstc[2*i]** contains the real parts, and **dstc[2*i+1]** contains the imaginary parts.
- **srcc** Complex source signal array. **srcc[2*i]** contains the real parts, and **srcc[2*i+1]** contains the imaginary parts.
- **srcdstr** Source and destination signal array that contains the real parts.
- **srcdsti** Source and destination signal array that contains the imaginary parts.
- **srcdstc** Complex source and destination signal array. **srcdstc[2*i]** contains the real parts, and **srcdstc[2*i+1]** contains the imaginary parts.
- **order** Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values** The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_2(3MLIB), mlib_SignalFFT_3(3MLIB), mlib_SignalFFT_4(3MLIB), mlib_SignalIFFT_1(3MLIB), mlib_SignalIFFT_3(3MLIB), mlib_SignalIFFT_4(3MLIB), attributes(5)
Name  mlib_SignalIFFT_3, mlib_SignalIFFT_3_S16_S16_Mod, mlib_SignalIFFT_3_S16C_S16C_Mod, mlib_SignalIFFT_3_S16_S16C_Mod, mlib_SignalIFFT_3_S16_Mod, mlib_SignalIFFT_3_S16C_Mod, mlib_SignalIFFT_3_F32_F32, mlib_SignalIFFT_3_F32C_F32C, mlib_SignalIFFT_3_F32_F32C, mlib_SignalIFFT_3_F32C, mlib_SignalIFFT_3_F32, mlib_SignalIFFT_3_D64_D64, mlib_SignalIFFT_3_D64C_D64C, mlib_SignalIFFT_3_D64_D64C, mlib_SignalIFFT_3_D64, mlib_SignalIFFT_3_D64C – signal inverse Fast Fourier Transform (IFFT)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_SignalIFFT_3_S16_S16_Mod(mlib_s16 *dstr, mlib_s16 *dsti, const mlib_s16 *srcr, const mlib_s16 *srci, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_S16C_S16C_Mod(mlib_s16 *dstc, const mlib_s16 *srcc, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_S16_S16C_Mod(mlib_s16 *dstr, const mlib_s16 *srcc, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_S16_Mod(mlib_s16 *srcdstr, mlib_s16 *srcdsti, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_S16C_Mod(mlib_s16 *srcdstc, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_F32_F32(mlib_f32 *dstr, mlib_f32 *dsti, const mlib_f32 *srcr, const mlib_f32 *srci, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_F32C_F32C(mlib_f32 *dstc, const mlib_f32 *srcc, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_F32_F32C(mlib_f32 *dstr, const mlib_f32 *srcc, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_F32C(mlib_f32 *srcdstr, mlib_f32 *srcdsti, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_F32C(mlib_f32 *srcdstc, mlib_s32 order);

mlib_status mlib_SignalIFFT_3_D64_D64(mlib_d64 *dstr, mlib_d64 *dsti, const mlib_d64 *srcr, const mlib_d64 *srci, mlib_s32 order);
mlib_status mlib_SignalIFFT_3_D64C_D64C(mlib_d64 *dsrc, 
    const mlib_d64 *srcc, 
    mlib_s32 order); 
mlib_status mlib_SignalIFFT_3_D64_D64C(mlib_d64 *dstr, 
    const mlib_d64 *srcc, 
    mlib_s32 order); 
mlib_status mlib_SignalIFFT_3_D64(mlib_d64 *srcdstr, 
    mlib_d64 *srcdsti, 
    mlib_s32 order); 
mlib_status mlib_SignalIFFT_3_D64C(mlib_d64 *srcdstc, mlib_s32 order); 

Each of the functions in this group performs Inverse Fast Fourier Transform (IFFT).

The following equation is used for forward FFT:

\[
\text{dst}[k] = \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \times \exp(-j2\pi n k / N)
\]

and the following equation is used for inverse FFT (IFFT):

\[
\text{dst}[n] = \frac{1}{N} \sum_{k=0}^{N-1} \text{src}[k] \times \exp(j2\pi n k / N)
\]

where

\(k = 0, 1, \ldots, (N - 1)\)

\(n = 0, 1, \ldots, (N - 1)\)

\(N = 2^\text{order}\)

The signal FFT/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

mlib_Signal[FFT|IFFT]_ScaleMode_OutType_InType_OpMode()
mlib_Signal[FFT|IFFT]_ScaleMode_DataType_OpMode()

The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, C1 = 1 and C2 = 2**order.
- For ScaleMode = 2, C1 = 2**order and C2 = 1.
- For ScaleMode = 3, C1 = C2 = 2**((order/2)) when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.
- For ScaleMode = 4, C1 = 2**P and C2 = 2**Q, where P and Q are adaptive scaling factors and are generated by the functions.
For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters** Each function takes some of the following arguments:

- **dstr** Destination signal array that contains the real parts.
- **dsti** Destination signal array that contains the imaginary parts.
- **srcr** Source signal array that contains the real parts.
- **srci** Source signal array that contains the imaginary parts.
- **dstc** Complex destination signal array. \( \text{dstc}[2*i] \) contains the real parts, and \( \text{dstc}[2*i+1] \) contains the imaginary parts.
- **srcr** Complex source signal array. \( \text{srcr}[2*i] \) contains the real parts, and \( \text{srcr}[2*i+1] \) contains the imaginary parts.
- **srcdstr** Source and destination signal array that contains the real parts.
- **srcdsti** Source and destination signal array that contains the imaginary parts.
- **srcdstrc** Complex source and destination signal array. \( \text{srcdstrc}[2*i] \) contains the real parts, and \( \text{srcdstrc}[2*i+1] \) contains the imaginary parts.
- **order** Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values** The function returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

**Attributes** See attributes\(^{(5)}\) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** \texttt{mlib\_SignalFFT\_1(3MLIB)}, \texttt{mlib\_SignalFFT\_2(3MLIB)}, \texttt{mlib\_SignalFFT\_3(3MLIB)}, \texttt{mlib\_SignalFFT\_4(3MLIB)}, \texttt{mlib\_SignalIFFT\_1(3MLIB)}, \texttt{mlib\_SignalIFFT\_2(3MLIB)}, \texttt{mlib\_SignalIFFT\_4(3MLIB)}, attributes\(^{(5)}\)
Inverse Fast Fourier Transform (IFFT)

The following equation is used for forward FFT:

\[
dst[k] = \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \cdot \exp(-j2\pi n k/N)
\]

and the following equation is used for inverse FFT (IFFT):

\[
dst[n] = \frac{1}{N} \sum_{k=0}^{N-1} \text{src}[k] \cdot \exp(j2\pi n k/N)
\]

where

- \( k = 0, 1, \ldots, (N - 1) \)
- \( n = 0, 1, \ldots, (N - 1) \)
- \( N = 2^{\text{order}} \)

The signal FFT/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

- \text{mlib_Signal[FFT|IFFT]}\_ScaleMode\_DataType\_OpMode()
For ScaleMode = 1, C1 = 1 and C2 = 2**order.

For ScaleMode = 2, C1 = 2**order and C2 = 1.

For ScaleMode = 3, C1 = C2 = 2**(order/2) when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.

For ScaleMode = 4, C1 = 2**P and C2 = 2**Q, where P and Q are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters** Each function takes some of the following arguments:

- **dstr** Destination signal array that contains the real parts.
- **dsti** Destination signal array that contains the imaginary parts.
- **srcr** Source signal array that contains the real parts.
- **srci** Source signal array that contains the imaginary parts.
- **dstc** Complex destination signal array. dstc[2*i] contains the real parts, and dstc[2*i+1] contains the imaginary parts.
- **srcc** Complex source signal array. srcc[2*i] contains the real parts, and srcc[2*i+1] contains the imaginary parts.
- **srcdstr** Source and destination signal array that contains the real parts.
- **srcdsti** Source and destination signal array that contains the imaginary parts.
- **srcdsrc** Complex source and destination signal array. srcdsrc[2*i] contains the real parts, and srcdsrc[2*i+1] contains the imaginary parts.

- **order** Order of the transformation. The base-2 logarithm of the number of data samples.

- **scale** Adaptive scaling factor.

**Return Values** The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>
See Also  

mlib_SignalFFT_1(3MLIB), mlib_SignalFFT_2(3MLIB), mlib_SignalFFT_3(3MLIB),
mlib_SignalFFT_4(3MLIB), mlib_SignalIFFT_1(3MLIB), mlib_SignalIFFT_2(3MLIB),
mlib_SignalIFFT_3(3MLIB), attributes(5)
Each of the functions in this group performs Inverse Fast Fourier Transform with windowing (IFFTW).

The FFTW functions use the following equation:
The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

```
mlib_Signal[FFTW|IFFTW]_ScaleMode_OutType_InType_OpMode()
mlib_Signal[FFTW|IFFTW]_ScaleMode_DataType_OpMode()
```

The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, C1 = 1 and C2 = 2**order.
- For ScaleMode = 2, C1 = 2**order and C2 = 1.
- For ScaleMode = 3, C1 = C2 = 2**((order/2) when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.
- For ScaleMode = 4, C1 = 2**P and C2 = 2**Q, where P and Q are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- `dstr` Destination signal array that contains the real parts.
- `dsti` Destination signal array that contains the imaginary parts.
- `srcr` Source signal array that contains the real parts.
- `srci` Source signal array that contains the imaginary parts.


**srcdstr** Source and destination signal array that contains the real parts.

**srcdsti** Source and destination signal array that contains the imaginary parts.

**srcdstc** Complex source and destination signal array. \( \text{srcdstc}[2*i] \) contains the real parts, and \( \text{srcdstc}[2*i+1] \) contains the imaginary parts.

**window** Window coefficient array with \( 2^{**\text{order}} \) real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.

**order** Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values** Each function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See [attributes(5)] for descriptions of the following attributes:

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</table>

**See Also** [mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_3(3MLIB), mlib_SignalFFTW_4(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)]
REFERENCE

Multimedia Library Functions - Part 5
Name  mlib_SignalIFFTW_2, mlib_SignalIFFTW_2_S16_S16_Mod,
      mlib_SignalIFFTW_2_S16C_S16C_Mod, mlib_SignalIFFTW_2_S16_S16C_Mod,
      mlib_SignalIFFTW_2_S16_Mod, mlib_SignalIFFTW_2_S16C_Mod,
      mlib_SignalIFFTW_2_F32_F32, mlib_SignalIFFTW_2_F32C_F32C,
      mlib_SignalIFFTW_2_F32_F32C, mlib_SignalIFFTW_2_F32, mlib_SignalIFFTW_2_F32C –
signal Inverse Fast Fourier Transform with windowing (IFFTW)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIFFTW_2_S16_S16_Mod(mlib_s16 *dstr,
        mlib_s16 *dsti,
        const mlib_s16 *srcre, const mlib_s16 *srci, const mlib_s16 *window,
        mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_S16C_S16C_Mod(mlib_s16 *dstr,
        mlib_s16 *dstc,
        const mlib_s16 *srcre, const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_S16_S16C_Mod(mlib_s16 *dstr,
        const mlib_s16 *srcre,
        const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_S16_Mod(mlib_s16 *srdstr,
        mlib_s16 *srdsti,
        const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_S16C_Mod(mlib_s16 *srdstr,
        const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_F32_F32C(mlib_f32 *dstr,
        mlib_f32 *dsti,
        const mlib_f32 *srcre, const mlib_f32 *srci, const mlib_f32 *window,
        mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_F32C_F32C(mlib_f32 *dstr,
        mlib_f32 *dstc,
        const mlib_f32 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_F32_F32(mlib_f32 *dstr,
        mlib_f32 *dstc,
        const mlib_f32 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_F32C_F32C(mlib_f32 *srdstr,
        mlib_f32 *srcdstr,
        const mlib_f32 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_F32(mlib_f32 *srdstr,
        const mlib_f32 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_2_F32C(mlib_f32 *srdstr,
        const mlib_f32 *window, mlib_s32 order);
Each of the functions in this group performs Inverse Fast Fourier Transform with windowing (IFFTW).

The FFTW functions use the following equation:

$$\frac{1}{N-1} \sum_{n=0}^{N-1} \{src[n] \times \text{window}[n] \times \exp(-j2\pi n k / N)\}$$

and the IFFTW functions use the following equation:

$$\frac{1}{N-1} \sum_{k=0}^{N-1} \{src[k] \times \text{window}[k] \times \exp(j2\pi n k / N)\}$$

where

- \(k = 0, 1, ..., (N - 1)\)
- \(n = 0, 1, ..., (N - 1)\)
- \(N = 2^{\text{order}}\)

The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

- `mlib_Signal[FFTW|IFFTW]_ScaleMode_OutType_InType_OpMode()`
- `mlib_Signal[FFTW|IFFTW]_ScaleMode_DataType_OpMode()`

The scaling factors \(C_1\) and \(C_2\) used in the equations are defined as follows:

- For ScaleMode = 1, \(C_1 = 1\) and \(C_2 = 2^{\text{order}}\).
- For ScaleMode = 2, \(C_1 = 2^{\text{order}}\) and \(C_2 = 1\).
- For ScaleMode = 3, \(C_1 = C_2 = 2^{\text{order}/2}\) when order is even, or \(C_1 = 2^{\text{order+1}/2}\) and \(C_2 = 2^{\text{order-1}/2}\) when order is odd.
- For ScaleMode = 4, \(C_1 = 2^{\text{P}}\) and \(C_2 = 2^{\text{Q}}\), where \(\text{P}\) and \(\text{Q}\) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- `dstr` Destination signal array that contains the real parts.
- `dsti` Destination signal array that contains the imaginary parts.
- `srcr` Source signal array that contains the real parts.
- `srci` Source signal array that contains the imaginary parts.
**dstc**  Complex destination signal array. \( \text{dstc}[2\times i] \) contains the real parts, and \( \text{dstc}[2\times i+1] \) contains the imaginary parts.

**srcc**  Complex source signal array. \( \text{srcc}[2\times i] \) contains the real parts, and \( \text{srcc}[2\times i+1] \) contains the imaginary parts.

**srcdstr**  Source and destination signal array that contains the real parts.

**srcdsti**  Source and destination signal array that contains the imaginary parts.

**srcdstc**  Complex source and destination signal array. \( \text{srcdstc}[2\times i] \) contains the real parts, and \( \text{srcdstc}[2\times i+1] \) contains the imaginary parts.

**window**  Window coefficient array with \( 2^\text{order} \) real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.

**order**  Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values**  Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
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</tbody>
</table>

**See Also**  mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_3(3MLIB), mlib_SignalFFTW_4(3MLIB), mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)
mlib_SignalIFFTW_3, mlib_SignalIFFTW_3_S16_S16_Mod,
mlib_SignalIFFTW_3_S16C_S16C_Mod, mlib_SignalIFFTW_3_S16_S16C_Mod,
mlib_SignalIFFTW_3_S16_Mod, mlib_SignalIFFTW_3_S16C_Mod,
mlib_SignalIFFTW_3_F32_F32, mlib_SignalIFFTW_3_F32C_F32C,
mlib_SignalIFFTW_3_F32_F32C, mlib_SignalIFFTW_3_F32, mlib_SignalIFFTW_3_F32C –
signal Inverse Fast Fourier Transform with windowing (IFFTW)

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIFFTW_3_S16_S16_Mod(mlib_s16 *dstr, mlib_s16 *dsti,
const mlib_s16 *srcr, const mlib_s16 *srci, const mlib_s16 *window,
mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_S16C_S16C_Mod(mlib_s16 *dstrc,
const mlib_s16 *srcc,
const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_S16_S16C_Mod(mlib_s16 *dstr,
const mlib_s16 *srcc,
const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_S16_S16_S16C_Mod(mlib_s16 *dstr,
const mlib_s16 *srcc,
const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_S16_S16C_S16C_Mod(mlib_s16 *dstrc,
const mlib_s16 *srcc,
const mlib_s16 *window, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_S16C_S16C_F32_F32C(mlib_f32 *dstrf,
mlib_f32 *dstif,
const mlib_f32 *srcrf, const mlib_f32 *srcifi, const mlib_f32 *windowf,
mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_S16C_F32_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_S16C_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_F32C_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_S16C_S16C_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_F32C_S16C_S16C_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_F32C_S16C_S16C_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_S16C_S16C_F32C(mlib_f32 *dstrf,
const mlib_f32 *dstif,
const mlib_f32 *windowf, mlib_s32 order);

mlib_status mlib_SignalIFFTW_3_F32_F32C_S16C_S16C_F32C(mlib_f32 *dstrf,
Each of the functions in this group performs Inverse Fast Fourier Transform with windowing (IFFTW).

The FFTW functions use the following equation:

\[
dst[k] = \frac{1}{N} \sum_{n=0}^{N-1} src[n] \cdot window[n] \cdot \exp(-j2\pi n k/N)
\]

and the IFFTW functions use the following equation:

\[
dst[n] = \frac{1}{N} \sum_{k=0}^{N-1} src[k] \cdot window[k] \cdot \exp(j2\pi n k/N)
\]

where

- \( k = 0, 1, \ldots, (N - 1) \)
- \( n = 0, 1, \ldots, (N - 1) \)
- \( N = 2^{\text{order}} \)

The signal FFTW/IFFTW functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

- mlib_Signal[FFTW|IFFTW]_ScaleMode_OutType_InType_OpMode()
- mlib_Signal[FFTW|IFFTW]_ScaleMode_DataType_OpMode()

The scaling factors \( C_1 \) and \( C_2 \) used in the equations are defined as follows:

- For \( \text{ScaleMode} = 1 \), \( C_1 = 1 \) and \( C_2 = 2^{\text{order}} \).
- For \( \text{ScaleMode} = 2 \), \( C_1 = 2^{\text{order}} \) and \( C_2 = 1 \).
- For \( \text{ScaleMode} = 3 \), \( C_1 = C_2 = 2^{\text{order}/2} \) when \( \text{order} \) is even, or \( C_1 = 2^{\text{order}/2} \) and \( C_2 = 2^{((\text{order}-1)/2)} \) when \( \text{order} \) is odd.
- For \( \text{ScaleMode} = 4 \), \( C_1 = 2^{\text{P}} \) and \( C_2 = 2^{\text{Q}} \), where \( \text{P} \) and \( \text{Q} \) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

Each function takes some of the following arguments:

- \( dstr \) Destination signal array that contains the real parts.
- \( dsti \) Destination signal array that contains the imaginary parts.
- \( srcr \) Source signal array that contains the real parts.
- \( srci \) Source signal array that contains the imaginary parts.
**dstc**
Complex destination signal array. \( \text{dstc}[2*i] \) contains the real parts, and \( \text{dstc}[2*i+1] \) contains the imaginary parts.

**srcc**
Complex source signal array. \( \text{srcc}[2*i] \) contains the real parts, and \( \text{srcc}[2*i+1] \) contains the imaginary parts.

**srcdstr**
Source and destination signal array that contains the real parts.

**srcdsti**
Source and destination signal array that contains the imaginary parts.

**srcdstc**
Complex source and destination signal array. \( \text{srcdstc}[2*i] \) contains the real parts, and \( \text{srcdstc}[2*i+1] \) contains the imaginary parts.

**window**
Window coefficient array with \( 2^\text{order} \) real elements. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.

**order**
Order of the transformation. The base-2 logarithm of the number of data samples.

**Return Values**
Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_3(3MLIB), mlib_SignalFFTW_4(3MLIB), mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), mlib_SignalIFFTW_4(3MLIB), attributes(5)
mlib_SignalIFFTW_4, mlib_SignalIFFTW_4_S16_S16, mlib_SignalIFFTW_4_S16C_S16C, mlib_SignalIFFTW_4_S16_S16C, mlib_SignalIFFTW_4_S16, mlib_SignalIFFTW_4_S16C – signal Inverse Fast Fourier Transform with windowing (IFFTW)

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalIFFTW_4_S16_S16(mlib_s16 *dstr, mlib_s16 *dsti,
    const mlib_s16 *srcr, const mlib_s16 *srci, const mlib_s16 *window,
    mlib_s32 order, mlib_s32 *scale);

mlib_status mlib_SignalIFFTW_4_S16C_S16C(mlib_s16 *dstr,
    const mlib_s16 *srcc, const mlib_s16 *window, mlib_s32 order, mlib_s32 *scale);

mlib_status mlib_SignalIFFTW_4_S16_S16C(mlib_s16 *dstr,
    const mlib_s16 *srcc,
    const mlib_s16 *window, mlib_s32 order, mlib_s32 *scale);

mlib_status mlib_SignalIFFTW_4_S16C(mlib_s16 *srcdstr,
    const mlib_s16 *window, mlib_s32 order, mlib_s32 *scale);

mlib_status mlib_SignalIFFTW_4_S16_S16C(mlib_s16 *srcdstr, mlib_s16 *srcdsti,
    const mlib_s16 *window, mlib_s32 order, mlib_s32 *scale);

mlib_status mlib_SignalIFFTW_4_S16C(mlib_s16 *srcdstc,
    const mlib_s16 *window, mlib_s32 order, mlib_s32 *scale);

Description
Each of the functions in this group performs Inverse Fast Fourier Transform with windowing (IFFTW).

The FFTW functions use the following equation:

\[
\begin{align*}
    \text{dst}[k] &= \frac{1}{N} \sum_{n=0}^{N-1} \text{src}[n] \times \text{window}[n] \times \exp(-j2\pi n k / N)
\end{align*}
\]

and the IFFT functions use the following equation:

\[
\begin{align*}
    \text{dst}[n] &= \frac{1}{N} \sum_{k=0}^{N-1} \text{src}[k] \times \text{window}[k] \times \exp(j2\pi n k / N)
\end{align*}
\]

where

\[
\begin{align*}
    k &= 0, 1, \ldots, (N - 1) \\
    n &= 0, 1, \ldots, (N - 1) \\
    N &= 2^{\text{order}}
\end{align*}
\]

The signal FFTW/IFFT functions can be categorized into four groups according to the ScaleMode in the function names in the following form:

\[
\begin{align*}
    \text{mlib_Signal[FTFW|IFFTW]}_{\text{ScaleMode}}_{\text{OutType}}_{\text{InType}}_{\text{OpMode}}()
\end{align*}
\]
The scaling factors C1 and C2 used in the equations are defined as follows:

- For ScaleMode = 1, \( C_1 = 1 \) and \( C_2 = 2^{\text{order}} \).
- For ScaleMode = 2, \( C_1 = 2^{\text{order}} \) and \( C_2 = 1 \).
- For ScaleMode = 3, \( C_1 = C_2 = 2^{*\text{(order/2)\text{ when order is even, or C1 = 2**((order+1)/2) and C2 = 2**((order-1)/2) when order is odd.}} \)
- For ScaleMode = 4, \( C_1 = 2^{*P} \) and \( C_2 = 2^{*Q} \), where \( P \) and \( Q \) are adaptive scaling factors and are generated by the functions.

For functions with only real parts for the source signal, the imaginary parts are assumed to be all zero. For functions with only real parts for the destination signal, the imaginary parts are discarded. The functions with only one data type in their names perform the operation in place.

**Parameters**

Each function takes some of the following arguments:

- \( dstr \) Destination signal array that contains the real parts.
- \( dsti \) Destination signal array that contains the imaginary parts.
- \( srcr \) Source signal array that contains the real parts.
- \( srci \) Source signal array that contains the imaginary parts.
- \( dstc \) Complex destination signal array. \( dstc[2*i] \) contains the real parts, and \( dstc[2*i+1] \) contains the imaginary parts.
- \( srcc \) Complex source signal array. \( srcc[2*i] \) contains the real parts, and \( srcc[2*i+1] \) contains the imaginary parts.
- \( srcdstr \) Source and destination signal array that contains the real parts.
- \( srcdsti \) Source and destination signal array that contains the imaginary parts.
- \( srcdstdc \) Complex source and destination signal array. \( srcdstdc[2*i] \) contains the real parts, and \( srcdstdc[2*i+1] \) contains the imaginary parts.
- \( window \) Window coefficient array with 2**\text{order real elements}. The window coefficients are in Q15 format for the S16 data type, or in float format for the F32 data type.
- \( order \) Order of the transformation. The base-2 logarithm of the number of data samples.
- \( scale \) Adaptive scaling factor.

**Return Values**

Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes\((5)\) for descriptions of the following attributes:
### mlib_SignalFFTW_4(3MLIB)

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
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<tbody>
<tr>
<td>Interface Stability</td>
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</tr>
<tr>
<td>MT-Level</td>
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</tr>
</tbody>
</table>

**See Also**  
mlib_SignalFFTW_1(3MLIB), mlib_SignalFFTW_2(3MLIB), mlib_SignalFFTW_3(3MLIB), mlib_SignalFFTW_4(3MLIB), mlib_SignalIFFTW_1(3MLIB), mlib_SignalIFFTW_2(3MLIB), mlib_SignalIFFTW_3(3MLIB), attributes(5)
Name  mlib_SignalIIR_Biquad_S16_S16_Sat, mlib_SignalIIR_Biquad_S16S_S16S_Sat, mlib_SignalIIR_Biquad_F32_F32, mlib_SignalIIR_Biquad_F32S_F32S – biquad Infinite Impulse Response (IIR) filtering

Synopsis  cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIIR_Biquad_S16_S16_Sat(mlib_s16 *dst, const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalIIR_Biquad_S16S_S16S_Sat(mlib_s16 *dst, const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalIIR_Biquad_F32_F32(mlib_f32 *dst, const mlib_f32 *src, void *filter, mlib_s32 n);
mlib_status mlib_SignalIIR_Biquad_F32S_F32S(mlib_f32 *dst, const mlib_f32 *src, void *filter, mlib_s32 n);

Description  Each of these functions applies a biquad IIR filter to a signal array.

\[
X = x(n) \quad n = 0, 1, ...
\]

\[
Z = z(n) \quad n = 0, 1, ...
\]

\[
N = \sum_{k=0}^{M} a_k x(n-k) + \sum_{k=1}^{M} b_k z(n-k) \quad n = 0, 1, ...
\]

\[
H(z) = \frac{a_0 + a_1 z^{-1} + a_2 z^{-2}}{1 + b_1 z^{-1} + b_2 z^{-2}}
\]

The biquad IIR filter is represented by the following figure:
Each of the functions takes the following arguments:

- **dst** | Destination signal array.
- **src** | Source signal array.
- **filter** | Internal filter structure.
- **n** | Number of samples in the source signal array.

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
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</table>

**See Also**

- mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
- mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
- mlib_SignalIIRFree_P4_S16_S16(3MLIB),
- mlib_SignalIIRInit_Biquad_S16_S16(3MLIB),
- mlib_SignalIIRInit_P4_S16_S16(3MLIB), attributes(5)
mlib_SignalIIRFree_Biquad_F32_F32

**Name**
mlib_SignalIIRFree_Biquad_F32_F32, mlib_SignalIIRFree_Biquad_F32S_F32S — biquad Infinite Impulse Response (IIR) filtering

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalIIRFree_Biquad_F32_F32(void *filter);
void mlib_SignalIIRFree_Biquad_F32S_F32S(void *filter);

**Description**
Each of these functions releases the memory allocated for the internal filter structure.

**Parameters**
Each of the functions takes the following arguments:

- **filter** Internal filter structure.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
mlib_SignalIIR_P4_S16_S16_Sat(3MLIB), mlib_SignalIIRFree_P4_S16_S16(3MLIB),
mlib_SignalIIRInit_Biquad_S16_S16(3MLIB),
mlib_SignalIIRInit_P4_S16_S16(3MLIB), attributes(5)
**mlib_SignalIIRFree_Biquad_S16_S16, mlib_SignalIIRFree_Biquad_S16S_S16S** – biquad Infinite Impulse Response (IIR) filtering

**Synopsis**

```plaintext
c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalIIRFree_Biquad_S16_S16(void *filter);
void mlib_SignalIIRFree_Biquad_S16S_S16S(void *filter);
```

**Description**

Each of these functions releases the memory allocated for the internal filter structure.

**Parameters**

Each of the functions takes the following arguments:

- `filter` Internal filter structure.

**Return Values**

None.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB)`,
- `mlib_SignalIIR_P4_S16_S16_Sat(3MLIB)`,
- `mlib_SignalIIRFree_P4_S16_S16(3MLIB)`,
- `mlib_SignalIIRInit_Biquad_S16_S16(3MLIB)`,
- `mlib_SignalIIRInit_P4_S16_S16(3MLIB)`, attributes(5)
**Name**
mlib_SignalIIRFree_P4_F32_F32, mlib_SignalIIRFree_P4_F32S_F32S – parallel Infinite Impulse Response (IIR) filtering

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalIIRFree_P4_F32_F32(void *filter);
void mlib_SignalIIRFree_P4_F32S_F32S(void *filter);
```

**Description**
Each of these functions releases the memory allocated for the internal filter structure.

**Parameters**
Each of the functions takes the following arguments:
- `filter` Internal filter structure.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
mlib_SignalIIR_P4_S16_S16_Sat(3MLIB),
mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
mlib_SignalIIRInit_Biquad_S16_S16(3MLIB),
mlib_SignalIIRInit_P4_S16_S16(3MLIB), attributes(5)
Name  mlib_SignalIIRFree_P4_S16_S16, mlib_SignalIIRFree_P4_S16S_S16S – parallel Infinite Impulse Response (IIR) filtering

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          #include <mlib.h>

          void mlib_SignalIIRFree_P4_S16_S16(void *filter);
          void mlib_SignalIIRFree_P4_S16S_S16S(void *filter);

Description  Each of these functions releases the memory allocated for the internal filter structure.

Parameters  Each of the functions takes the following arguments:

filter  Internal filter structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
          mlib_SignalIIR_P4_S16_S16_Sat(3MLIB),
          mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
          mlib_SignalIIRInit_Biquad_S16_S16(3MLIB),
          mlib_SignalIIRInit_P4_S16_S16(3MLIB), attributes(5)
mlib_SignalIIRInit_Biquad_F32_F32(3MLIB)

Name  mlib_SignalIIRInit_Biquad_F32_F32, mlib_SignalIIRInit_Biquad_F32S_F32S – biquad Infinite Impulse Response (IIR) filtering

Synopsis  
cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalIIRInit_Biquad_F32_F32(void **filter,
     const mlib_f32 *flt);
mlib_status mlib_SignalIIRInit_Biquad_F32S_F32S(void **filter,
     const mlib_f32 *flt);

Description  Each of these functions allocates memory for the internal file structure and converts the filter coefficients into an internal representation.

Parameters  Each of the functions takes the following arguments:

- filter  Internal filter structure.
- flt  Array of five filter coefficients: a0, a1, a2, b1, and b2.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
mlib_SignalIIR_P4_S16_S16_Sat(3MLIB),
mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
mlib_SignalIIRFree_P4_S16_S16(3MLIB), mlib_SignalIIRInit_P4_S16_S16(3MLIB), attributes(5)
Infinite Impulse Response (IIR) filtering

```c
#include <mlib.h>
mlib_status mlib_SignalIIRInit_Biquad_S16_S16(void **filter, const mlib_f32 *flt);
mlib_status mlib_SignalIIRInit_Biquad_S16S_S16S(void **filter, const mlib_f32 *flt);
```

Each of these functions allocates memory for the internal file structure and converts the filter coefficients into an internal representation.

Parameters

- `filter` Internal filter structure.
- `flt` Array of five filter coefficients: a0, a1, a2, b1, and b2.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

- mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
- mlib_SignalIIR_P4_S16_S16_Sat(3MLIB),
- mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
- mlib_SignalIIRFree_P4_S16_S16(3MLIB),
- mlib_SignalIIRInit_P4_S16_S16(3MLIB),
- attributes(5)
mlib_SignalIIRInit_P4_F32_F32, mlib_SignalIIRInit_P4_F32S_F32S – parallel Infinite Impulse Response (IIR) filtering

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIIRInit_P4_F32_F32(void **filter, const mlib_f32 flt);
mlib_status mlib_SignalIIRInit_P4_F32S_F32S(void **filter, const mlib_f32 flt);

Description
Each of these functions allocates memory for the internal filter structure and converts the filter coefficients to an internal representation.

Parameters
Each of the functions takes the following arguments:

- **filter** Internal filter structure.
- **flt** Array of nine filter coefficients: c, a00, a10, b20, a01, a11, b11, and b21.

Return Values
Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

Attributes
See `attributes(5)` for descriptions of the following attributes:

<table>
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See Also
mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
mlib_SignalIIR_P4_S16_S16_Sat(3MLIB),
mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
mlib_SignalIIRFree_P4_S16_S16(3MLIB),
mlib_SignalIIRInit_Biquad_S16_S16(3MLIB), attributes(5)
mlib_SignalIIRInit_P4_S16_S16, mlib_SignalIIRInit_P4_S16S_S16S – parallel Infinite Impulse Response (IIR) filtering

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIIRInit_P4_S16_S16(void **filter, const mlib_f32 flt);
mlib_status mlib_SignalIIRInit_P4_S16S_S16S(void **filter, const mlib_f32 flt);

Description
Each of these functions allocates memory for the internal filter structure and converts the filter coefficients to an internal representation.

Parameters
Each of the functions takes the following arguments:

- filter: Internal filter structure.
- flt: Array of nine filter coefficients: c, a00, a10, b10, b20, a01, a11, b11, and b21.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
mlib_SignalIIR_P4_S16_S16_Sat(3MLIB),
mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
mlib_SignalIIRFree_P4_S16_S16(3MLIB),
mlib_SignalIIRInit_Biquad_S16_S16(3MLIB), attributes(5)
mli_SignalIIR_P4_S16_S16_Sat, mli_SignalIIR_P4_S16S_S16S_Sat, mli_SignalIIR_P4_F32_F32, mli_SignalIIR_P4_F32S_F32S – parallel Infinite Impulse Response (IIR) filtering

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mli_SignalIIR_P4_S16_S16_Sat(mlib_s16 *dst,
        const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mli_SignalIIR_P4_S16S_S16S_Sat(mlib_s16 *dst,
        const mlib_s16 *src, void *filter, mlib_s32 n);
mlib_status mli_SignalIIR_P4_F32_F32(mlib_f32 *dst,
        const mlib_f32 *src, void *filter, mlib_s32 n);
mlib_status mli_SignalIIR_P4_F32S_F32S(mlib_f32 *dst,
        const mlib_f32 *src, void *filter, mlib_s32 n);
```

**Description**

Each of these functions applies a fourth order parallel IIR filter to one signal packet and updates the filter state.

\[
X = x(n) \quad n = 0, 1, ...
\]

\[
Z = z(n) \quad n = 0, 1, ...
\]

\[
N = \sum_{k=0}^{N} a_k x(n-k) + \sum_{k=1}^{M} b_k z(n-k) \quad n = 0, 1, ...
\]

\[
H(z) = C + \sum_{k=0}^{1} \frac{(a_{2k} + a_{1k} z^{-1})}{(1 + b_{1k} z^{-1} + b_{2k} z^{-2})}
\]

The fourth order parallel IIR filter is represented by the following figure:
Each of the functions takes the following arguments:

- `dst`  Destination signal array.
- `src`  Source signal array.
- `filter`  Internal filter structure.
- `n`  Number of signal samples.

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_SignalIIR_Biquad_S16_S16_Sat(3MLIB),
mlib_SignalIIRFree_Biquad_S16_S16(3MLIB),
mlib_SignalIIRFree_P4_S16_S16(3MLIB),
mlib_SignalIIRInit_Biquad_S16_S16(3MLIB),
mlib_SignalIIRInit_P4_S16_S16(3MLIB), attributes(5)
Name  mlib_SignalIMDCT_D64 – Dolby AC-3 digital audio standard transformation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          #include <mlib.h>

          mlib_status mlib_SignalIMDCT_D64(mlib_d64 *data);

Description  The mlib_SignalIMDCT_D64() function performs the inverse modified discrete cosine
              transformation in Dolby's AC-3 digital audio standard.

Parameters  The function takes the following arguments:

              data    Pointer to the data array. data[2*i] contains the real parts, and data[2*i+1]
                      contains the imaginary parts.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalIMDCT_F32(3MLIB), mlib_SignalIMDCTSplit_D64(3MLIB),
          mlib_SignalIMDCTSplit_F32(3MLIB), attributes(5)
mlib_SignalIMDCT_F32 - Dolby AC-3 digital audio standard transformation

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIMDCT_F32(mlib_f32 *data);

Description

The mlib_SignalIMDCT_F32() function performs the inverse modified discrete cosine transformation in Dolby's AC-3 digital audio standard.

Parameters

The function takes the following arguments:

\[ \text{data} \]

Pointer to the data array. data[2*i] contains the real parts, and data[2*i+1] contains the imaginary parts.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_SignalIMDCT_D64(3MLIB), mlib_SignalIMDCTSplit_D64(3MLIB),
mlib_SignalIMDCTSplit_F32(3MLIB), attributes(5)
The `mlib_SignalIMDCTSplit_D64()` function performs the inverse modified discrete cosine transformation in Dolby’s AC-3 digital audio standard.

The function takes the following arguments:

- `data`  
  Pointer to the data array. `data[4*i]` contains the real parts of the first array, `data[4*i+1]` contains the real parts of the second array, `data[4*i+2]` contains the imaginary parts of the first array, and `data[4*i+3]` contains the imaginary parts of the second array.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

`mlib_SignalIMDCT_D64(3MLIB), mlib_SignalIMDCT_F32(3MLIB), mlib_SignalIMDCTSplit_F32(3MLIB), attributes(5)`
mlib_SignalIMDCTSplit_F32 – Dolby AC-3 digital audio standard transformation

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalIMDCTSplit_F32(mlib_f32 *data);

Description

The mlib_SignalIMDCTSplit_F32() function performs the inverse modified discrete cosine transformation in Dolby's AC-3 digital audio standard.

Parameters

The function takes the following arguments:

data  

Pointer to the data array. data[4*i] contains the real parts of the first array, data[4*i+1] contains the real parts of the second array, data[4*i+2] contains the imaginary parts of the first array, and data[4*i+3] contains the imaginary parts of the second array.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

mlib_SignalIMDCT_D64(3MLIB), mlib_SignalIMDCT_F32(3MLIB), mlib_SignalIMDCTSplit_D64(3MLIB), attributes(5)
Each of these functions performs hard limiting.

For monaural signals, the following equation is used:

\[
\begin{align*}
  dst[i] &= low[0] &\text{ if } src[i] < low[0] \\
  dst[i] &= src[i] &\text{ if } low[0] \leq src[i] < high[0] \\
  dst[i] &= high[0] &\text{ if } src[i] \geq high[0]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

For stereo signals, the following equation is used:

\[
\begin{align*}
  dst[2*i] &= low[0] &\text{ if } src[2*i] < low[0] \\
  dst[2*i] &= high[0] &\text{ if } src[2*i] \geq high[0] \\
\end{align*}
\]

where i = 0, 1, ..., (n - 1).

**Parameters**  Each of the functions takes some of the following arguments:

- **dst**: Destination signal array.
- **src**: Source signal array.
- **srcdst**: Source and destination signal array.
- **low**: Lower input limit. In the stereo version, low[0] contains the lower limit for channel 0, and low[1] contains the lower limit for channel 1.
- **high**: Upper input limit. In the stereo version, high[0] contains the upper limit for channel 0, and high[1] contains the upper limit for channel 1.
- **n**: Number of samples in the source signal array.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  attributes(5)
The `mlib_SignalLinear2ADPCM2Bits()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from 2-bit ADPCM to 16-bit linear PCM to G.723 or G.726 16kbps format.

### Parameters
The function takes the following arguments:

- **adpcm**: ADPCM code array.
- **pcm**: Linear PCM sample array.
- **state**: Internal structure of the codec.
- **n**: Number of samples in the source array.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

### See Also
`mlib_SignalLinear2ADPCM2Bits(3MLIB)`, `mlib_SignalADPCM2Bits2Linear(3MLIB)`, `mlib_SignalADPCM3Bits2Linear(3MLIB)`, `mlib_SignalADPCM4Bits2Linear(3MLIB)`, `mlib_SignalADPCM5Bits2Linear(3MLIB)`, `mlib_SignalADPCMFree(3MLIB)`, `mlib_SignalADPCMInit(3MLIB)`, `mlib_SignalLinear2ADPCM3Bits(3MLIB)`, `mlib_SignalLinear2ADPCM4Bits(3MLIB)`, `mlib_SignalLinear2ADPCM5Bits(3MLIB)`, attributes(5)
The `mlib_SignalLinear2ADPCM3Bits()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from 16-bit linear PCM to G.723 or G.726 24kpbs 3-bit ADPCM format.

The function takes the following arguments:

- `adpcm` : ADPCM code array.
- `pcm` : Linear PCM sample array.
- `state` : Internal structure of the codec.
- `n` : Number of samples in the source array.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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Multimedia Library Functions - Part 5 991
The `mlib_SignalLinear2ADPCM4Bits()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from 16-bit linear PCM to G.721 or G.726 32kbps 4-bit ADPCM format.

The function takes the following arguments:

- `adpcm` ADPCM code array.
- `pcm` Linear PCM sample array.
- `state` Internal structure of the codec.
- `n` Number of samples in the source array.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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</table>

### See Also

- `mlib_SignalADPCM2Bits2Linear(3MLIB)`, `mlib_SignalADPCM3Bits2Linear(3MLIB)`, `mlib_SignalADPCM4Bits2Linear(3MLIB)`, `mlib_SignalADPCM5Bits2Linear(3MLIB)`, `mlib_SignalADPCMFree(3MLIB)`, `mlib_SignalADPCMinit(3MLIB)`, `mlib_SignalLinear2ADPCM2Bits(3MLIB)`, `mlib_SignalLinear2ADPCM3Bits(3MLIB)`, `mlib_SignalLinear2ADPCM4Bits(3MLIB)`, `mlib_SignalLinear2ADPCM5Bits(3MLIB)`, `attributes(5)`
mlib_SignalLinear2ADPCM5Bits — adaptive differential pulse code modulation (ADPCM)

Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalLinear2ADPCM5Bits(mlib_u8 *adpcm,
                                        const mlib_s16 *pcm,
                                        void *state,
                                        mlib_s32 n);
```

Description

The `mlib_SignalLinear2ADPCM5Bits()` function performs adaptive differential pulse code modulation (ADPCM) in compliance with the ITU (former CCITT) G.721, G.723, and G.726 specifications. It converts data from 16-bit linear PCM to G.723 or G.726 40kbps 5-bit ADPCM format.

Parameters

The function takes the following arguments:

- `adpcm` ADPCM code array.
- `pcm` Linear PCM sample array.
- `state` Internal structure of the codec.
- `n` Number of samples in the source array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

- `mlib_SignalADPCM2Bits2Linear(3MLIB)`
- `mlib_SignalADPCM3Bits2Linear(3MLIB)`
- `mlib_SignalADPCM4Bits2Linear(3MLIB)`
- `mlib_SignalADPCM5Bits2Linear(3MLIB)`
- `mlib_SignalADPCMFree(3MLIB)`
- `mlib_SignalADPCMInit(3MLIB)`
- `mlib_SignalLinear2ADPCM2Bits(3MLIB)`
- `mlib_SignalLinear2ADPCM3Bits(3MLIB)`
- `mlib_SignalLinear2ADPCM4Bits(3MLIB)`, attributes(5)
mlib_SignalLinear2ALaw – ITU G.711 m-law and A-law compression and decompression

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLinear2ALaw(mlib_u8 *acode,
        const mlib_s16 *pcm, mlib_s32 n);

Description

The mlib_SignalLinear2ALaw() function performs ITU G.711 m-law and A-law compression and decompression in compliance with the ITU (Former CCITT) G.711 specification.

Parameters

The function takes the following arguments:

- acode  A-law code array.
- pcm   Linear PCM sample array.
- n   Number of samples in the source array.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

mlib_SignalALaw2Linear(3MLIB), mlib_SignalALaw2uLaw(3MLIB),
mlib_SignalLinear2uLaw(3MLIB), mlib_SignaluLaw2ALaw(3MLIB),
mlib_SignaluLaw2Linear(3MLIB), attributes(5)
mlib_SignalLinear2uLaw – ITU G.711 m-law and A-law compression and decompression

Synopsis

\[ \text{cc \{flag...\} file... -lmlib \{library...\}} \]
\[
\text{#include <mlib.h>}
\]
\[
\text{mlib_status mlib_SignalLinear2uLaw(mlib_u8 *ucode,}
\]
\[
\text{const mlib_s16 *pcm, mlib_s32 n);}\]

Description

The `mlib_SignalLinear2uLaw()` function performs ITU G.711 m-law and A-law compression and decompression in compliance with the ITU (Former CCITT) G.711 specification.

Parameters

- `ucode` m-law code array.
- `pcm` Linear PCM sample array.
- `n` Number of samples in the source array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

- `mlib_SignalALaw2Linear(3MLIB)`, `mlib_SignalALaw2uLaw(3MLIB)`,
- `mlib_SignalLinear2ALaw(3MLIB)`, `mlib_SignaluLaw2ALaw(3MLIB)`,
- `mlib_SignaluLaw2Linear(3MLIB)`, `attributes(5)`
Name  mlib_SignalLMSFilter, mlib_SignalLMSFilterInit_S16_S16,
      mlib_SignalLMSFilterInit_S16S_S16S, mlib_SignalLMSFilterInit_F32_F32,
      mlib_SignalLMSFilterInit_F32S_F32S, mlib_SignalLMSFilter_S16_S16_Sat,
      mlib_SignalLMSFilter_S16S_S16S_Sat, mlib_SignalLMSFilter_F32_F32,
      mlib_SignalLMSFilter_F32S_F32S, mlib_SignalLMSFilterNonAdapt_S16_S16_Sat,
      mlib_SignalLMSFilterNonAdapt_S16S_S16S_Sat, mlib_SignalLMSFilterNonAdapt_F32_F32,
      mlib_SignalLMSFilterNonAdapt_F32S_F32S, mlib_SignalLMSFilterFree_S16_S16,
      mlib_SignalLMSFilterFree_S16S_S16S, mlib_SignalLMSFilterFree_F32_F32S_F32S – least mean
      square (LMS) adaptive filtering

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

  mlib_status mlib_SignalLMSFilterInit_S16_S16(void **filter,
       const mlib_f32 *flt,
       mlib_s32 tap, mlib_f32 beta);

  mlib_status mlib_SignalLMSFilterInit_S16S_S16S(void **filter,
       const mlib_f32 *flt,
       mlib_s32 tap, mlib_f32 beta);

  mlib_status mlib_SignalLMSFilterInit_F32_F32(void **filter,
       const mlib_f32 *flt,
       mlib_s32 tap, mlib_f32 beta);

  mlib_status mlib_SignalLMSFilterInit_F32S_F32S(void **filter,
       const mlib_f32 *flt,
       mlib_s32 tap, mlib_f32 beta);

  mlib_status mlib_SignalLMSFilter_S16_S16_Sat(mlib_s16 *dst,
       const mlib_s16 *src,
       const mlib_s16 *ref, void *filter, mlib_s32 n);

  mlib_status mlib_SignalLMSFilter_S16S_S16S_Sat(mlib_s16 *dst,
       const mlib_s16 *src,
       const mlib_s16 *ref, void *filter, mlib_s32 n);

  mlib_status mlib_SignalLMSFilter_F32_F32(mlib_f32 *dst,
       const mlib_f32 *src,
       const mlib_f32 *ref, void *filter, mlib_s32 n);

  mlib_status mlib_SignalLMSFilter_F32S_F32S(mlib_f32 *dst,
       const mlib_f32 *src,
       const mlib_f32 *ref, void *filter, mlib_s32 n);

  mlib_status mlib_SignalLMSFilterNonAdapt_S16_S16_Sat(mlib_s16 *dst,
       const mlib_s16 *src, const mlib_s16 *ref,
       void *filter, mlib_s32 n);
The basic LMS adaptive algorithm is summarized as follows:

1. Initialize the weights $W_k(i), i = 0, 1, \ldots, \text{tap} - 1$.
2. Initialize previous source elements $X_0(i), i = 0, 1, \ldots, \text{tap} - 1$.
3. Read $X_k(t)$ from src and $Y_k(t)$ from ref, $t = 0, 1, \ldots, n - 1$.
4. Compute filter output: $n_k = \sum (W_k(i) \cdot X_k(t - i)), i = 0, 1, \ldots, \text{tap} - 1$. If $i > t$, use previous source elements stored in the $X_0$ vector.
5. Store filter output: $\text{dst}[t] = n_k$.
6. Compute the error estimate: $E_k = Y_k - n_k$.
7. Compute factor $BE_0 = 2 \cdot \beta \cdot E_k$.
8. Update filter weights: $W_k(i) += BE_0 \cdot X_k(t - i), i = 0, 1, \ldots, \text{tap} - 1$. If $i > t$, use previous source elements stored in $X_0$ vector.
9. Next $t$, go to step 3.
10. Store $N$ ending source elements in previous source elements vector $X_0$: if $N > n$, $N = n$; else $N = \text{tap}$.

The functions assume that the input signal has a power maximum equal to 1. If it is not, $\beta$ should be divided by power maximum. Power maximum is calculated according to the following formula:

$$\text{Power\_max} = \max \left\{ \frac{1}{\text{flt\_len}} \sum_{k=0}^{n} \text{signal}(n + k)^2 \right\}$$

It is necessary to consider the maximum of power maxima of both components as the stereo signal’s power maximum.
Each of the FilterInit functions allocates memory for the internal filter structure and converts the parameters into the internal representation.

Each of the Filter functions applies the LMS adaptive filter on one signal packet and updates the filter states.

Each of the FilterNoAdapt functions applies the LMS filter on one signal packet and updates the filter states but without changing the filter weights.

Each of the FilterFree functions releases the memory allocated for the internal filter structure.

### Parameters
Each of the functions takes some of the following arguments:

- `filter` Internal filter structure.
- `flt` Filter coefficient array.
- `tap` Taps of the filter.
- `beta` Error weighting factor. \(0 < \beta < 1\).
- `dst` Destination signal array.
- `src` Source signal array.
- `ref` Reference or “desired” signal array.
- `n` Number of samples in the source signal array.

### Return Values
Each of the FilterInit, Filter and FilterNoAdapt functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE. The FilterFree functions don’t return anything.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

### See Also
mlib_SignalNLMSFilter(3MLIB), attributes(5)
**Name**
mlib_SignalLPC2Cepstral_F32 – convert linear prediction coefficients to cepstral coefficients

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPC2Cepstral_F32(mlib_f32 *cepst,
const mlib_f32 *lpc, mlib_f32 gain, mlib_s32 length,
mlib_s32 order);

**Description**
The `mlib_SignalLPC2Cepstral_F32()` function converts linear prediction coefficients to cepstral coefficients.

The cepstral coefficients are the coefficients of the Fourier transform representation of the log magnitude spectrum.

The LPC cepstral coefficients can be derived recursively from the LPC coefficients as following.

\[ c(0) = \log(G) \]

\[ c(m) = a(m) + \sum_{k=1}^{m-1} c(k) \cdot a(m-k), \quad 1 \leq m \leq M \]

\[ c(m) = \sum_{k=1}^{m-1} c(k) \cdot a(m-k), \quad m > M \]


**Parameters**
The function takes the following arguments:

- **cepst** The cepstral coefficients.
- **lpc** The linear prediction coefficients.
- **gain** The gain of the LPC model.
- **length** The length of the cepstral coefficients.
- **order** The order of the linear prediction filter.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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mlib_SignalLPC2Cepstral_F32(3MLIB)

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See Also  
mlib_SignalLPC2Cepstral_S16(3MLIB), mlib_SignalLPC2Cepstral_S16_Adaptive(3MLIB), mlib_SignalLPC2Cepstral_F32(3MLIB), attributes(5)
The `mlib_SignalLPC2Cepstral_S16()` function converts linear prediction coefficients to cepstral coefficients. The user supplied scaling factor, `cscale`, will be used and the output will be saturated if necessary.

The cepstral coefficients are the coefficients of the Fourier transform representation of the log magnitude spectrum.

The LPC cepstral coefficients can be derived recursively from the LPC coefficients as following.

\[
c(0) = \log(G)
\]

\[
c(m) = a(m) + \sum_{k=1}^{m-1} c(k) \cdot a(m-k), \quad 1 \leq m \leq M
\]

\[
c(m) = \sum_{k=1}^{m-1} c(k) \cdot a(m-k), \quad m > M
\]


### Parameters

The function takes the following arguments:

- `cepst`  The cepstral coefficients.
- `cscale`  The scaling factor of the cepstral coefficients, where actual_data = output_data * 2**(-scaling_factor).
- `lpc`  The linear prediction coefficients.
- `lscale`  The scaling factor of the linear prediction coefficients, where actual_data = input_data * 2**(-scaling_factor).
- `gain`  The gain of the LPC model.
- `gscale`  The scaling factor of the gain of the LPC model, where actual_data = input_data * 2**(-scaling_factor).
- `length`  The length of the cepstral coefficients.
order  The order of the linear prediction filter.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalLPC2Cepstral_S16(3MLIB), mlib_SignalLPC2Cepstral_S16_Adp(3MLIB), mlib_SignalLPC2Cepstral_F32(3MLIB), attributes(5)
mlib_SignalLPC2Cepstral_S16_Adp — convert linear prediction coefficients to cepstral coefficients

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPC2Cepstral_S16_Adp(mlib_s16 *cepst,
   mlib_s32 *cscale, const mlib_s16 *lpc, mlib_s32 lscale,
   mlib_s16 gain, mlib_s32 gscale, mlib_s32 length,
   mlib_s32 order);
```

**Description**
The `mlib_SignalLPC2Cepstral_S16_Adp()` function converts linear prediction coefficients to cepstral coefficients. The scaling factor of the output data, `cscale`, will be calculated based on the actual data.

The cepstral coefficients are the coefficients of the Fourier transform representation of the log magnitude spectrum.

The LPC cepstral coefficients can be derived recursively from the LPC coefficients as following.

\[
c(0) = \log(G)
\]

\[
c(m) = a(m) + \sum_{k=1}^{m-1} c(k) \times a(m-k), \; 1 \leq m \leq M
\]

\[
c(m) = \sum_{k=1}^{m-1} c(k) \times a(m-k), \; m > M
\]


**Parameters**
The function takes the following arguments:

- `cepst` The cepstral coefficients.
- `cscale` The scaling factor of the cepstral coefficients, where `actual_data = output_data * 2**(-scaling_factor)`.
- `lpc` The linear prediction coefficients.
- `lscale` The scaling factor of the linear prediction coefficients, where `actual_data = input_data * 2**(-scaling_factor)`.
- `gain` The gain of the LPC model.
- `gscale` The scaling factor of the gain of the LPC model, where `actual_data = input_data * 2**(-scaling_factor)`.
- `length` The length of the cepstral coefficients.
order The order of the linear prediction filter.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_SignalLPC2Cepstral_S16(3MLIB), mlib_SignalLPC2Cepstral_S16_Adp(3MLIB), mlib_SignalLPC2Cepstral_F32(3MLIB), attributes(5)
The `mlib_SignalLPC2LSP_F32()` function converts linear prediction coefficients to line spectral pair coefficients.

The line spectral pair (LPS) coefficients are defined as the roots of the following two polynomials:

\[
P(z) = A(z) + z^{-1} A(z^-1) \]
\[
Q(z) = A(z) - z^{-1} A(z^-1) \]

where \(A(z)\) is the inverse filter

\[
A(z) = 1 - \sum_{i=1}^{M} a(i) z^{-i} \]

Note that since \(P(z)\) is symmetric and \(Q(z)\) is antisymmetric all roots of these polynomials are on the unit circle and they alternate each other. \(P(z)\) has a root at \(z = -1 (w = \pi)\) and \(Q(z)\) has a root at \(z = 1 (w = 0)\).

The line spectral frequency (LPF) are the angular frequency of the line spectral pair (LPS) coefficients.

\[
q = \cos(w) \]

where \(q\) is the LPS and \(w\) is the LPF.


**Parameters**

The function takes the following arguments:

- `lsp` The line spectral pair coefficients.
- `lpc` The linear prediction coefficients.
- `order` The order of the linear prediction filter.
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
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<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** mlib_SignalLSP2LPC_F32(3MLIB), attributes(5)
The `mlib_SignalLPC2LSP_S16()` function converts linear prediction coefficients to line spectral pair coefficients.

The line spectral pair (LPS) coefficients are defined as the roots of the following two polynomials:

\[ P(z) = A(z) + z^{-1} A(z) \]

\[ Q(z) = A(z) - z^{-1} A(z) \]

where \( A(z) \) is the inverse filter

\[ A(z) = \sum_{i=1}^{M} a(i) z^{-i} \]

Note that since \( P(z) \) is symmetric and \( Q(z) \) is antisymmetric all roots of these polynomials are on the unit circle and they alternate each other. \( P(z) \) has a root at \( z = -1 \) (\( w = \pi \)) and \( Q(z) \) has a root at \( z = 1 \) (\( w = 0 \)).

The line spectral frequency (LPF) are the angular frequency of the line spectral pair (LPS) coefficients.

\[ q = \cos(w) \]

where \( q \) is the LPS and \( w \) is the LPF.


### Parameters
The function takes the following arguments:

- \( lsp \) The line spectral pair coefficients in Q15 format.
- \( lpc \) The linear prediction coefficients.
- \( lscale \) The scaling factor of the linear prediction coefficients, where \( \text{actual\_data} = \text{input\_data} * 2^{\text{scaling\_factor}} \).
- \( order \) The order of the linear prediction filter.

### Return Values
The function returns \( \text{MLIB\_SUCCESS} \) if successful. Otherwise it returns \( \text{MLIB\_FAILURE} \).
Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalLSP2LPC_S16(3MLIB), attributes(5)
mlib_SignalLPCAutoCorrel_F32 – perform linear predictive coding with autocorrelation method

Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalLPCAutoCorrel_F32(mlib_f32 *coeff,
const mlib_f32 *signal, void *state);
```

Description

The `mlib_SignalLPCAutoCorrel_F32()` function performs linear predictive coding with autocorrelation method.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past M samples.

\[
M \quad s(n) = \sum_{i=1}^{M} a(i) \ast s(n-i) + G \ast u(n)
\]

where \(s(*)\) is the speech signal, \(u(*)\) is the excitation signal, and \(G\) is the gain constant, \(M\) is the order of the linear prediction filter. Given \(s(*)\), the goal is to find a set of coefficient \(a(*)\) that minimizes the prediction error \(e(*)\).

\[
M \quad e(n) = s(n) - \sum_{i=1}^{M} a(i) \ast s(n-i)
\]

In autocorrelation method, the coefficients can be obtained by solving following set of linear equations.

\[
M \quad \sum_{i=1}^{M} a(i) \ast r(|i-k|) = r(k), k=1,...,M
\]

where

\[
N-k-1 \quad r(k) = \sum_{j=0}^{N-k-1} s(j) \ast s(j+k)
\]

are the autocorrelation coefficients of \(s(*)\), \(N\) is the length of the input speech vector. \(r(0)\) is the energy of the speech signal.

Note that the autocorrelation matrix \(R\) is a Toeplitz matrix (symmetric with all diagonal elements equal), and the equations can be solved efficiently with Levinson-Durbin algorithm.

mlib_SignalLPCAutoCorrel_F32(3MLIB)

**Parameters**  The function takes the following arguments:

- `coeff`  The linear prediction coefficients.
- `signal`  The input signal vector.
- `state`  Pointer to the internal state structure.

**Return Values**  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  
mlib_SignalLPCAutoCorrelInit_F32(3MLIB),
mlib_SignalLPCAutoCorrelGetEnergy_F32(3MLIB),
mlib_SignalLPCAutoCorrelGetPARCOR_F32(3MLIB),
mlib_SignalLPCAutoCorrelFree_F32(3MLIB), attributes(5)
Name  mlib_SignalLPCAutoCorrelFree_S16, mlib_SignalLPCAutoCorrelFree_F32 – clean up for autocorrelation method

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          #include <mlib.h>
          void mlib_SignalLPCAutoCorrelFree_S16(void *state);
          void mlib_SignalLPCAutoCorrelFree_F32(void *state);

Description  Each of these functions frees the internal state structure for autocorrelation method of linear predictive coding (LPC).

This function cleans up the internal state structure and releases all memory buffers.

Parameters  Each of the functions takes the following arguments:

    state    Pointer to the internal state structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalLPCAutoCorrelInit_S16(3MLIB),
          mlib_SignalLPCAutoCorrelInit_F32(3MLIB),
          mlib_SignalLPCAutoCorrel_S16(3MLIB),
          mlib_SignalLPCAutoCorrel_S16_Adaptive(3MLIB),
          mlib_SignalLPCAutoCorrel_F32(3MLIB),
          mlib_SignalLPCAutoCorrelGetEnergy_S16(3MLIB),
          mlib_SignalLPCAutoCorrelGetEnergy_F32(3MLIB),
          mlib_SignalLPCAutoCorrelGetPARCOR_S16(3MLIB),
          mlib_SignalLPCAutoCorrelGetPARCOR_F32(3MLIB), attributes(5)
The `mlib_SignalLPCAutoCorrelGetEnergy_F32()` function returns the energy of the input signal.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past \( M \) samples.

\[
s(n) = \sum_{i=1}^{M} a(i) * s(n-i) + G * u(n)
\]

where \( s(*) \) is the speech signal, \( u(*) \) is the excitation signal, and \( G \) is the gain constants, \( M \) is the order of the linear prediction filter. Given \( s(*) \), the goal is to find a set of coefficient \( a(*) \) that minimizes the prediction error \( e(*) \).

\[
e(n) = s(n) - \sum_{i=1}^{M} a(i) * s(n-i)
\]

In autocorrelation method, the coefficients can be obtained by solving following set of linear equations.

\[
\sum_{i=1}^{M} a(i) * r(|i-k|) = r(k), \quad k=1,\ldots,M
\]

where

\[
r(k) = \sum_{j=0}^{N-k-1} s(j) * s(j+k)
\]

are the autocorrelation coefficients of \( s(*) \), \( N \) is the length of the input speech vector. \( r(0) \) is the energy of the speech signal.

Note that the autocorrelation matrix \( R \) is a Toeplitz matrix (symmetric with all diagonal elements equal), and the equations can be solved efficiently with Levinson-Durbin algorithm.

The function takes the following arguments:

- **energy**: The energy of the input signal.
- **state**: Pointer to the internal state structure.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- mlib_SignalLPCAutoCorrelInit_F32(3MLIB)
- mlib_SignalLPCAutoCorrel_F32(3MLIB)
- mlib_SignalLPCAutoCorrelGetPARCOR_F32(3MLIB)
- mlib_SignalLPCAutoCorrelFree_F32(3MLIB)
- attributes(5)
Name  mlib_SignalLPCAutoCorrelGetEnergy_S16, 
      mlib_SignalLPCAutoCorrelGetEnergy_S16_Adp – return the energy of the input signal

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPCAutoCorrelGetEnergy_S16(
    mlib_s16 *energy, mlib_s32 escale, void *state);

mlib_status mlib_SignalLPCAutoCorrelGetEnergy_S16_Adp(
    mlib_s16 *energy, mlib_s32 *escale, void *state);

Description  Each of the functions returns the energy of the input signal.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past \( M \) samples.

\[
M \\
S(n) = \sum_{i=1}^{M} a(i) * s(n-i) + G * u(n)
\]

where \( s(*) \) is the speech signal, \( u(*) \) is the excitation signal, and \( G \) is the gain constants, \( M \) is the order of the linear prediction filter. Given \( s(*) \), the goal is to find a set of coefficient \( a(*) \) that minimizes the prediction error \( e(*) \).

\[
M \\
e(n) = s(n) - \sum_{i=1}^{M} a(i) * s(n-i)
\]

In autocorrelation method, the coefficients can be obtained by solving following set of linear equations.

\[
M \\
\sum_{i=1}^{M} a(i) * r(|i-k|) = r(k), k=1,\ldots,M
\]

where

\[
N-k-1 \\
r(k) = \sum_{j=0}^{N-k-1} s(j) * s(j+k)
\]

are the autocorrelation coefficients of \( s(*) \), \( N \) is the length of the input speech vector. \( r(0) \) is the energy of the speech signal.

Note that the autocorrelation matrix \( R \) is a Toeplitz matrix (symmetric with all diagonal elements equal), and the equations can be solved efficiently with Levinson-Durbin algorithm.

Note for functions with adaptive scaling (with _Adp postfix), the scaling factor of the output data will be calculated based on the actual data; for functions with non-adaptive scaling (without _Adp postfix), the user supplied scaling factor will be used and the output will be saturated if necessary.

**Parameters**
Each function takes the following arguments:

- **energy**  
The energy of the input signal.

- **escale**  
The scaling factor of the energy, where actual_data = output_data * 2**(-scaling_factor).

- **state**  
Pointer to the internal state structure.

**Return Values**
Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalLPCAutoCorrelInit_S16(3MLIB), mlib_SignalLPCAutoCorrel_S16(3MLIB),
mlib_SignalLPCAutoCorrelGetPACOR_S16(3MLIB),
mlib_SignalLPCAutoCorrelFree_S16(3MLIB), attributes(5)
The `mlib_SignalLPCAutoCorrelGetPARCOR_F32()` function returns the partial correlation (PARCOR) coefficients.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past \( M \) samples.

\[
M \quad s(n) = \sum_{i=1}^{M} a(i) * s(n-i) + G * u(n)
\]

where \( s(*) \) is the speech signal, \( u(*) \) is the excitation signal, and \( G \) is the gain constant, \( M \) is the order of the linear prediction filter. Given \( s(*) \), the goal is to find a set of coefficient \( a(*) \) that minimizes the prediction error \( e(*) \).

\[
M \quad e(n) = s(n) - \sum_{i=1}^{M} a(i) * s(n-i)
\]

In autocorrelation method, the coefficients can be obtained by solving following set of linear equations.

\[
M \quad \sum_{i=1}^{M} a(i) * r(|i-k|) = r(k), \, k=1,...,M
\]

where

\[
N-k-1 \quad r(k) = \sum_{j=0}^{N-k-1} s(j) * s(j+k)
\]

are the autocorrelation coefficients of \( s(*) \), \( N \) is the length of the input speech vector. \( r(0) \) is the energy of the speech signal.

Note that the autocorrelation matrix \( R \) is a Toeplitz matrix (symmetric with all diagonal elements equal), and the equations can be solved efficiently with Levinson-Durbin algorithm.

The function takes the following arguments:

- `parcor` The partial correlation (PARCOR) coefficients.
- `state` Pointer to the internal state structure.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

mlib_SignalLPCAutoCorrelInit_F32(3MLIB), mlib_SignalLPCAutoCorrelGetEnergy_F32(3MLIB), mlib_SignalLPCAutoCorrelFree_F32(3MLIB), attributes(5)
mlib_SignalLPCAutoCorrelGetPARCOR_S16,
mlib_SignalLPCAutoCorrelGetPARCOR_S16_Adp – return the partial correlation (PARCOR) coefficients

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPCAutoCorrelGetPARCOR_S16(
    mlib_s16 *parcor, mlib_s32 pscale, void *state);

mlib_status mlib_SignalLPCAutoCorrelGetPARCOR_S16_Adp(
    mlib_s16 *parcor, mlib_s32 *pscale, void *state);

Description

Each of the functions returns the partial correlation (PARCOR) coefficients.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past M samples.

\[ M \]
\[ s(n) = \sum_{i=1}^{M} a(i) \times s(n-i) + G \times u(n) \]

where \( s(*) \) is the speech signal, \( u(*) \) is the excitation signal, and \( G \) is the gain constants, \( M \) is the order of the linear prediction filter. Given \( s(*) \), the goal is to find a set of coefficient \( a(*) \) that minimizes the prediction error \( e(*) \).

\[ M \]
\[ e(n) = s(n) - \sum_{i=1}^{M} a(i) \times s(n-i) \]

In autocorrelation method, the coefficients can be obtained by solving following set of linear equations.

\[ M \]
\[ \sum_{i=1}^{M} a(i) \times r(|i-k|) = r(k), k=1,\ldots,M \]

where

\[ N-k-1 \]
\[ r(k) = \sum_{j=0}^{N-k-1} s(j) \times s(j+k) \]

are the autocorrelation coefficients of \( s(*) \), \( N \) is the length of the input speech vector. \( r(0) \) is the energy of the speech signal.

Note that the autocorrelation matrix \( R \) is a Toeplitz matrix (symmetric with all diagonal elements equal), and the equations can be solved efficiently with Levinson-Durbin algorithm.

Note for functions with adaptive scaling (with \_Adp postfix), the scaling factor of the output data will be calculated based on the actual data; for functions with non-adaptive scaling (without \_Adp postfix), the user supplied scaling factor will be used and the output will be saturated if necessary.

**Parameters** Each function takes the following arguments:

- **parcor**: The partial correlation (PARCOR) coefficients.
- **pscale**: The scaling factor of the partial correlation (PARCOR) coefficients, where \( \text{actual\_data} = \text{output\_data} \times 2^{-\text{scaling\_factor}} \).
- **state**: Pointer to the internal state structure.

**Return Values** Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See attributes(5) for descriptions of the following attributes:

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**See Also** mlib_SignalLPCAutoCorrelInit_S16(3MLIB), mlib_SignalLPCAutoCorrel_S16(3MLIB), mlib_SignalLPCAutoCorrelGetEnergy_S16(3MLIB), mlib_SignalLPCAutoCorrelFree_S16(3MLIB), attributes(5)
Name  mlib_SignalLPCAutoCorrelInit_S16, mlib_SignalLPCAutoCorrelInit_F32 – initialization for autocorrelation method of linear predictive coding

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPCAutoCorrelInit_S16(void *state,
        mlib_s32 length, mlib_s32 order);
mlib_status mlib_SignalLPCAutoCorrelInit_F32(void *state,
        mlib_s32 length, mlib_s32 order);

Description  Each function initializes the internal state structure for autocorrelation method of linear predictive coding (LPC).

The init function performs internal state structure allocation and global initialization. Per LPC function call initialization is done in LPC function, so the same internal state structure can be reused for multiple LPC function calls.

Parameters  Each function takes the following arguments:

state    Pointer to the internal state structure.
length   The length of the input signal vector.
order    The order of the linear prediction filter.

Return Values  Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalLPCAutoCorrel_S16(3MLIB),
mlib_SignalLPCAutoCorrelGetEnergy_S16(3MLIB),
mlib_SignalLPCAutoCorrelGetPARCOR_S16(3MLIB),
mlib_SignalLPCAutoCorrelFree_S16(3MLIB),attributes(5)
Each function performs linear predictive coding with autocorrelation method.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past $M$ samples.

$$ s(n) = \sum_{i=1}^{M} a(i) \cdot s(n-i) + G \cdot u(n) $$

where $s(*)$ is the speech signal, $u(*)$ is the excitation signal, and $G$ is the gain constants, $M$ is the order of the linear prediction filter. Given $s(*)$, the goal is to find a set of coefficient $a(*)$ that minimizes the prediction error $e(*)$.

$$ e(n) = s(n) - \sum_{i=1}^{M} a(i) \cdot s(n-i) $$

In autocorrelation method, the coefficients can be obtained by solving following set of linear equations.

$$ \sum_{i=1}^{M} a(i) \cdot r(|i-k|) = r(k), \quad k=1,\ldots,M $$

where

$$ r(k) = \sum_{j=0}^{N-k-1} s(j) \cdot s(j+k) $$

are the autocorrelation coefficients of $s(*)$, $N$ is the length of the input speech vector. $r(0)$ is the energy of the speech signal.

Note that the autocorrelation matrix $R$ is a Toeplitz matrix (symmetric with all diagonal elements equal), and the equations can be solved efficiently with Levinson-Durbin algorithm.

Note for functions with adaptive scaling (with _Adp postfix), the scaling factor of the output data will be calculated based on the actual data; for functions with non-adaptive scaling (without _Adp postfix), the user supplied scaling factor will be used and the output will be saturated if necessary.

**Parameters**

Each function takes the following arguments:

- `coeff` The linear prediction coefficients.
- `cscale` The scaling factor of the linear prediction coefficients, where `actual_data = output_data * 2**(-scaling_factor)`.
- `signal` The input signal vector with samples in Q15 format.
- `state` Pointer to the internal state structure.

**Return Values**

Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

mlib_SignalLPCAutoCorrelInit_S16(3MLIB),
mlib_SignalLPCAutoCorrelGetEnergy_S16(3MLIB),
mlib_SignalLPCAutoCorrelGetPARCOR_S16(3MLIB),
mlib_SignalLPCAutoCorrelFree_S16(3MLIB), attributes(5)
**mlib_SignalLPCCovariance_F32** – perform linear predictive coding with covariance method

### Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalLPCCovariance_F32(mlib_f32 *coeff,
    const mlib_f32 *signal, void *state);
```

### Description

The `mlib_SignalLPCCovariance_F32()` function performs linear predictive coding with covariance method.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past \( M \) samples.

\[
s(n) = \sum_{i=1}^{M} a(i) * s(n-i) + G * u(n)
\]

where \( s(*) \) is the speech signal, \( u(*) \) is the excitation signal, and \( G \) is the gain constants, \( M \) is the order of the linear prediction filter. Given \( s(*) \), the goal is to find a set of coefficient \( a(*) \) that minimizes the prediction error \( e(*) \).

\[
e(n) = s(n) - \sum_{i=1}^{M} a(i) * s(n-i)
\]

In covariance method, the coefficients can be obtained by solving following set of linear equations.

\[
\sum_{i=1}^{M} a(i) * c(i,k) = c(0,k), \ k=1,\ldots,M
\]

where

\[
c(i,k) = \sum_{j=0}^{N-k-1} s(j) * s(j+k-i)
\]

are the covariance coefficients of \( s(*) \), \( N \) is the length of the input speech vector.

Note that the covariance matrix \( R \) is a symmetric matrix, and the equations can be solved efficiently with Cholesky decomposition method.


### Parameters

The function takes the following arguments:

- **coeff** The linear prediction coefficients.
- **signal** The input signal vector.
state Pointer to the internal state structure.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_SignalLPCCovarianceInit_F32(3MLIB), mlib_SignalLPCCovarianceFree_F32(3MLIB), attributes(5)
**mlib_SignalLPCCovarianceFree_S16, mlib_SignalLPCCovarianceFree_F32** – clean up for covariance method

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalLPCCovarianceFree_S16(void *state);
void mlib_SignalLPCCovarianceFree_F32(void *state);
```

**Description**
Each of these functions frees the internal state structure for covariance method of linear predictive coding (LPC).

This function cleans up the internal state structure and releases all memory buffers.

**Parameters**
Each of the functions takes the following arguments:
- `state` Pointer to the internal state structure.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalLPCCovarianceInit_S16(3MLIB),
mlib_SignalLPCCovarianceInit_F32(3MLIB), mlib_SignalLPCCovariance_S16(3MLIB),
mlib_SignalLPCCovariance_S16_Adp(3MLIB), mlib_SignalLPCCovariance_F32(3MLIB),
attributes(5)
mlib_SignalLPCCovarianceInit_S16, mlib_SignalLPCCovarianceInit_F32 – initialization for covariance method of linear predictive coding

Synopsis

`cc [ flag... ] file... -lmilb [ library... ]`
#include <mlib.h>

```c
mlib_status mlib_SignalLPCCovarianceInit_S16(void *state,
                                              mlib_s32 length,
                                              mlib_s32 order);

mlib_status mlib_SignalLPCCovarianceInit_F32(void *state,
                                              mlib_s32 length,
                                              mlib_s32 order);
```

Description

Each function initializes the internal state structure for covariance method of linear predictive coding (LPC).

The init function performs internal state structure allocation and global initialization. Per LPC function call initialization is done in LPC function, so the same internal state structure can be reused for multiple LPC function calls.

Parameters

Each function takes the following arguments:

- `state` Pointer to the internal state structure.
- `length` The length of the input signal vector.
- `order` The order of the linear prediction filter.

Return Values

Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

mlib_SignalLPCCovariance_S16(3MLIB), mlib_SignalLPCCovarianceFree_S16(3MLIB), attributes(5)
### Name
mlib_SignalLPCCovariance_S16, mlib_SignalLPCCovariance_S16_Adp – perform linear predictive coding with covariance method

### Synopsis
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalLPCCovariance_S16(mlib_s16 *coeff, mlib_s32 cscale, const mlib_s16 *signal, void *state);
mlib_status mlib_SignalLPCCovariance_S16_Adp(mlib_s16 *coeff, mlib_s32 *cscale, const mlib_s16 *signal, void *state);
```

### Description
Each function performs linear predictive coding with covariance method.

In linear predictive coding (LPC) model, each speech sample is represented as a linear combination of the past $M$ samples.

$$
s(n) = \sum_{i=1}^{M} a(i) \cdot s(n-i) + G \cdot u(n)
$$

where $s(*)$ is the speech signal, $u(*)$ is the excitation signal, and $G$ is the gain constants, $M$ is the order of the linear prediction filter. Given $s(*)$, the goal is to find a set of coefficient $a(*)$ that minimizes the prediction error $e(*)$.

$$
e(n) = s(n) - \sum_{i=1}^{M} a(i) \cdot s(n-i)
$$

In covariance method, the coefficients can be obtained by solving following set of linear equations.

$$
\sum_{i=1}^{M} a(i) \cdot c(i,k) = c(0,k), \quad k=1,\ldots,M
$$

where

$$
c(i,k) = \sum_{j=0}^{N-k-1} s(j) \cdot s(j+k-i)
$$

are the covariance coefficients of $s(*)$, $N$ is the length of the input speech vector.

Note that the covariance matrix $R$ is a symmetric matrix, and the equations can be solved efficiently with Cholesky decomposition method.

Not for functions with adaptive scaling (with _Adp postfix), the scaling factor of the output data will be calculated based on the actual data; for functions with non-adaptive scaling (without _Adp postfix), the user supplied scaling factor will be used and the output will be saturated if necessary.

**Parameters**
Each function takes the following arguments:

- `coeff` The linear prediction coefficients.
- `cscale` The scaling factor of the linear prediction coefficients, where `actual_data = output_data * 2 ** (-scaling_factor)`.
- `signal` The input signal vector with samples in Q15 format.
- `state` Pointer to the internal state structure.

**Return Values**
Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_SignalLPCCovarianceInit_S16(3MLIB),
mlib_SignalLPCCovarianceFree_S16(3MLIB), attributes(5)
The `mlib_SignalLPCPerceptWeight_F32()` function performs perceptual weighting on input signal.

The perceptual weighting filter is defined as following.

\[
W(z) = \frac{A(z * r_1)}{A(z * r_2)}
\]

where \(A(z)\) is the inverse filter

\[
A(z) = 1 - \sum_{i=1}^{M} a(i) * z^{-i}
\]


**Parameters**
- `sigwgt` The weighted signal vector.
- `signal` The input signal vector.
- `lpc` The linear prediction coefficients.
- `r1` The perceptual weighting filter coefficient, it is treated as 1 if 0 is supplied.
- `r2` The perceptual weighting filter coefficient, it is treated as 1 if 0 is supplied.
- `state` Pointer to the internal state structure.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</table>
See Also  
mlib_SignalLPCPerceptWeightInit_F32(3MLIB),
mlib_SignalLPCPerceptWeightFree_F32(3MLIB), attributes(5)
Name mlib_SignalLPCPerceptWeightFree_S16, mlib_SignalLPCPerceptWeightFree_F32 - clean up for perceptual weighting

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalLPCPerceptWeightFree_S16(void *state);
void mlib_SignalLPCPerceptWeightFree_F32(void *state);

Description

Each of these functions frees the internal state structure for perceptual weighting of linear predictive coding (LPC).

This function cleans up the internal state structure and releases all memory buffers.

Parameters

Each of the functions takes the following arguments:

state Pointer to the internal state structure.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also mlib_SignalLPCPerceptWeightInit_S16(3MLIB), mlib_SignalLPCPerceptWeightInit_F32(3MLIB), mlib_SignalLPCPerceptWeight_S16(3MLIB), mlib_SignalLPCPerceptWeight_F32(3MLIB), attributes(5)
mlib_SignalLPCPerceptWeightInit_S16, mlib_SignalLPCPerceptWeightInit_F32 –
initialization for perceptual weighting of linear predictive coding

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPCPerceptWeightInit_S16(void *state,
             mlib_s32 length, mlib_s32 order);
mlib_status mlib_SignalLPCPerceptWeightInit_F32(void *state,
             mlib_s32 length, mlib_s32 order);

Description

Each function initializes the internal state structure for perceptual weighting of linear
predictive coding (LPC).

The init function performs internal state structure allocation and global initialization. Per LPC
function call initialization is done in LPC function, so the same internal state structure can be
reused for multiple LPC function calls.

Parameters

Each function takes the following arguments:

- state : Pointer to the internal state structure.
- length : The length of the input signal vector.
- order : The order of the linear prediction filter.

Return Values

Each function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_SignalLPCPerceptWeight_S16(3MLIB),
mlib_SignalLPCPerceptWeightInitF32(3MLIB), attributes(5)
The `mlib_SignalLPCPerceptWeight_S16()` function performs perceptual weighting on input signal.

The perceptual weighting filter is defined as following.

\[ W(z) = \frac{A(z*r1)}{A(z*r2)} \]

where \( A(z) \) is the inverse filter

\[ A(z) = 1 - \sum_{i=1}^{M} a(i) * z^{-i} \]


### Parameters

- **sigwgt** The weighted signal vector, the signal samples are in Q15 format.
- **signal** The input signal vector, the signal samples are in Q15 format.
- **lpc** The linear prediction coefficients.
- **lscale** The scaling factor of the linear prediction coefficients, where \( \text{actual\_data} = \text{input\_data} * 2^{\text{-scaling\_factor}}. \)
- **r1** The perceptual weighting filter coefficient, the coefficient is in Q15 format, it is treated as 1 if 0 is supplied.
- **r2** The perceptual weighting filter coefficient, the coefficient is in Q15 format, it is treated as 1 if 0 is supplied.
- **state** Pointer to the internal state structure.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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</table>
### `mlib_SignalLPCPerceptWeight_S16(3MLIB)`

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**See Also**  
`mlib_SignalLPCPerceptWeightInit_S16(3MLIB)`,  
`mlib_SignalLPCPerceptWeightFree_S16(3MLIB)`,  
`attributes(5)`
mlib_SignalLPCPitchAnalyze_F32 – perform open-loop pitch analysis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalLPCPitchAnalyze_F32(mlib_s32 *pitch,
const mlib_f32 *sigwgt, const mlib_s32 *region,
mlib_s32 length);

The mlib_SignalLPCPitchAnalyze_F32() function performs open-loop pitch analysis.
The open-loop pitch analysis uses perceptual weighted signal and is done with following steps.

In the first step, three maxima of the correlation

\[
R(k) = \sum_{j=0}^{N-1} \text{sw}(j) \ast \text{sw}(j-k)
\]

where \( N = \text{length} \), is located for each of the three search regions.

In the second step, the retained maxima \( R(T_i), i=0, 1, 2 \) are normalized as following.

\[
R(T_i)
Rn(t_i) = \frac{R(T_i)}{\sqrt{\sum_{j=0}^{N-1} \text{sw}(j-T_i)^2}}
\]

where \( N = \text{length} \).

In the third step, the best open-loop delay \( T_{opt} \) is determined as following.

\[
T_{opt} = T_0
\]
\[
\text{if } (R(T_1) \geq (0.85 \ast Rn(T_{opt})))
\]
\[
T_{opt} = t_1
\]
\[
\text{if } (R(T_2) \geq (0.85 \ast Rn(T_{opt})))
\]
\[
T_{opt} = t_2
\]

See G.729, G.729A, GSM EFR standards.

The function takes the following arguments:

- **pitch** The speech pitch estimated.
- **sigwgt** The weighted signal vector. \( \text{sigwgt} \) points to the current sample of the weighted signal vector, \( \text{length} \) samples must be available after this point, and \( \text{MAX}\{\text{region}[i], i=0, 1,\ldots, 5\} \) samples must be available before this point.
- **region** The lower/upper boundaries of the three search regions, where \( \text{region}[2*1] \) is the lower boundary of search region \( i \) and \( \text{region}[2*1+1] \) is the upper boundary of search region \( i \).
The length of the signal vectors over which the correlation is calculated.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_SignalLPCPitchAnalyze_S16(3MLIB), attributes(5)
The mlib_SignalLPCPitchAnalyze_S16() function performs open-loop pitch analysis. The open-loop pitch analysis uses perceptual weighted signal and is done with following steps.

In the first step, three maxima of the correlation

\[ R(k) = \sum_{j=0}^{N-1} sw(j) \times sw(j-k) \]

where \( N = \text{length} \), is located for each of the three search regions.

In the second step, the retained maxima \( R(T_i) \), \( i=0,1,2 \) are normalized as following.

\[ Rn(T_i) = \frac{R(T_i)}{\sqrt{\sum_{j=0}^{N-1} sw(j-T_i)^2}} \]

where \( N = \text{length} \).

In the third step, the best open-loop delay \( T_{opt} \) is determined as following.

\[ T_{opt} = T_0 \]
\[ \text{if } (Rn(t_1) \geq 0.85 \times Rn(T_{opt})) \]
\[ T_{opt} = t_1 \]
\[ \text{if } (Rn(t_2) \geq 0.85 \times Rn(T_{opt})) \]
\[ T_{opt} = t_2 \]

See G.729, G.729A, GSM EFR standards.

Parameters

The function takes the following arguments:

- \( pitch \) The speech pitch estimated.
- \( sigwgt \) The weighted signal vector with samples in Q15 format. \( sigwgt \) points to the current sample of the weighted signal vector, \( length \) samples must be available after this point, and \( \max\{ \text{region}[i], i=0,1,\ldots,5 \} \) samples must be available before this point.
- \( region \) The lower/upper boundaries of the three search regions, where \( \text{region}[2*i] \) is the lower boundary of search region \( i \) and \( \text{region}[2*i+1] \) is the upper boundary of search region \( i \).
length  The length of the signal vectors over which the correlation is calculated.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalLPCPitchAnalyze_F32(3MLIB), attributes(5)
The `mlib_SignalLSP2LPC_F32()` function converts line spectral pair coefficients to linear prediction coefficients.

The line spectral pair (LPS) coefficients are defined as the roots of the following two polynomials:

\[
P(z) = A(z) + z^{-1} A(z^{-1})
\]

\[
Q(z) = A(z) - z^{-1} A(z^{-1})
\]

where \( A(z) \) is the inverse filter

\[
A(z) = \sum_{i=1}^{M} a(i) z^{-i}
\]

Noting that since \( P(z) \) is symmetric and \( Q(z) \) is antisymmetric, all roots of these polynomials are on the unit circle and they alternate each other. \( P(z) \) has a root at \( z = -1 \) (\( \omega = \pi \)) and \( Q(z) \) has a root at \( z = 1 \) (\( \omega = 0 \)).

The line spectral frequency (LPF) are the angular frequency of the line spectral pair (LPS) coefficients.

\[
q = \cos(\omega)
\]

where \( q \) is the LPS and \( \omega \) is the LPF.


**Parameters**

- `lpc` The linear prediction coefficients.
- `lsp` The line spectral pair coefficients.
- `order` The order of the linear prediction filter.
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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See Also  
`mlib_SignalLPC2LSP_F32(3MLIB), attributes(5)`
mlib_SignalLSP2LPC_S16, mlib_SignalLSP2LPC_S16_Adp – convert linespectral pair coefficients to linear prediction coefficients

Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalLSP2LPC_S16(mlib_s16 *lpc, mlib_s32 lscale, const mlib_s16 *lsp, mlib_s32 order);

mlib_status mlib_SignalLSP2LPC_S16_Adp(mlib_s16 *lpc, mlib_s32 *lscale, const mlib_s16 *lsp, mlib_s32 order);
```

Description

Each of the functions in this group converts line spectral pair coefficients to linear prediction coefficients.

The line spectral pair (LPS) coefficients are defined as the roots of the following two polynomials:

\[
\begin{align*}
P(z) &= A(z) + z^{-1} \ast A(z) \\
Q(z) &= A(z) - z^{-1} \ast A(z)
\end{align*}
\]

where \(A(z)\) is the inverse filter

\[
A(z) = \sum_{i=1}^{M} a(i) \ast z^{-i}
\]

Note that since \(P(z)\) is symmetric and \(Q(z)\) is antisymmetric all roots of these polynomials are on the unit circle and they alternate each other. \(P(z)\) has a root at \(z = -1 (w = \pi)\) and \(Q(z)\) has a root at \(z = 1 (w = 0)\).

The line spectral frequency (LPF) are the angular frequency of the line spectral pair (LPS) coefficients.

\[
q = \cos(w)
\]

where \(q\) is the LPS and \(w\) is the LPF.


Note for functions with adaptive scaling (with _Adp postfix), the scaling factor of the output data will be calculated based on the actual data; for functions with non-adaptive scaling (without _Adp postfix), the user supplied scaling factor will be used and the output will be saturated if necessary.
Each function takes the following arguments:

- **lpc**: The linear prediction coefficients.
- **lscale**: The scaling factor of the line spectral pair coefficients, where \( \text{actual\_data} = \text{output\_data} \times 2^{-\text{scaling\_factor}} \).
- **lsp**: The line spectral pair coefficients in Q15 format.
- **order**: The order of the linear prediction filter.

Each function returns **MLIB_SUCCESS** if successful. Otherwise, it returns **MLIB_FAILURE**.

See attributes(5) for descriptions of the following attributes:

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See Also mlib_SignalLSP2LPC_S16(3MLIB), attributes(5)
The `mlib_SignalMelCepstral_F32()` function performs cepstral analysis in mel frequency scale.

The first two steps of mel scale cepstral analysis is the same as in general cepstral analysis. After the logarithm of the spectrum magnitude is obtained, it is converted into mel frequency scale before the inverse Fourier transform.

\[
\begin{align*}
\text{Linear} & \quad \text{Inverse} \\
\cdots \quad \cdots & \quad \cdots \quad \cdots \\
X'(k) & \quad X''(m)
\end{align*}
\]

where \(X'(k)\) is defined in linear frequency scale and \(X''(m)\) is defined in mel frequency scale.

The mel frequency scale is defined as following.

\[
\text{freq}_\text{mel} = \text{melmul} \times \log_{10}(1 + \text{freq}_\text{linear} / \text{meldiv})
\]

where \(\text{freq}_\text{mel}\) is the frequency in mel scale, \(\text{freq}_\text{linear}\) is the frequency in linear scale, \(\text{melmul}\) is the multiplying factor, \(\text{meldiv}\) is the dividing factor.

Optionally, a bank of band pass filters in linear frequency scale can be used below the bank of band pass filters in mel frequency scale, as shown below in linear frequency scale.

\[
0 \quad f_1 \quad f_2 \quad f_3 \quad fp \quad fp+1 \quad fp+2 \quad fp+3 \quad fp+q \\
\cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \\
\text{freq}
\]

where \(fp = \text{melbgn}\), \(fp+q = \text{melend}\), \(p = n\text{linear}\), \(q = n\text{mel}\); the filters number 1 to \(p\) are defined in linear frequency scale which have equal bandwidth in linear frequency scale; the filters number \(p+1\) to \(p+q\) are defined in mel frequency scale which have equal bandwidth in mel frequency scale and increasing bandwidth in linear frequency scale.


The function takes the following arguments:

- \textit{cepst} The cepstral coefficients.
- \textit{signal} The input signal vector.
- \textit{state} Pointer to the internal state structure.

The function returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Parameters**

- \texttt{cepst} The cepstral coefficients.
- \texttt{signal} The input signal vector.
- \texttt{state} Pointer to the internal state structure.

**Return Values**

The function returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Attributes**

See \texttt{attributes(5)} for descriptions of the following attributes:

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**See Also** \texttt{mlibSignalMelCepstralInit_F32(3MLIB)}, \texttt{mlibSignalMelCepstralFree_F32(3MLIB)}, \texttt{attributes(5)}
**mlib_SignalMelCepstralFree_S16**

**Name**
mlib_SignalMelCepstralFree_S16, mlib_SignalMelCepstralFree_F32 – clean up for cepstral analysis in mel frequency scale

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalMelCepstralFree_S16(void *state);
void mlib_SignalMelCepstralFree_F32(void *state);

**Description**
Each of these functions frees the internal *state* structure and releases all memory buffers for cepstral analysis in mel frequency scale.

**Parameters**
Each of the functions takes the following arguments:
- *state*  Pointer to the internal state structure.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalMelCepstral_S16(3MLIB), mlib_SignalMelCepstral_F32(3MLIB),
mlib_SignalMelCepstral_S16_Adp(3MLIB), mlib_SignalMelCepstralInit_S16(3MLIB),
mlib_SignalMelCepstralInit_F32(3MLIB), attributes(5)
mlib_SignalMelCepstralInit_S16, mlib_SignalMelCepstralInit_F32 – initialization for cepstral analysis in mel frequency scale

```
cc [ flag... ] file... -tmlib [ library... ]

#include <mlib.h>

mlib_status mlib_SignalMelCepstralInit_S16(void * state, mlib_s32 nlinear,
                                          mlib_s32 nmel, mlib_f32 melbgn, mlib_f32 melend, mlib_f32 meldiv,
                                          mlib_s32 order);

mlib_status mlib_SignalMelCepstralInit_F32(void * state, mlib_s32 nlinear,
                                          mlib_s32 nmel, mlib_f32 melbgn, mlib_f32 melend, mlib_f32 meldiv,
                                          mlib_s32 order);
```

Description
Each of these functions initializes the internal state structure for cepstral analysis in mel frequency scale.

The init function performs internal state structure allocation and global initialization. Per function call initialization is done in each function, so the same internal state structure can be reused for multiple function calls.

Parameters
Each of the functions takes the following arguments:

- **state**: Pointer to the internal state structure.
- **nlinear**: The number of band pass filters in linear frequency scale.
- **nmel**: The number of band pass filters in mel frequency scale.
- **melbgn**: The begin radian frequency of the mel scale filter bank defined in linear frequency scale, where \( 0 \leq \text{melbgn} < \text{melend} \leq \pi \). \text{melbgn} is ignored if \text{nlinear} = 0.
- **melend**: The end radian frequency of the mel scale filter bank defined in linear frequency scale, where \( 0 \leq \text{melbgn} < \text{melend} \leq \pi \).
- **meldiv**: The dividing factor in linear to mel scale conversion, linear scale is measured in radians, with PI corresponding to half the sampling rate.
- **order**: The order of the input signal vector and the cepstral coefficients, where \text{length} = 2^{\text{order}}.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</table>
mlib_SignalMelCepstralInit_S16(3MLIB)

See Also  
mlib_SignalMelCepstral_S16(3MLIB), mlib_SignalMelCepstral_F32(3MLIB),
mlib_SignalMelCepstral_S16_Adp(3MLIB), mlib_SignalMelCepstralFree_S16(3MLIB),
mlib_SignalMelCepstralFree_F32(3MLIB), attributes(5)
Name  

mlib_SignalMelCepstral_S16 – perform cepstral analysis in mel frequency scale

Synopsis  

cc [ flag... ] file... -mlib [ library... ]

#include <mlib.h>

mlib_status mlib_SignalMelCepstral_S16(mlib_s16 *cepst,
                                       mlib_s32 cscale,
                                       const mlib_s16 *signal,
                                       void *state);

Description  

The mlib_SignalMelCepstral_S16() function performs cepstral analysis in mel frequency scale. The user supplied scaling factor will be used and the output will be saturated if necessary.

The first two steps of mel scale cepstral analysis is the same as in general cepstral analysis. After the logarithm of the spectrum magnitude is obtained, it is converted into mel frequency scale before the inverse Fourier transform.

```
+-----------+ +-----------+
| Linear    | | Inverse   |
| ... ------>| to |------->| Fourier |------>
| X'(k)     | Mel Scale | X''(m) | Transform | c(n)
+-----------+ +-----------+
```

where $X'(k)$ is defined in linear frequency scale and $X''(m)$ is defined in mel frequency scale.

The mel frequency scale is defined as following.

\[
\text{freq\_mel} = \text{melmul} \times \log_{10}(1 + \frac{\text{freq\_linear}}{\text{meldiv}})
\]

where \( \text{freq\_mel} \) is the frequency in mel scale, \( \text{freq\_linear} \) is the frequency in linear scale, \( \text{melmul} \) is the multiplying factor, \( \text{meldiv} \) is the dividing factor.

Optionally, a bank of band pass filters in linear frequency scale can be used below the bank of band pass filters in mel frequency scale, as shown below in linear frequency scale.

\[
0 \quad f_1 \quad f_2 \quad f_3 \quad fp \quad fp+1 \quad fp+2 \quad fp+3 \quad fp+q
\]

where \( fp = \text{melbgn}, \) \( fp+q = \text{melend}, \) \( p = nlinear, \) \( q = nmel; \) the filters number 1 to \( p \) are defined in linear frequency scale which have equal bandwidth in linear frequency scale; the filters number \( p+1 \) to \( p+q \) are defined in mel frequency scale which have equal bandwidth in mel frequency scale and increasing bandwidth in linear frequency scale.


The function takes the following arguments:

- **cepst**: The cepstral coefficients.
- **cscale**: The scaling factor of cepstral coefficients, where \( \text{actual\_data} = \text{output\_data} \times 2^{-\text{scaling\_factor}} \).
- **signal**: The input signal vector, the signal samples are in Q15 format.
- **state**: Pointer to the internal state structure.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

mlib_SignalMelCepstralInit_S16(3MLIB), mlib_SignalMelCepstral_S16_Adp(3MLIB), mlib_SignalMelCepstralFree_S16(3MLIB), attributes(5)
mlib_SignalMelCepstral_S16_Adp - perform cepstral analysis in mel frequency scale

Synopsis

cc [ flag ] file... -lmlib [ library ]
#include <mlib.h>

mlib_status mlib_SignalMelCepstral_S16_Adp(mlib_s16 *cepst,
        mlib_s32 *cscale, const mlib_s16 *signal, void *state);

Description

The mlib_SignalMelCepstral_S16_Adp() function performs cepstral analysis in mel frequency scale. The scaling factor of the output data will be calculated based on the actual data.

The first two steps of mel scale cepstral analysis is the same as in general cepstral analysis. After the logarithm of the spectrum magnitude is obtained, it is converted into mel frequency scale before the inverse Fourier transform.

```
+-----------+ +-----------+
| Linear    | | Inverse   |
... --------->| to |------->| Fourier       |
X'(k) | Mel Scale | X''(m) | Transform | c(n)
+-----------+ +-----------+
```

where $X'(k)$ is defined in linear frequency scale and $X''(m)$ is defined in mel frequency scale.

The mel frequency scale is defined as following.

$$\text{freq}_\text{mel} = \text{melmul} \times \log_{10}(1 + \text{freq}_\text{linear} / \text{meldiv})$$

where $\text{freq}_\text{mel}$ is the frequency in mel scale, $\text{freq}_\text{linear}$ is the frequency in linear scale, $\text{melmul}$ is the multiplying factor, $\text{meldiv}$ is the dividing factor.

Optionally, a bank of bandpass filters in linear frequency scale can be used below the bank of band pass filters in mel frequency scale, as shown below in linear frequency scale.

```
0 f1 f2 f3 fp fp+1 fp+2 fp+3 fp+q
|-----|-----|-----|-----|-----|-----|
```

where $fp = \text{melbgn}$, $fp+q = \text{melend}$, $p = \text{nlinear}$, $q = \text{nmel}$; the filters number 1 to $p$ are defined in linear frequency scale which have equal bandwidth in linear frequency scale; the filters number $p+1$ to $p+q$ are defined in mel frequency scale which have equal bandwidth in mel frequency scale and increasing bandwidth in linear frequency scale.


The function takes the following arguments:

- **cepst**: The cepstral coefficients.
- **cscale**: The scaling factor of cepstral coefficients, where `actual_data = output_data * 2**(scaling_factor)`.
- **signal**: The input signal vector, the signal samples are in Q15 format.
- **state**: Pointer to the internal state structure.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
mlib_SignalMelCepstralInit_S16(3MLIB), mlib_SignalMelCepstral_S16(3MLIB), mlib_SignalMelCepstralFree_S16(3MLIB), attributes(5)
The `mlib_SignalMerge_F32S_F32()` function merges two signal arrays to form a stereo signal array.

**Parameters**

- **dst**  

- **ch0**  
  Input signal array of Channel 0.

- **ch1**  
  Input signal array of Channel 1.

- **n**  
  Number of samples in the source signal arrays.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_SignalMerge_S16S_S16(3MLIB)`
- `mlib_SignalSplit_F32_F32S(3MLIB)`
- `mlib_SignalSplit_S16_S16S(3MLIB)`
- attributes(5)
mlib_SignalMerge_S16S_S16

**Name** | mlib_SignalMerge_S16S_S16 – merge
---|---

**Synopsis** | 
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMerge_S16S_S16(mlib_s16 *dst, const mlib_s16 *ch0, const mlib_s16 *ch1, mlib_s32 n);
```

**Description** | The `mlib_SignalMerge_S16S_S16()` function merges two signal arrays to form a stereo signal array.

**Parameters** | The function takes the following arguments:
- **ch0** | Input signal array of Channel 0.
- **ch1** | Input signal array of Channel 1.
- **n** | Number of samples in the source signal arrays.

**Return Values** | The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** | See attributes(5) for descriptions of the following attributes:

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**See Also** | mlib_SignalMerge_F32S_F32(3MLIB), mlib_SignalSplit_F32_F32S(3MLIB), mlib_SignalSplit_S16_S16S(3MLIB), attributes(5)
mlib_SignalMulBartlett_F32, mlib_SignalMulBartlett_F32S – Bartlett windowing multiplication

Synopsis
```c
#include <mlib.h>

mlib_status mlib_SignalMulBartlett_F32(mlib_f32 *srcdst, mlib_s32 n);
mlib_status mlib_SignalMulBartlett_F32S(mlib_f32 *srcdst, mlib_s32 n);
```

Description
Each of these functions performs multiplication of the Bartlett window.

Parameters
Each of the functions takes the following arguments:
- `srcdst` Input and output signal array.
- `n` Number of samples in signal and window arrays.

Return Values
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_SignalMulBartlett_F32_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB), mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB), mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHanning_F32_F32(3MLIB), mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB), mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB), mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB), attributes(5)
mlib_SignalMulBartlett_F32_F32, mlib_SignalMulBartlett_F32S_F32S – Bartlett windowing multiplication

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulBartlett_F32_F32(mlib_f32 *dst,
    const mlib_f32 *src, mlib_s32 n);
mlib_status mlib_SignalMulBartlett_F32S_F32S(mlib_f32 *dst,
    const mlib_f32 *src, mlib_s32 n);
```

**Description**

Each of these functions performs multiplication of the Bartlett window.

**Parameters**

Each of the functions takes the following arguments:

- `dst` Output signal array.
- `src` Input signal array.
- `n` Number of samples in signal and window arrays.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB), mlib_SignalMulBlackman_F32S_F32S(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB), mlib_SignalMulHann_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
mlib_SignalMulBartlett_S16(3MLIB)

Name  mlib_SignalMulBartlett_S16, mlib_SignalMulBartlett_S16S – Bartlett windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulBartlett_S16(mlib_s16 *srcdst, mlib_s32 n);
mlib_status mlib_SignalMulBartlett_S16S(mlib_s16 *srcdst, mlib_s32 n);

Description  Each of these functions performs multiplication of the Bartlett window.

Parameters  Each of the functions takes the following arguments:

srcdst     Input and output signal array.
n     Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBlackman_S16_S16(3MLIB),
mlib_SignalMulBlackman_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB),
mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB),
mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB),
mlib_SignalMulRectangular_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
mlib_SignalMulWindow_S16_S16(3MLIB), attributes(5)
Name  mlib_SignalMulBartlett_S16_S16, mlib_SignalMulBartlett_S16S_S16S – Bartlett windowing multiplication

Synopsis  cc [-Iflag... ] file... -lmli [ -llibrary... ]
#include <mlib.h>

mlib_status mlib_SignalMulBartlett_S16_S16(mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 n);
mlib_status mlib_SignalMulBartlett_S16S_S16S(mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 n);

Description  Each of these functions performs multiplication of the Bartlett window.

Parameters  Each of the functions takes the following arguments:

    dst  Output signal array.
    src  Input signal array.
    n    Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBlackman_S16(3MLIB),
mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulHamming_S16(3MLIB),
mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHanning_S16(3MLIB),
mlib_SignalMulHanning_S16_S16(3MLIB), mlib_SignalMulKaiser_S16(3MLIB),
mlib_SignalMulKaiser_S16_S16(3MLIB), mlib_SignalMulRectangular_S16(3MLIB),
mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
attributes(5)
mlib_SignalMulBlackman_F32(3MLIB)

Name  mlib_SignalMulBlackman_F32, mlib_SignalMulBlackman_F32S – Blackman windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulBlackman_F32(mlib_f32 *srcdst, mlib_f32 alpha, mlib_s32 n);
mlib_status mlib_SignalMulBlackman_F32S(mlib_f32 *srcdst, mlib_f32 alpha, mlib_s32 n);

Description  Each of these functions performs multiplication of the Bartlett window.

Parameters  Each of the functions takes the following arguments:

- **srcdst**  Input and output signal array.
- **alpha**  Blackman window parameter. -1 < alpha < 0.
- **n**  Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB), mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB), mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB), mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB), attributes(5)
mlib_SignalMulBlackman_F32_F32(3MLIB)

**Name**
mlib_SignalMulBlackman_F32_F32, mlib_SignalMulBlackman_F32S_F32S – Blackman windowing multiplication

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulBlackman_F32_F32(mlib_f32 *dst,
    const mlib_f32 *src, mlib_f32 alpha, mlib_s32 n);
mlib_status mlib_SignalMulBlackman_F32S_F32S(mlib_f32 *dst,
    const mlib_f32 *src, mlib_f32 alpha, mlib_s32 n);

**Description**
Each of these functions performs multiplication of the Bartlett window.

**Parameters**
Each of the functions takes the following arguments:
- **dst** Output signal array.
- **src** Input signal array.
- **alpha** Blackman window parameter. -1 < alpha < 0.
- **n** Number of samples in signal and window arrays.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB), mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB), mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB), mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulHanning_F32_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB), mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB), mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
mlib_SignalMulBlackman_S16, mlib_SignalMulBlackman_S16S – Blackman windowing multiplication

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulBlackman_S16(mlib_s16 *srcdst, mlib_f32 alpha, mlib_s32 n);
mlib_status mlib_SignalMulBlackman_S16S(mlib_s16 *srcdst, mlib_f32 alpha, mlib_s32 n);

Description
Each of these functions performs multiplication of the Bartlett window.

Parameters
Each of the functions takes the following arguments:

srcdst   Input and output signal array.
alpha    Blackman window parameter. -1 < alpha < 0.
n        Number of samples in signal and window arrays.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16(3MLIB),
mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulHamming_S16(3MLIB),
mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB),
mlib_SignalMulRectangular_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
mlib_SignalMulWindow_S16(3MLIB), attributes(5)
### Name

mlib_SignalMulBlackman_S16_S16, mlib_SignalMulBlackman_S16S_S16S – Blackman windowing multiplication

### Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalMulBlackman_S16_S16(mlib_s16 *dst,
                                          const mlib_s16 *src, mlib_f32 alpha, mlib_s32 n);

mlib_status mlib_SignalMulBlackman_S16S_S16S(mlib_s16 *dst,
                                              const mlib_s16 *src, mlib_f32 alpha, mlib_s32 n);
```

### Description

Each of these functions performs multiplication of the Bartlett window.

### Parameters

Each of the functions takes the following arguments:

- **dst**
  - Output signal array.
- **src**
  - Input signal array.
- **alpha**
  - Blackman window parameter. \(-1 < \alpha < 0\).
- **n**
  - Number of samples in signal and window arrays.

### Return Values

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

### See Also

- mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBlackman_S16_S16S(3MLIB), mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB), mlib_SignalMulKaiser_S16_S16_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulRectangular_S16_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16_S16(3MLIB), attributes(5)
mlib_SignalMul_F32, mlib_SignalMul_F32S – multiplication

Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalMul_F32(mlib_f32 *scr1dst, const mlib_f32 *src2, mlib_s32 n);
mlib_status mlib_SignalMul_F32S(mlib_f32 *scr1dst, const mlib_f32 *src2, mlib_s32 n);
```

Description

Each of these functions performs multiplication.

Parameters

Each of the functions takes the following arguments:

- `scr1dst` The first input and the output signal array.
- `src2` The second input signal array.
- `n` Number of samples in the input signal arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

attributes(5)
Name mlib_SignalMul_F32_F32, mlib_SignalMul_F32S_F32S – multiplication

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMul_F32_F32(mlib_f32 *dst, const mlib_f32 *src1, const mlib_f32 *src2, const mlib_s32 n);
mlib_status mlib_SignalMul_F32S_F32S(mlib_f32 *dst, const mlib_f32 *src1, const mlib_f32 *src2, const mlib_s32 n);

Description Each of these functions performs multiplication.

Parameters Each of the functions takes the following arguments:
src1 dst The output signal array.
src1 The first input signal array
src2 The second input signal array.
n Number of samples in the input signal arrays.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also attributes(5)
mlib_SignalMulHamming_F32(3MLIB)

Name  
mlib_SignalMulHamming_F32, mlib_SignalMulHamming_F32S – Bartlett windowing multiplication

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulHamming_F32(mlib_f32 *srcdst, mlib_s32 n);
mlib_status mlib_SignalMulHamming_F32S(mlib_f32 *srcdst, mlib_s32 n);

Description  
Each of these functions performs multiplication of the Hamming window.

Parameters  
Each of the functions takes the following arguments:

srcdst  
Input and output signal array.

n  
Number of samples in signal and window arrays.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also  
mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB), mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB), mlib_SignalMulHanning_F32_F32(3MLIB), mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
Name  mlib_SignalMulHamming_F32_F32, mlib_SignalMulHamming_F32S_F32S – Hamming windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulHamming_F32_F32(mlib_f32 *dst,
const mlib_f32 *src, mlib_s32 n);
mlib_status mlib_SignalMulHamming_F32S_F32S(mlib_f32 *dst,
const mlib_f32 *src, mlib_s32 n);

Description  Each of these functions performs multiplication of the Hamming window.

Parameters  Each of the functions takes the following arguments:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dst</td>
<td>Output signal array.</td>
</tr>
<tr>
<td>src</td>
<td>Input signal array.</td>
</tr>
<tr>
<td>n</td>
<td>Number of samples in signal and window arrays.</td>
</tr>
</tbody>
</table>

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB),
mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB),
mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB),
mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB),
mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB),
mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB),
mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
mlib_SignalMulHamming_S16(3MLIB)

Name    mlib_SignalMulHamming_S16, mlib_SignalMulHamming_S16S – Bartlett windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          
#include <mlib.h>

mlib_status mlib_SignalMulHamming_S16(mlib_s16 *srcdst, mlib_s32 n);
mlib_status mlib_SignalMulHamming_S16S(mlib_s16 *srcdst, mlib_s32 n);

Description Each of these functions performs multiplication of the Hamming window.

Parameters Each of the functions takes the following arguments:

srcdst     Input and output signal array.

n          Number of samples in signal and window arrays.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16(3MLIB),
mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulBlackman_S16(3MLIB),
mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB),
mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB),
mlib_SignalMulRectangular_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
mlib_SignalMulWindow_S16(3MLIB), attributes(5)
Name  mlib_SignalMulHamming_S16_S16, mlib_SignalMulHamming_S16S_S16S – Hamming windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulHamming_S16_S16(mlib_s16 *dst,
const mlib_s16 *src, mlib_s32 n);

mlib_status mlib_SignalMulHamming_S16S_S16S(mlib_s16 *dst,
const mlib_s16 *src, mlib_s32 n);

Description  Each of these functions performs multiplication of the Hamming window.

Parameters  Each of the functions takes the following arguments:

- *dst*  Output signal array.
- *src*  Input signal array.
- *n*  Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBartlett_S16_S16(3MLIB),
mlib_SignalMulBlackman_S16(3MLIB), mlib_SignalMulBlackman_S16_S16(3MLIB),
mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB),
mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB),
mlib_SignalMulRectangular_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB),
mlib_SignalMulWindow_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
attributes(5)
mlib_SignalMulHanning_F32(3MLIB)

Name  
mlib_SignalMulHanning_F32, mlib_SignalMulHanning_F32S – Hanning windowing multiplication

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulHanning_F32(mlib_f32 *srcdst, mlib_s32 n);
mlib_status mlib_SignalMulHanning_F32S(mlib_f32 *srcdst, mlib_s32 n);

Description  
Each of these functions performs multiplication of the Hanning window.

Parameters  
Each of the functions takes the following arguments:

srcdst  
Source and destination signal array.

n  
Number of samples in signal and window arrays.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB),
mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB),
mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB),
mlib_SignalMulHanning_F32_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB),
mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB),
mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB),
mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
mlib_SignalMulHanning_F32_F32, mlib_SignalMulHanning_F32S_F32S – Hanning windowing multiplication

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulHanning_F32_F32(mlib_f32 *dst,
                          mlib_s32const mlib_f32 *src, n);
mlib_status mlib_SignalMulHanning_F32S_F32S(mlib_f32 *dst,
                          mlib_s32const mlib_f32 *src, mlib_s32 n);

Description
Each of these functions performs multiplication of the Hanning window.

Parameters
Each of the functions takes the following arguments:

dst  Destination signal array.
src  Source signal array.

n   Number of samples in signal and window arrays.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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See Also
mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB),
mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB),
mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB),
mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulHanning_F32S_F32S(3MLIB),
mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB),
mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB),
mlib_SignalMulWindow_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
mlib_SignalMulHanning_S16(3MLIB)

Name  mlib_SignalMulHanning_S16, mlib_SignalMulHanning_S16S – Hanning windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
  #include <mlib.h>
  
  mlib_status mlib_SignalMulHanning_S16(mlib_s16 *srcdst, mlib_s32 n);
  mlib_status mlib_SignalMulHanning_S16S(mlib_s16 *srcdst, mlib_s32 n);

Description  Each of these functions performs multiplication of the Hanning window.

Parameters  Each of the functions takes the following arguments:
  
  srcdst  Source and destination signal array.
  
  n  Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16(3MLIB),
  mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulBlackman_S16(3MLIB),
  mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHamming_S16(3MLIB),
  mlib_SignalMulHanning_S16_S16(3MLIB), mlib_SignalMulHanning_S16(3MLIB),
  mlib_SignalMulKaiser_S16_S16(3MLIB), mlib_SignalMulKaiser_S16(3MLIB),
  mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulRectangular_S16(3MLIB),
  mlib_SignalMulWindow_S16_S16(3MLIB), mlib_SignalMulWindow_S16(3MLIB), attributes(5)
mlib_SignalMulHanning_S16_S16, mlib_SignalMulHanning_S16S_S16S – Hanning windowing multiplication

Synopsis

cc [ flag... ] file... -lmlib [ library... ] #include <mlib.h>

mlib_status mlib_SignalMulHanning_S16_S16(mlib_s16 *dst,
const mlib_s16 *src, mlib_s32 n);

mlib_status mlib_SignalMulHanning_S16S_S16S(mlib_s16 *dst,
const mlib_s16 *src, mlib_s32 n);

Description

Each of these functions performs multiplication of the Hanning window.

Parameters

Each of the functions takes the following arguments:

dst Destination signal array.
src Source signal array.
n Number of samples in signal and window arrays.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16(3MLIB),
mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulBlackman_S16(3MLIB),
mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHamming_S16(3MLIB),
mlib_SignalMulHanning_S16_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB),
mlib_SignalMulRectangular_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
attributes(5)
lib_SignalMulKaiser_F32, mlib_SignalMulKaiser_F32S – Kaiser windowing multiplication

**Synopsis**

```c
cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulKaiser_F32(mlib_f32 *srcdst, mlib_f32 beta,
                     mlib_s32 n);
mlib_status mlib_SignalMulKaiser_F32S(mlib_f32 *srcdst, mlib_f32 beta,
                         mlib_s32 n);
```

**Description**

Each of these functions performs multiplication of the Kaiser window.

**Parameters**

Each of the functions takes the following arguments:

- `srcdst` Source and destination signal array.
- `beta` Kaiser window parameter.
- `n` Number of samples in signal and window arrays.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB),
- mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB),
- mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB),
- mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulHanning_F32_F32(3MLIB),
- mlib_SignalMulKaiser_F32_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB),
- mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB),
- mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
Name  mlib_SignalMulKaiser_F32_F32, mlib_SignalMulKaiser_F32S_F32S – Kaiser windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulKaiser_F32_F32(mlib_f32 *dst,
    const mlib_f32 *src, mlib_f32 beta, mlib_s32 n);
mlib_status mlib_SignalMulKaiser_F32S_F32S(mlib_f32 *dst,
    const mlib_f32 *src, mlib_f32 beta, mlib_s32 n);

Description  Each of these functions performs multiplication of the Kaiser window.

Parameters  Each of the functions takes the following arguments:

    dst  Output signal array.
    src  Input signal array.
    beta Kaiser window parameter.
    n    Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB),
mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB),
mlib_SignalMulHanning_F32(3MLIB), mlib_SignalMulHanning_F32_F32(3MLIB),
mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB),
mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulRectangular_F32_F32(3MLIB),
mlib_SignalMulWindow_F32(3MLIB), mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)


Name

mlib_SignalMulKaiser_S16, mlib_SignalMulKaiser_S16S – Kaiser windowing multiplication

Synopsis

cc [ flag... ] file... -tlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulKaiser_S16(mlib_s16 *srcdst, mlib_f32 beta,
mlib_s32 n);
mlib_status mlib_SignalMulKaiser_S16S(mlib_s16 *srcdst, mlib_f32 beta,
mlib_s32 n);

Description

Each of these functions performs multiplication of the Kaiser window.

Parameters

Each of the functions takes the following arguments:

srcdst Source and destination signal array.
beta Kaiser window parameter.
n Number of samples in signal and window arrays.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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See Also

mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBartlett_S16_S16(3MLIB),
mlib_SignalMulBlackman_S16(3MLIB), mlib_SignalMulBlackman_S16_S16(3MLIB),
mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB),
mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16_S16(3MLIB), mlib_SignalMulRectangular_S16(3MLIB),
mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
attributes(5)
mlib_SignalMulKaiser_S16_S16(3MLIB)

Name  
mlib_SignalMulKaiser_S16_S16, mlib_SignalMulKaiser_S16S_S16S – Kaiser windowing multiplication

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulKaiser_S16_S16(mlib_s16 *dst, 
    const mlib_s16 *src, mlib_f32 beta, mlib_s32 n);
mlib_status mlib_SignalMulKaiser_S16S_S16S(mlib_s16 *dst, 
    const mlib_s16 *src, mlib_f32 beta, mlib_s32 n);

Description  
Each of these functions performs multiplication of the Kaiser window.

Parameters  
Each of the functions takes the following arguments:

dst  
   Output signal array.

src  
   Input signal array.

beta  
   Kaiser window parameter.

n  
   Number of samples in signal and window arrays.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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<tr>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  
mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBartlett_S16_S16(3MLIB),
mlib_SignalMulBlackman_S16(3MLIB), mlib_SignalMulBlackman_S16_S16(3MLIB),
mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB),
mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulRectangular_S16(3MLIB),
mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulWindow_S16(3MLIB),
mlib_SignalMulWindow_S16_S16(3MLIB), attributes(5)
mlib_SignalMulRectangular_F32, mlib_SignalMulRectangular_F32S – rectangular windowing multiplication

**Synopsis**

```c
#include <mlib.h>

mlib_status mlib_SignalMulRectangular_F32(mlib_f32 *srcdst, mlib_s32 m, mlib_s32 n);
mlib_status mlib_SignalMulRectangular_F32S(mlib_f32 *srcdst, mlib_s32 m, mlib_s32 n);
```

Description

Each of these functions performs multiplication of the rectangular window.

Parameters

Each of the functions takes the following arguments:

- `srcdst` Input and output signal array.
- `m` Rectangular window parameter.
- `n` Number of samples in signal and window arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

See Also

- mlib_SignalMulBartlett_F32(3MLIB)
- mlib_SignalMulBartlett_F32_F32(3MLIB)
- mlib_SignalMulBlackman_F32(3MLIB)
- mlib_SignalMulBlackman_F32_F32(3MLIB)
- mlib_SignalMulHamming_F32(3MLIB)
- mlib_SignalMulHamming_F32_F32(3MLIB)
- mlib_SignalMulKaiser_F32(3MLIB)
- mlib_SignalMulKaiser_F32_F32(3MLIB)
- mlib_SignalMulRectangular_F32_F32(3MLIB)
- mlib_SignalMulWindow_F32(3MLIB)
- mlib_SignalMulWindow_F32_F32(3MLIB)
- attributes(5)
Name  mlib_SignalMulRectangular_F32_F32, mlib_SignalMulRectangular_F32S_F32S –
rectangular windowing multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulRectangular_F32_F32(mlib_f32 *dst,
const mlib_f32 *src, mlib_s32 m, mlib_s32 n);
mlib_status mlib_SignalMulRectangular_F32S_F32S(mlib_f32 *dst,
const mlib_f32 *src, mlib_s32 m, mlib_s32 n);

Description  Each of these functions performs multiplication of the Hamming window.

Parameters  Each of the functions takes the following arguments:

dst  Output signal array.
src  Input signal array.
m  Rectangular window parameter.
n  Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalMulBartlett_F32(3MLIB), mlib_SignalMulBartlett_F32_F32(3MLIB),
mlib_SignalMulBlackman_F32(3MLIB), mlib_SignalMulBlackman_F32_F32(3MLIB),
mlib_SignalMulHamming_F32(3MLIB), mlib_SignalMulHamming_F32_F32(3MLIB),
mlib_SignalMulKaiser_F32(3MLIB), mlib_SignalMulKaiser_F32_F32(3MLIB),
mlib_SignalMulRectangular_F32(3MLIB), mlib_SignalMulWindow_F32(3MLIB),
mlib_SignalMulWindow_F32_F32(3MLIB), attributes(5)
**Name**
mlib_SignalMulRectangular_S16, mlib_SignalMulRectangular_S16S – rectangular windowing multiplication

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulRectangular_S16(mlib_s16 *srcdst, mlib_s32 m, mlib_s32 n);
mlib_status mlib_SignalMulRectangular_S16S(mlib_s16 *srcdst, mlib_s32 m, mlib_s32 n);

**Description**
Each of these functions performs multiplication of the rectangular window.

**Parameters**
Each of the functions takes the following arguments:

- *srcdst* Input and output signal array.
- *m* Rectangular window parameter.
- *n* Number of samples in signal and window arrays.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulBlackman_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB), mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB), mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB), attributes(5)
mlib_SignalMulRectangular_S16_S16, mlib_SignalMulRectangular_S16S_S16S – rectangular windowing multiplication

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulRectangular_S16_S16(mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 m, mlib_s32 n);
mlib_status mlib_SignalMulRectangular_S16S_S16S(mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 m, mlib_s32 n);
```

Description

Each of these functions performs multiplication of the Hamming window.

Parameters

Each of the functions takes the following arguments:

- `dst` Output signal array.
- `src` Input signal array.
- `m` Rectangular window parameter.
- `n` Number of samples in signal and window arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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See Also

mlib_SignalMulBartlett_S16_S16(3MLIB), mlib_SignalMulBartlett_S16S_S16S(3MLIB),
mlib_SignalMulBlackman_S16_S16(3MLIB), mlib_SignalMulBlackman_S16S_S16S(3MLIB),
mlib_SignalMulHamming_S16_S16(3MLIB), mlib_SignalMulHamming_S16S_S16S(3MLIB),
mlib_SignalMulHannings_S16_S16(3MLIB), mlib_SignalMulHannings_S16S_S16S(3MLIB),
mlib_SignalMulKaiser_S16_S16(3MLIB), mlib_SignalMulKaiser_S16S_S16S(3MLIB),
mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
mllib_SignalMulWindow_S16S_S16S(3MLIB), attributes(5)
Name  mlib_SignalMul_S16_S16_Sat, mlib_SignalMul_S16S_S16S_Sat - multiplication

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMul_S16_S16_Sat(mlib_s16 *dst,
       const mlib_s16 *src1, const mlib_s16 *src2, mlib_s32 n);
mlib_status mlib_SignalMul_S16S_S16S_Sat(mlib_s16 *dst,
       const mlib_s16 *src1, const mlib_s16 *src2, mlib_s32 n);

Description  Each of these functions performs multiplication.

Parameters  Each of the functions takes the following arguments:

   dst     Output signal array.
   src1    The first input signal array.
   src2    The second input signal array.
   n       Number of samples in the input signal arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalMul_S16_Sat(3MLIB), attributes(5)
**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMul_S16_Sat(mlib_s16 *scr1dst,
  const mlib_s16 *src2, mlib_s32 n);
mlib_status mlib_SignalMul_S16S_Sat(mlib_s16 *scr1dst,
  const mlib_s16 *src2, mlib_s32 n);
```

**Description**

Each of these functions performs multiplication.

**Parameters**

Each of the functions takes the following arguments:

- `src1dst` The first input and the output signal array.
- `src2` The second input signal array.
- `n` Number of samples in the input signal arrays.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

- `mlib_SignalMul_S16_S16_Sat(3MLIB)`, `attributes(5)`

---

**Name**

`mlib_SignalMul_S16_Sat`, `mlib_SignalMul_S16S_Sat` – multiplication
Name  

mlib_SignalMulSAdd_F32, mlib_SignalMulSAdd_F32S – multiplication by a scalar plus addition

Synopsis  

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulSAdd_F32(mlib_f32 *src1dst,
    const mlib_f32 *const mlib_f32 *src2, c, mlib_s32 n);

mlib_status mlib_SignalMulSAdd_F32S(mlib_f32 *src1dst,
    const mlib_f32 *const mlib_f32 *src2, const mlib_f32 *c,
    mlib_s32 n);

Description  

Each of these functions performs multiplication by a scalar plus addition.

Parameters  

Each of the functions takes the following arguments:

- src1dst  The first input and the output signal array.
- src2  The second input signal array.
- c  Scaling factor. In the stereo version, c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
- n  Number of samples in the input signal arrays.

Return Values  

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  

See attributes(5) for descriptions of the following attributes:

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See Also  

mlib_SignalMulSAdd_F32_F32(3MLIB), attributes(5)
mlib_SignalMulSAdd_F32_F32, mlib_SignalMulSAdd_F32S_F32S – multiplication by a scalar plus addition

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulSAdd_F32_F32(mlib_f32 *dst,
    const mlib_f32 *src1, const mlib_f32 *src2, const mlib_f32 *c,
    mlib_s32 n);

mlib_status mlib_SignalMulSAdd_F32S_F32S(mlib_f32 *dst,
    const mlib_f32 *src1, const mlib_f32 *src2, const mlib_f32 *c,
    mlib_s32 n);

Description
Each of these functions performs multiplication by a scalar.

Parameters
Each of the functions takes the following arguments:

dst    Output signal array.
src1   The first input signal array.
src2   The second input signal array.
c      Scaling factor. In the stereo version, c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
n      Number of samples in the input signal arrays.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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</table>

See Also
mlib_SignalMulSAdd_F32_F32(3MLIB), attributes(5)
mlib_SignalMulSAdd_S16_S16_Sat, mlib_SignalMulSAdd_S16S_S16S_Sat – multiplication by a scalar plus addition

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulSAdd_S16_S16_Sat(mlib_s16 *dst,
                                             const mlib_s16 *src1, const mlib_s16 *src2, const mlib_s16 *c,
                                             mlib_s32 n);
mlib_status mlib_SignalMulSAdd_S16S_S16S_Sat(mlib_s16 *dst,
                                             const mlib_s16 *src1, const mlib_s16 *src2, const mlib_s16 *c,
                                             mlib_s32 n);
```

Description

Each of these functions performs multiplication by a scalar.

Parameters

Each of the functions takes the following arguments:

- `dst` Output signal array.
- `src1` The first input signal array.
- `src2` The second input signal array.
- `c` Scaling factor. The scaling factor is in Q15 format. In the stereo version; `c[0]` contains the scaling factor for channel 0, and `c[1]` holds the scaling factor for channel 1.
- `n` Number of samples in the input signal arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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See Also

mlib_SignalMulSAdd_S16_Sat(3MLIB), attributes(5)
Name  mlib_SignalMulSAdd_S16_Sat, mlib_SignalMulSAdd_S16S_Sat – multiplication by a scalar plus addition

Synopsis  
```
cc [ flag... ] file... -lm  
#include <mlib.h>

mlib_status mlib_SignalMulSAdd_S16_Sat(mlib_s16 *src1dst,
    const mlib_s16 *src2, const mlib_s16 *c, mlib_s32 n);

mlib_status mlib_SignalMulSAdd_S16S_Sat(mlib_s16 *src1dst,
    const mlib_s16 *src2, const mlib_s16 *c, mlib_s32 n);
```

Description  Each of these functions performs multiplication by a scalar plus addition.

Parameters  Each of the functions takes the following arguments:

- **src1dst**  The first input and the output signal array.
- **src2**  The second input signal array.
- **c**  Scaling factor. The scaling factor is in Q15 format. In the stereo version, c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
- **n**  Number of samples in the input signal arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalMulSAdd_S16_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulS_F32_F32(3MLIB)

Name  mlib_SignalMulS_F32, mlib_SignalMulS_F32_S – multiplication by a scalar

Synopsis  

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalMulS_F32(mlib_f32 *srcdst, const mlib_f32 *c,
     mlib_s32 n);
mlib_status mlib_SignalMulS_F32_S(mlib_f32 *srcdst, const mlib_f32 *c,
    mlib_s32 n);
```

Description  Each of these functions performs multiplication by a scalar.

Parameters  Each of the functions takes the following arguments:

- `srcdst` Input and output signal array.
- `c` Scaling factor. In the stereo version, `c[0]` contains the scaling factor for channel 0, and `c[1]` holds the scaling factor for channel 1.
- `n` Number of samples in the input signal arrays.

Return Values  Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  See `attributes(5)` for descriptions of the following attributes:

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See Also  `mlib_SignalMulS_F32_F32(3MLIB), attributes(5)`
mlib_SignalMulS_F32_F32, mlib_SignalMulS_F32S_F32S – multiplication by a scalar

cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_SignalMulS_F32_F32(mlib_f32 *dst, const mlib_f32 *src, const mlib_f32 *c, mlib_s32 n);

mlib_status mlib_SignalMulS_F32S_F32S(mlib_f32 *dst, const mlib_f32 *src, const mlib_f32 *c, mlib_s32 n);

Description
Each of these functions performs multiplication by a scalar.

Parameters
Each of the functions takes the following arguments:

dst Output signal array.

src Input signal array.

c Scaling factor. In the stereo version, c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.

n Number of samples in the input signal arrays.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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See Also
mlib_SignalMulS_F32_F32(3MLIB), attributes(5)
Name  mlib_SignalMulShift_S16_S16_Sat, mlib_SignalMulShift_S16S_S16S_Sat – multiplication with shifting

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulShift_S16_S16_Sat(mlib_s16 *dst,
   const mlib_s16 *src1, const mlib_s16 *src2,
   mlib_s32 shift, mlib_s32 n);

mlib_status mlib_SignalMulShift_S16S_S16S_Sat(mlib_s16 *dst,
   const mlib_s16 *src1, const mlib_s16 *src2,
   mlib_s32 shift, mlib_s32 n);

Description  Each of these functions performs multiplication with shifting.

Parameters  Each of the functions takes the following arguments:

dst  Output signal array.
src1  The first input signal array.
src2  The second input signal array.
shift  Left shifting factor.
n  Number of samples in the input signal arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulShift_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulShift_S16_Sat, mlib_SignalMulShift_S16S_Sat – multiplication with shifting

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulShift_S16_Sat(mlib_s16 *src1dst,
const mlib_s16 *src2, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalMulShift_S16S_Sat(mlib_s16 *src1dst,
const mlib_s16 *src2, mlib_s32 shift, mlib_s32 n);

Each of these functions performs multiplication with shifting.

Parameters
Each of the functions takes the following arguments:
src1dst  The first input and the output signal array.
src2    The second input signal array.
shift   Left shifting factor.
n       Number of samples in the input signal arrays.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

See Also
mlib_SignalMulShift_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulS_S16_S16_Sat, mlib_SignalMulS_S16S_S16S_Sat – multiplication by a scalar

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulS_S16_S16_Sat(mlib_s16 *dst,
   const mlib_s16 *src, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_SignalMulS_S16S_S16S_Sat(mlib_s16 *dst,
   const mlib_s16 *src, const mlib_s16 *c, mlib_s32 n);
```

Description

Each of these functions performs multiplication by a scalar.

Parameters

Each of the functions takes the following arguments:

- `dst` Output signal array.
- `src` Input signal array.
- `c` Scaling factor. The scaling factor is in Q15 format. In the stereo version; c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
- `n` Number of samples in the input signal arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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See Also

mlib_SignalMulS_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulS_S16_Sat, mlib_SignalMulS_S16S_Sat – multiplication by a scalar

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulS_S16_Sat(mlib_s16 *srcdst, const mlib_s16 *c,
      mlib_s32 n);
mlib_status mlib_SignalMulS_S16S_Sat(mlib_s16 *srcdst, const mlib_s16 *c,
      mlib_s32 n);
```

Description

Each of these functions performs multiplication by a scalar.

Parameters

Each of the functions takes the following arguments:

- **srcdst**: Input and output signal array.
- **c**: Scaling factor. The scaling factor is in Q15 format. In the stereo version, c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
- **n**: Number of samples in the input signal arrays.

Return Values

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

Attributes

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</table>

See Also

mlib_SignalMulS_S16_S16_Sat(3MLIB), attributes(5)
Each of these functions performs multiplication by a scalar with shifting plus addition. Each of the functions takes the following arguments:

- **dst**: Output signal array.
- **src1**: The first input signal array.
- **src2**: The second input signal array.
- **c**: Scaling factor. The scaling factor is in Q15 format. In the stereo version; c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
- **shift**: Left shifting factor.
- **n**: Number of samples in the input signal arrays.

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

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**See Also**

mlib_SignalMulSShiftAdd_S16_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulSShiftAdd_S16_Sat, mlib_SignalMulSShiftAdd_S16S_Sat – multiplication by a scalar plus addition

Synopsis

```
#include <mlib.h>
mlib_status mlib_SignalMulSShiftAdd_S16_Sat(mlib_s16 *src1dst, const mlib_s16 *src2, const mlib_s16 *c, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalMulSShiftAdd_S16S_Sat(mlib_s16 *src1dst, const mlib_s16 *src2, const mlib_s16 *c, mlib_s32 shift, mlib_s32 n);
```

Description

Each of these functions performs multiplication by a scalar with shifting plus addition.

Parameters

Each of the functions takes the following arguments:

- **`src1dst`**: The first input and the output signal array.
- **`src2`**: The second input signal array.
- **`c`**: Scaling factor. The scaling factor is in Q15 format. In the stereo version; c[0] contains the scaling factor for channel 0, and c[1] holds the scaling factor for channel 1.
- **`n`**: Number of samples in the input signal arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

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See Also

mlib_SignalMulSShiftAdd_S16_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulSShift_S16_S16_Sat, mlib_SignalMulSShift_S16S_S16S_Sat – multiplication by a scalar with shifting

Synopsis

```c
#include <mlib.h>
mlib_status mlib_SignalMulSShift_S16_S16_Sat(mlib_s16 *dst,
                                              const mlib_s16 *src,
                                              const mlib_s16 *c,
                                              mlib_s32 shift,
                                              mlib_s32 n);
mlib_status mlib_SignalMulSShift_S16S_S16S_Sat(mlib_s16 *dst,
                                                 const mlib_s16 *src,
                                                 const mlib_s16 *c,
                                                 mlib_s32 shift,
                                                 mlib_s32 n);
```

Description

Each of these functions performs multiplication by a scalar with shifting.

Parameters

Each of the functions takes the following arguments:

- `dst` Destination signal array.
- `src` Source signal array.
- `c` Scaling factor. The scaling factor is in Q15 format. In the stereo version; `c[0]` contains the scaling factor for channel 0, and `c[1]` holds the scaling factor for channel 1.
- `shift` Left shifting factor.
- `n` Number of samples in the input signal arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

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See Also

mlib_SignalMulSShift_S16_S16_Sat(3MLIB), attributes(5)
mlib_SignalMulSShift_S16_Sat, mlib_SignalMulSShift_S16S_Sat – multiplication by a scalar with shifting

**Synopsis**
```
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulSShift_S16_Sat(mlib_s16 *srcdst,
     const mlib_s16 *c, mlib_s32 shift, mlib_s32 n);
mlib_status mlib_SignalMulSShift_S16S_Sat(mlib_s16 *srcdst,
     const mlib_s16 *c, mlib_s32 shift, mlib_s32 n);
```

**Description**
Each of these functions performs multiplication by a scalar with shifting.

**Parameters**
Each of the functions takes the following arguments:
- `srcdst`  Source and destination signal array.
- `c`  Scaling factor. The scaling factor is in Q15 format. In the stereo version, `c[0]` contains the scaling factor for channel 0, and `c[1]` holds the scaling factor for channel 1.
- `shift`  Left shifting factor.
- `n`  Number of samples in the input signal arrays.

**Return Values**
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**
`mlib_SignalMulSShift_S16_S16_Sat(3MLIB), attributes(5)`
mlib_SignalMulWindow_F32() function performs a windowing operation.

The function takes the following arguments:

- **srcdst**: Input and output signal array.
- **window**: Window coefficient array. The window coefficients are in Q15 format.
- **n**: Number of samples in signal and window arrays.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

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**See Also**  
attributes(5)
The `mlib_SignalMulWindow_F32_F32()` function performs a windowing operation. The function takes the following arguments:

- `dst` Output signal array.
- `src` Input signal array.
- `window` Window coefficient array. The window coefficients are in Q15 format.
- `n` Number of samples in signal and window arrays.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

The `mlib_SignalMulWindow_F32_F32()` function performs a windowing operation.

**Attributes**

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**See Also** attributes(5)
The `mlib_SignalMulWindow_F32S()` function performs a windowing operation.

**Parameters**
The function takes the following arguments:

- `srcdst` Input and output signal array are in stereo format where `srcdst[0]` contains the values for channel 0, and `srcdst[1]` holds the values for channel 1.
- `window` Window coefficient array. The window coefficients are in Q15 format.
- `n` Number of samples in signal and window arrays.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
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See Also attributes(5)
# mlib_SignalMulWindow_F32S_F32S

## Synopsis

```c
#include <mlib.h>
mlib_status mlib_SignalMulWindow_F32S_F32S(mlib_f32 *dst, const mlib_f32 *src, const mlib_f32 *window, mlib_s32 n);
```

## Description

The `mlib_SignalMulWindow_F32S_F32S()` function performs a windowing operation.

## Parameters

- **dst**: Output signal array is in stereo format where `dst[0]` contains the values for channel 0, and `dst[1]` holds the values for channel 1.
- **src**: Input signal array is in stereo format where `src[0]` contains the values for channel 0, and `src[1]` holds the values for channel 1.
- **window**: Window coefficient array. The window coefficients are in Q15 format.
- **n**: Number of samples in signal and window arrays.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

`attributes(5)`
Name  mlib_SignalMulWindow_S16, mlib_SignalMulWindow_S16S – windowing

Synopsis  cc [ flag... ] file... -tlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalMulWindow_S16(mlib_s16 *srcdst,
    const mlib_s16 *window, mlib_s32 n);
mlib_status mlib_SignalMulWindow_S16S(mlib_s16 *srcdst,
    const mlib_s16 *window, mlib_s32 n);

Description  Each of these functions performs a windowing operation.

Parameters  Each of the functions takes the following arguments:

srcdst      Input and output signal array.
window      Window coefficient array. The window coefficients are in Q15 format.
n      Number of samples in signal and window arrays.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMulBartlett_S16(3MLIB), mlib_SignalMulBartlett_S16_S16(3MLIB),
mlib_SignalMulBlackman_S16(3MLIB), mlib_SignalMulBlackman_S16_S16(3MLIB),
mlib_SignalMulHamming_S16(3MLIB), mlib_SignalMulHamming_S16_S16(3MLIB),
mlib_SignalMulHanning_S16(3MLIB), mlib_SignalMulHanning_S16_S16(3MLIB),
mlib_SignalMulKaiser_S16(3MLIB), mlib_SignalMulKaiser_S16_S16(3MLIB),
mlib_SignalMulRectangular_S16(3MLIB),
mlib_SignalMulRectangular_S16_S16(3MLIB), mlib_SignalMulWindow_S16_S16(3MLIB),
attributes(5)
mlib_SignalMulWindow_S16_S16, mlib_SignalMulWindow_S16S_S16S — windowing

Synopsis

```c
#include <mlib.h>

mlib_status mlib_SignalMulWindow_S16_S16(mlib_s16 *dst, 
    const mlib_s16 *src, const mlib_s16 *window, mlib_s32 n);

mlib_status mlib_SignalMulWindow_S16S_S16S(mlib_s16 *dst, 
    const mlib_s16 *src, const mlib_s16 *window, mlib_s32 n);
```

Description

Each of these functions performs a windowing operation.

Parameters

Each of the functions takes the following arguments:

- **dst**
  Output signal array.

- **src**
  Input signal array.

- **window**
  Window coefficient array. The window coefficients are in Q15 format.

- **n**
  Number of samples in signal and window arrays.

Return Values

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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See Also

- `mlib_SignalMulBartlett_S16(3MLIB)`, `mlib_SignalMulBartlett_S16_S16(3MLIB)`, `mlib_SignalMulBlackman_S16(3MLIB)`, `mlib_SignalMulBlackman_S16_S16(3MLIB)`, `mlib_SignalMulHamming_S16(3MLIB)`, `mlib_SignalMulHamming_S16_S16(3MLIB)`, `mlib_SignalMulHanning_S16(3MLIB)`, `mlib_SignalMulHanning_S16_S16(3MLIB)`, `mlib_SignalMulKaiser_S16(3MLIB)`, `mlib_SignalMulKaiser_S16_S16(3MLIB)`, `mlib_SignalMulRectangular_S16(3MLIB)`, `mlib_SignalMulRectangular_S16_S16(3MLIB)`, `mlib_SignalMulWindow_S16(3MLIB)`
mlib_NLMSFilter returns normalized least mean square (NLMS) adaptive filtering.

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalNLMSFilterInit_S16_S16(void **filter,
   const mlib_f32 *flt, mlib_s32 tap, mlib_f32 beta);
mlib_status mlib_SignalNLMSFilterInit_S16S_S16S(void **filter,
   const mlib_f32 *flt, mlib_s32 tap, mlib_f32 beta);
mlib_status mlib_SignalNLMSFilterInit_F32_F32(void **filter,
   const mlib_f32 *flt, mlib_s32 tap, mlib_f32 beta);
mlib_status mlib_SignalNLMSFilterInit_F32S_F32S(void **filter,
   const mlib_f32 *flt, mlib_s32 tap, mlib_f32 beta);
mlib_status mlib_SignalNLMSFilter_S16_S16_Sat(mlib_s16 *dst,
   const mlib_s16 *src, const mlib_s16 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilter_S16S_S16S_Sat(mlib_s16 *dst,
   const mlib_s16 *src, const mlib_s16 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilter_F32_F32(mlib_f32 *dst,
   const mlib_f32 *src, const mlib_f32 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilter_F32S_F32S(mlib_f32 *dst,
   const mlib_f32 *src, const mlib_f32 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilterNonAdapt_S16_S16_Sat(mlib_s16 *dst,
   const mlib_s16 *src, const mlib_s16 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilterNonAdapt_S16S_S16S_Sat(mlib_s16 *dst,
   const mlib_s16 *src, const mlib_s16 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilterNonAdapt_F32_F32(mlib_f32 *dst,
   const mlib_f32 *src, const mlib_f32 *ref, void *filter, mlib_s32 n);
mlib_status mlib_SignalNLMSFilterNonAdapt_F32S_F32S(mlib_f32 *dst,
   const mlib_f32 *src, const mlib_f32 *ref, void *filter, mlib_s32 n);
void mlib_SignalNLMSFilterFree_S16_S16(void *filter);
void mlib_SignalNLMSFilterFree_S16S_S16S(void *filter);
void mlib_SignalNLMSFilterFree_F32_F32(void *filter);
The normalized LMS adaptive algorithm is summarized as follows:

1. Initialize the weights \( W_k(i), i = 0, 1, \ldots, \text{tap} - 1 \).
2. Initialize previous source elements \( X_0(i), i = 0, 1, \ldots, \text{tap} - 1 \).
3. Read \( X_k(t) \) from \( \text{src} \) and \( Y_k(t) \) from \( \text{ref} \), \( t = 0, 1, \ldots, n - 1 \).
4. Compute filter output: \( n_k = \sum(W_k(i) \times X_k(t - i)), i = 0, 1, \ldots, \text{tap} - 1 \). If \( i > t \), use previous source elements stored in the \( X_0 \) vector.
5. Compute source elements power: \( P_{wk} = \sum(X_k(t - i) \times X_k(t - i)), i = 0, 1, \ldots, \text{tap} - 1 \). If \( i > t \), use previous source elements stored in the \( X_0 \) vector.
6. Store filter output: \( \text{dst}[t] = n_k \).
7. Compute the error estimate: \( E_k = Y_k - n_k \).
8. Compute factor \( \beta E_0 = 2 \times \beta \times E_k / P_{wk} \).
9. Update filter weights: \( W_k(i) += \beta E_0 \times X_k(t - i), i = 0, 1, \ldots, \text{tap} - 1 \). If \( i > t \), use previous source elements stored in the \( X_0 \) vector.
10. Next \( t \), go to step 3.
11. Store \( N \) ending source elements in previous source elements vector \( X_0 \): if \( N > n, N = n; \) else \( N = \text{tap} \).

Each of the \texttt{FilterInit} functions allocates memory for the internal filter structure and converts the parameters into the internal representation.

Each of the \texttt{Filter} functions applies the NLMS adaptive filter on one signal packet and updates the filter states.

Each of the \texttt{FilterNoAdapt} functions applies the NLMS filter on one signal packet and updates the filter states but without changing the filter weights.

Each of the \texttt{FilterFree} functions releases the memory allocated for the internal filter structure.

Each of the functions takes some of the following arguments:

- \texttt{filter} Internal filter structure.
- \texttt{flt} Filter coefficient array.
- \texttt{tap} Taps of the filter.
- \texttt{beta} Error weighting factor. \( 0 < \beta < 1 \).
- \texttt{dst} Destination signal array.
- \texttt{src} Source signal array.
- \texttt{ref} Reference or "desired" signal array.
Number of samples in the source signal array.

Return Values Each of the FilterInit, Filter and FilterNonAdapt functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE. The FilterFree functions don’t return anything.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_SignalLMSFilter(3MLIB), attributes(5)
The `mlib_SignalQuant2_S16_F32()` function quantizes a signal array by using the following equation:

\[
X = x(n) \quad n = 0, 1, \ldots \\
Z = z(n) \quad n = 0, 1, \ldots \\
= \text{offset} \quad \text{for } x(n) < t(0) \\
= \text{offset} + k \quad \text{for } t(k) \leq x(n) < t(k+1) \\
= \text{offset} + \text{length} - 1 \quad \text{for } x(n) \geq t(\text{length} - 1)
\]

**Parameters**

- `dst` Output signal array.
- `src` Input signal array.
- `thresh` Array of thresholds.
- `length` Length of the array of thresholds.
- `offset` Offset for thresholds.
- `n` Number of samples in the input signal array.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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The `mlib_SignalQuant2_S16S_F32S()` function quantizes a signal array by using the following equation:

\[
X = x(n) \quad n = 0, 1, \ldots \\
Z = z(n) \quad n = 0, 1, \ldots \\
= \text{offset} \quad \text{for } x(n) < t(0) \\
= \text{offset} + k \quad \text{for } t(k) \leq x(n) < t(k+1) \\
= \text{offset} + \text{length} - 1 \quad \text{for } x(n) \geq t(\text{-length} - 1)
\]

The function takes the following arguments:

- `dst` Output signal array in two-channel interleaved stereo format.
- `src` Input signal array in two-channel interleaved stereo format.
- `thresh` Array of thresholds.
- `length` Length of the array of thresholds.
- `offset` Offset for thresholds.
- `n` Number of samples in the input signal array.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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<thead>
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<tbody>
<tr>
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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also attributes(5)
mlib_SignalQuant_S16_F32 – float to 16-bit quantization

Synopsis
c[flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalQuant_S16_F32(mlib_s16 *dst, const mlib_f32 *src, const mlib_f32 *thresh, mlib_s32 n);

Description
The mlib_SignalQuant_S16_F32() function quantizes a signal array by using the following equation:

\[ X = x(n) \quad n = 0, 1, \ldots \]
\[ Z = z(n) \quad n = 0, 1, \ldots \]
\[ = -32768 \quad \text{for} \ x(n) < t(-32768) \]
\[ = k \quad \text{for} \ t(k) \leq x(n) < t(k+1) \]
\[ = +32767 \quad \text{for} \ x(n) \geq t(+32767) \]

Parameters
The function takes the following arguments:

- **dst** Output signal array
- **src** Input signal array.
- **thresh** Array of 65536 thresholds.
- **n** Number of samples in the input signal array.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

See Also
attributes(5)
mlib_SignalQuant_S16S_F32S – float to 16-bit quantization

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalQuant_S16S_F32S(mlib_s16 *dst,
const mlib_f32 *src, const mlib_f32 *thresh, mlib_s32 n);

Description

The mlib_SignalQuant_S16S_F32S() function quantizes a signal array by using the following equation:

\[ X = x(n) \quad n = 0, 1, \ldots \]

\[ Z = z(n) \quad n = 0, 1, \ldots \]

\[ = -32768 \quad \text{for } x(n) < t(-32768) \]

\[ = k \quad \text{for } t(k) \leq x(n) < t(k+1) \]

\[ = +32767 \quad \text{for } x(n) \geq t(+32767) \]

The function takes the following arguments:

- **dst**: Output signal array in two-channel interleaved stereo format.
- **src**: Input signal array in two-channel interleaved stereo format.
- **thresh**: Array of 65536 thresholds.
- **n**: Number of samples in the input signal array.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

attributes(5)
**Name** mlib_SignalQuant_U8_F32 – float to 8-bit quantization

**Synopsis**
```c
cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalQuant_U8_F32(mlib_u8 *dst,
    const mlib_f32 *src, const mlib_f32 *thresh, mlib_s32 n);
```

**Description** The `mlib_SignalQuant_U8_F32()` function quantizes a signal array by using the following equation:

\[
X = x(n), \quad n = 0, 1, \ldots \\
Z = z(n), \quad n = 0, 1, \ldots \\
= 0 \quad \text{for } x(n) < t(0) \\
= k \quad \text{for } t(k) \leq x(n) < t(k+1) \\
= 255 \quad \text{for } x(n) \geq t(255)
\]

**Parameters** The function takes the following arguments:
- `dst` Output signal array
- `src` Input signal array.
- `thresh` Array of 256 thresholds.
- `n` Number of samples in the input signal array.

**Return Values** The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes** See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also** `attributes(5)`
Name mlib_SignalQuant_U8_S16, mlib_SignalQuant_U8S_S16S – 16-bit to 8-bit quantization

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalQuant_U8_S16(mlib_u8 *dst,
    const mlib_s16 *src, const mlib_s16 *thresh, mlib_s32 n);

mlib_status mlib_SignalQuant_U8S_S16S(mlib_u8 *dst,
    const mlib_s16 *src, const mlib_s16 *thresh, mlib_s32 n);

Description Each of these functions quantizes a signal array by using the following equation:

\[ X = x(n) \quad n = 0, 1, \ldots \]
\[ Z = z(n) \quad n = 0, 1, \ldots \]
\[ = 0 \quad \text{for} \ x(n) < t(0) \]
\[ = k \quad \text{for} \ t(k) \leq x(n) < t(k+1) \]
\[ = 255 \quad \text{for} \ x(n) \geq t(255) \]

Parameters Each of the functions takes the following arguments:

- **dst** Output signal array.
- **src** Input signal array.
- **thresh** Array of 256 thresholds.
- **n** Number of samples in the input signal array.

Return Values Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also attributes(5)
mlib_SignalQuant_U8S_F32S – float to 8-bit quantization

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalQuant_U8S_F32S(mlib_u8 *dst,
    const mlib_f32 *src, const mlib_f32 *thresh, mlib_s32 n);
```

Description

The `mlib_SignalQuant_U8S_F32S()` function quantizes a signal array by using the following equation:

\[
X = x(n) \quad n = 0, 1, \ldots \\
Z = z(n) \quad n = 0, 1, \ldots \\
= 0 \quad \text{for } x(n) < t(0) \\
= k \quad \text{for } t(k) \leq x(n) < t(k+1) \\
= 255 \quad \text{for } x(n) \geq t(255)
\]

Parameters

The function takes the following arguments:

- `dst` : Output signal array in two-channel interleaved stereo format.
- `src` : Input signal array in two-channel interleaved stereo format.
- `thresh` : Array of 256 thresholds.
- `n` : Number of samples in the input signal array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`attributes(5)`
The `mlib_SignalReSampleFIR_F32_F32()` function performs rational sample rate conversion with FIR filtering between the upsampling and downsampling.

**Parameters**
The function takes the following arguments:

- `dst` Output signal array.
- `src` Input signal array.
- `state` Internal state structure.
- `n` Number of samples in the input signal array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
attributes(5)
mlib_SignalReSampleFIR_F32S_F32S() function performs rational sample rate conversion with FIR filtering between the upsampling and downsampling.

### Description

The `mlib_SignalReSampleFIR_F32S_F32S()` function takes the following arguments:

- **dst**: Output signal array in two-channel interleaved stereo format.
- **src**: Input signal array in two-channel interleaved stereo format.
- **state**: Internal state structure.
- **n**: Number of samples in the input signal array.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

attributes(5)
The `mlib_SignalReSampleFIRFree_F32_F32()` function releases the memory allocated for the internal state structure for rational sample rate conversion with FIR filtering between upsampling and downsampling.

Parameters

The function takes the following arguments:

- `state` Internal state structure.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also `attributes(5)`
mlib_SignalReSampleFIRFree_F32S_F32S - resampling with filtering

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalReSampleFIRFree_F32S_F32S(void *state);

Description
The mlib_SignalReSampleFIRFree_F32S_F32S() function releases the memory allocated for
the internal state structure for rational sample rate conversion with FIR filtering between
upsampling and downsampling.

Parameters
The function takes the following arguments:
state Internal state structure.

Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

See Also attributes(5)
mlib_SignalReSampleFIRFree_S16_S16, mlib_SignalReSampleFIRFree_S16S_S16S —
resampling with filtering

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalReSampleFIRFree_S16_S16(void *state);
void mlib_SignalReSampleFIRFree_S16S_S16S(void *state);

Description
Each of these functions releases the memory allocated for the internal state structure for
rational sample rate conversion with FIR filtering between upsampling and downsampling.

Parameters
Each of the functions takes the following arguments:

state Internal state structure.

Return Values
None.

Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

See Also
mlib_SignalReSampleFIR_S16_S16_Sat(3MLIB),
mlib_SignalReSampleFIRInit_S16_S16(3MLIB), attributes(5)
includes memory for the internal state structure and converts the parameters into an internal representation for rational sample rate conversion with FIR filtering between upsampling and downsampling.

**Parameters**
Each of the functions takes the following arguments:

- `state` Internal state structure.
- `flt` Filter coefficient array, two-channel interleaved in the cases of stereo.
- `tap` Taps of the filter.
- `ufactor` Factor by which to upsample.
- `uphase` Phase in upsampling. $0 \leq uphase < ufactor$.
- `dfactor` Factor by which to downsample.
- `dphase` Phase in downsampling. $0 \leq dphase < dfactor$.

**Return Values**
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_SignalReSampleFIR_S16_S16_Sat(3MLIB),
mlib_SignalReSampleFIR_F32_F32(3MLIB),
mlib_SignalReSampleFIRFree_S16_S16(3MLIB),
mlib_SignalReSampleFIRFree_F32_F32(3MLIB), attributes(5)
Name  mlib_SignalReSampleFIR_S16_S16_Sat, mlib_SignalReSampleFIR_S16S_S16S_Sat –
resampling with filtering

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalReSampleFIR_S16_S16_Sat(mlib_s16 *dst,
const mlib_s16 *src, void *state, mlib_s32 n);

mlib_status mlib_SignalReSampleFIR_S16S_S16S_Sat(mlib_s16 *dst,
const mlib_s16 *src, void *state, mlib_s32 n);

Description  Each of these functions performs rational sample rate conversion with FIR filtering between
the upsampling and downsampling.

Parameters  Each of the functions takes the following arguments:

dst  Output signal array.
src  Input signal array.
state  Internal state structure.
n  Number of samples in the input signal array.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  attributes(5)
### mlib_SignalSineWave_F32

**Name**  
mlib_SignalSineWave_F32 – sine wave generation

**Synopsis**  
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_SignalSineWave_F32(mlib_f32 *sine, void *state,
        mlib_s32 n);
```

**Description**  
The `mlib_SignalSineWave_F32()` function generates one packet of sine wave and updates the internal state.

**Parameters**  
The function takes the following arguments:
- `sine`  
  Generated sine wave array.
- `state`  
  Internal state structure.
- `n`  
  Length of the generated sine wave array in number of samples.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

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**See Also**  
`attributes(5)`
mlib_SignalSineWaveFree_F32 – sine wave generation

**Synopsis**

```c
#include <mlib.h>

void mlib_SignalSineWaveFree_F32(void *state);
```

**Description**

The `mlib_SignalSineWaveFree_F32()` function releases the memory allocated for the internal state’s structure.

**Parameters**

The function takes the following arguments:

- `state` Internal state structure.

**Return Values**

None.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_SignalSineWave_S16(3MLIB)`, `mlib_SignalSineWaveInit_S16(3MLIB)`, attributes(5)
Name  mlib_SignalSineWaveFree_S16 – sine wave generation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

    void mlib_SignalSineWaveFree_S16(void *state);

Description  The mlib_SignalSineWaveFree_S16() function releases the memory allocated for the internal state's structure.

Parameters  The function takes the following arguments:

    state  Internal state structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  attributes(5)
The `mlib_SignalSineWaveInit_F32` function allocates memory for an internal state structure and converts the parameters of the wave to an internal representation.

### Parameters
The function takes the following arguments:
- `state` Internal state structure.
- `mag` Magnitude of sine wave to be generated, in Q15 format.
- `freq` Angular frequency of the sine wave to be generated, measured in radians per sample.
- `phase` Start phase of the sine wave to be generated, measured in radians.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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See Also attributes(5)
The `mlib_SignalSineWaveInit_S16()` function allocates memory for an internal state structure and converts the parameters of the wave to an internal representation.

**Parameters**

The function takes the following arguments:

- `state` Internal state structure.
- `mag` Magnitude of sine wave to be generated, in Q15 format.
- `freq` Angular frequency of the sine wave to be generated, measured in radians per sample.
- `phase` Start phase of the sine wave to be generated, measured in radians.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**

`mlib_SignalSineWave_S16(3MLIB), mlib_SignalSineWaveFree_S16(3MLIB), attributes(5)`
**Name**  
mlib_SignalSineWave_S16 – sine wave generation

**Synopsis**  
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalSineWave_S16(mlib_s16 *sine, void *state,
    mlib_s32 n);
```

**Description**  
The `mlib_SignalSineWave_S16()` function generates one packet of sine wave and updates the internal state.

**Parameters**  
The function takes the following arguments:
- `sine`  
  Generated sine wave array.
- `state`  
  Internal state structure.
- `n`  
  Length of the generated sine wave array in number of samples.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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**See Also**  
`mlib_SignalSineWaveFree_S16(3MLIB), mlib_SignalSineWaveInit_S16(3MLIB), attributes(5)"
mlib_SignalSplit_F32_F32S – split

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalSplit_F32_F32S(mlib_f32 *ch0,
    mlib_f32 *ch1, const mlib_f32 *src, mlib_s32 n);
```

Description

The following function splits a stereo signal array into two signal arrays.

Parameters

- `ch0` Destination signal array of Channel 0.
- `ch1` Destination signal array of Channel 1.
- `n` Number of samples in the source signal array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

attributes(5)
Name  mlib_SignalSplit_S16_S16S - split

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalSplit_S16_S16S(mlib_s16 *ch0, mlib_s16 *ch1, const mlib_s16 *src, mlib_s32 n);

Description  The following function splits a stereo signal array into two signal arrays.

Parameters  The function takes the following arguments:
    ch0  Destination signal array of Channel 0.
    ch1  Destination signal array of Channel 1.
    n    Number of samples in the source signal array.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalMerge_S16S_S16(3MLIB), attributes(5)
The `mlib_SignaluLaw2ALaw()` function performs ITU G.711 m-law and A-law compression and decompression in compliance with the ITU (formerly CCITT) G.711 specification.

### Parameters
The function takes the following arguments:

- `acode` A-law code array.
- `ucode` m-law code array.
- `n` Number of samples in the input array.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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<thead>
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<tbody>
<tr>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
`mlib_SignalALaw2Linear(3MLIB), mlib_SignalALaw2uLaw(3MLIB), mlib_SignalLinear2ALaw(3MLIB), mlib_SignalLinear2uLaw(3MLIB), mlib_SignaluLaw2Linear(3MLIB), attributes(5)`
mlib_SignaluLaw2Linear – ITU G.711 m-law and A-law compression and decompression

Synopsis

```c
cc [ flag...] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignaluLaw2Linear(mlib_s16 *pcm,
        const mlib_u8 *ucode, mlib_s32 n);
```

Description

The `mlib_SignaluLaw2Linear()` function performs ITU G.711 m-law and A-law compression and decompression in compliance with the ITU (formerly CCITT) G.711 specification.

Parameters

The function takes the following arguments:

- `pcm` Linear PCM sample array.
- `ucode` m-law code array.
- `n` Number of samples in the input array.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`mlib_SignalALaw2Linear(3MLIB)`, `mlib_SignalALaw2uLaw(3MLIB)`, `mlib_SignalLinear2ALaw(3MLIB)`, `mlib_SignalLinear2uLaw(3MLIB)`, `mlib_SignaluLaw2ALaw(3MLIB)`, `attributes(5)`
**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalUpSampleFIR_F32_F32(mlib_f32 *dst,
const mlib_f32 *src, void *state, mlib_s32 n);
```

**Description**
The `mlib_SignalUpSampleFIR_F32_F32()` function performs upsampling immediately followed by FIR filtering on one packet of signal and updates the internal state.

**Parameters**
The function takes the following arguments:
- `dst` - Output signal array.
- `src` - Input signal array.
- `state` - Internal state structure.
- `n` - Number of samples in the input signal array.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**
`attributes(5)`


Name    
mlib_SignalUpSampleFIR_F32S_F32S – upsampling with filtering

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_SignalUpSampleFIR_F32S_F32S(mlib_f32 *dst,  
const mlib_f32 *src, void *state, mlib_s32 n);

Description  
The mlib_SignalUpSampleFIR_F32S_F32S() function performs upsampling immediately  
followed by FIR filtering on one packet of signal and updates the internal state.

Parameters  
The function takes the following arguments:

dst   Output stereo signal array. src[2*i] contains Channel 0, and src[2*i+1] contains  
      Channel 1.
src   Source stereo signal array. src[2*i] contains Channel 0, and src[2*i+1] contains  
      Channel 1.
state Internal state structure.
n    Number of samples in the input signal array.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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</table>

See Also  
attributes(5)
The `mlib_SignalUpSampleFIRFree_F32_F32()` function releases the memory allocated for the internal state structure for upsampling immediately followed by FIR filtering.

**Parameters**

The function takes the following arguments:

- `state`  
  Internal state structure.

**Return Values**

None.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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**See Also**

`attributes(5)`
The `mlib_SignalUpSampleFIRFree_F32S_F32S()` function releases the memory allocated for the internal state structure for upsampling immediately followed by FIR filtering.

### Parameters

- **state**: Internal state structure.

### Return Values

None.

### Attributes

See attributes(5) for descriptions of the following attributes:

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</table>
Name  mlib_SignalUpSampleFIRFree_S16_S16, mlib_SignalUpSampleFIRFree_S16S_S16S – upsampling with filtering

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_SignalUpSampleFIRFree_S16_S16(void *state);
void mlib_SignalUpSampleFIRFree_S16S_S16S(void *state);

Description  Each of these functions releases the memory allocated for the internal state structure for upsampling immediately followed by FIR filtering.

Parameters  Each of the functions takes the following arguments:

state Internal state structure.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalUpSampleFIR_S16_S16_Sat(3MLIB),
mlib_SignalUpSampleFIRInit_S16_S16(3MLIB), attributes(5)
The `mlib_SignalUpSampleFIRInit_F32_F32()` function allocates memory for the internal state structure and converts the parameters into an internal representation for upsampling immediately followed by FIR filtering.

**Parameters**
The function takes the following arguments:

- `state` - Internal state structure.
- `flt` - Filter coefficient array.
- `tap` - Taps of the filter.
- `factor` - Factor by which to upsample.
- `phase` - Parameter that determines the relative position of an input value, within the output signal. $0 \leq \text{phase} < \text{factor}$.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also attributes(5)
The `mlib_SignalUpSampleFIRInit_F32S_F32S()` function allocates memory for the internal state structure and converts the parameters into an internal representation for upsampling immediately followed by FIR filtering.

**Parameters**
The function takes the following arguments:

- **state**: Internal state structure.
- **flt**: Filter coefficient array in two-channel stereo format. `src[2*i]` contains channel 0, and `src[2*i+1]` contains channel 1 array.
- **tap**: Taps of the filter.
- **factor**: Factor by which to upsample.
- **phase**: Parameter that determines the relative position of an input value, within the output signal. `0 ≤ phase < factor`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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See Also `attributes(5)`
mlib_SignalUpSampleFIRInit_S16_S16, mlib_SignalUpSampleFIRInit_S16S_S16S – upampling with filtering

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalUpSampleFIRInit_S16_S16(void **state, 
    const mlib_f32 *flt, mlib_s32 tap, mlib_s32 factor, 
    mlib_s32 phase);

mlib_status mlib_SignalUpSampleFIRInit_S16S_S16S(void **state, 
    const mlib_f32 *flt, mlib_s32 tap, mlib_s32 factor, 
    mlib_s32 phase);

Description

Each of these functions allocates memory for the internal state structure and converts the parameters into an internal representation for upsampling immediately followed by FIR filtering.

Parameters

Each of the functions takes the following arguments:

- state Internal state structure.
- flt Filter coefficient array.
- tap Taps of the filter.
- factor Factor by which to upsample.
- phase Parameter that determines the relative position of an input value, within the output signal. \(0 \leq \text{phase} < \text{factor}\).

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

mlib_SignalUpSampleFIR_S16_S16_Sat(3MLIB),
mlib_SignalUpSampleFIRFree_S16_S16(3MLIB), attributes(5)
Name  mlib_SignalUpSampleFIR_S16_S16_Sat, mlib_SignalUpSampleFIR_S16S_S16S_Sat –
upsampling with filtering

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalUpSampleFIR_S16_S16_Sat(mlib_s16 *dst,
    const mlib_s16 *src, void *state, mlib_s32 n);
mlib_status mlib_SignalUpSampleFIR_S16S_S16S_Sat(mlib_s16 *dst,
    const mlib_s16 *src, void *state, mlib_s32 n);

Description  Each of these functions performs upsampling immediately followed by FIR filtering on one
packet of signal and updates the internal state.

Parameters  Each of the functions takes the following arguments:

dst       Output signal array.
src       Input signal array.
state     Internal state structure.
          Number of samples in the input signal array.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_SignalUpSampleFIRFree_S16_S16(3MLIB),
mlib_SignalUpSampleFIRInit_S16_S16(3MLIB), attributes(5)
Each of these functions performs upsampling.

For monaural signals, the following equation is used:

\[
\text{dst}[i] = \text{src}[k] \quad \text{if} \quad i = k \times \text{factor} + \text{phase}
\]
\[
\text{dst}[i] = 0 \quad \text{if} \quad i \neq k \times \text{factor} + \text{phase}
\]

where \( k = 0, 1, \ldots, (n - 1) \); \( i = 0, 1, \ldots, (n \times \text{factor} - 1) \).

For stereo signals, the following equation is used:

\[
\text{dst}[2i] = \text{src}[2k] \quad \text{if} \quad i = k \times \text{factor} + \text{phase}
\]
\[
\text{dst}[2i] = 0 \quad \text{if} \quad i \neq k \times \text{factor} + \text{phase}
\]
\[
\text{dst}[2i + 1] = \text{src}[2k + 1] \quad \text{if} \quad i = k \times \text{factor} + \text{phase}
\]
\[
\text{dst}[2i + 1] = 0 \quad \text{if} \quad i \neq k \times \text{factor} + \text{phase}
\]

where \( k = 0, 1, \ldots, (n - 1) \); \( i = 0, 1, \ldots, (n \times \text{factor} - 1) \).

**Parameters**

Each of the functions takes the following arguments:

- **dst**: Output signal array.
- **src**: Input signal array.
- **factor**: Factor by which to upsample. \( \text{factor} \geq 1 \).
- **phase**: Parameter that determines relative position of an input value, within the output signal. \( 0 \leq \text{phase} < \text{factor} \).
- **n**: Number of samples in the input signal array.
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_SignalDownSample_S16_S16(3MLIB), attributes(5)
mlib_SignalWhiteNoise_F32 — white noise generation

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalWhiteNoise_F32(mlib_f32 *wnoise,
            void *state, mlib_s32 n);

Description

The mlib_SignalWhiteNoise_F32() function generates one packet of white noise and
updates the internal state.

Parameters

The function takes the following arguments:

- wnoise  Generated white noise array.
- state   Internal state structure.
- n       Length of the generated sine wave array in number of samples.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

attributes(5)
The `mlib_SignalWhiteNoiseFree_F32` function releases the memory allocated for the internal state's structure.

Parameters

- `state` Internal state structure.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`attributes(5)`
The `mlib_SignalWhiteNoiseFree_S16()` function releases the memory allocated for the internal state's structure.

**Parameters**

The function takes the following arguments:

- `state`  
  Internal state structure.

**Return Values**

None.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_SignalWhiteNoise_S16(3MLIB)`, `mlib_SignalWhiteNoiseInit_S16(3MLIB)`, attributes(5)
Name  
mlib_SignalWhiteNoiseInit_F32 – white noise generation

Synopsis

c c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_SignalWhiteNoiseInit_F32(void **state, mlib_f32 mag,
mlib_f32 seed);

Description
The mlib_SignalWhiteNoiseInit_F32() function allocates memory for an internal state
structure and converts the parameters into an internal representation.

Parameters
The function takes the following arguments:

state  Internal state structure.
mag    Magnitude of white noise to be generated, in Q15 format.
seed   Seed value for the pseudorandom number generator.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
attributes(5)
The `mlib_SignalWhiteNoiseInit_S16()` function allocates memory for an internal state structure and converts the parameters into an internal representation.

### Parameters
- **state**: Internal state structure.
- **mag**: Magnitude of white noise to be generated, in Q15 format.
- **seed**: Seed value for the pseudorandom number generator.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_SignalWhiteNoise_S16(3MLIB)`, `mlib_SignalWhiteNoiseFree_S16(3MLIB)`, attributes(5)
The `mlib_SignalWhiteNoise_S16()` function generates one packet of white noise and updates the internal state.

The function takes the following arguments:

- `wnoise` Generated white noise array.
- `state` Internal state structure.
- `n` Length of the generated sine wave array in number of samples.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_SignalWhiteNoiseFree_S16(3MLIB)`, `mlib_SignalWhiteNoiseInit_S16(3MLIB)`, `attributes(5)`
mlib_VectorAddS_U8_Mod, mlib_VectorAddS_U8_Sat, mlib_VectorAddS_S8_Mod, mlib_VectorAddS_S8_Sat, mlib_VectorAddS_S8C_Mod, mlib_VectorAddS_S8C_Sat, mlib_VectorAddS_S16_Mod, mlib_VectorAddS_S16_Sat, mlib_VectorAddS_S16C_Mod, mlib_VectorAddS_S16C_Sat, mlib_VectorAddS_S32_Mod, mlib_VectorAddS_S32_Sat, mlib_VectorAddS_S32C_Mod, mlib_VectorAddS_S32C_Sat – vector addition to scalar, in place

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_VectorAddS_U8_Mod(mlib_u8 *xz, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_U8_Sat(mlib_u8 *xz, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_U8C_Mod(mlib_u8 *xz, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_U8C_Sat(mlib_u8 *xz, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8_Mod(mlib_s8 *xz, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8_Sat(mlib_s8 *xz, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8C_Mod/mlib_s8 *xz, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8C_Sat/mlib_s8 *xz, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_Mod/mlib_s16 *xz, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_Sat/mlib_s16 *xz, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_Mod/mlib_s16 *xz, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_Sat/mlib_s16 *xz, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S32_Mod/mlib_s32 *xz, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S32_Sat/mlib_s32 *xz, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S32C_Mod/mlib_s32 *xz, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S32C_Sat/mlib_s32 *xz, const mlib_s32 *c, mlib_s32 n);
```
mlib_VectorAddS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c, mlib_s32 n);

Description  Each of these functions performs an in-place addition of a scalar to a vector.

For real data, the following equation is used:

\[ xz[i] = c[0] + xz[i] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the first element of the source and destination vector.
- \( c \)  Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( n \)  Number of elements in the vectors.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VectorAddS_U8_U8_Mod(3MLIB), attributes(5)
Name  
mlib_VectorAddS_U8_U8_Mod, mlib_VectorAddS_U8_U8_Sat,
mlib_VectorAddS_U8C_U8C_Mod, mlib_VectorAddS_U8C_U8C_Sat,
mlib_VectorAddS_S8_S8_Mod, mlib_VectorAddS_S8_S8_Sat,
mlib_VectorAddS_S8C_S8C_Mod, mlib_VectorAddS_S8C_S8C_Sat,
mlib_VectorAddS_S16_U8_Mod, mlib_VectorAddS_S16_U8_Sat,
mlib_VectorAddS_S16_S8_Mod, mlib_VectorAddS_S16_S8_Sat,
mlib_VectorAddS_S16_S16_Mod, mlib_VectorAddS_S16_S16_Sat,
mlib_VectorAddS_S16C_U8C_Mod, mlib_VectorAddS_S16C_U8C_Sat,
mlib_VectorAddS_S16C_S8C_Mod, mlib_VectorAddS_S16C_S8C_Sat,
mlib_VectorAddS_S16C_S16C_Mod, mlib_VectorAddS_S16C_S16C_Sat,
mlib_VectorAddS_S32_S16_Mod, mlib_VectorAddS_S32_S16_Sat,
mlib_VectorAddS_S32_S32_Mod, mlib_VectorAddS_S32_S32_Sat,
mlib_VectorAddS_S32C_S16C_Mod, mlib_VectorAddS_S32C_S16C_Sat,
mlib_VectorAddS_S32C_S32C_Mod, mlib_VectorAddS_S32C_S32C_Sat – vector addition
to scalar

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorAddS_U8_U8_Mod(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_U8_U8_Sat(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_U8C_U8C_Mod(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_U8C_U8C_Sat(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8_S8_Mod(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8_S8_Sat(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8C_S8C_Mod(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S8C_S8C_Sat(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_U8_Mod(mlib_s16 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_U8_Sat(mlib_s16 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_S8_Mod(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_S8_Sat(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_S16_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16_S16_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_U8C_Mod(mlib_s16 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_U8C_Sat(mlib_s16 *z,
    const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_S8C_Mod(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_S8C_Sat(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_S16C_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorAddS_S16C_S16C_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
Each of these functions adds a scalar to a vector.

For real data, the following equation is used:

\[ z[i] = c[0] + x[i] \]
where $i = 0, 1, \ldots, (n - 1)$.

For complex data, the following equation is used:

\[
\begin{align*}
z[2i] &= c[0] + x[2i] \\
z[2i + 1] &= c[1] + x[2i + 1]
\end{align*}
\]

where $i = 0, 1, \ldots, (n - 1)$.

**Parameters**

Each of the functions takes the following arguments:

- $z$ Pointer to the first element of the destination vector.
- $x$ Pointer to the first element of the source vector.
- $c$ Pointer to the source scalar. When the function is used with complex data types, $c[0]$ contains the scalar for the real part, and $c[1]$ contains the scalar for the imaginary part.
- $n$ Number of elements in the vectors.

**Return Values**

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**

mlib_VectorAddS_U8_U8_Mod(3MLIB), attributes(5)
mlib_VectorAdd_U8_Mod, mlib_VectorAdd_U8_Sat, mlib_VectorAdd_U8C_Mod,
mlib_VectorAdd_U8C_Sat, mlib_VectorAdd_S8_Mod, mlib_VectorAdd_S8_Sat,
mlib_VectorAdd_S8C_Mod, mlib_VectorAdd_S8C_Sat, mlib_VectorAdd_S16_Mod,
mlib_VectorAdd_S16_Sat, mlib_VectorAdd_S16C_Mod, mlib_VectorAdd_S16C_Sat,
mlib_VectorAdd_S32_Mod, mlib_VectorAdd_S32_Sat, mlib_VectorAdd_S32C_Mod,
mlib_VectorAdd_S32C_Sat - vector addition, in place

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorAdd_U8_Mod(mlib_u8 *xz,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_U8_Sat(mlib_u8 *xz,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_U8C_Mod(mlib_u8 *xz,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_U8C_Sat(mlib_u8 *xz,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S8_Mod(mlib_s8 *xz,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S8_Sat(mlib_s8 *xz,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S8C_Mod(mlib_s8 *xz,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S8C_Sat(mlib_s8 *xz,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16_Mod(mlib_s16 *xz,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16_Sat(mlib_s16 *xz,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_Mod(mlib_s16 *xz,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_Sat(mlib_s16 *xz,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32_Mod(mlib_s32 *xz,
const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32_Sat(mlib_s32 *xz,
const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32C_Mod(mlib_s32 *xz,
const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32C_Sat(mlib_s32 *xz,  
const mlib_s32 *y, mlib_s32 n);

**Description**  Each of these functions performs the in-place addition of one vector to another vector.

It uses the following equation:

\[ xz[i] = xz[i] + y[i] \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2n - 1) \) for complex data.

**Parameters**  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the first element of the first source and destination vector.
- \( y \)  Pointer to the first element of the second source vector.
- \( n \)  Number of elements in the vectors.

**Return Values**  Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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**See Also**  `mlib_VectorAdd_U8_U8_Mod(3MLIB), attributes(5)`
### Synopsis

```c
#include <mlib.h>

mlib_status mlib_VectorAdd_U8_U8_Mod(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_U8_U8_Sat(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_U8C_U8C_Mod(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_U8C_U8C_Sat(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S8_S8_Mod(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S8_S8_Sat(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16_S16_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16_S16_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32_S32_Mod(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32_S32_Sat(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_U8C_Mod(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_U8C_Sat(mlib_u8 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_S8C_Mod(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_S8C_Sat(mlib_s8 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_S16C_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S16C_S16C_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32C_S16C_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32C_S16C_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32C_S32C_Mod(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAdd_S32C_S32C_Sat(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
```
Each of these functions performs the addition of one vector to another vector. It uses the following equation:

\[ z[i] = x[i] + y[i] \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2n - 1) \) for complex data.

**Parameters** Each of the functions takes the following arguments:
z  Pointer to the first element of the destination vector.

x  Pointer to the first element of the first source vector.

y  Pointer to the first element of the second source vector.

n  Number of elements in the vectors.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VectorAdd_U8_U8_Mod(3MLIB), attributes(5)
Name  mlib_VectorAng_U8C, mlib_VectorAng_S8C, mlib_VectorAng_S16C, mlib_VectorAng_S32C - vector complex phase (angle)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorAng_U8C(mlib_d64 *a,
   const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorAng_S8C(mlib_d64 *a,
   const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorAng_S16C(mlib_d64 *a,
   const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorAng_S32C(mlib_d64 *a,
   const mlib_s32 *x, mlib_s32 n);

Description Each of these functions computes the phase vector of a complex vector.

The following equation is used:

\[ a[i] = \arctan( x[2*i + 1] / x[2*i]) \]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters Each of the functions takes the following arguments:

- \( a \) Pointer to the destination phase vector.
- \( x \) Pointer to the source vector
- \( n \) Number of elements in the vector.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also attributes(5)
mlib_VectorAve_U8(3MLIB)

Name  
mlib_VectorAve_U8, mlib_VectorAve_U8C, mlib_VectorAve_S8, mlib_VectorAve_S8C,
mlib_VectorAve_S16, mlib_VectorAve_S16C, mlib_VectorAve_S32, mlib_VectorAve_S32C

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorAve_U8(mlib_u8 *xz,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAve_U8C(mlib_u8 *xz,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorAve_S8(mlib_s8 *xz,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAve_S8C(mlib_s8 *xz,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorAve_S16(mlib_s16 *xz,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAve_S16C(mlib_s16 *xz,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorAve_S32(mlib_s32 *xz,
const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorAve_S32C(mlib_s32 *xz,
const mlib_s32 *y, mlib_s32 n);

Description  
Each of these functions performs an in-place averaging of two vectors.

It uses the following equation:

\[ xz[i] = \frac{(xz[i] + y[i] + 1)}{2} \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2n - 1) \) for complex data.

Parameters  
Each of the functions takes the following arguments:

xz  
Pointer to the first element of the first source and destination vector.

y  
Pointer to the first element of the second source vector.

n  
Number of elements in the vectors.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:
### mlib_VectorAve_U8(3MLIB)

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See Also  `mlib_VectorAve_U8_U8(3MLIB), attributes(5)`
Each of these functions computes the average of two vectors. It uses the following equation:
\[ z[i] = \frac{x[i] + y[i] + 1}{2} \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2n - 1) \) for complex data.

**Parameters**  Each of the functions takes the following arguments:

- \( z \)  Pointer to the first element of the destination vector.
- \( x \)  Pointer to the first element of the first source vector.
- \( y \)  Pointer to the first element of the second source vector.
- \( n \)  Number of elements in the vectors.

**Return Values**  Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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**See Also**  \texttt{mlib_VectorAve_U8_U8(3MLIB)}, attributes(5)
mlib_VectorConjRev_S8C_S8C_Sat, mlib_VectorConjRev_S16C_S16C_Sat, mlib_VectorConjRev_S32C_S32C_Sat – vector conjugation reversion

Synopsis

```c
#include <mlib.h>

mlib_status mlib_VectorConjRev_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConjRev_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConjRev_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x, mlib_s32 n);
```

Description

Each of these functions computes the complex reversion of a complex vector.

The source and destination vectors must be in the same data type.

The following equation is used:

\[
\begin{align*}
z[2i] &= x[2(n - 1 - i)] \\
z[2i + 1] &= -x[2(n - 1 - i) + 1]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters

- **z**: Pointer to the first element of the destination vector.
- **x**: Pointer to the first element of the source vector.
- **n**: Number of elements in the vectors.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

attributes(5)
Name  
mlib_VectorConj_S8C_S8C_Sat, mlib_VectorConj_S16C_S16C_Sat, 
mlib_VectorConj_S32C_S32C_Sat – vector conjugation

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorConj_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, mlib_s32 n);

mlib_status mlib_VectorConj_S16C_S16C_Sat(mlib_s16 *z,
const mlib_s16 *x, mlib_s32 n);

mlib_status mlib_VectorConj_S32C_S32C_Sat(mlib_s32 *z,
const mlib_s32 *x, mlib_s32 n);

Description  
Each of these functions computes the complex conjugate of a complex vector.
The source and destination vectors must be in the same data type.
The following equation is used:
z[2*i] = x[2*i]
z[2*i + 1] = -x[2*i + 1]
where i = 0, 1, ..., (n - 1).

Parameters  
Each of the functions takes the following arguments:
z  Pointer to the first element of the destination vector.
x  Pointer to the first element of the source vector.
n  Number of elements in the vectors.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
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See Also  
attributes(5)
Name  mlib_VectorConj_S8C_Sat, mlib_VectorConj_S16C_Sat, mlib_VectorConj_S32C_Sat –
vector conjugation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_VectorConj_S8C_Sat(mlib_s8 *xz, mlib_s32 n);
mlib_status mlib_VectorConj_S16C_Sat(mlib_s16 *xz, mlib_s32 n);
mlib_status mlib_VectorConj_S32C_Sat(mlib_s32 *xz, mlib_s32 n);

Description  Each of these functions computes the in-place complex conjugate of a complex vector.
The following equation is used:
xz[2*i + 1] = -xz[2*i + 1]
where i = 0, 1, ..., (n - 1).

Parameters  Each of the functions takes the following arguments:
xz  Pointer to the first element of the source and destination vector.
n  Number of elements in the vector.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  attributes(5)
mlib_VectorConjSymExt_S8C_S8C_Sat, mlib_VectorConjSymExt_S16C_S16C_Sat, mlib_VectorConjSymExt_S32C_S32C_Sat – vector conjugate-symmetric extension

Synopsis

cc [ flag... ] file... -mlib [ library... ]
#include <mlib.h>

lib_status mlib_VectorConjSymExt_S8C_S8C_Sat(mlib_s8 *z,
                                          const mlib_s8 *x, mlib_s32 n);
lib_status mlib_VectorConjSymExt_S16C_S16C_Sat(mlib_s16 *z,
                                          const mlib_s16 *x, mlib_s32 n);
lib_status mlib_VectorConjSymExt_S32C_S32C_Sat(mlib_s32 *z,
                                          const mlib_s32 *x, mlib_s32 n);

Description

Each of these functions computes the complex conjugate extension of a complex vector.

The source and destination vectors must be in the same data type.

When \( n \) is even, the following equation is used:

\[
\begin{align*}
  z[2*i] & = x[2*i] \\
  z[2*i + 1] & = -x[2*i + 1]
\end{align*}
\]

for \( i = 0, 1, \ldots, (n - 1) \).

\[
\begin{align*}
  z[2*i] & = x[2*(2*n - 1 - i)] \\
  z[2*i + 1] & = -x[2*(2*n - 1 - i) + 1]
\end{align*}
\]

for \( i = n, (n + 1), \ldots, (2*n - 1) \).

When \( n \) is odd, the following equation is used:

\[
\begin{align*}
  z[2*i] & = x[2*i] \\
  z[2*i + 1] & = -x[2*i + 1]
\end{align*}
\]

for \( i = 0, 1, \ldots, (n - 1) \).

\[
\begin{align*}
  z[2*i] & = x[2*(2*n - 2 - i)] \\
  z[2*i + 1] & = -x[2*(2*n - 2 - i) + 1]
\end{align*}
\]

for \( i = n, (n + 1), \ldots, (2*n - 2) \).

Parameters

Each of the functions takes the following arguments:

\( z \) Pointer to the first element of the destination vector.
\( x \) Pointer to the first element of the source vector.
\( n \) Number of elements in the source vector.
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also attributes(5)
REFERENCE

Multimedia Library Functions - Part 6
Name

mlib_VectorConvert_U8_S8_Mod, mlib_VectorConvert_U8_S16_Mod,
mlib_VectorConvert_U8_S32_Mod, mlib_VectorConvert_S8_U8_Mod,
mlib_VectorConvert_S8_S16_Mod, mlib_VectorConvert_S8_S32_Mod,
mlib_VectorConvert_S16_U8_Mod, mlib_VectorConvert_S16_S8_Mod,
mlib_VectorConvert_S16_S16_Mod, mlib_VectorConvert_S32_U8_Mod,
mlib_VectorConvert_S32_S8_Mod, mlib_VectorConvert_S32_S16_Mod,
mlib_VectorConvert_S32_S32_Mod, mlib_VectorConvert_U8C_S8C_Mod,
mlib_VectorConvert_U8C_S16C_Mod, mlib_VectorConvert_U8C_S32C_Mod,
mlib_VectorConvert_S8C_S16C_Mod, mlib_VectorConvert_S8C_S32C_Mod,
mlib_VectorConvert_S16C_U8C_Mod, mlib_VectorConvert_S16C_S8C_Mod,
mlib_VectorConvert_S16C_S16C_Mod, mlib_VectorConvert_S32C_U8C_Mod,
mlib_VectorConvert_S32C_S8C_Mod, mlib_VectorConvert_S32C_S16C_Mod,
mlib_VectorConvert_S32C_S32C_Mod, mlib_VectorConvert_U8_S8_Sat,
mlib_VectorConvert_U8_S16_Sat, mlib_VectorConvert_U8_S32_Sat,
mlib_VectorConvert_S8_U8_Sat, mlib_VectorConvert_S8_S16_Sat,
mlib_VectorConvert_S8_S32_Sat, mlib_VectorConvert_S16_U8_Sat,
mlib_VectorConvert_S16_S8_Sat, mlib_VectorConvert_S16_S16_Sat,
mlib_VectorConvert_S32_U8_Sat, mlib_VectorConvert_S32_S8_Sat,
mlib_VectorConvert_S32_S16_Sat, mlib_VectorConvert_S32_S32_Sat,
mlib_VectorConvert_U8C_S8C_Sat, mlib_VectorConvert_U8C_S16C_Sat,
mlib_VectorConvert_U8C_S32C_Sat, mlib_VectorConvert_S8C_U8C_Sat,
mlib_VectorConvert_S8C_S16C_Sat, mlib_VectorConvert_S8C_S32C_Sat,
mlib_VectorConvert_S16C_U8C_Sat, mlib_VectorConvert_S16C_S8C_Sat,
mlib_VectorConvert_S16C_S32C_Sat, mlib_VectorConvert_S32C_U8C_Sat,
mlib_VectorConvert_S32C_S8C_Sat, mlib_VectorConvert_S32C_S16C_Sat

Synopsis

cc [ flag... ] file... -lmlib [ library... ]

#include <mlib.h>

mlib_status mlib_VectorConvert_U8_S8_Mod(mlib_u8 *z, const mlib_s8 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_U8_S16_Mod(mlib_u8 *z, const mlib_s16 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_U8_S32_Mod(mlib_u8 *z, const mlib_s32 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S8_U8_Mod(mlib_s8 *z, const mlib_u8 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S8_S16_Mod(mlib_s8 *z, const mlib_s16 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S8_S32_Mod(mlib_s8 *z, const mlib_s32 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S16_S32_Mod(mlib_s16 *z, const mlib_s32 *x,
mlib_s32 n);

mlib_status mlib_VectorConvert_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
mlib_s32 n);
mlib_status mlib_VectorConvert_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16_S32_Mod(mlib_s16 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32_U8_Mod(mlib_s32 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32_S8_Mod(mlib_s32 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8C_S8C_Mod(mlib_u8 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8C_S16C_Mod(mlib_u8 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8C_S32C_Mod(mlib_u8 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8C_U8C_Mod(mlib_s8 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8C_S16C_Mod(mlib_s8 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8C_S32C_Mod(mlib_s8 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16C_S32C_Mod(mlib_s16 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32C_U8C_Mod(mlib_s32 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32C_S8C_Mod(mlib_s32 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8_S8_Sat(mlib_u8 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8_S16_Sat(mlib_u8 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8_S32_Sat(mlib_u8 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8_U8_Sat(mlib_s8 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8_S16_Sat(mlib_s8 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8_S32_Sat(mlib_s8 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16_S32_Sat(mlib_s16 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32_U8_Sat(mlib_s32 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32_S8_Sat(mlib_s32 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8C_S8C_Sat(mlib_u8 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8C_S16C_Sat(mlib_u8 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_U8C_S32C_Sat(mlib_u8 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8C_U8C_Sat(mlib_s8 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8C_S16C_Sat(mlib_s8 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S8C_S32C_Sat(mlib_s8 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorConvert_S16C_S32C_Sat(mlib_s16 *z, const mlib_s32 *x, mlib_s32 n);
Each of these functions copies data from one vector to another vector, of different data types.

For real data, the following equation is used:

\[ z[i] = x[i] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[ z[2*i] = x[2*i] \]
\[ z[2*i + 1] = x[2*i + 1] \]

where \( i = 0, 1, \ldots, (n - 1) \).

See the following tables for available variations of the data type convert function.

```
<table>
<thead>
<tr>
<th>Type[*]</th>
<th>U8</th>
<th>S8</th>
<th>S16</th>
<th>S32</th>
</tr>
</thead>
<tbody>
<tr>
<td>U8</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>S8</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>S16</td>
<td></td>
<td></td>
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<td>Y</td>
</tr>
<tr>
<td>S32</td>
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<td></td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th>Type[*]</th>
<th>U8C</th>
<th>S8C</th>
<th>S16C</th>
<th>S32C</th>
</tr>
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<tbody>
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<td>U8C</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>S8C</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>S16C</td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>S32C</td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
```

[*] Each row represents a source data type. Each column represents a destination data type.
Each of the functions takes the following arguments:

- $z$ Pointer to the first element of the destination vector.
- $x$ Pointer to the first element of the source vector.
- $n$ Number of elements in the vectors.

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also attributes(5)
mlib_VectorCopy_U8(3MLIB)

Name  mlib_VectorCopy_U8, mlib_VectorCopy_U8C, mlib_VectorCopy_S8, mlib_VectorCopy_S8C, mlib_VectorCopy_S16, mlib_VectorCopy_S16C, mlib_VectorCopy_S32, mlib_VectorCopy_S32C – vector copy

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorCopy_U8(mlib_u8 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_U8C(mlib_u8 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_S8(mlib_s8 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_S8C(mlib_s8 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_S16(mlib_s16 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_S16C(mlib_s16 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_S32(mlib_s32 *z, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorCopy_S32C(mlib_s32 *z, const mlib_s32 *x, mlib_s32 n);

Description  Each of these functions copies one vector to another vector of the same data type. The input and output vectors must be in the same data type.
For real data, the following equation is used:
\[ z[i] = x[i] \]
where \( i = 0, 1, \ldots, (n - 1) \).
For complex data, the following equation is used:
\[
\begin{align*}
  z[2*i] &= x[2*i] \\
  z[2*i + 1] &= x[2*i + 1]
\end{align*}
\]
where \( i = 0, 1, \ldots, (n - 1) \).

Parameters  Each of the functions takes the following arguments:
- \( z \) Pointer to the first element of the destination vector.
- \( x \) Pointer to the first element of the source vector.
- \( n \) Number of elements in the vectors.

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Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes\((5)\) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  attributes\((5)\)
Name  mlib_VectorDistance_U8_Sat, mlib_VectorDistance_S8_Sat, mlib_VectorDistance_S16_Sat, mlib_VectorDistance_S32_Sat – vector Euclidean distance

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorDistance_U8_Sat(mlib_d64 *z, const mlib_u8 *x,
const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorDistance_S8_Sat(mlib_d64 *z, const mlib_s8 *x,
const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorDistance_S16_Sat(mlib_d64 *z, const mlib_s16 *x,
const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorDistance_S32_Sat(mlib_d64 *z, const mlib_s32 *x,
const mlib_s32 *y, mlib_s32 n);

Description  Each of these functions computes the Euclidean distances between two vectors.

The following equation is used:

\[ z[0] = \sqrt{\sum_{i=0}^{n-1} (x[i] - y[i])^2} \]

Parameters  Each of the functions takes the following arguments:

- \( z \)  Pointer to the distance between the two vectors.
- \( x \)  Pointer to the first element of the first source vector.
- \( y \)  Pointer to the first element of the second source vector.
- \( n \)  Number of elements in the vectors.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  attributes(5)
mlib_VectorDotProd_U8_Sat(mlib_d64 *z, const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_U8C_Sat(mlib_d64 *z, const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_S8_Sat(mlib_d64 *z, const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_S8C_Sat(mlib_d64 *z, const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_S16_Sat(mlib_d64 *z, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_S16C_Sat(mlib_d64 *z, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_S32_Sat(mlib_d64 *z, const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorDotProd_S32C_Sat(mlib_d64 *z, const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);

Each of these functions computes the dot product of two vectors, defined by the following equation:

\[ Z = X \cdot Y^* \]

where \( Y^* \) is the conjugate of the \( Y \) vector.

For real data, the following equation is used:

\[
\sum_{i=0}^{n-1} (x[i] \cdot y[i])
\]

For complex data, the following equation is used:

\[
\sum_{i=0}^{n-1} \left( x[2i] \cdot y[2i] + x[2i + 1] \cdot y[2i + 1] \right)
\]
\[ z[1] = \sum_{i=0} \left( x[2i + 1]y[2i] - x[2i]y[2i + 1] \right) \]

**Parameters** Each of the functions takes the following arguments:
- \( z \) Pointer to the dot product of the two vectors.
- \( x \) Pointer to the first element of the first source vector.
- \( y \) Pointer to the first element of the second source vector.
- \( n \) Number of elements in the vectors.

**Return Values** Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** attributes(5)
# mlib_VectorMag

## Name
mlib_VectorMag_U8C, mlib_VectorMag_S8C, mlib_VectorMag_S16C, mlib_VectorMag_S32C – vector complex magnitude

## Synopsis
c
c[ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_VectorMag_U8C(mlib_d64 *m, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorMag_S8C(mlib_d64 *m, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorMag_S16C(mlib_d64 *m, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorMag_S32C(mlib_d64 *m, const mlib_s32 *x, mlib_s32 n);
```

## Description
Each of these functions computes the magnitude vector of the complex input vector.

The following equation is used:

\[
m[i] = (x[2*i]**2 + x[2*i + 1]**2)**0.5
\]

where \( i = 0, 1, \ldots, (n - 1) \).

## Parameters
Each of the functions takes the following arguments:
- \( m \) Pointer to the destination magnitude vector.
- \( x \) Pointer to the source vector
- \( n \) Number of elements in the vector.

## Return Values
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

## See Also
`attributes(5)`

---

**mlib_VectorMag_U8C(3MLIB)**

[1178] man pages section 3: Multimedia Library Functions • Last Revised 2 Mar 2007
Name  mlib_VectorMaximumMag_U8C, mlib_VectorMaximumMag_S8C, mlib_VectorMaximumMag_S16C, mlib_VectorMaximumMag_S32C, mlib_VectorMaximumMag_F32C, mlib_VectorMaximumMag_D64C – find the first element with the maximum magnitude in a vector.

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMaximumMag_U8C(mlib_u8 *max, 
    const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorMaximumMag_S8C(mlib_s8 *max, 
    const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorMaximumMag_S16C(mlib_s16 *max, 
    const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorMaximumMag_S32C(mlib_s32 *max, 
    const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorMaximumMag_F32C(mlib_f32 *max, 
    const mlib_f32 *x, mlib_s32 n);
mlib_status mlib_VectorMaximumMag_D64C(mlib_d64 *max, 
    const mlib_d64 *x, mlib_s32 n);

Description  Each of these functions finds the first element with the maximum magnitude in a complex vector, then puts the real and imaginary parts of it into max[0] and max[1], respectively.

Parameters  Each of the functions takes the following arguments:

    max    Pointer to the first element with the maximum magnitude.
    x      Pointer to the first element of the source vector.
    n      Number of elements in the source vector.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_VectorMinimumMag_U8C(3MLIB), mlib_MatrixMaximumMag_U8C(3MLIB), mlib_MatrixMinimumMag_U8C(3MLIB), attributes(5)
mlib_VectorMaximum_U8(3MLIB)

Name
mlib_VectorMaximum_U8, mlib_VectorMaximum_S8, mlib_VectorMaximum_S16,
mlib_VectorMaximum_S32, mlib_VectorMaximum_F32, mlib_VectorMaximum_D64 –
find the maximum value in a vector

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMaximum_U8(mlib_u8 *max, const mlib_u8 *x,
mlib_s32 n);
mlib_status mlib_VectorMaximum_S8(mlib_s8 *max, const mlib_s8 *x,
mlib_s32 n);
mlib_status mlib_VectorMaximum_S16(mlib_s16 *max, const mlib_s16 *x,
mlib_s32 n);
mlib_status mlib_VectorMaximum_S32(mlib_s32 *max, const mlib_s32 *x,
mlib_s32 n);
mlib_status mlib_VectorMaximum_F32(mlib_f32 *max, const mlib_f32 *x,
mlib_s32 n);
mlib_status mlib_VectorMaximum_D64(mlib_d64 *max, const mlib_d64 *x,
mlib_s32 n);

Description
Each of these functions finds the maximum value of all elements in a vector.
The following equation is used:
max[0] = MAX{ x[i]  i = 0, 1, ..., (n - 1) }

Parameters
Each of the functions takes the following arguments:
max    Pointer to the maximum value.
x      Pointer to the first element of the source vector.
n      Number of elements in the source vector.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_VectorMinimum_U8(3MLIB), mlib_MatrixMaximum_U8(3MLIB),
mlib_MatrixMinimum_U8(3MLIB), attributes(5)
Name mlib_VectorMerge_U8C_U8, mlib_VectorMerge_S8C_S8, mlib_VectorMerge_S16C_S16, mlib_VectorMerge_S32C_S32 – vector merge

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMerge_U8C_U8(mlib_u8 *z, const mlib_u8 *r,
const mlib_u8 *i, mlib_s32 n);
mlib_status mlib_VectorMerge_S8C_S8(mlib_s8 *z, const mlib_s8 *r,
const mlib_s8 *i, mlib_s32 n);
mlib_status mlib_VectorMerge_S16C_S16(mlib_s16 *z, const mlib_s16 *r,
const mlib_s16 *i, mlib_s32 n);
mlib_status mlib_VectorMerge_S32C_S32(mlib_s32 *z, const mlib_s32 *r,
const mlib_s32 *i, mlib_s32 n);

Description Each of these functions computes the complex vector from two vectors representing the real and imaginary parts.

The following equation is used:
\[
\begin{align*}
z[2k] & = r[k] \\
z[2k + 1] & = i[k]
\end{align*}
\]
where \( k = 0, 1, \ldots, (n - 1) \).

Parameters Each of the functions takes the following arguments:
\[
\begin{align*}
z & \quad \text{Pointer to the first complex element of the destination vector. } z[2k] \text{ contains the real part, and } z[2k + 1] \text{ contains the imaginary part.} \\
r & \quad \text{Pointer to the first element of the real part.} \\
i & \quad \text{Pointer to the first element of the imaginary part.} \\
n & \quad \text{Number of elements in the vectors.}
\end{align*}
\]

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>
See Also  mllib_VectorSplit_U8_U8C(3MLIB), attributes(5)
**Name**
mlib_VectorMinimumMag_U8C, mlib_VectorMinimumMag_S8C,
mlib_VectorMinimumMag_S16C, mlib_VectorMinimumMag_S32C,
mlib_VectorMinimumMag_F32C, mlib_VectorMinimumMag_D64C – find the first element
with the minimum magnitude in a vector.

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMinimumMag_U8C(mlib_u8 *min, const mlib_u8 *x,
            mlib_s32 n);
mlib_status mlib_VectorMinimumMag_S8C(mlib_s8 *min, const mlib_s8 *x,
            mlib_s32 n);
mlib_status mlib_VectorMinimumMag_S16C(mlib_s16 *min, const mlib_s16 *x,
            mlib_s32 n);
mlib_status mlib_VectorMinimumMag_S32C(mlib_s32 *min, const mlib_s32 *x,
            mlib_s32 n);
mlib_status mlib_VectorMinimumMag_F32C(mlib_f32 *min, const mlib_f32 *x,
            mlib_s32 n);
mlib_status mlib_VectorMinimumMag_D64C(mlib_d64 *min, const mlib_d64 *x,
            mlib_s32 n);

**Description**
Each of these functions finds the first element with the minimum magnitude in a complex
vector, then puts the real and imaginary parts of it into min[0] and min[1], respectively.

**Parameters**
Each of the functions takes the following arguments:
- **min** Pointer to the first element with the minimum magnitude.
- **x** Pointer to the first element of the source vector.
- **n** Number of elements in the source vector.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_VectorMaximumMag_U8C(3MLIB), mlib_MatrixMaximumMag_U8C(3MLIB),
mlib_MatrixMinimumMag_U8C(3MLIB), attributes(5)
Name
mlib_VectorMinimum_U8, mlib_VectorMinimum_S8, mlib_VectorMinimum_S16, mlib_VectorMinimum_S32, mlib_VectorMinimum_F32, mlib_VectorMinimum_D64 – find the minimum value in a vector

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMinimum_U8(mlib_u8 *min, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorMinimum_S8(mlib_s8 *min, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorMinimum_S16(mlib_s16 *min, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorMinimum_S32(mlib_s32 *min, const mlib_s32 *x, mlib_s32 n);
mlib_status mlib_VectorMinimum_F32(mlib_f32 *min, const mlib_f32 *x, mlib_s32 n);
mlib_status mlib_VectorMinimum_D64(mlib_d64 *min, const mlib_d64 *x, mlib_s32 n);

Description
Each of these functions finds the minimum value of all elements in a vector.

The following equation is used:
max[0] = MIN{ x[i]  i = 0, 1, ..., (n - 1) }

Parameters
Each of the functions takes the following arguments:

min Pointer to the minimum value.
x Pointer to the first element of the source vector.
n Number of elements in the source vector.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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See Also
mlib_VectorMaximum_U8(3MLIB), mlib_MatrixMaximum_U8(3MLIB), mlib_MatrixMinimum_U8(3MLIB), attributes(5)
Name  mlib_VectorMulMShift_S16_S16_Mod, mlib_VectorMulMShift_S16_S16_Sat, mlib_VectorMulMShift_S16C_S16C_Mod, mlib_VectorMulMShift_S16C_S16C_Sat – multiplication of vector by matrix with shifting

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulMShift_S16_S16_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 m,
    mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulMShift_S16_S16_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 m,
    mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulMShift_S16C_S16C_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 m,
    mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulMShift_S16C_S16C_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 m,
    mlib_s32 n, mlib_s32 shift);

Description  Each of these functions multiplies a vector by a matrix and shifts the results.

For real data, the following equation is used:

\[
m-1
z[i] = \{ \sum_{j=0}^{m-1} (x[j] * y[j*m + i]) \} * 2^{(-shift)}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
m-1
z[2*i] = \{ \sum_{j=0}^{m-1} (xR*yR - xI*yI) \} * 2^{(-shift)}
\]

\[
m-1
z[2*i + 1] = \{ \sum_{j=0}^{m-1} (xR*yI + xI*yR) \} * 2^{(-shift)}
\]

where \( i = 0, 1, \ldots, (n - 1) \), and

\[
xR = x[2*j]
xI = x[2*j + 1]
yR = y[2*(j*m + i)]
yI = y[2*(j*m + i) + 1]
\]
Each of the functions takes the following arguments:

- $z$ Pointer to the first element of the destination vector.
- $x$ Pointer to the first element of the source vector.
- $y$ Pointer to the first element of the source matrix.
- $m$ Number of rows in the matrix, and number of elements in the source vector.
- $n$ Number of columns in the matrix, and number of elements in the destination vector.
- $shift$ Right shifting factor.

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also mlib_VectorMulMShift_S16_S16_Mod(3MLIB), attributes(5)
Name  mlib_VectorMulM_U8_U8_Mod, mlib_VectorMulM_U8_U8_Sat,  
mlib_VectorMulM_U8C_U8C_Mod, mlib_VectorMulM_U8C_U8C_Sat,  
mlib_VectorMulM_S8_S8_Mod, mlib_VectorMulM_S8_S8_Sat,  
mlib_VectorMulM_S8C_S8C_Mod, mlib_VectorMulM_S8C_S8C_Sat,  
mlib_VectorMulM_S16_U8_Mod, mlib_VectorMulM_S16_U8_Sat,  
mlib_VectorMulM_S16_S8_Mod, mlib_VectorMulM_S16_S8_Sat,  
mlib_VectorMulM_S16_S16_Mod, mlib_VectorMulM_S16_S16_Sat,  
mlib_VectorMulM_S16C_U8C_Mod, mlib_VectorMulM_S16C_U8C_Sat,  
mlib_VectorMulM_S16C_S8C_Mod, mlib_VectorMulM_S16C_S8C_Sat,  
mlib_VectorMulM_S16C_S16C_Mod, mlib_VectorMulM_S16C_S16C_Sat,  
mlib_VectorMulM_S32_S16_Mod, mlib_VectorMulM_S32_S16_Sat,  
mlib_VectorMulM_S32_S32_Mod, mlib_VectorMulM_S32_S32_Sat – multiplication  
of vector by matrix

Synopsis  cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_VectorMulM_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,  
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,  
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,  
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,  
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,  
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,  
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,  
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,  
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S16_S16_Mod(mlib_s16 *z, const mlib_u8 *x,  
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S16_S16_Sat(mlib_s16 *z, const mlib_u8 *x,  
const mlib_u8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,  
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);

mlib_status mlib_VectorMulM_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,  
const mlib_s8 *y, mlib_s32 m, mlib_s32 n);
Each of these functions multiplies a vector by a matrix.

For real data, the following equation is used:

\[ z_i = \sum_{j=0}^{n-1} x_j y_j \]
\[ z[i] = \sum_{j=0}^{m-1} x[j] \cdot y[j \cdot m + i] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[ z[2i] = \sum_{j=0}^{m-1} (xR \cdot yR - xI \cdot yI) \]
\[ z[2i + 1] = \sum_{j=0}^{m-1} (xR \cdot yI + xI \cdot yR) \]

where \( i = 0, 1, \ldots, (n - 1) \), and

\[ xR = x[2j] \]
\[ xI = x[2j + 1] \]
\[ yR = y[2(j \cdot m + i)] \]
\[ yI = y[2(j \cdot m + i) + 1] \]

**Parameters**  Each of the functions takes the following arguments:
- \( z \)  Pointer to the first element of the destination vector.
- \( x \)  Pointer to the first element of the source vector.
- \( y \)  Pointer to the first element of the source matrix.
- \( m \)  Number of rows in the matrix, and number of elements in the source vector.
- \( n \)  Number of columns in the matrix, and number of elements in the destination vector.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

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**See Also**  mlib_VectorMulM_U8_U8_Mod(3MLIB), attributes(5)
Name

mlib_VectorMulSAdd_U8_Mod, mlib_VectorMulSAdd_U8_Sat,
mlib_VectorMulSAdd_U8C_Mod, mlib_VectorMulSAdd_U8C_Sat,
mlib_VectorMulSAdd_S8_Mod, mlib_VectorMulSAdd_S8_Sat,
mlib_VectorMulSAdd_S8C_Mod, mlib_VectorMulSAdd_S8C_Sat,
mlib_VectorMulSAdd_S16_Mod, mlib_VectorMulSAdd_S16_Sat,
mlib_VectorMulSAdd_S16C_Mod, mlib_VectorMulSAdd_S16C_Sat,
mlib_VectorMulSAdd_S32_Mod, mlib_VectorMulSAdd_S32_Sat,
mlib_VectorMulSAdd_S32C_Mod, mlib_VectorMulSAdd_S32C_Sat – vector multiplication
by scalar plus addition, in place.

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulSAdd_U8_Mod(mlib_u8 *xz,
    const mlib_u8 *y, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_U8_Sat(mlib_u8 *xz,
    const mlib_u8 *y, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_U8C_Mod(mlib_u8 *xz,
    const mlib_u8 *y, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_U8C_Sat(mlib_u8 *xz,
    const mlib_u8 *y, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S8_Mod(mlib_s8 *xz,
    const mlib_s8 *y, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S8_Sat(mlib_s8 *xz,
    const mlib_s8 *y, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S8C_Mod(mlib_s8 *xz,
    const mlib_s8 *y, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S8C_Sat(mlib_s8 *xz,
    const mlib_s8 *y, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S16_Mod(mlib_s16 *xz,
    const mlib_s16 *y, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S16_Sat(mlib_s16 *xz,
    const mlib_s16 *y, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S16C_Mod(mlib_s16 *xz,
    const mlib_s16 *y, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S16C_Sat(mlib_s16 *xz,
    const mlib_s16 *y, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S32_Mod(mlib_s32 *xz,
    const mlib_s32 *y, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S32_Sat(mlib_s32 *xz,
    const mlib_s32 *y, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S32C_Mod(mlib_s32 *xz,
    const mlib_s32 *y, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S32C_Sat(mlib_s32 *xz,
    const mlib_s32 *y, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S32C_Mod(mlib_s32 *xz, const mlib_s32 *y, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S32C_Sat(mlib_s32 *xz, const mlib_s32 *y, const mlib_s32 *c, mlib_s32 n);

### Description
Each of these functions computes an in-place multiplication of a vector by a scalar and adds the result to another vector.

For real data, the following equation is used:

\[ xz[i] = xz[i] + y[i] \times c[0] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
xz[2\times i] &= xz[2\times i] + y[2\times i] \times c[0] - y[2\times i + 1] \times c[1] \\
xz[2\times i + 1] &= xz[2\times i + 1] + y[2\times i] \times c[1] + y[2\times i + 1] \times c[0]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

### Parameters
Each of the functions takes the following arguments:

- **xz** Pointer to the first element of the first source and destination vector.
- **y** Pointer to the first element of the second source vector.
- **c** Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the real part of the scalar, and \( c[1] \) contains the imaginary part of the scalar.
- **n** Number of elements in the vectors.

### Return Values
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
`mlib_VectorMulSAdd_U8_U8_Mod(3MLIB), attributes(5)`
Name

mlib_VectorMulSAdd_U8_U8_Mod, mlib_VectorMulSAdd_U8_U8_Sat,
mlib_VectorMulSAdd_U8C_U8C_Mod, mlib_VectorMulSAdd_U8C_U8C_Sat,
mlib_VectorMulSAdd_S8_S8_Mod, mlib_VectorMulSAdd_S8_S8_Sat,
mlib_VectorMulSAdd_S8C_S8C_Mod, mlib_VectorMulSAdd_S8C_S8C_Sat,
mlib_VectorMulSAdd_S16_U8_Mod, mlib_VectorMulSAdd_S16_U8_Sat,
mlib_VectorMulSAdd_S16_S8_Mod, mlib_VectorMulSAdd_S16_S8_Sat,
mlib_VectorMulSAdd_S16_S16_Mod, mlib_VectorMulSAdd_S16_S16_Sat,
mlib_VectorMulSAdd_S16C_U8C_Mod, mlib_VectorMulSAdd_S16C_U8C_Sat,
mlib_VectorMulSAdd_S16C_S8C_Mod, mlib_VectorMulSAdd_S16C_S8C_Sat,
mlib_VectorMulSAdd_S16C_S16C_Mod, mlib_VectorMulSAdd_S16C_S16C_Sat,
mlib_VectorMulSAdd_S32_S16_Mod, mlib_VectorMulSAdd_S32_S16_Sat,
mlib_VectorMulSAdd_S32_S32_Mod, mlib_VectorMulSAdd_S32_S32_Sat,
mlib_VectorMulSAdd_S32C_S16C_Mod, mlib_VectorMulSAdd_S32C_S16C_Sat,
mlib_VectorMulSAdd_S32C_S32C_Mod, mlib_VectorMulSAdd_S32C_S32C_Sat - vector
multiplication by scalar plus addition

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulSAdd_U8_U8_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_U8_U8_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_U8C_U8C_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_U8C_U8C_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_S8_S8_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_S8_S8_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_S8C_S8C_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c,
mlib_s32 n);

mlib_status mlib_VectorMulSAdd_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c,
mlib_s32 n);
mlib_status mlib_VectorMulSAdd_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *y, const mlib_u8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *y, const mlib_s8 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *y, const mlib_s16 *c, mib_se32 n);

mlib_status mlib_VectorMulSAdd_S16_S16_Sat(3MLIB);
Each of these functions multiplies a vector by a scalar and adds the result to another vector.

For real data, the following equation is used:

\[ z[i] = x[i] + y[i] \times c[0] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
  z[2 \times i] &= x[2 \times i] + y[2 \times i] \times c[0] - y[2 \times i + 1] \times c[1] \\
  z[2 \times i + 1] &= x[2 \times i + 1] + y[2 \times i] \times c[1] + y[2 \times i + 1] \times c[0]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters**

- **z** Pointer to the first element of the destination vector.
- **x** Pointer to the first element of the first source vector.
- **y** Pointer to the first element of the second source vector.
- **c** Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the real part of the scalar, and \( c[1] \) contains the imaginary part of the scalar.
- **n** Number of elements in the vectors.
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes** See attributes(5) for descriptions of the following attributes:

<table>
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<tr>
<th>ATTRIBUTE TYPE</th>
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<tr>
<td>Interface Stability</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** `mlib_VectorMulSAdd_U8_U8_Mod(3MLIB)`, attributes(5)
Name  
mlib_VectorMulShift_U8_Mod, mlib_VectorMulShift_U8_Sat,
mlib_VectorMulShift_U8C_Mod, mlib_VectorMulShift_U8C_Sat,
mlib_VectorMulShift_S8_Mod, mlib_VectorMulShift_S8_Sat,
mlib_VectorMulShift_S8C_Mod, mlib_VectorMulShift_S8C_Sat,
mlib_VectorMulShift_S16_Mod, mlib_VectorMulShift_S16_Sat,
mlib_VectorMulShift_S16C_Mod, mlib_VectorMulShift_S16C_Sat,
mlib_VectorMulShift_S32_Mod, mlib_VectorMulShift_S32_Sat,
mlib_VectorMulShift_S32C_Mod, mlib_VectorMulShift_S32C_Sat – vector multiplication
with shifting, in place

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulShift_U8_Mod(mlib_u8 *xz,
   const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_U8_Sat(mlib_u8 *xz,
   const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_U8C_Mod(mlib_u8 *xz,
   const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_U8C_Sat(mlib_u8 *xz,
   const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S8_Mod(mlib_s8 *xz,
   const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S8_Sat(mlib_s8 *xz,
   const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S8C_Mod(mlib_s8 *xz,
   const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S8C_Sat(mlib_s8 *xz,
   const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S16_Mod(mlib_s16 *xz,
   const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S16_Sat(mlib_s16 *xz,
   const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S16C_Mod(mlib_s16 *xz,
   const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S16C_Sat(mlib_s16 *xz,
   const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S32_Mod(mlib_s32 *xz,
   const mlib_s32 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S32_Sat(mlib_s32 *xz,
   const mlib_s32 *y, mlib_s32 n, mlib_s32 shift);
Each of these functions performs an in-place multiplication of two vectors and shifts the result.

For real data, the following equation is used:

\[ xz[i] = xz[i] \times y[i] \times 2^{-shift} \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\text{tmp} & = xz[2*i] \\
xz[2*i] & = (\text{tmp} \times y[2*i] - xz[2*i + 1] \times y[2*i + 1]) \times 2^{-shift} \\
xz[2*i + 1] & = (\text{tmp} \times y[2*i + 1] + xz[2*i + 1] \times y[2*i]) \times 2^{-shift}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

Each of the functions takes the following arguments:

- \( xz \)  
  Pointer to the first element of the first source and result vector.
- \( y \)  
  Pointer to the first element of the second source vector.
- \( n \)  
  Number of elements in each vector.
- \( shift \)  
  Right shifting factor. The ranges of valid \( shift \) are:
  
  \[ 1 \leq \text{shift} \leq 8 \quad \text{for U8, S8, U8C, S8C types} \]
  
  \[ 1 \leq \text{shift} \leq 16 \quad \text{for S16, S16C types} \]
  
  \[ 1 \leq \text{shift} \leq 31 \quad \text{for S32, S32C types} \]

Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

See \texttt{attributes(5)} for descriptions of the following attributes:

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</table>

\textbf{See Also} \texttt{mlib\_VectorMulShift\_U8\_U8\_Mod(3MLIB)}, \texttt{attributes(5)}
mlib_VectorMulShift_U8_U8_Mod, mlib_VectorMulShift_U8C_U8C_Mod, mlib_VectorMulShift_S8_S8_Mod, mlib_VectorMulShift_S8C_S8C_Mod, mlib_VectorMulShift_S16_S16_Mod, mlib_VectorMulShift_S16C_S16C_Mod, mlib_VectorMulShift_S32_S32_Mod, mlib_VectorMulShift_S32C_S32C_Mod – vector multiplication with shifting

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulShift_U8_U8_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_U8_U8_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_U8C_U8C_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_U8C_U8C_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S8_S8_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S8_S8_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S8C_S8C_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S16_S16_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S16_S16_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S16C_S16C_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S16C_S16C_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S32_S32_Mod(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S32_S32_Sat(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulShift_S32C_S32C_Mod(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n, mlib_s32 shift);

mlib_status mlib_VectorMulShift_S32C_S32C_Sat(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n, mlib_s32 shift);

**Description**  
Each of these functions performs a multiplication of two vectors, shifts the result, and puts it into a third vector.

For real data, the following equation is used:

\[ z[i] = x[i] \times y[i] \times 2^{-\text{shift}} \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
z[2i] &= (x[2i] \times y[2i] - x[2i + 1] \times y[2i + 1]) \times 2^{-\text{shift}} \\
z[2i + 1] &= (x[2i] \times y[2i + 1] + x[2i + 1] \times y[2i + 1]) \times 2^{-\text{shift}}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters**  
Each of the functions takes the following arguments:

- **z**  
  Pointer to the first element of the result vector.

- **x**  
  Pointer to the first element of the first source vector.

- **y**  
  Pointer to the first element of the second source vector.

- **n**  
  Number of elements in each vector.

- **shift**  
  Right shifting factor. The ranges of valid shift are:

  - \( 1 \leq \text{shift} \leq 8 \) for U8, S8, U8C, S8C types
  - \( 1 \leq \text{shift} \leq 16 \) for S16, S16C types
  - \( 1 \leq \text{shift} \leq 31 \) for S32, S32C types

**Return Values**  
Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**  
mlib_VectorMulShift_U8_U8_Mod(3MLIB), attributes(5)
mlib_VectorMulSShift_U8_Mod, mlib_VectorMulSShift_U8_Sat, 
mlib_VectorMulSShift_U8C_Mod, mlib_VectorMulSShift_U8C_Sat, 
mlib_VectorMulSShift_S8_Mod, mlib_VectorMulSShift_S8_Sat, 
mlib_VectorMulSShift_S8C_Mod, mlib_VectorMulSShift_S8C_Sat, 
mlib_VectorMulSShift_S16_Mod, mlib_VectorMulSShift_S16_Sat, 
mlib_VectorMulSShift_S16C_Mod, mlib_VectorMulSShift_S16C_Sat, 
mlib_VectorMulSShift_S32_Mod, mlib_VectorMulSShift_S32_Sat, 
mlib_VectorMulSShift_S32C_Mod, mlib_VectorMulSShift_S32C_Sat – vector multiplication 
by scalar plus shifting, in place

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulSShift_U8_Mod(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_U8_Sat(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S8_Mod(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S8_Sat(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S16_Mod(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S16_Sat(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S32_Mod(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S32_Sat(mlib_u8 *xz,
   const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S32C_Mod(mlib_s32 *xz, 
const mlib_s32 *c, mlib_s32 n, mlib_s32 shift);  
mlib_status mlib_VectorMulSShift_S32C_Sat(mlib_s32 *xz, 
const mlib_s32 *c, mlib_s32 n, mlib_s32 shift);

Description Each of these functions performs an in-place multiplication of a vector by a scalar and shifts 
the result.

For real data, the following equation is used:

\[ xz[i] = xz[i] \times c[0] \times 2^{-shift} \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
tmp &= xz[2*i] \\
xz[2*i] &= (tmp*c[0] - xz[2*i+1]*c[1]) \times 2^{-shift} \\
xz[2*i+1] &= (tmp*c[1] + xz[2*i+1]*c[0]) \times 2^{-shift}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters Each of the functions takes the following arguments:

- \( xz \) Pointer to the first element of the source and result vector.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) 
  contains the real part of the scalar, and \( c[1] \) contains the imaginary part of the scalar.
- \( n \) Number of elements in each vector.
- \( shift \) Right shifting factor. The ranges of valid shift are:

\[
\begin{align*}
1 & \leq shift \leq 8 \quad \text{for U8, S8, U8C, S8C types} \\
1 & \leq shift \leq 16 \quad \text{for S16, S16C types} \\
1 & \leq shift \leq 31 \quad \text{for S32, S32C types}
\end{align*}
\]

Return Values Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

Attributes See attributes\texttt{(5)} for descriptions of the following attributes:

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</table>

See Also \texttt{mlib_VectorMulSShift_U8_U8_Mod(3MLIB)}, attributes\texttt{(5)}
Name
mlib_VectorMulSShift_U8_U8_Mod, mlib_VectorMulSShift_U8_U8_Sat,
mlib_VectorMulSShift_U8C_U8C_Mod, mlib_VectorMulSShift_U8C_U8C_Sat,
mlib_VectorMulSShift_S8_S8_Mod, mlib_VectorMulSShift_S8_S8_Sat,
mlib_VectorMulSShift_S8C_S8C_Mod, mlib_VectorMulSShift_S8C_S8C_Sat,
mlib_VectorMulSShift_S16_S16_Mod, mlib_VectorMulSShift_S16_S16_Sat,
mlib_VectorMulSShift_S16C_S16C_Mod, mlib_VectorMulSShift_S16C_S16C_Sat,
mlib_VectorMulSShift_S32_S32_Mod, mlib_VectorMulSShift_S32_S32_Sat,
mlib_VectorMulSShift_S32C_S32C_Mod, mlib_VectorMulSShift_S32C_S32C_Sat
-vector multiplication by scalar plus shifting

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulSShift_U8_U8_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_U8_U8_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_U8C_U8C_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_U8C_U8C_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S8_S8_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S8_S8_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S8C_S8C_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S16_S16_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S16_S16_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S16C_S16C_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S16C_S16C_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S32_S32_Mod(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n, mlib_s32 shift);
mlib_status mlib_VectorMulSShift_S32_S32_Sat(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n, mlib_s32 shift);
Each of these functions performs a multiplication of a vector by a scalar and shifts the result.

For real data, the following equation is used:
\[ z[i] = x[i] * c[0] * 2^{-shift} \]
where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:
\[ z[2*i] = (x[2*i]*c[0] - x[2*i + 1]*c[1]) * 2^{-shift} \]
\[ z[2*i + 1] = (x[2*i]*c[1] + x[2*i + 1]*c[0]) * 2^{-shift} \]
where \( i = 0, 1, \ldots, (n - 1) \).

Each of the functions takes the following arguments:

- **\( z \)**: Pointer to the first element of the result vector.
- **\( x \)**: Pointer to the first element of the source vector.
- **\( c \)**: Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the real part of the scalar, and \( c[1] \) contains the imaginary part of the scalar.
- **\( n \)**: Number of elements in each vector.
- **\( shift \)**: Right shifting factor. The ranges of valid \( shift \) are:
  - \( 1 \leq shift \leq 8 \) for U8, S8, U8C, S8C types
  - \( 1 \leq shift \leq 16 \) for S16, S16C types
  - \( 1 \leq shift \leq 31 \) for S32, S32C types

Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  
mlib_VectorMulSShift_U8_U8_Mod(3MLIB), attributes(5)
**Name**
milib_VectorMulS_U8_Mod, mlib_VectorMulS_U8_Sat, mlib_VectorMulS_U8C_Mod,
mlib_VectorMulS_U8C_Sat, mlib_VectorMulS_S8_Mod, mlib_VectorMulS_S8_Sat,
mlib_VectorMulS_S8C_Mod, mlib_VectorMulS_S8C_Sat, mlib_VectorMulS_S16_Mod,
mlib_VectorMulS_S16_Sat, mlib_VectorMulS_S16C_Mod, mlib_VectorMulS_S16C_Sat,
mlib_VectorMulS_S32_Mod, mlib_VectorMulS_S32_Sat, mlib_VectorMulS_S32C_Mod,
mlib_VectorMulS_S32C_Sat

**Synopsis**

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulS_U8_Mod(mlib_u8 *xz,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_U8_Sat(mlib_u8 *xz,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_U8C_Mod(mlib_u8 *xz,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_U8C_Sat(mlib_u8 *xz,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8_Mod(mlib_s8 *xz,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8_Sat(mlib_s8 *xz,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8C_Mod(mlib_s8 *xz,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8C_Sat(mlib_s8 *xz,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_Mod(mlib_s16 *xz,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_Sat(mlib_s16 *xz,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_Mod(mlib_s16 *xz,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_Sat(mlib_s16 *xz,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_Mod(mlib_s32 *xz,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_Sat(mlib_s32 *xz,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_Mod(mlib_s32 *xz,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_Sat(mlib_s32 *xz,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_Sat(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 n);

Description Each of these functions computes an in-place multiplication of a vector by a scalar.

For real data, the following equation is used:

\[ xz[i] = xz[i] \times c[0] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\text{tmp} &= xz[2*i] \\
xz[2*i] &= \text{tmp}*c[0] - xz[2*i + 1]*c[1] \\
xz[2*i + 1] &= \text{tmp}*c[1] + xz[2*i + 1]*c[0]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters Each of the functions takes the following arguments:

- \( xz \) Pointer to the first element of the source and destination vector.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the real part of the scalar, and \( c[1] \) contains the imaginary part of the scalar.
- \( n \) Number of elements in the vectors.

Return Values Each of the functions returns MLLIB_SUCCESS if successful. Otherwise it returns MLLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_VectorMulS_U8_U8_Mod(3MLIB), attributes(5)
mlib_VectorMulS_U8_U8_Mod(3MLIB)

Name
mlib_VectorMulS_U8_U8_Mod, mlib_VectorMulS_U8_U8_Sat,
mlib_VectorMulS_U8C_U8C_Mod, mlib_VectorMulS_U8C_U8C_Sat,
mlib_VectorMulS_S8_S8_Mod, mlib_VectorMulS_S8_S8_Sat,
mlib_VectorMulS_S8C_S8C_Mod, mlib_VectorMulS_S8C_S8C_Sat,
mlib_VectorMulS_S16_U8_Mod, mlib_VectorMulS_S16_U8_Sat,
mlib_VectorMulS_S16_S8_Mod, mlib_VectorMulS_S16_S8_Sat,
mlib_VectorMulS_S16_S16_Mod, mlib_VectorMulS_S16_S16_Sat,
mlib_VectorMulS_S16C_U8C_Mod, mlib_VectorMulS_S16C_U8C_Sat,
mlib_VectorMulS_S16C_S8C_Mod, mlib_VectorMulS_S16C_S8C_Sat,
mlib_VectorMulS_S16C_S16C_Mod, mlib_VectorMulS_S16C_S16C_Sat,
mlib_VectorMulS_S32_S16_Mod, mlib_VectorMulS_S32_S16_Sat,
mlib_VectorMulS_S32_S32_Mod, mlib_VectorMulS_S32_S32_Sat,
mlib_VectorMulS_S32C_S16C_Mod, mlib_VectorMulS_S32C_S16C_Sat,
mlib_VectorMulS_S32C_S32C_Mod, mlib_VectorMulS_S32C_S32C_Sat – vector multiplication by scalar

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMulS_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x,
const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x,
const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x,
const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x,
const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_U8C_Mod(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_U8C_Sat(mlib_s16 *z, const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S8C_Mod(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S8C_Sat(mlib_s16 *z, const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S16C_Mod(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S16C_Sat(mlib_s32 *z, const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S32C_Mod(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorMulS_S32C_S32C_Sat(mlib_s32 *z, const mlib_s32 *x, const mlib_s32 *c, mlib_s32 n);

Description
Each of these functions multiplies a vector by a scalar.

For real data, the following equation is used:

\[ z[i] = x[i] \times c[0] \]
where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters** Each of the functions takes the following arguments:

- \( z \) Pointer to the first element of the destination vector.
- \( x \) Pointer to the first element of the source vector.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the real part of the scalar, and \( c[1] \) contains the imaginary part of the scalar.
- \( n \) Number of elements in the vectors.

**Return Values** Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes** See attributes(5) for descriptions of the following attributes:

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<td>MT-Level</td>
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</tr>
</tbody>
</table>

**See Also** `mlib_VectorMulS_U8_U8_Mod(3MLIB)`
Name  
mlib_VectorMul_U8_Mod, mlib_VectorMul_U8_Sat, mlib_VectorMul_U8C_Mod, 
mlib_VectorMul_U8C_Sat, mlib_VectorMul_S8_Mod, mlib_VectorMul_S8_Sat, 
mlib_VectorMul_S8C_Mod, mlib_VectorMul_S8C_Sat, mlib_VectorMul_S16_Mod, 
mlib_VectorMul_S16_Sat, mlib_VectorMul_S16C_Mod, mlib_VectorMul_S16C_Sat, 
mlib_VectorMul_S32_Mod, mlib_VectorMul_S32_Sat, mlib_VectorMul_S32C_Mod, 
mlib_VectorMul_S32C_Sat – vector multiplication, in place

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMul_U8_Mod(mlib_u8 *xz, const mlib_u8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_U8_Sat(mlib_u8 *xz, const mlib_u8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_U8C_Mod(mlib_u8 *xz, const mlib_u8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_U8C_Sat(mlib_u8 *xz, const mlib_u8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S8_Mod(mlib_s8 *xz, const mlib_s8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S8_Sat(mlib_s8 *xz, const mlib_s8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S8C_Mod(mlib_s8 *xz, const mlib_s8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S8C_Sat(mlib_s8 *xz, const mlib_s8 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S16_Mod(mlib_s16 *xz, const mlib_s16 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S16_Sat(mlib_s16 *xz, const mlib_s16 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S16C_Mod(mlib_s16 *xz, const mlib_s16 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S16C_Sat(mlib_s16 *xz, const mlib_s16 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S32_Mod(mlib_s32 *xz, const mlib_s32 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S32_Sat(mlib_s32 *xz, const mlib_s32 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S32C_Mod(mlib_s32 *xz, const mlib_s32 *y, 
mlib_s32 n);
mlib_status mlib_VectorMul_S32C_Sat(mlib_s32 *xz, const mlib_s32 *y, mlib_s32 n);

**Description**  
Each of these functions performs an in-place multiplication of one vector by another vector.

For real data, the following equation is used:

\[ xz[i] = xz[i] \times y[i] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\text{tmp} & = xz[2*i] \\
xz[2*i + 1] & = \text{tmp}*y[2*i + 1] + xz[2*i + 1]*y[2*i]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters**  
Each of the functions takes the following arguments:

- \( xz \)  
  Pointer to the first element of the first source and destination vector.

- \( y \)  
  Pointer to the first element of the second source vector.

- \( n \)  
  Number of elements in the vectors.

**Return Values**  
Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
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</tbody>
</table>

**See Also**  
mlib_VectorMul_U8_U8_Mod(3MLIB), attributes(5)
Name  

mlib_VectorMul_U8_U8_Mod, mlib_VectorMul_U8_U8_Sat,
mlib_VectorMul_U8C_U8C_Mod, mlib_VectorMul_U8C_U8C_Sat,
mlib_VectorMul_S8_S8_Mod, mlib_VectorMul_S8_S8_Sat,
mlib_VectorMul_S8C_S8C_Mod, mlib_VectorMul_S8C_S8C_Sat,
mlib_VectorMul_S16_U8_Mod, mlib_VectorMul_S16_U8_Sat,
mlib_VectorMul_S16_S8_Mod, mlib_VectorMul_S16_S8_Sat,
mlib_VectorMul_S16_S16_Mod, mlib_VectorMul_S16_S16_Sat,
mlib_VectorMul_S16C_U8C_Mod, mlib_VectorMul_S16C_U8C_Sat,
mlib_VectorMul_S16C_S8C_Mod, mlib_VectorMul_S16C_S8C_Sat,
mlib_VectorMul_S16C_S16C_Mod, mlib_VectorMul_S16C_S16C_Sat,
mlib_VectorMul_S32_S16_Mod, mlib_VectorMul_S32_S16_Sat,
mlib_VectorMul_S32_S32_Mod, mlib_VectorMul_S32_S32_Sat,
mlib_VectorMul_S32C_S16C_Mod, mlib_VectorMul_S32C_S16C_Sat,
mlib_VectorMul_S32C_S32C_Mod, mlib_VectorMul_S32C_S32C_Sat – vector
multiplication

Synopsis  

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorMul_U8_U8_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_U8_U8_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_U8C_U8C_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_U8C_U8C_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S8_S8_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S8_S8_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S8C_S8C_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_U8_Mod(mlib_s16 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_U8_Sat(mlib_s16 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_S8_Mod(mlib_s16 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_S8_Sat(mlib_s16 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_S8_Sat(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_S16_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16_S16_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16C_U8C_Mod(mlib_s16 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16C_U8C_Sat(mlib_s16 *z,
    const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16C_S8C_Mod(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16C_S8C_Sat(mlib_s16 *z,
    const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16C_S16C_Mod(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S16C_S16C_Sat(mlib_s16 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32_S16_Mod(mlib_s32 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32_S16_Sat(mlib_s32 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32_S32_Mod(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32_S32_Sat(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32C_S16C_Mod(mlib_s32 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32C_S16C_Sat(mlib_s32 *z,
    const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32C_S32C_Mod(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorMul_S32C_S32C_Sat(mlib_s32 *z,
    const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);

**Description**  Each of these functions multiplies one vector by another vector.

For real data, the following equation is used:

\[ z[i] = x[i] \times y[i] \]
where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters**  Each of the functions takes the following arguments:

- \( z \)  Pointer to the first element of the destination vector.
- \( x \)  Pointer to the first element of the first source vector.
- \( y \)  Pointer to the first element of the second source vector.
- \( n \)  Number of elements in the vectors.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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<tbody>
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</table>

**See Also**  mlib_VectorMul_U8_U8_Mod(3MLIB), attributes(5)
mlib_VectorNorm_U8_Sat, mlib_VectorNorm_S8_Sat, mlib_VectorNorm_S16_Sat, mlib_VectorNorm_S32_Sat - vector norm

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorNorm_U8_Sat(mlib_d64 *z, const mlib_u8 *x, mlib_s32 n);
mlib_status mlib_VectorNorm_S8_Sat(mlib_d64 *z, const mlib_s8 *x, mlib_s32 n);
mlib_status mlib_VectorNorm_S16_Sat(mlib_d64 *z, const mlib_s16 *x, mlib_s32 n);
mlib_status mlib_VectorNorm_S32_Sat(mlib_d64 *z, const mlib_s32 *x, mlib_s32 n);

Description

Each of these functions computes the vector norm.

The following equation is used:

\[ \sum_{i=0}^{n-1} x[i]**2 \]

Parameters

Each of the functions takes the following arguments:

- \( z \) Pointer to the norm of the vector.
- \( x \) Pointer to the first element of the source vector.
- \( n \) Number of elements in the vectors.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

attributes(5)
The `mlib_VectorReverseByteOrder()` function changes the encoding of each element from big endian to little endian, or from little endian to big endian. It copies and reverses the byte order of each element of the input vector into the output vector.

**Parameters**
The function takes the following arguments:
- `z` Pointer to the output vector.
- `x` Pointer to the input vector.
- `n` Number of elements in the vectors.
- `s` Size of elements in bytes.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**
- `mlib_VectorReverseByteOrder_Inp(3MLIB)`,
- `mlib_VectorReverseByteOrder_S16(3MLIB)`,
- `mlib_VectorReverseByteOrder_S16_S16(3MLIB)`,
- `attributes(5)`
**Name**
mlib_VectorReverseByteOrder_Inp – reverse byte order of vector, in place

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorReverseByteOrder_Inp(void *xz,
   mlib_s32 n, mlib_s32 s);
```

**Description**
The `mlib_VectorReverseByteOrder_Inp()` function changes the encoding of each element from big endian to little endian, or from little endian to big endian.

It reverses the byte order of each element of the vector, in place.

**Parameters**
The function takes the following arguments:
- `xz` Pointer to the input and output vector.
- `n` Number of elements in the vectors.
- `s` Size of elements in bytes.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_VectorReverseByteOrder(3MLIB), mlib_VectorReverseByteOrder_S16(3MLIB), mlib_VectorReverseByteOrder_S16_S16(3MLIB), attributes(5)`
mlib_VectorReverseByteOrder_S16, mlib_VectorReverseByteOrder_U16,
mlib_VectorReverseByteOrder_S32, mlib_VectorReverseByteOrder_U32,
mlib_VectorReverseByteOrder_S64, mlib_VectorReverseByteOrder_U64,
mlib_VectorReverseByteOrder_F32, mlib_VectorReverseByteOrder_D64 – reverse byte
order of vector, in place

Synopsis
cc [-flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorReverseByteOrder_S16(mlib_s16 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_U16(mlib_u16 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_S32(mlib_s32 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_U32(mlib_u32 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_S64(mlib_s64 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_U64(mlib_u64 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_F32(mlib_f32 *xz,
mlib_s32 n);
mlib_status mlib_VectorReverseByteOrder_D64(mlib_d64 *xz,
mlib_s32 n);

Description
Each of these functions changes the encoding of each element from big endian to little endian,
or from little endian to big endian.

It reverses the byte order of each element of the vector, in place.

Parameters
Each of the functions takes the following arguments:
xz        Pointer to input and output vector.
n         Number of elements in the vectors.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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### mlib_VectorReverseByteOrder_S16(3MLIB)

<table>
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**See Also**  
mlib_VectorReverseByteOrder(3MLIB), mlib_VectorReverseByteOrder_Inp(3MLIB), mlib_VectorReverseByteOrder_S16_S16(3MLIB), attributes(5)
mlib_VectorReverseByteOrder_S16_S16, mlib_VectorReverseByteOrder_U16_U16,
mlib_VectorReverseByteOrder_S32_S32, mlib_VectorReverseByteOrder_U32_U32,
mlib_VectorReverseByteOrder_S64_S64, mlib_VectorReverseByteOrder_U64_U64,
mlib_VectorReverseByteOrder_F32_F32, mlib_VectorReverseByteOrder_D64_D64

Each of these functions changes the encoding of each element from big endian to little endian,
or from little endian to big endian.

It copies and reverses the byte order of each element of the input vector into the output vector.

Parameters
Each of the functions takes the following arguments:

- **z** Pointer to the output vector.
- **x** Pointer to input vector.
- **n** Number of elements in the vectors.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:
### mlib_VectorReverseByteOrder_S16_S16 (3MLIB)

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**See Also**  
`mlib_VectorReverseByteOrder(3MLIB), mlib_VectorReverseByteOrder_Inp(3MLIB), mlib_VectorReverseByteOrder_S16(3MLIB), attributes(5)`
Name  
mlib_VectorScale_U8_Mod, mlib_VectorScale_U8_Sat, mlib_VectorScale_U8C_Mod,  
mlib_VectorScale_U8C_Sat, mlib_VectorScale_S8_Mod, mlib_VectorScale_S8_Sat,  
mlib_VectorScale_S8C_Mod, mlib_VectorScale_S8C_Sat, mlib_VectorScale_S16_Mod,  
mlib_VectorScale_S16_Sat, mlib_VectorScale_S16C_Mod, mlib_VectorScale_S16C_Sat,  
mlib_VectorScale_S32_Mod, mlib_VectorScale_S32_Sat, mlib_VectorScale_S32C_Mod,  
mlib_VectorScale_S32C_Sat – vector linear scaling, in place

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorScale_U8_Mod(mlib_u8 *xz,  
    const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_U8_Sat(mlib_u8 *xz,  
    const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_U8C_Mod(mlib_u8 *xz,  
    const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_U8C_Sat(mlib_u8 *xz,  
    const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8_Mod(mlib_s8 *xz,  
    const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8_Sat(mlib_s8 *xz,  
    const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8C_Mod(mlib_s8 *xz,  
    const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8C_Sat(mlib_s8 *xz,  
    const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_Mod(mlib_s16 *xz,  
    const mlib_s16 *a, const mlib_s16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_Sat(mlib_s16 *xz,  
    const mlib_s16 *a, const mlib_s16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16C_Mod(mlib_s16 *xz,  
    const mlib_s16 *a, const mlib_s16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16C_Sat(mlib_s16 *xz,  
    const mlib_s16 *a, const mlib_s16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32_Mod(mlib_s32 *xz,  
    const mlib_s32 *a, const mlib_s32 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32_Sat(mlib_s32 *xz,  
    const mlib_s32 *a, const mlib_s32 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32C_Mod(mlib_s32 *xz,  
    const mlib_s32 *a, const mlib_s32 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32C_Sat(mlib_s32 *xz,  
const mlib_s32 *a, const mlib_s32 *b, mlib_s32 n);

Description  Each of these functions performs an in-place scaling of a vector by multiplying by a scalar and adding an offset.

For real data, the following equation is used:

\[ xz[i] = a[0] \cdot xz[i] + b[0] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\text{tmp} & = xz[2*i] \\
xz[2*i] & = a[0]\cdot\text{tmp} - a[1]\cdot xz[2*i + 1] + b[0] \\
xz[2*i + 1] & = a[1]\cdot\text{tmp} + a[0]\cdot xz[2*i + 1] + b[1]
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters  Each of the functions takes the following arguments:

\( xz \)  
Pointer to the first element of the source and destination vector.

\( a \)  
Pointer to the source scaling factor. When the function is used with complex data types, \( a[0] \) contains the real part of the scaling factor, and \( a[1] \) contains the imaginary part of the scaling factor.

\( b \)  
Pointer to the source offset. When the function is used with complex data types, \( b[0] \) contains the real part of the offset, and \( b[1] \) contains the imaginary part of the offset.

\( n \)  
Number of elements in the vectors.

Return Values  Each of the functions returns \texttt{MLIB\_SUCCESS} if successful. Otherwise it returns \texttt{MLIB\_FAILURE}.

Attributes  See attributes\( ^{(5)} \) for descriptions of the following attributes:

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</table>

See Also  \texttt{mlib\_VectorScale\_U8\_U8\_Mod(3MLIB)}, attributes\( ^{(5)} \)
Name mlib_VectorScale_U8_U8_Mod, mlib_VectorScale_U8_U8_Sat,
mlib_VectorScale_U8C_U8C_Mod, mlib_VectorScale_U8C_U8C_Sat,
mlib_VectorScale_S8_S8_Mod, mlib_VectorScale_S8_S8_Sat,
mlib_VectorScale_S8C_S8C_Mod, mlib_VectorScale_S8C_S8C_Sat,
mlib_VectorScale_S16_U8_Mod, mlib_VectorScale_S16_U8_Sat,
mlib_VectorScale_S16_S8_Mod, mlib_VectorScale_S16_S8_Sat,
mlib_VectorScale_S16_S16_Mod, mlib_VectorScale_S16_S16_Sat,
mlib_VectorScale_S16C_U8C_Mod, mlib_VectorScale_S16C_U8C_Sat,
mlib_VectorScale_S16C_S8C_Mod, mlib_VectorScale_S16C_S8C_Sat,
mlib_VectorScale_S16C_S16C_Mod, mlib_VectorScale_S16C_S16C_Sat,
mlib_VectorScale_S32_S16_Mod, mlib_VectorScale_S32_S16_Sat,
mlib_VectorScale_S32_S32_Mod, mlib_VectorScale_S32_S32_Sat--vectorlinear
scaling

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorScale_U8_U8_Mod(mlib_u8 *z, const mlib_u8 *x,
                                 const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_U8_U8_Sat(mlib_u8 *z, const mlib_u8 *x,
                                 const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_U8C_U8C_Mod(mlib_u8 *z, const mlib_u8 *x,
                                 const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_U8C_U8C_Sat(mlib_u8 *z, const mlib_u8 *x,
                                 const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8_S8_Mod(mlib_s8 *z, const mlib_s8 *x,
                                  const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8_S8_Sat(mlib_s8 *z, const mlib_s8 *x,
                                  const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8C_S8C_Mod(mlib_s8 *z, const mlib_s8 *x,
                                  const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S8C_S8C_Sat(mlib_s8 *z, const mlib_s8 *x,
                                  const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_U8_Mod(mlib_s16 *z, const mlib_u8 *x,
                                  const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_U8_Sat(mlib_s16 *z, const mlib_u8 *x,
                                  const mlib_u8 *a, const mlib_u8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_S8_Mod(mlib_s16 *z, const mlib_s8 *x,
                                  const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_S8_Sat(mlib_s16 *z, const mlib_s8 *x,
                                  const mlib_s8 *a, const mlib_s8 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_S16_Mod(mlib_s16 *z, const mlib_s16 *x,
                                  const mlib_s16 *a, const mlib_s16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16_S16_Sat(mlib_s16 *z, const mlib_s16 *x,
                                  const mlib_s16 *a, const mlib_s16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16C_S16C_Mod(mlib_s16 *z, const mlib_s16 *x,
                                   const mlib_s16C *a, const mlib_s16C *b, mlib_s32 n);
mlib_status mlib_VectorScale_S16C_S16C_Sat(mlib_s16 *z, const mlib_s16 *x,
                                   const mlib_s16C *a, const mlib_s16C *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32_S16_Mod(mlib_s32 *z, const mlib_s16 *x,
                                  const mlib_S16 *a, const mlib_S16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32_S16_Sat(mlib_s32 *z, const mlib_s16 *x,
                                  const mlib_S16 *a, const mlib_S16 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32_S32_Mod(mlib_s32 *z, const mlib_s32 *x,
                                  const mlib_s32 *a, const mlib_s32 *b, mlib_s32 n);
mlib_status mlib_VectorScale_S32_S32_Sat(mlib_s32 *z, const mlib_s32 *x,
                                  const mlib_s32 *a, const mlib_s32 *b, mlib_s32 n);
Each of these functions scales a vector by multiplying by a scalar and adding an offset. For real data, the following equation is used:

\[ z[i] = a[0] \times x[i] + b[0] \]
where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters** Each of the functions takes the following arguments:

- \( z \): Pointer to the first element of the destination vector.
- \( x \): Pointer to the first element of the source vector.
- \( a \): Pointer to the source scaling factor. When the function is used with complex data types, \( a[0] \) contains the real part of the scaling factor, and \( a[1] \) contains the imaginary part of the scaling factor.
- \( b \): Pointer to the source offset. When the function is used with complex data types, \( b[0] \) contains the real part of the offset, and \( b[1] \) contains the imaginary part of the offset.
- \( n \): Number of elements in the vectors.

**Return Values** Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Attributes** See attributes\(^{(5)}\) for descriptions of the following attributes:

<table>
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<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also** \texttt{mlib\_VectorScale\_U8\_U8\_Mod(3MLIB)}, attributes\(^{(5)}\)
Each of these functions sets a vector to a specified value.

For real data, the following equation is used:

\[ z[i] = c[0] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[ z[2*i] = c[0] \]
\[ z[2*i + 1] = c[1] \]

where \( i = 0, 1, \ldots, (n - 1) \).

Parameters
Each of the functions takes the following arguments:

- \( z \) Pointer to the first element of the destination vector.
- \( c \) Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scaling factor for the real part, and \( c[1] \) contains the scaling factor for the imaginary part.
- \( n \) Number of elements in the vector.
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also attributes(5)
**Name**  
mlib_VectorSplit_U8_U8C, mlib_VectorSplit_S8_S8C, mlib_VectorSplit_S16_S16C, mlib_VectorSplit_S32_S32C – vector split

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>  
mlib_status mlib_VectorSplit_U8_U8C(mlib_u8 *r, mlib_u8 *i,  
const mlib_u8 *x, mlib_s32 n);  
mlib_status mlib_VectorSplit_S8_S8C(mlib_s8 *r, mlib_s8 *i,  
const mlib_s8 *x, mlib_s32 n);  
mlib_status mlib_VectorSplit_S16_S16C(mlib_s16 *r, mlib_s16 *i,  
const mlib_s16 *x, mlib_s32 n);  
mlib_status mlib_VectorSplit_S32_S32C(mlib_s32 *r, mlib_s32 *i,  
const mlib_s32 *x, mlib_s32 n);

**Description**  
Each of these functions splits a complex vector into separate vectors containing the real and imaginary parts.

The following equation is used:

\[ r[k] = z[2*k] \]
\[ i[k] = z[2*k + 1] \]

where \( k = 0, 1, \ldots, (n - 1) \).

**Parameters**  
Each of the functions takes the following arguments:

- **r**  
  Pointer to the first element of the real part.

- **i**  
  Pointer to the first element of the imaginary part.

- **x**  
  Pointer to the first complex element of the source vector. \( x[2*k] \) contains the real part, and \( x[2*k + 1] \) contains the imaginary part.

- **n**  
  Number of elements in the vectors.

**Return Values**  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>
See Also  
mlib_VectorMerge_U8C_U8C(3MLIB), attributes(5)
### Name
mlib_VectorSubS_U8_Mod, mlib_VectorSubS_U8_Sat, mlib_VectorSubS_U8C_Mod, mlib_VectorSubS_U8C_Sat, mlib_VectorSubS_S8_Mod, mlib_VectorSubS_S8_Sat, mlib_VectorSubS_S8C_Mod, mlib_VectorSubS_S8C_Sat, mlib_VectorSubS_S16_Mod, mlib_VectorSubS_S16_Sat, mlib_VectorSubS_S16C_Mod, mlib_VectorSubS_S16C_Sat, mlib_VectorSubS_S32_Mod, mlib_VectorSubS_S32_Sat, mlib_VectorSubS_S32C_Mod, mlib_VectorSubS_S32C_Sat – vector subtraction from scalar, in place

### Synopsis
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorSubS_U8_Mod(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_U8_Sat(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_U8C_Mod(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_U8C_Sat(mlib_u8 *xz,
    const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8_Mod(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8_Sat(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8C_Mod(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8C_Sat(mlib_s8 *xz,
    const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16_Mod(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16_Sat(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_Mod(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_Sat(mlib_s16 *xz,
    const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32_Mod(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32_Sat(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32C_Mod(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32C_Sat(mlib_s32 *xz,
    const mlib_s32 *c, mlib_s32 n);
```
mlib_status mlib_VectorSubS_S32C_Sat(mlib_s32 *xz, const mlib_s32 *c, mlib_s32 n);

**Description**  Each of these functions performs an in-place subtraction of a vector from a scalar.

For real data, the following equation is used:

\[ xz[i] = c[0] - xz[i] \]

where \( i = 0, 1, \ldots, (n - 1) \).

For complex data, the following equation is used:

\[
\begin{align*}
\end{align*}
\]

where \( i = 0, 1, \ldots, (n - 1) \).

**Parameters**  Each of the functions takes the following arguments:

- \( xz \)  Pointer to the first element of the source and destination vector.
- \( c \)  Pointer to the source scalar. When the function is used with complex data types, \( c[0] \) contains the scalar for the real part, and \( c[1] \) contains the scalar for the imaginary part.
- \( n \)  Number of elements in the vectors.

**Return Values**  Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

**Attributes**  See attributes\((5)\) for descriptions of the following attributes:

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</tr>
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</table>

**See Also**  \texttt{mlib_VectorSubS_U8_U8_Mod(3MLIB)}, attributes\((5)\)
Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorSubS_U8_U8_Mod(mlib_u8 *z,
                   const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_U8_U8_Sat(mlib_u8 *z,
                   const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_U8C_U8C_Mod(mlib_u8 *z,
                   const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_U8C_U8C_Sat(mlib_u8 *z,
                   const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8_S8_Mod(mlib_s8 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8_S8_Sat(mlib_s8 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8C_S8C_Mod(mlib_s8 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S8C_S8C_Sat(mlib_s8 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16_S8_Mod(mlib_s16 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16_S8_Sat(mlib_s16 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16_S16_Mod(mlib_s16 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16_S16_Sat(mlib_s16 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_U8C_Mod(mlib_s16 *z,
                   const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_U8C_Sat(mlib_s16 *z,
                   const mlib_u8 *x, const mlib_u8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_S8C_Mod(mlib_s16 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_S8C_Sat(mlib_s16 *z,
                   const mlib_s8 *x, const mlib_s8 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_S16C_Mod(mlib_s16 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S16C_S16C_Sat(mlib_s16 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32_S16_Mod(mlib_s32 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32_S16_Sat(mlib_s32 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32C_S16C_Mod(mlib_s32 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
mlib_status mlib_VectorSubS_S32C_S16C_Sat(mlib_s32 *z,
                   const mlib_s16 *x, const mlib_s16 *c, mlib_s32 n);
Each of these functions subtracts a vector from a scalar.

For real data, the following equation is used:

\[ z[i] = c[0] - x[i] \]
where $i = 0, 1, \ldots, (n - 1)$.

For complex data, the following equation is used:

$z[2*i] = c[0] - x[2*i]$  
$z[2*i + 1] = c[1] - x[2*i + 1]$

where $i = 0, 1, \ldots, (n - 1)$.

**Parameters**  
Each of the functions takes the following arguments:

- $z$  
  Pointer to the first element of the destination vector.

- $x$  
  Pointer to the first element of the source vector.

- $c$  
  Pointer to the source scalar. When the function is used with complex data types, $c[0]$ contains the scalar for the real part, and $c[1]$ contains the scalar for the imaginary part.

- $n$  
  Number of elements in the vectors.

**Return Values**  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**  
mlib_VectorSubS_U8_U8_Mod(3MLIB), attributes(5)
mlib_VectorSub_U8_Mod, mlib_VectorSub_U8_Sat, mlib_VectorSub_U8C_Mod, mlib_VectorSub_U8C_Sat, mlib_VectorSub_S8_Mod, mlib_VectorSub_S8_Sat, mlib_VectorSub_S8C_Mod, mlib_VectorSub_S8C_Sat, mlib_VectorSub_S16_Mod, mlib_VectorSub_S16_Sat, mlib_VectorSub_S16C_Mod, mlib_VectorSub_S16C_Sat, mlib_VectorSub_S32_Mod, mlib_VectorSub_S32_Sat, mlib_VectorSub_S32C_Mod, mlib_VectorSub_S32C_Sat – vector subtraction, in place

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorSub_U8_Mod(mlib_u8 *xz,
        const mlib_u8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_U8_Sat(mlib_u8 *xz,
        const mlib_u8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_U8C_Mod(mlib_u8 *xz,
        const mlib_u8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_U8C_Sat(mlib_u8 *xz,
        const mlib_u8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_S8_Mod(mlib_s8  *xz,
        const mlib_s8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_S8_Sat(mlib_s8  *xz,
        const mlib_s8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_S8C_Mod(mlib_s8  *xz,
        const mlib_s8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_S8C_Sat(mlib_s8  *xz,
        const mlib_s8  *y, mlib_s32  n);
mlib_status mlib_VectorSub_S16_Mod(mlib_s16 *xz,
        const mlib_s16 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S16_Sat(mlib_s16 *xz,
        const mlib_s16 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S16C_Mod(mlib_s16 *xz,
        const mlib_s16 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S16C_Sat(mlib_s16 *xz,
        const mlib_s16 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S32_Mod(mlib_s32 *xz,
        const mlib_s32 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S32_Sat(mlib_s32 *xz,
        const mlib_s32 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S32C_Mod(mlib_s32 *xz,
        const mlib_s32 *y, mlib_s32  n);
mlib_status mlib_VectorSub_S32C_Sat(mlib_s32 *xz,
mlib_status mlib_VectorSub_S32C_Sat(mlib_s32 *xz,
    const mlib_s32 *y, mlib_s32 n);

Description Each of these functions performs an in-place subtraction of a vector from another vector.

It uses the following equation:

\[ xz[i] = xz[i] - y[i] \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2n - 1) \) for complex data.

Parameters Each of the functions takes the following arguments:

- **xz** Pointer to the first element of the first source and destination vector.
- **y** Pointer to the first element of the second source vector.
- **n** Number of elements in the vectors.

Return Values Each of the functions returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_VectorSub_U8_U8_Mod(3MLIB), attributes(5)
Name
mlib_VectorSub_U8_U8_Mod, mlib_VectorSub_U8_U8_Sat,
mlib_VectorSub_U8C_U8C_Mod, mlib_VectorSub_U8C_U8C_Sat,
mlib_VectorSub_S8_S8_Mod, mlib_VectorSub_S8_S8_Sat,
mlib_VectorSub_S8C_S8C_Mod, mlib_VectorSub_S8C_S8C_Sat,
mlib_VectorSub_S16_U8_Mod, mlib_VectorSub_S16_U8_Sat,
mlib_VectorSub_S16_S8_Mod, mlib_VectorSub_S16_S8_Sat,
mlib_VectorSub_S16_S16_Mod, mlib_VectorSub_S16_S16_Sat,
mlib_VectorSub_S16C_U8C_Mod, mlib_VectorSub_S16C_U8C_Sat,
mlib_VectorSub_S16C_S8C_Mod, mlib_VectorSub_S16C_S8C_Sat,
mlib_VectorSub_S16C_S16C_Mod, mlib_VectorSub_S16C_S16C_Sat,
mlib_VectorSub_S32_S16_Mod, mlib_VectorSub_S32_S16_Sat,
mlib_VectorSub_S32_S32_Mod, mlib_VectorSub_S32_S32_Sat,
mlib_VectorSub_S32C_S16C_Mod, mlib_VectorSub_S32C_S16C_Sat,
mlib_VectorSub_S32C_S32C_Mod, mlib_VectorSub_S32C_S32C_Sat – vector subtraction

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorSub_U8_U8_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_U8_U8_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_U8C_U8C_Mod(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_U8C_U8C_Sat(mlib_u8 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S8_S8_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S8_S8_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S8C_S8C_Mod(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S8C_S8C_Sat(mlib_s8 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16_U8_Mod(mlib_s16 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16_U8_Sat(mlib_s16 *z,
const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16_S8_Mod(mlib_s16 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16_S8_Sat(mlib_s16 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16_S16_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16_S16_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16C_S8C_Mod(mlib_s16 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16C_S8C_Sat(mlib_s16 *z,
const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16C_S16C_Mod(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S16C_S16C_Sat(mlib_s16 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S32_S16_Mod(mlib_s32 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S32_S16_Sat(mlib_s32 *z,
const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S32_S32_Mod(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S32_S32_Sat(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S32C_S32C_Mod(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
mlib_status mlib_VectorSub_S32C_S32C_Sat(mlib_s32 *z,
const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
### Description
Each of these functions subtracts one vector from another vector.

It uses the following equation:

\[ z[i] = x[i] - y[i] \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2n - 1) \) for complex data.

### Parameters
Each of the functions takes the following arguments:
Point to the first element of the destination vector.

$x$  Pointer to the first element of the first source vector.

$y$  Pointer to the first element of the second source vector.

$n$  Number of elements in the vectors.

**Return Values**  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**  mlib_VectorSub_U8_U8_Mod(3MLIB), attributes(5)
## mlib_VectorSumAbsDiff_U8_Sat(3MLIB)

**Name**
mlib_VectorSumAbsDiff_U8_Sat, mlib_VectorSumAbsDiff_S8_Sat,
mlib_VectorSumAbsDiff_S16_Sat, mlib_VectorSumAbsDiff_S32_Sat – sum of the absolute values of the differences of two vectors

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_VectorSumAbsDiff_U8_Sat(mlib_d64 *z, const mlib_u8 *x, const mlib_u8 *y, mlib_s32 n);
mlib_status mlib_VectorSumAbsDiff_S8_Sat(mlib_d64 *z, const mlib_s8 *x, const mlib_s8 *y, mlib_s32 n);
mlib_status mlib_VectorSumAbsDiff_S16_Sat(mlib_d64 *z, const mlib_s16 *x, const mlib_s16 *y, mlib_s32 n);
mlib_status mlib_VectorSumAbsDiff_S32_Sat(mlib_d64 *z, const mlib_s32 *x, const mlib_s32 *y, mlib_s32 n);
```

**Description**
Each of these functions computes the sum of the absolute values of the differences of two vectors.

The following equation is used:

\[
\begin{align*}
n-1 \\
z[0] &= \sum_{i=0}^{n-1} |x[i] - y[i]| \\
\end{align*}
\]

**Parameters**
Each of the functions takes the following arguments:
- **z** Pointer to the sum of the absolute differences between two vectors.
- **x** Pointer to the first element of the first source vector.
- **y** Pointer to the first element of the second source vector.
- **n** Number of elements in the vectors.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**
attributes(5)
Name: mlib_VectorSumAbs_U8_Sat, mlib_VectorSumAbs_S8_Sat, mlib_VectorSumAbs_S16_Sat, mlib_VectorSumAbs_S32_Sat - sum of the absolute values of a vector

Synopsis: cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorSumAbs_U8_Sat(mlib_d64 *z, const mlib_u8 *x, 
        mlib_s32 n);
mlib_status mlib_VectorSumAbs_S8_Sat(mlib_d64 *z, const mlib_s8 *x, 
        mlib_s32 n);
mlib_status mlib_VectorSumAbs_S16_Sat(mlib_d64 *z, const mlib_s16 *x, 
        mlib_s32 n);
mlib_status mlib_VectorSumAbs_S32_Sat(mlib_d64 *z, const mlib_s32 *x, 
        mlib_s32 n);

Description: Each of these functions computes the sum of the absolute values of a vector.

The following equation is used:

\[
z[0] = \sum_{i=0}^{n-1} |x[i]|
\]

Parameters: Each of the functions takes the following arguments:
- z Pointer to the sum of the absolute values of the vector.
- x Pointer to the first element of the first source vector.
- n Number of elements in the vectors.

Return Values: Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes: See attributes(5) for descriptions of the following attributes:

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</table>

See Also: attributes(5)
Name  

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VectorZero_U8(mlib_u8 *z, mlib_s32 n);
mlib_status mlib_VectorZero_U8C(mlib_u8 *z, mlib_s32 n);
mlib_status mlib_VectorZero_S8(mlib_s8 *z, mlib_s32 n);
mlib_status mlib_VectorZero_S8C(mlib_s8 *z, mlib_s32 n);
mlib_status mlib_VectorZero_S16(mlib_s16 *z, mlib_s32 n);
mlib_status mlib_VectorZero_S16C(mlib_s16 *z, mlib_s32 n);
mlib_status mlib_VectorZero_S32(mlib_s32 *z, mlib_s32 n);
mlib_status mlib_VectorZero_S32C(mlib_s32 *z, mlib_s32 n);

Description  
Each of these functions initializes a vector to zero.

The following equation is used:

\[ z[i] = 0 \]

where \( i = 0, 1, \ldots, (n - 1) \) for real data; \( i = 0, 1, \ldots, (2*n - 1) \) for complex data.

Parameters  
Each of the functions takes the following arguments:

\( z \)  
Pointer to the first element of the destination vector.

\( n \)  
Number of elements in the vector.

Return Values  
Each of the functions returns \texttt{MLIB_SUCCESS} if successful. Otherwise it returns \texttt{MLIB_FAILURE}.

Attributes  
See \texttt{attributes(5)} for descriptions of the following attributes:

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</table>

See Also  
\texttt{attributes(5)}
The `mlib_version()` function returns a string about the version of the library being used. This function returns a string in the following format:

```
lib_name:version:build_date:target_isa
```

The `lib_name` is `mediaLib`. The `version` consists of four digits. The first two digits of the version are the major version. The third digit is the minor version, and the fourth digit is the micro version. The `build_date` is in the `yyyymmdd` format. The `target_isa` is the value used for the `-xarch=a` flag of the compiler when the library was built. For example, the following version string corresponds to a library in `mediaLib` version 2.1.0, which was built on 11/01/2001 and for the `sparcv8plus+vis` architecture.

```
mediaLib:0210:20011101:v8plusa
```

**Parameters**
The function takes no argument.

**Return Values**
The function returns a pointer to a string of characters.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
attributes(5)
**mlib_VideoAddBlock_U8_S16**

**Name**  
mlib_VideoAddBlock_U8_S16 – adds motion-compensated 8x8 block to the current block

**Synopsis**  
```c
cc [ flag... ] file... -tmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoAddBlock_U8_S16(mlib_u8 *curr_block,
    const mlib_s16 *mc_block, mlib_s32 stride);
```

**Description**  
The `mlib_VideoAddBlock_U8_S16()` function performs additions of prediction and coefficient data. In other words, the function adds a motion-compensated 8x8 block to the current block. The stride applies to the current block.

**Parameters**  
The function takes the following arguments:

- `curr_block` Pointer to the current block. `curr_block` must be 8-byte aligned.
- `mc_block` Pointer to an 8x8 motion-compensated block (prediction data). `mc_block` must be 8-byte aligned.
- `stride` Stride, in bytes, between adjacent rows in the current block. `stride` must be a multiple of eight.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

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**See Also**  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB), mlib_VideoH263OverlappedMC_S16_U8(3MLIB), mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveX_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
The `mlib_VideoColorABGR2JFIFYCC420()` function performs color space conversion from ABGR to YCbCr together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- **y0**: Pointer to upper destination Y component row. y0 must be 8-byte aligned.
- **y1**: Pointer to lower destination Y component row. y1 must be 8-byte aligned.
- **cb**: Pointer to destination Cb component row. cb must be 8-byte aligned.
- **cr**: Pointer to destination Cr component row. cr must be 8-byte aligned.
- **abgr0**: Pointer to upper source ABGR multi-component row. abgr0 must be 8-byte aligned.
- **abgr1**: Pointer to lower source ABGR multi-component row. abgr1 must be 8-byte aligned.
- **n**: Length of Y component row. n must be even. The length of Cb and Cr component rows must be n/2. The length of the ABGR multi-component row must be 4*n.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See Also: `mlib_VideoColorABGR2JFIFYCC422(3MLIB)`, `mlib_VideoColorARGB2JFIFYCC420(3MLIB)`, `mlib_VideoColorARGB2JFIFYCC422(3MLIB)`, `mlib_VideoColorRGB2JFIFYCC420(3MLIB)`, `mlib_VideoColorRGB2JFIFYCC422(3MLIB)`, `attributes(5)`
The `mlib_VideoColorABGR2JFIFYCC422()` function performs color space conversion from ABGR to YCbCr together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

### Parameters

The function takes the following arguments:

- **y**: Pointer to destination Y component row. `y` must be 8-byte aligned.
- **cb**: Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- **cr**: Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- **abgr**: Pointer to source ABGR multi-component row. `abgr` must be 8-byte aligned.
- **n**: Length of Y component row. `n` must be even. The length of Cb and Cr component rows must be `n/2`. The length of the ABGR multi-component row must be `4*n`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

`mlib_VideoColorABGR2JFIFYCC420(3MLIB), mlib_VideoColorARGB2JFIFYCC420(3MLIB), mlib_VideoColorARGB2JFIFYCC422(3MLIB), mlib_VideoColorRGB2JFIFYCC420(3MLIB), mlib_VideoColorRGB2JFIFYCC422(3MLIB), attributes(5)"
The `mlib_VideoColorABGR2JFIFYCC444` function performs color space conversion from ABGR to YCbCr when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
\begin{align*}
Y &= 0.2990 \times R + 0.5870 \times G + 0.1140 \times B \\
Cb &= -0.16874 \times R - 0.33126 \times G + 0.50000 \times B + 128 \\
Cr &= 0.50000 \times R - 0.41869 \times G - 0.08131 \times B + 128
\end{align*}
\]

The function takes the following arguments:

- `y` Pointer to destination Y component row. `y` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `abgr` Pointer to source ABGR multi-component row. `abgr` must be 8-byte aligned.
- `n` Length of Y component row. The length of Cb and Cr component rows must be `n`. The length of the ABGR multi-component row must be `4*n`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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</tbody>
</table>

Multimedia Library Functions - Part 6
REFERENCE

Multimedia Library Functions - Part 7
Name  mlib_VideoColorABGR2RGB – color conversion

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

  mlib_status mlib_VideoColorABGR2RGB(mlib_u8 *rgb, const mlib_u8 */abgr,
                                     mlib_s32 n);

Description  The mlib_VideoColorABGR2RGB() function performs ABGR to RGB color order conversion.

Parameters  The function takes the following arguments:

  rgb  Pointer to RGB row.
  abgr  Pointer to ABGR row.
  n  Number of pixels.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_VideoColorARGB2RGB(3MLIB), mlib_VideoColorRGB2ABGR(3MLIB),
           mlib_VideoColorRGB2ARGB(3MLIB), attributes(5)
mlib_VideoColorABGRint_to_ARGBint(3MLIB)

**Name**: mlib_VideoColorABGRint_to_ARGBint – convert ABGR interleaved to ARGB

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
void mlib_VideoColorABGRint_to_ARGBint(mlib_u32 *ARGB,
                const mlib_u32 *ABGR, mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
                mlib_s32 slb);
```

**Description**
The ABGR pixel stream is broken apart and recombined into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. The buffers have dimensions \( w \) and \( h \). Within each 32-bit input word, the component ordering is \( A \) (bits 31-24), \( B \) (bits 23-16), \( G \) (bits 15-8), and \( R \) (bits 7-0). Within each 32-bit output word, the component ordering is \( A \) (bits 31-24), \( R \) (bits 23-16), \( G \) (bits 15-8), and \( B \) (bits 7-0).

**Parameters**
The function takes the following arguments:
- **ARGB** Pointer to output buffer.
- **ABGR** Pointer to input buffer.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for output buffer.
- **slb** Linebytes for input buffer.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_VideoColorRGBAint_to_ABGRint(3MLIB),
mlib_VideoColorBGRAint_to_ABGRint(3MLIB), attributes(5)
The `mlib_VideoColorARGB2JFIFYCC420()` function performs color space conversion from ARGB to YCbCr together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- `y0` Pointer to upper destination Y component row. `y0` must be 8-byte aligned.
- `y1` Pointer to lower destination Y component row. `y1` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `argb0` Pointer to upper source ARGB multi-component row. `argb0` must be 8-byte aligned.
- `argb1` Pointer to lower source ARGB multi-component row. `argb1` must be 8-byte aligned.
- `n` Length of Y component row. `n` must be even. The length of Cb and Cr component rows must be `n/2`. The length of the ARGB multi-component row must be `4*n`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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See Also `mlib_VideoColorABGR2JFIFYCC420(3MLIB), mlib_VideoColorABGR2JFIFYCC422(3MLIB), mlib_VideoColorARGB2JFIFYCC420(3MLIB), mlib_VideoColorARGB2JFIFYCC422(3MLIB), mlib_VideoColorRGB2JFIFYCC420(3MLIB), mlib_VideoColorRGB2JFIFYCC422(3MLIB), attributes(5)`. 

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_VideoColorARGB2JFIFYCC420(mlib_u8 *y0,
    mlib_u8 *y1, mlib_u8 *cb, mlib_u8 *cr,
    const mlib_u8 *argb0,
    const mlib_u8 *argb1, mlib_s32 n);
```
mlib_VideoColorARGB2JFIFYCC422 – ARGB to JFIF YCbCr color conversion

Synopsis
```
c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorARGB2JFIFYCC422(mlib_u8 *y, mlib_u8 *cb,
                                           mlib_u8 *cr,         const mlib_u8 *argb, mlib_s32 n);
```

Description
The `mlib_VideoColorARGB2JFIFYCC422()` function performs color space conversion from ARGB to YCbCr together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

Parameters
The function takes the following arguments:

- `y` Pointer to destination Y component row. `y` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `argb` Pointer to source ARGB multi-component row. `argb` must be 8-byte aligned.
- `n` Length of Y component row. `n` must be even. The length of Cb and Cr component rows must be `n/2`. The length of the ARGB multi-component row must be `4*n`.

Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_VideoColorABGR2JFIFYCC420(3MLIB), mlib_VideoColorABGR2JFIFYCC422(3MLIB),
mlib_VideoColorARGB2JFIFYCC420(3MLIB), mlib_VideoColorARGB2JFIFYCC422(3MLIB),
mlib_VideoColorRGB2JFIFYCC420(3MLIB), mlib_VideoColorRGB2JFIFYCC422(3MLIB), attributes(5)
**Synopsis**

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
mlib_status mlib_VideoColorARGB2JFIFYCC444(mlib_u8 *y,
                                           mlib_u8 *cb,
                                           mlib_u8 *cr,
                                           const mlib_u8 *argb,
                                           mlib_s32 n);
```

**Description**
The `mlib_VideoColorARGB2JFIFYCC444()` function performs color space conversion from ARGB to YCbCr when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
Y = 0.29900 \times R + 0.58700 \times G + 0.11400 \times B
\]

\[
Cb = -0.16874 \times R - 0.33126 \times G + 0.50000 \times B + 128
\]

\[
Cr = 0.50000 \times R - 0.41869 \times G - 0.08131 \times B + 128
\]

**Parameters**
The function takes the following arguments:

- `y` Pointer to destination Y component row. `y` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `argb` Pointer to source ARGB multi-component row. `rgb` must be 8-byte aligned.
- `n` Length of Y component row. The length of Cb and Cr component rows must be `n`. The length of the ARGB multi-component row must be `4*n`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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<tbody>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
`mlib_VideoColorABGR2JFIFYCC444(3MLIB), mlib_VideoColorRGB2JFIFYCC444(3MLIB), mlib_VideoColorRGB2JFIFYCC444_S16(3MLIB), attributes(5)`
The `mlib_VideoColorARGB2RGB()` function performs ARGB to RGB color order conversion. The function takes the following arguments:

- `rgb`        Pointer to RGB row.
- `argb`       Pointer to ARGB row.
- `n`          Number of pixels.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See **attributes(5)** for descriptions of the following attributes:

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</table>

### See Also

- `mlib_VideoColorABGR2RGB(3MLIB)`, `mlib_VideoColorRGB2ABGR(3MLIB)`, `mlib_VideoColorRGB2ARGB(3MLIB)`, attributes(5)
The `mlib_VideoColorBGR2JFIFYCC420()` function performs color space conversion from BGR to YCbCr together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- `y0` Pointer to upper destination Y component row. `y0` must be 8-byte aligned.
- `y1` Pointer to lower destination Y component row. `y1` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `bgr0` Pointer to upper source BGR multi-component row. `bgr0` must be 8-byte aligned.
- `bgr1` Pointer to lower source BGR multi-component row. `bgr1` must be 8-byte aligned.
- `n` Length of Y component row. `n` must be even. The length of Cb and Cr component rows must be `n/2`. The length of the BGR multi-component row must be `3*n`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_VideoColorBGR2JFIFYCC422(3MLIB), mlib_VideoColorBGR2JFIFYCC444(3MLIB), mlib_VideoColorBGR2JFIFYCC444_S16(3MLIB), attributes(5)`.
Name  mlib_VideoColorBGR2JFIFYCC422 – BGR to JFIF YCbCr color conversion

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
         #include <mlib.h>

         mlib_status mlib_VideoColorBGR2JFIFYCC422(mlib_u8 *y, mlib_u8 *cb,
               mlib_u8 *cr, const mlib_u8 *bgr, mlib_s32 n);

Description  The mlib_VideoColorBGR2JFIFYCC422() function performs color space conversion from
BGR to YCbCr together with sampling rate conversion when used in the JPEG File
Interchange Format (JFIF).

Parameters  The function takes the following arguments:

   y  Pointer to destination Y component row. y must be 8-byte aligned.
   cb Pointer to destination Cb component row. cb must be 8-byte aligned.
   cr Pointer to destination Cr component row. cr must be 8-byte aligned.
   bgr Pointer to source BGR multi-component row. bgr must be 8-byte aligned.
   n  Length of Y component row. n must be even. The length of Cb and Cr component
      rows must be n/2. The length of the BGR multi-component row must be 3*n.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_VideoColorBGR2JFIFYCC420(3MLIB), mlib_VideoColorBGR2JFIFYCC444(3MLIB),
          mlib_VideoColorBGR2JFIFYCC444_S16(3MLIB), attributes(5)
The *mlib_VideoColorBGR2JFIFYCC444()* function performs color space conversion from BGR to YCbCr when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
Y = 0.2990 \cdot R + 0.5870 \cdot G + 0.1140 \cdot B \\
Cb = -0.16874 \cdot R - 0.33126 \cdot G + 0.5000 \cdot B + 128 \\
Cr = 0.5000 \cdot R - 0.41869 \cdot G - 0.08131 \cdot B + 128
\]

**Parameters** The function takes the following arguments:

- **y** Pointer to destination Y component row. *y* must be 8-byte aligned.
- **cb** Pointer to destination Cb component row. *cb* must be 8-byte aligned.
- **cr** Pointer to destination Cr component row. *cr* must be 8-byte aligned.
- **bgr** Pointer to source BGR multi-component row. *bgr* must be 8-byte aligned.
- **n** Length of Y component row. The length of Cb and Cr component rows must be *n*. The length of the BGR multi-component row must be 3\( \times n \).

**Return Values** The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes** See *attributes*(5) for descriptions of the following attributes:

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**See Also** *mlib_VideoColorBGR2JFIFYCC420*(3MLIB), *mlib_VideoColorBGR2JFIFYCC422*(3MLIB), *mlib_VideoColorBGR2JFIFYCC444_S16*(3MLIB), *attributes*(5)
Name  
mlib_VideoColorBGR2JFIFYCC444_S16 - BGR to JFIF YCbCr color conversion

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorBGR2JFIFYCC444_S16(mlib_s16 *y, mlib_s16 *cb,
       mlib_s16 *cr, const mlib_s16 *bgr, mlib_s32 n);

Description  The mlib_VideoColorBGR2JFIFYCC444_S16() function performs color space conversion from BGR to YCbCr when used in the JPEG File Interchange Format (JFIF).

Both the input BGR components and the output YCbCr components are supposed to be in the range of [0, 4095].

The following equation is used:

\[ Y = 0.2990 \times R + 0.5870 \times G + 0.1140 \times B \]
\[ Cb = -0.16874 \times R - 0.33126 \times G + 0.50000 \times B + 2048 \]
\[ Cr = 0.50000 \times R - 0.41869 \times G - 0.08131 \times B + 2048 \]

Parameters  The function takes the following arguments:

\( y \)  Pointer to destination Y component row. \( y \) must be 8-byte aligned.
\( cb \)  Pointer to destination Cb component row. \( cb \) must be 8-byte aligned.
\( cr \)  Pointer to destination Cr component row. \( cr \) must be 8-byte aligned.
\( bgr \)  Pointer to source BGR multi-component row. \( bgr \) must be 8-byte aligned.
\( n \)  Length of Y component row. The length of Cb and Cr component rows must be \( n \). The length of the BGR multi-component row must be \( 3 \times n \).

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorBGR2JFIFYCC420(3MLIB), mlib_VideoColorBGR2JFIFYCC422(3MLIB), mlib_VideoColorBGR2JFIFYCC444(3MLIB), attributes(5)
void mlib_VideoColorBGRAint_to_ABGRint(mlib_u32 *ABGR, const mlib_u32 *BGRA, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);

The function takes the following arguments:

- **ABGR**: Pointer to output buffer.
- **BGRA**: Pointer to input buffer.
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **dlb**: Linebytes for output buffer.
- **slb**: Linebytes for input buffer.

None.

See also **mlib_VideoColorABGRint_to_ARGBint(3MLIB)**, **mlib_VideoColorRGBAint_to_ABGRint(3MLIB)**, **attributes(5)**
**Name**  
mlib_VideoColorBGRint_to_ABGRint – convert BGR interleaved to ABGR interleaved

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
void mlib_VideoColorBGRint_to_ABGRint(mlib_u32 *ABGR,
            const mlib_u8 *BGR, const mlib_u8 *A_array, mlib_u8 A_const,
            mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb, mlib_s32 alb);
```

**Description**  
The interleaved BGR stream, and the A values are combined into an A, B, G, R interleaved byte stream. Within each 24-bit input pixel, the component ordering is B (bits 23-16), G (bits 15-8), and R (bits 7-0). Within each 32-bit output word, the component ordering is A (bits 31-24), B (bits 23-16), G (bits 15-8), and R (bits 7-0).

The alpha values for this function work in the following fashion:

- If **A_array** pointer is not NULL, the values are taken from there. It has to have the same dimensions as the R, G, and B buffers.
- If **A_array** pointer is NULL, the alpha values for every pixel are set to **A_const**.

**Parameters**  
The function takes the following arguments:

- **ABGR**  
  Pointer to output buffer.
- **BGR**  
  Pointer to input buffer.
- **A_array**  
  Array of alpha values.
- **A_const**  
  Constant alpha value.
- **w**  
  Image width in pixels.
- **h**  
  Image height in lines.
- **dlb**  
  Line bytes for output buffer.
- **slb**  
  Line bytes for input buffer.
- **alb**  
  Line bytes for alpha buffer.

**Return Values**  
None.

**Attributes**  
See [attributes(5)] for descriptions of the following attributes:

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</tbody>
</table>
See Also

- mlib_VideoColorRGBseq_to_ABGRInt(3MLIB),
- mlib_VideoColorRGBInt_to_ABGRInt(3MLIB),
- mlib_VideoColorRGBXInt_to_ABGRInt(3MLIB),
- mlib_VideoColorRGBXInt_to_ARGBInt(3MLIB),
- mlib_VideoColorXRGBInt_to_ABGRInt(3MLIB),
- mlib_VideoColorXRGBInt_to_ARGBInt(3MLIB),
- attributes(5)
Name mlib_VideoColorBlendABGR, mlib_VideoColorBlendABGR_ResetAlpha – image blend

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorBlendABGR(mlib_u32 *dst,
const mlib_u32 *src1,const mlib_u32 *src2,
mlib_s32 src1_w, mlib_s32 src1_h,
mlib_s32 src2_w,mlib_s32 src2_h,
mlib_s32 src2_x, mlib_s32 src2_y,
mlib_s32 dst_lb,mlib_s32 src1_lb,
mlib_s32 src2_lb, mlib_blend src1_blend,
mlib_blend src2_blend);

void mlib_VideoColorBlendABGR_ResetAlpha(mlib_u32 *dst,
const mlib_u32 *src1,const mlib_u32 *src2,
mlib_s32 src1_w, mlib_s32 src1_h,
mlib_s32 src2_w,mlib_s32 src2_h,
mlib_s32 src2_x, mlib_s32 src2_y,
mlib_s32 dst_lb,mlib_s32 src1_lb,
mlib_s32 src2_lb, mlib_blend src1_blend,
mlib_blend src2_blend);

Description The functions use the following equation for blending images:

dst = (src1 * src1_blend) + (src2 * src2_blend)

The two multi-banded source images (src1 and src2) are blended together and stored in the destination image (dst). The image buffers pointed to by dst, src1, and src2 contain 4-banded ABGR images, 8 bits per component. src1_w and src1_h are the dimensions of the src1 input buffer. src2_w and src2_h are the dimensions of the src2 input buffer. The output buffer must be at least as large as the src1 input buffer. src2_x and src2_y are the offset of the src2 input buffer relative to src1. Where pixels in src2 overlap pixels in src1, the pixels are blended. Pixels in src1 which are outside of src2 are copied into dst. Pixels in the dst image outside of src1 are left unchanged. src1_blend specifies the blend function to be applied to the pixels of src1 image and src2_blend specifies the blend function to be applied to the pixels of src2.

Possible blend functions are:

MLIB_BLEND_ZERO
MLIB_BLEND_ONE
MLIB_BLEND_SRC_ALPHA
MLIB_BLEND_ONE_MINUS_SRC_ALPHA
MLIB_BLEND_DST_ALPHA
MLIB_BLEND_ONE_MINUS_DST_ALPHA

MLIB_BLEND_SRC_ALPHA is the alpha component of image src2 scaled to the range 0.0 to 1.0. MLIB_BLEND_DST_ALPHA is the alpha component of image src1 scaled to the range 0.0 to 1.0. All pixel components are treated as unsigned 8-bit quantities and the output pixel component values are clamped to the range 0 to 255.
For the `mlib_VideoColorBlendABGR_ResetAlpha()` function, the alpha value of every pixel in destination image is set to 0 after blending is complete.

**Parameters**

Each of the functions takes the following arguments:

- `dst` Pointer to output image.
- `src1` Pointer to 1st input image.
- `src2` Pointer to 2nd input image.
- `src1_w` `src1` image width in pixels.
- `src1_h` `src1` image height in rows.
- `src2_w` `src2` image width in pixels.
- `src2_h` `src2` image height in rows.
- `src2_x` `src2` horizontal displacement (in pixels), relative to the upper-left corner of `src1`.
- `src2_y` `src2` vertical displacement (in rows), relative to the upper-left corner of `src1`.
- `dst_lb` Linebytes for output image.
- `src1_lb` Linebytes for 1st input image.
- `src2_lb` Linebytes for 2nd input image.
- `src1_blend` Blend function for `src1` image.
- `src2_blend` Blend function for `src2` image.

**Return Values**

None.

**Attributes**

See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**

`mlib_VideoColorBlendABGR_Inp(3MLIB), attributes(5)`
The functions use the following equation for blending images:

\[ \text{src1dst} = (\text{src1dst} \times \text{src1dst\_blend}) + (\text{src2} \times \text{src2\_blend}) \]

The two multi-banded source images (src1dst and src2) are blended together and the result is stored in src1dst. src1dst\_blend specifies the blend function to be applied to the src1dst image and src2\_blend specifies the blend function to be applied to the src2 image. src2\_x and src2\_y specify position of src2 relative to the upper-left corner of src1dst. src2 is clipped to the boundaries of src1dst, if needed.

Possible blend functions are:

- MLIB_BLEND_ZERO
- MLIB_BLEND_ONE
- MLIB_BLEND_SRC_ALPHA
- MLIB_BLEND_ONE_MINUS_SRC_ALPHA
- MLIB_BLEND_DST_ALPHA
- MLIB_BLEND_ONE_MINUS_DST_ALPHA
- MLIB_BLEND_DST_ALPHA
- MLIB_BLEND_SRC_ALPHA
- MLIB_BLEND_ONE_MINUS_SRC_ALPHA
- MLIB_BLEND_DST_ALPHA
- MLIB_BLEND_ONE_MINUS_DST_ALPHA

MLIB_BLEND_DST_ALPHA is the alpha band of image src1 scaled to the range 0 to 1.
MLIB_BLEND_SRC_ALPHA is the alpha band of image src2 scaled to the range 0 to 1. The output pixel bands are clamped to the range 0 to 255.

For the mlib_VideoColorBlendABGR_ResetAlpha_Inp() function, the alpha value of every pixel in destination image is set to 0 after blending is complete.
Parameters Each of the functions takes the following arguments:

- `src1dst` Pointer to 1st input image (also dest. image).
- `src2` Pointer to 2nd input image.
- `src1dst_w` `src1dst` image width in pixels.
- `src1dst_h` `src1dst` image height in rows.
- `src2_w` `src2` image width in pixels.
- `src2_h` `src2` image height in rows.
- `src2_x` `src2` horizontal displacement (in pixels), relative to the upper-left corner of `src1dst`.
- `src2_y` `src2` vertical displacement (in rows), relative to the upper-left corner of `src1dst`.
- `src1dst_lb` Linebytes for `src1dst` image.
- `src2_lb` Linebytes for `src2` image.
- `src1dst_blend` Blend function for `src1dst` image.
- `src2_blend` Blend function for `src2` image.

Return Values None.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_VideoColorBlendABGR(3MLIB), attributes(5)
#include <mlib.h>

mlib_status mlib_VideoColorCMYK2JFIFYCCK444(mlib_u8 *y, mlib_u8 *cb, mlib_u8 *cr, mlib_u8 *k, const mlib_u8 *cmyk, mlib_s32 n);

The mlib_VideoColorCMYK2JFIFYCCK444() function performs color space conversion from CMYK to YCbCrK when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
\begin{align*}
R &= 255 - C \\
G &= 255 - M \\
B &= 255 - Y \\
Y &= 0.29900 \times R + 0.58700 \times G + 0.11400 \times B \\
Cb &= -0.16874 \times R - 0.33126 \times G + 0.50000 \times B + 128 \\
Cr &= 0.50000 \times R - 0.41869 \times G - 0.08131 \times B + 128 \\
K &= K
\end{align*}
\]

The function takes the following arguments:

- **y**: Pointer to destination Y component row. y must be 8-byte aligned.
- **cb**: Pointer to destination Cb component row. cb must be 8-byte aligned.
- **cr**: Pointer to destination Cr component row. cr must be 8-byte aligned.
- **k**: Pointer to destination K component row. k must be 8-byte aligned.
- **cmyk**: Pointer to source CMYK multi-component row. cmyk must be 8-byte aligned.
- **n**: Length of Y, Cb, Cr, and K component rows. The length of the CMYK multi-component row must be 4*n.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

## Attributes

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</table>

See Also: mlib_VideoColorJFIFYCCK2CMYK444(3MLIB), attributes(5)
The `mlib_VideoColorJFIFYCC2ABGR444()` function performs color space conversion from YCbCr to ABGR when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
\begin{align*}
A &= 0xFF \\
R &= Y + 1.40200 \times (Cr - 128) \\
G &= Y - 0.34414 \times (Cb - 128) - 0.71414 \times (Cr - 128) \\
B &= Y + 1.77200 \times (Cb - 128)
\end{align*}
\]

**Parameters**

- **abgr** Pointer to destination ABGR multi-component row. abgr must be 8-byte aligned.
- **y** Pointer to source Y component row. y must be 8-byte aligned.
- **cb** Pointer to source Cb component row. cb must be 8-byte aligned.
- **cr** Pointer to source Cr component row. cr must be 8-byte aligned.
- **n** Length of Y component row. The length of Cb and Cr component rows must be n. The length of the ABGR multi-component row must be 4*n.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

`mlib_VideoColorJFIFYCC2ARGB444(3MLIB)`, `mlib_VideoColorJFIFYCC2RGB444(3MLIB)`, `mlib_VideoColorJFIFYCC2RGB444_S16(3MLIB)`, attributes(5)
mlib_VideoColorJFIFYCC2ARGB444() – JFIF YCbCr to ARGB color conversion

The `mlib_VideoColorJFIFYCC2ARGB444()` function performs color space conversion from YCbCr to ARGB when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
\begin{align*}
A &= 0xFF \\
R &= Y + 1.40200 \times (Cr - 128) \\
G &= Y - 0.34414 \times (Cb - 128) - 0.71414 \times (Cr - 128) \\
B &= Y + 1.77200 \times (Cb - 128)
\end{align*}
\]

The function takes the following arguments:

- `argb` Pointer to destination ARGB multi-component row. `argb` must be 8-byte aligned.
- `y` Pointer to source Y component row. `y` must be 8-byte aligned.
- `cb` Pointer to source Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to source Cr component row. `cr` must be 8-byte aligned.
- `n` Length of Y component row. The length of Cb and Cr component rows must be `n`. The length of the ARGB multi-component row must be \(4n\).

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See also `mlib_VideoColorJFIFYCC2ARGB444(3MLIB), mlib_VideoColorJFIFYCC2RGB444(3MLIB), mlib_VideoColorJFIFYCC2RGB444_S16(3MLIB), attributes(5)`
The `mlib_VideoColorJFIFYCC2RGB420()` function performs color space conversion from YCbCr to RGB together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

### Parameters

- **rgb0**  
  Pointer to upper destination RGB multi-component row. rgb0 must be 8-byte aligned.

- **rgb1**  
  Pointer to lower destination RGB multi-component row. rgb1 must be 8-byte aligned.

- **y0**  
  Pointer to upper destination Y component row. y0 must be 8-byte aligned.

- **y1**  
  Pointer to lower destination Y component row. y1 must be 8-byte aligned.

- **cb0**  
  Pointer to source upper Cb component row. cb0 must be 8-byte aligned.

- **cr0**  
  Pointer to source upper Cr component row. cr0 must be 8-byte aligned.

- **cb1**  
  Pointer to source middle Cb component row. cb1 must be 8-byte aligned.

- **cr1**  
  Pointer to source middle Cr component row. cr1 must be 8-byte aligned.

- **cb2**  
  Pointer to source lower Cb component row. cb2 must be 8-byte aligned.

- **cr2**  
  Pointer to source lower Cr component row. cr2 must be 8-byte aligned.

- **n**  
  Length of Y component row. n must be even. The length of Cb and Cr component rows must be n/2. The length of the RGB multi-component row must be 3*n.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTETYPE</th>
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</tbody>
</table>
See Also  mlib_VideoColorJFIFYCC2RGB420_Nearest(3MLIB),
mlib_VideoColorJFIFYCC2RGB422(3MLIB),
mlib_VideoColorJFIFYCC2RGB422_Nearest(3MLIB), attributes(5)
The `mlib_VideoColorJFIFYCC2RGB420_Nearest()` function performs color space conversion from YCbCr to RGB together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- `rgb0` Pointer to upper destination RGB multi-component row. `rgb0` must be 8-byte aligned.
- `rgb1` Pointer to lower destination RGB multi-component row. `rgb1` must be 8-byte aligned.
- `y0` Pointer to upper destination Y component row. `y0` must be 8-byte aligned.
- `y1` Pointer to lower destination Y component row. `y1` must be 8-byte aligned.
- `cb` Pointer to source Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to source Cr component row. `cr` must be 8-byte aligned.
- `n` Length of Y component row. `n` must be even. The length of Cb and Cr component rows must be `n/2`. The length of the RGB multi-component row must be `3*n`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See also `mlib_VideoColorJFIFYCC2RGB420(3MLIB), mlib_VideoColorJFIFYCC2RGB422(3MLIB), mlib_VideoColorJFIFYCC2RGB422_Nearest(3MLIB), attributes(5)`
Name  
mlib_VideoColorJFIFYCC2RGB422 – JFIF YCbCr to RGB color conversion

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorJFIFYCC2RGB422(mlib_u8 *rgb,
   const mlib_u8 *y, const mlib_u8 *cb,
   const mlib_u8 *cr, mlib_s32 n);

Description  
The mlib_VideoColorJFIFYCC2RGB422() function performs color space conversion from
YCbCr to RGB together with sampling rate conversion when used in the JPEG File
Interchange Format (JFIF).

Parameters  
The function takes the following arguments:
rgb  Pointer to destination RGB multi-component row. rgb must be 8-byte aligned.
y  Pointer to destination Y component row. y must be 8-byte aligned.
     cb  Pointer to source Cb component row. cb must be 8-byte aligned.
     cr  Pointer to source Cr component row. cr must be 8-byte aligned.
     n  Length of Y component row. n must be even. The length of Cb and Cr component
rows must be n/2. The length of the RGB multi-component row must be 3*n.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoColorJFIFYCC2RGB420(3MLIB),
mlib_VideoColorJFIFYCC2RGB420_Nearest(3MLIB),
mlib_VideoColorJFIFYCC2RGB422_Nearest(3MLIB), attributes(5)
The `mlib_VideoColorJFIFYCC2RGB422_Nearest()` function performs color space conversion from YCbCr to RGB together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

### Parameters
- `rgb` Pointer to destination RGB multi-component row. rgb must be 8-byte aligned.
- `y` Pointer to destination Y component row. y must be 8-byte aligned.
- `cb` Pointer to source Cb component row. cb must be 8-byte aligned.
- `cr` Pointer to source Cr component row. cr must be 8-byte aligned.
- `n` Length of Y component row. n must be even. The length of Cb and Cr component rows must be n/2. The length of the RGB multi-component row must be 3*n.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_VideoColorJFIFYCC2RGB420(3MLIB)`,
- `mlib_VideoColorJFIFYCC2RGB420_Nearest(3MLIB)`,
- `mlib_VideoColorJFIFYCC2RGB422(3MLIB)`, attributes(5)
The `mlib_VideoColorJFIFYCC2RGB444()` function performs color space conversion from YCbCr to RGB when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
R = Y + 1.40200 \times (Cr - 128) \\
G = Y - 0.34414 \times (Cb - 128) - 0.71414 \times (Cr - 128) \\
B = Y + 1.77200 \times (Cb - 128)
\]

The function takes the following arguments:

- `rgb` Pointer to destination RGB multi-component row. rgb must be 8-byte aligned.
- `y` Pointer to source Y component row. y must be 8-byte aligned.
- `cb` Pointer to source Cb component row. cb must be 8-byte aligned.
- `cr` Pointer to source Cr component row. cr must be 8-byte aligned.
- `n` Length of Y component row. The length of Cb and Cr component rows must be n. The length of the RGB multi-component row must be 3*n.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `malib_VideoColorJFIFYCC2ABGR444`, `mlib_VideoColorJFIFYCC2ARGB444`, `mlib_VideoColorJFIFYCC2RGB444_S16`, `attributes(5)`.
The `mlib_VideoColorJFIFYCC2RGB444_S16()` function performs color space conversion from YCbCr to RGB when used in the JPEG File Interchange Format (JFIF).

Both the input YCbCr components and the output RGB components are supposed to be in the range of [0, 4095].

The following equation is used:

\[
R = Y + 1.40200 \times (Cr - 2048) \\
G = Y - 0.34414 \times (Cb - 2048) - 0.71414 \times (Cr - 2048) \\
B = Y + 1.77200 \times (Cb - 2048)
\]

The function takes the following arguments:

- `rgb` Pointer to destination RGB multi-component row. rgb must be 8-byte aligned.
- `y` Pointer to source Y component row. y must be 8-byte aligned.
- `cb` Pointer to source Cb component row. cb must be 8-byte aligned.
- `cr` Pointer to source Cr component row. cr must be 8-byte aligned.
- `n` Length of Y component row. The length of Cb and Cr component rows must be n. The length of the RGB multi-component row must be 3*n.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See `attributes(5)` for descriptions of the following attributes:

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</table>

See Also `mlib_VideoColorJFIFYCC2RGB444(3MLIB)`,
The `mlib_VideoColorJFIFYCCK2CMYK444()` function performs color space conversion from YCbCrK to CMYK when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
\begin{align*}
R &= Y + 1.40200 \times (Cr - 128) \\
G &= Y - 0.34414 \times (Cb - 128) - 0.71414 \times (Cr - 128) \\
B &= Y + 1.77200 \times (Cb - 128) \\
C &= (255 - R) \\
M &= (255 - G) \\
Y &= (255 - B) \\
K &= K
\end{align*}
\]

The function takes the following arguments:

- `cmyk` Pointer to destination CMYK multi-component row. cmyk must be 8-byte aligned.
- `y` Pointer to source Y component row. y must be 8-byte aligned.
- `cb` Pointer to source Cb component row. cb must be 8-byte aligned.
- `cr` Pointer to source Cr component row. cr must be 8-byte aligned.
- `k` Pointer to source K component row. k must be 8-byte aligned.
- `n` Length of Y, Cb, Cr, and K component rows. The length of the CMYK multi-component row must be 4*n.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_VideoColorCMYK2JFIFYCCK444(3MLIB), attributes(5)`
# mlib_VideoColorMerge2 — color conversion (color channel merge)

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_VideoColorMerge2(mlib_u8 *colors,
const mlib_u8 *color1,const mlib_u8 *color2,
mlib_s32 n);
```

## Description

The `mlib_VideoColorMerge2()` function performs color channel merge.

## Parameters

The function takes the following arguments:

- `colors`  
  Pointer to colors multi-component row. colors must be 8-byte aligned.

- `color1`  
  Pointer to first color component row. color1 must be 8-byte aligned.

- `color2`  
  Pointer to second color component row. color2 must be 8-byte aligned.

- `n`  
  Length of color1 and color2 arrays. Length of colors must be 2\(^n\).

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

- `mlib_VideoColorMerge2_S16(3MLIB)`
- `mlib_VideoColorMerge3(3MLIB)`
- `mlib_VideoColorMerge3_S16(3MLIB)`
- `mlib_VideoColorMerge4(3MLIB)`
- `mlib_VideoColorMerge4_S16(3MLIB)`
- `mlib_VideoColorSplit2(3MLIB)`
- `mlib_VideoColorSplit2_S16(3MLIB)`
- `mlib_VideoColorSplit3(3MLIB)`
- `mlib_VideoColorSplit3_S16(3MLIB)`
- `mlib_VideoColorSplit4(3MLIB)`
- `mlib_VideoColorSplit4_S16(3MLIB)`
- `attributes(5)`
mlib_VideoColorMerge2_S16 - color conversion (color channel merge)

Synopsis

cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorMerge2_S16(mlib_s16 *colors,
const mlib_s16 *color1, const mlib_s16 *color2,
mlib_s32 n);

Description

The mlib_VideoColorMerge2_S16() function performs color channel merge.

Parameters

The function takes the following arguments:

- colors: Pointer to colors multi-component row. Colors must be 8-byte aligned.
- color1: Pointer to first color component row. Color1 must be 8-byte aligned.
- color2: Pointer to second color component row. Color2 must be 8-byte aligned.
- n: Length of color1 and color2 arrays. Length of colors must be 2*n.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge3(3MLIB),
mlib_VideoColorMerge3_S16(3MLIB), mlib_VideoColorMerge4(3MLIB),
mlib_VideoColorMerge4_S16(3MLIB), mlib_VideoColorSplit2(3MLIB),
mlib_VideoColorSplit2_S16(3MLIB), mlib_VideoColorSplit3(3MLIB),
mlib_VideoColorSplit3_S16(3MLIB), mlib_VideoColorSplit4(3MLIB),
mlib_VideoColorSplit4_S16(3MLIB), attributes(5)
mlib_VideoColorMerge3 – color conversion (color channel merge)

Synopsis  
cc [ flag... ] file... -tlib [ library... ] 
#include <mlib.h>

mlib_status mlib_VideoColorMerge3(mlib_u8 *colors, const mlib_u8 *color1, 
const mlib_u8 *color2, const mlib_u8 *color3, mlib_s32 n);

Description The mlib_VideoColorMerge3() function performs color channel merge.

Parameters The function takes the following arguments:

colors Pointer to colors multi-component row. colors must be 8-byte aligned.
color1 Pointer to first color component row. color1 must be 8-byte aligned.
color2 Pointer to second color component row. color2 must be 8-byte aligned.
color3 Pointer to third color component row. color3 must be 8-byte aligned.
n Length of color1, color2 and color3 arrays. Length of colors must be 3*n.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge2_S16(3MLIB), mlib_VideoColorMerge3_S16(3MLIB), mlib_VideoColorMerge4(3MLIB), mlib_VideoColorMerge4_S16(3MLIB), mlib_VideoColorSplit2(3MLIB), mlib_VideoColorSplit2_S16(3MLIB), mlib_VideoColorSplit3(3MLIB), mlib_VideoColorSplit3_S16(3MLIB), mlib_VideoColorSplit4(3MLIB), mlib_VideoColorSplit4_S16(3MLIB), attributes(5)
The `mlib_VideoColorMerge3_S16()` function performs color channel merge.

**Parameters**
- `colors`: Pointer to colors multi-component row. Colors must be 8-byte aligned.
- `color1`: Pointer to first color component row. `color1` must be 8-byte aligned.
- `color2`: Pointer to second color component row. `color2` must be 8-byte aligned.
- `color3`: Pointer to third color component row. `color3` must be 8-byte aligned.
- `n`: Length of `color1`, `color2` and `color3` arrays. Length of colors must be `3*n`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- `mlib_VideoColorMerge2(3MLIB)`, `mlib_VideoColorMerge2_S16(3MLIB)`,
- `mlib_VideoColorMerge3(3MLIB)`, `mlib_VideoColorMerge4(3MLIB)`,
- `mlib_VideoColorMerge4_S16(3MLIB)`,
Name  mlib_VideoColorMerge4 – color conversion (color channel merge)

Synopsis  
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorMerge4(mlib_u8 *colors, const mlib_u8 *color1,
        const mlib_u8 *color2, const mlib_u8 *color3, const mlib_u8 *color4,
        mlib_s32 n);
```

Description  The mlib_VideoColorMerge4() function performs color channel merge.

Parameters  The function takes the following arguments:

- **colors**: Pointer to colors multi-component row. colors must be 8-byte aligned.
- **color1**: Pointer to first color component row. color1 must be 8-byte aligned.
- **color2**: Pointer to second color component row. color2 must be 8-byte aligned.
- **color3**: Pointer to third color component row. color3 must be 8-byte aligned.
- **color4**: Pointer to fourth color component row. color4 must be 8-byte aligned.
- **n**: Length of color1, color2, color3, and color4 arrays. Length of colors must be 4*n.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge2_S16(3MLIB),
          mlib_VideoColorMerge3(3MLIB), mlib_VideoColorMerge3_S16(3MLIB),
          mlib_VideoColorMerge4_S16(3MLIB), mlib_VideoColorSplit2(3MLIB),
          mlib_VideoColorSplit2_S16(3MLIB), mlib_VideoColorSplit3(3MLIB),
          mlib_VideoColorSplit3_S16(3MLIB), mlib_VideoColorSplit4(3MLIB),
          mlib_VideoColorSplit4_S16(3MLIB), attributes(5)
Name  mlib_VideoColorMerge4_S16 – color conversion (color channel merge)

Synopsis  
`cc [ flag... ] file... -lmlib [ library... ]`

```c
#include <mlib.h>
mlib_status mlib_VideoColorMerge4_S16(mlib_s16 *colors,
    const mlib_s16 *color1, const mlib_s16 *color2,
    const mlib_s16 *color3, const mlib_s16 *color4,
    mlib_s32 n);
```

Description  The `mlib_VideoColorMerge4_S16()` function performs color channel merge.

Parameters  The function takes the following arguments:

- `colors`  Pointer to colors multi-component row. colors must be 8-byte aligned.
- `color1`  Pointer to first color component row. color1 must be 8-byte aligned.
- `color2`  Pointer to second color component row. color2 must be 8-byte aligned.
- `color3`  Pointer to third color component row. color3 must be 8-byte aligned.
- `color4`  Pointer to fourth color component row. color4 must be 8-byte aligned.
- `n`  Length of color1, color2, color3, and color4 arrays. Length of colors must be 4*n.

Return Values  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  See `attributes(5)` for descriptions of the following attributes:

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See Also  `mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge2_S16(3MLIB), mlib_VideoColorMerge3(3MLIB), mlib_VideoColorMerge3_S16(3MLIB), mlib_VideoColorMerge4(3MLIB), mlib_VideoColorSplit2(3MLIB), mlib_VideoColorSplit2_S16(3MLIB), mlib_VideoColorSplit3(3MLIB), mlib_VideoColorSplit3_S16(3MLIB), mlib_VideoColorSplit4(3MLIB), mlib_VideoColorSplit4_S16(3MLIB), attributes(5)`
The mlib_VideoColorResizeABGR() function resizes the source image with dimensions src_w, src_h into the destination image with dimensions dst_w, dst_h using nearest-neighbor, bilinear interpolation, or bicubic interpolation. The source buffer can contain multi-banded pixel stream, in which case, each band is resized independently. Edge conditions are handled according to the MLIB_EDGE_SRC_EXTEND scheme.

The function takes the following arguments:

- **dst**  Pointer to output image.
- **src**  Pointer to input image.
- **dst_w**  Output image width in pixels.
- **dst_h**  Output image height in rows.
- **dst_lb**  Input image width in pixels.
- **src_w**  Linebytes for input buffer.
- **src_h**  Input image height in lines.
- **src_lb**  Linebytes for input image.
- **filter**  Type of interpolation filter. It can be one of the following:
  - MLIB_NEAREST
  - MLIB_BILINEAR
  - MLIB_BICUBIC

None.

See attributes(5) for descriptions of the following attributes:

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See Also attributes(5)
mlib_VideoColorRGB2ABGR() – color conversion

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorRGB2ABGR(mlib_u8 *abgr, const mlib_u8 *rgb,
mlib_s32 n);

Description

The mlib_VideoColorRGB2ABGR() function performs RGB to ABGR color order conversion.

Parameters

The function takes the following arguments:

- `abgr` Pointer to ABGR row.
- `rgb` Pointer to RGB row.
- `n` Number of pixels.

Return Values

The function returns MLI_SUCCESS if successful. Otherwise it returns MLI_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_VideoColorABGR2RGB(3MLIB), mlib_VideoColorARGB2RGB(3MLIB),
mlib_VideoColorRGB2ARGB(3MLIB), attributes(5)
The `mlib_VideoColorRGB2ARGB()` function performs RGB to ARGB color order conversion.

### Description
The `mlib_VideoColorRGB2ARGB()` function takes the following arguments:

- `argb` Pointer to ARGB row.
- `rgb` Pointer to RGB row.
- `n` Number of pixels.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
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### See Also
- `mlib_VideoColorABGR2RGB(3MLIB)`, `mlib_VideoColorRGB2RGB(3MLIB)`, `mlib_VideoColorRGB2ABGR(3MLIB)`, `attributes(5)`
# mlib_VideoColorRGB2JFIFYCC420(3MLIB)

**Name**  
mlib_VideoColorRGB2JFIFYCC420 – RGB to JFIF YCbCr color conversion

**Synopsis**  
```c
#include <mlib.h>

mlib_status mlib_VideoColorRGB2JFIFYCC420(mlib_u8 *y0, mlib_u8 *y1,
    mlib_u8 *cb, mlib_u8 *cr, const mlib_u8 *rgb0, const mlib_u8 *rgb1,
    mlib_s32 n);
```

**Description**  
The `mlib_VideoColorRGB2JFIFYCC420()` function performs color space conversion from RGB to YCbCr together with sampling rate conversion when used in the JPEG File Interchange Format (JFIF).

**Parameters**  
The function takes the following arguments:

- `y0`  
  Pointer to upper destination Y component row. `y0` must be 8-byte aligned.

- `y1`  
  Pointer to lower destination Y component row. `y1` must be 8-byte aligned.

- `cb`  
  Pointer to destination Cb component row. `cb` must be 8-byte aligned.

- `cr`  
  Pointer to destination Cr component row. `cr` must be 8-byte aligned.

- `rgb0`  
  Pointer to upper source RGB multi-component row. `rgb0` must be 8-byte aligned.

- `rgb1`  
  Pointer to lower source RGB multi-component row. `rgb1` must be 8-byte aligned.

- `n`  
  Length of Y component row. `n` must be even. The length of Cb and Cr component rows must be `n/2`. The length of the RGB multi-component row must be `3*n`.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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<tr>
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<td>MT-Safe</td>
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</tbody>
</table>

**See Also**  
mlib_VideoColorABGR2JFIFYCC420(3MLIB), mlib_VideoColorABGR2JFIFYCC422(3MLIB), mlib_VideoColorRGB2JFIFYCC420(3MLIB), mlib_VideoColorRGB2JFIFYCC422(3MLIB), attributes(5)
Name  
mlib_VideoColorRGB2JFIFYCC422 – RGB to JFIF YCbCr color conversion

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_VideoColorRGB2JFIFYCC422(mlib_u8 *y, mlib_u8 *cb,  
mlib_u8 *cr, const mlib_u8 *rgb, mlib_s32 n);

Description  
The mlib_VideoColorRGB2JFIFYCC422() function performs color space conversion from  
RGB to YCbCr together with sampling rate conversion when used in the JPEG File  
Interchange Format (JFIF).

Parameters  
The function takes the following arguments:

- **y**  
  Pointer to destination Y component row. y must be 8-byte aligned.

- **cb**  
  Pointer to destination Cb component row. cb must be 8-byte aligned.

- **cr**  
  Pointer to destination Cr component row. cr must be 8-byte aligned.

- **rgb**  
  Pointer to source RGB multi-component row. rgb must be 8-byte aligned.

- **n**  
  Length of Y component row. n must be even. The length of Cb and Cr component  
  rows must be n/2. The length of the RGB multi-component row must be 3*n.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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</table>

See Also  
mlib_VideoColorABGR2JFIFYCC420(3MLIB), mlib_VideoColorABGR2JFIFYCC422(3MLIB),  
mlib_VideoColorARGB2JFIFYCC420(3MLIB), mlib_VideoColorARGB2JFIFYCC422(3MLIB),  
mlib_VideoColorRGB2JFIFYCC420(3MLIB), attributes(5)
The `mlib_VideoColorRGB2JFIFYCC444()` function performs color space conversion from RGB to YCbCr when used in the JPEG File Interchange Format (JFIF).

The following equation is used:

\[
Y = 0.2990 \times R + 0.5870 \times G + 0.1140 \times B \\
Cb = -0.16874 \times R - 0.33126 \times G + 0.50000 \times B + 128 \\
Cr = 0.50000 \times R - 0.41869 \times G - 0.08131 \times B + 128
\]

### Parameters

The function takes the following arguments:

- `y` Pointer to destination Y component row. `y` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `rgb` Pointer to source RGB multi-component row. `rgb` must be 8-byte aligned.
- `n` Length of Y component row. The length of Cb and Cr component rows must be `n`. The length of the RGB multi-component row must be `3*n`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_VideoColorBGR2JFIFYCC444(3MLIB)`, `mlib_VideoColorARGB2JFIFYCC444(3MLIB)`, `mlib_VideoColorRGB2JFIFYCC444_S16(3MLIB)`, attributes(5)
**Synopsis**

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorRGB2JFIFYCC444_S16(mlib_s16 *y, mlib_s16 *cb,
mlib_s16 *cr, const mlib_s16 *rgb, mlib_s32 n);

**Description**

The `mlib_VideoColorRGB2JFIFYCC444_S16()` function performs color space conversion from RGB to YCbCr when used in the JPEG File Interchange Format (JFIF).

Both the input RGB components and the output YCbCr components are supposed to be in the range of [0, 4095].

The following equation is used:

\[
Y = 0.2990 \times R + 0.5870 \times G + 0.1140 \times B
\]

\[
Cb = -0.16874 \times R - 0.33126 \times G + 0.50000 \times B + 2048
\]

\[
Cr = 0.50000 \times R - 0.41869 \times G - 0.08131 \times B + 2048
\]

**Parameters**

The function takes the following arguments:

- `y`  Pointer to destination Y component row. `y` must be 8-byte aligned.
- `cb` Pointer to destination Cb component row. `cb` must be 8-byte aligned.
- `cr` Pointer to destination Cr component row. `cr` must be 8-byte aligned.
- `rgb` Pointer to source RGB multi-component row. `rgb` must be 8-byte aligned.
- `n`  Length of Y component row. The length of Cb and Cr component rows must be `n`. The length of the RGB multi-component row must be `3*n`.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

`mlib_VideoColorABGR2JFIFYCC444(3MLIB)`, `mlib_VideoColorARGB2JFIFYCC444(3MLIB)`, `mlib_VideoColorRGB2JFIFYCC444(3MLIB)`
mlib_VideoColorRGBAint_to_ABGRint – convert RGBA interleaved to ABGR

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorRGBAint_to_ABGRint(mlib_u32 *ABGR,
const mlib_u32 *RGBA,mlib_s32 w,
mlib_s32 h, mlib_s32 dlb,
mlib_s32 slb);

Description  The RGBA pixel stream is broken apart and recombined into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. The buffers have dimensions w and h. Within each 32-bit input word, the component ordering is R (bits 31-24), G (bits 23-16), B (bits 15-8), and A (bits 7-0). Within each 32-bit output word, the component ordering is A (bits 31-24), B (bits 23-16), G (bits 15-8), and R (bits 7-0).

Parameters  The function takes the following arguments:

ABGR    Pointer to output buffer.
RGBA    Pointer to input buffer.
w    Image width in pixels.
h    Image height in lines.
dlb    Linebytes for output buffer.
slb    Linebytes for input buffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorABGRint_to_ARGBint(3MLIB),
mlib_VideoColorBGRAint_to_ABGRint(3MLIB), attributes(5)
Name  mlib_VideoColorRGBint_to_ABGRint – convert RGB interleaved to ABGR interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorRGBint_to_ABGRint(mlib_u32 *ABGR,
    const mlib_u8 *RGB, const mlib_u8 *A_array,
    mlib_u8 A_const, mlib_s32 w,
    mlib_s32 h, mlib_s32 dlb,
    mlib_s32 slb, mlib_s32 alb);

Description  The interleaved RGB stream, and the A values are combined into an A, B, G, R interleaved byte stream. Within each 24-bit input pixel, the component ordering is R (bits 23-16), G (bits 15-8), and B (bits 7-0). Within each 32-bit output word, the component ordering is A (bits 31-24), B (bits 23-16), G (bits 15-8), and R (bits 7-0).

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the R, G, and B buffers.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

Parameters  The function takes the following arguments:

- **ABGR**  Pointer to output buffer.
- **RGB**  Pointer to input buffer.
- **A_array**  Array of alpha values.
- **A_const**  Constant alpha value.
- **w**  Image width in pixels.
- **h**  Image height in lines.
- **dlb**  Linebytes for output buffer.
- **slb**  Linebytes for input buffer.
- **alb**  Linebytes for alpha buffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>
See Also  
mlib_VideoColorRGBseq_to_ABGRint(3MLIB),  
mlib_VideoColorBGRint_to_ABGRint(3MLIB),  
mlib_VideoColorRGBXint_to_ABGRint(3MLIB),  
mlib_VideoColorRGBXint_to_ARGBint(3MLIB),  
mlib_VideoColorXRGBint_to_ABGRint(3MLIB),  
mlib_VideoColorXRGBint_to_ARGBint(3MLIB), attributes(5)
The interleaved RGB stream and the A values are combined into an interleaved BGRA byte stream.

The alpha values for this function work in the following fashion:

- If the a_array pointer is not NULL, the values are taken from there. It has to have the at least 1/3 the dimension of the RGB buffer.
- If the a_array pointer is NULL, the alpha values for every pixel are set to a_const.

In other words, this function’s inner loop works like this:

```c
bgra[0] = rgb[2];
bgra[1] = rgb[1];
bgra[2] = rgb[0];
bgra[3] = (a_array == NULL) ? a_const : a_array[0];
```

The function takes the following arguments:

- **bgra** Pointer to the output BGRA buffer.
- **rgb** Pointer to the input RGB buffer.
- **a_array** Pointer to the alpha buffer.
- **a_const** Constant alpha value.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes of the output buffer.
- **slb** Linebytes of the input buffer.
- **alb** Linebytes of the alpha buffer.

None.

See attributes(5) for descriptions of the following attributes:
### mlib_VideoColorRGBint_to_ABGRint(3MLIB)

<table>
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**See Also**  
mlib_VideoColorRGBint_to_BGRAint(3MLIB), attributes(5)
mlib_VideoColorRGBseq_to_ABGRint – convert RGB sequential to ABGR interleaved

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorRGBseq_to_ABGRint(mlib_u32 *ABGR, const mlib_u8 *R, const mlib_u8 *G, const mlib_u8 *B, const mlib_u8 *A_array, mlib_u8 A_const, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);

Description

The R, G, and B streams, and the A values are combined into an A, B, G, R interleaved byte stream. Within each 32-bit output word, the component ordering is A (bits 31-24), B (bits 23-16), G (bits 15-8), and R (bits 7-0).

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the R, G, and B buffers.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

Parameters

The function takes the following arguments:

- **ABGR** Pointer to output buffer.
- **R** Pointer to input R buffer.
- **G** Pointer to input G buffer.
- **B** Pointer to input B buffer.
- **A_array** Array of alpha values.
- **A_const** Constant alpha value.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for output buffer.
- **slb** Linebytes for input buffers.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorRGBint_to_ABGRint(3MLIB),
mlib_VideoColorBGint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ARGBint(3MLIB),
mlib_VideoColorXRGBint_to_ABGRint(3MLIB),
mlib_VideoColorXRGBint_to_ARGBint(3MLIB), attributes(5)
Name mlib_VideoColorRGBXint_to_ABGRint – convert RGBX interleaved to ABGR interleaved

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

#include <mlib.h>

void mlib_VideoColorRGBXint_to_ABGRint(mlib_u32 * ABGR,
   const mlib_u32 * RBGX, const mlib_u8 * A_array,
   mlib_u8 A_const, mlib_s32 w,
   mlib_s32 h, mlib_s32 dlb,
   mlib_s32 slb, mlib_s32 alb);

Description The interleaved RGBX stream and the alpha values are combined into an interleaved A, B, G, R output stream. Within each 32-bit input pixel, the component ordering is R (bits 31-24), G (bits 23-16), and B (bits 15-8). Within each 32-bit output pixel, the component ordering is A (bits 31-24), B (bits 23-16), G (bits 15-8), and R (bits 7-0). The alpha values for this function work in the following fashion: if A_array is not NULL, the values are taken from the corresponding locations in the alpha array, otherwise a constant alpha value, specified by A_const, is stored in each output pixel. Each element in the alpha array is an unsigned byte. w and h define the dimensions of the region of the buffers to be processed. The linebyte parameters are used to advance the data pointers for each of the buffers.

Parameters The function takes the following arguments:
   ABGR Pointer to output buffer (word-aligned).
   RGBX Pointer to input buffer (word-aligned).
   A_array Pointer to array of alpha values (byte-aligned).
   A_const Constant alpha value (range = 0..255).
   w Image width in pixels.
   h Image height in lines.
   dlb Linebytes for output buffer.
   slb Linebytes for input buffer.
   alb Linebytes for alpha buffer.

Return Values None.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorRGBseq_to_ABGRint(3MLIB),
        mlib_VideoColorRGBint_to_ABGRint(3MLIB),
        mlib_VideoColorBGRint_to_ABGRint(3MLIB),
        mlib_VideoColorRGBXint_to_ARGBint(3MLIB),
        mlib_VideoColorXRGBint_to_ABGRint(3MLIB),
        mlib_VideoColorXRGBint_to_ARGBint(3MLIB), attributes(5)
Name  mlib_VideoColorRGBXint_to_ARGBint – convert RGBX interleaved to ARGB interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorRGBXint_to_ARGBint(mlib_u32 *ARGB,
const mlib_u32 *RGBX, const mlib_u8 *A_array,
mlib_u8 A_const, mlib_s32 w,
mlib_s32 h, mlib_s32 dlb,
mlib_s32 slb, mlib_s32 alb);

Description  Similar to mlib_VideoColorRGBXint_to_ABGRint() except that the output component ordering is: A (bits 31-24), R (bits 23-16), G (bits 15-8), and B (bits 7-0).

Parameters  The function takes the following arguments:

ARGB  Pointer to output buffer (word-aligned).
RGBX  Pointer to input buffer (word-aligned).
A_array  Pointer to array of alpha values (byte-aligned).
A_const  Constant alpha value (range = 0..255).
w  Image width in pixels.
h  Image height in lines.
dlb  Linebytes for output buffer.
slb  Linebytes for input buffer.
alb  Linebytes for alpha buffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorRGBseq_to_ABGRint(3MLIB),
mlib_VideoColorRGBint_to_ABGRint(3MLIB),
mlib_VideoColorBGRint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ABGRint(3MLIB),
mlib_VideoColorXRGBint_to_ABGRint(3MLIB),
mlib_VideoColorXRGBint_to_ARGBint(3MLIB),
attributes(5)
### Synopsis

```c
#include <mlib.h>

mlib_status mlib_VideoColorSplit2(mlib_u8 *color1, mlib_u8 *color2,
                                 const mlib_u8 *colors, mlib_s32 n);
```

### Description

The `mlib_VideoColorSplit2()` function performs color channel split. The elements of the `colors` array are alternately copied into the `color1` array and `color2` array.

### Parameters

- **color1**: Pointer to first color component row. `color1` must be 8-byte aligned.
- **color2**: Pointer to second color component row. `color2` must be 8-byte aligned.
- **colors**: Pointer to colors multi-component row. `colors` must be 8-byte aligned.
- **n**: Length of `color1` and `color2` arrays. Length of `colors` must be `2^n`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

- `mlib_VideoColorSplit2(3MLIB)`, `mlib_VideoColorMerge2(3MLIB)`
- `mlib_VideoColorSplit2_S16(3MLIB)`, `mlib_VideoColorMerge2_S16(3MLIB)`
- `mlib_VideoColorSplit3(3MLIB)`, `mlib_VideoColorMerge3(3MLIB)`
- `mlib_VideoColorSplit3_S16(3MLIB)`, `mlib_VideoColorMerge3_S16(3MLIB)`
- `mlib_VideoColorSplit4(3MLIB)`, `mlib_VideoColorMerge4(3MLIB)`
- `mlib_VideoColorSplit4_S16(3MLIB)`, `mlib_VideoColorMerge4_S16(3MLIB)`
The `mlib_VideoColorSplit2_S16()` function performs color channel split.

The elements of the `colors` array are alternately copied into the `color1` array and `color2` array.

Parameters

The function takes the following arguments:

- `color1`  Pointer to first color component row. `color1` must be 8-byte aligned.
- `color2`  Pointer to second color component row. `color2` must be 8-byte aligned.
- `colors`  Pointer to colors multi-component row. `colors` must be 8-byte aligned.
- `n` Length of `color1` and `color2` arrays. Length of `colors` must be `2^n`.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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</table>

See Also

- `mlib_VideoColorMerge2(3MLIB)`, `mlib_VideoColorMerge2_S16(3MLIB)`,
- `mlib_VideoColorMerge3(3MLIB)`, `mlib_VideoColorMerge3_S16(3MLIB)`,
- `mlib_VideoColorMerge4(3MLIB)`, `mlib_VideoColorMerge4_S16(3MLIB)`,
- `mlib_VideoColorSplit2(3MLIB)`, `mlib_VideoColorSplit3(3MLIB)`,
- `mlib_VideoColorSplit3_S16(3MLIB)`, `mlib_VideoColorSplit4(3MLIB)`,
- `mlib_VideoColorSplit4_S16(3MLIB)`, attributes(5)
The `mlib_VideoColorSplit3()` function performs color channel split. The elements of the colors array are selected in consecutive groups of three. As each group is processed, the first element is stored in the color1 array; the second element, in the color2 array; and the third element, in the color3 array. This process is repeated until the end of the colors array is reached.

The function takes the following arguments:

- `color1` Pointer to first color component row. `color1` must be 8-byte aligned.
- `color2` Pointer to second color component row. `color2` must be 8-byte aligned.
- `colors` Pointer to colors multi-component row. `colors` must be 8-byte aligned.
- `n` Length of color1, color2, and color3 arrays. Length of `colors` must be 3*n.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also `mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge2_S16(3MLIB), mlib_VideoColorMerge3(3MLIB), mlib_VideoColorMerge3_S16(3MLIB), mlib_VideoColorMerge4(3MLIB), mlib_VideoColorMerge4_S16(3MLIB), mlib_VideoColorSplit2(3MLIB), mlib_VideoColorSplit2_S16(3MLIB), mlib_VideoColorSplit3_S16(3MLIB), mlib_VideoColorSplit4(3MLIB), mlib_VideoColorSplit4_S16(3MLIB), attributes(5)`
The `mlib_VideoColorSplit3_S16()` function performs color channel split.

The elements of the colors array are selected in consecutive groups of three. As each group is processed, the first element is stored in the color1 array; the second element, in the color2 array; and the third element, in the color3 array. This process is repeated until the end of the colors array is reached.

The function takes the following arguments:

- `color1` Pointer to first color component row. `color1` must be 8-byte aligned.
- `color2` Pointer to second color component row. `color2` must be 8-byte aligned.
- `colors` Pointer to colors multi-component row. `colors` must be 8-byte aligned.
- `n` Length of `color1`, `color2`, and `color3` arrays. Length of `colors` must be 3*n.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See also `mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge2_S16(3MLIB), mlib_VideoColorMerge3(3MLIB), mlib_VideoColorMerge3_S16(3MLIB), mlib_VideoColorMerge4(3MLIB), mlib_VideoColorMerge4_S16(3MLIB), mlib_VideoColorSplit2(3MLIB), mlib_VideoColorSplit2_S16(3MLIB), mlib_VideoColorSplit3(3MLIB), mlib_VideoColorSplit3_S16(3MLIB), mlib_VideoColorSplit4(3MLIB), mlib_VideoColorSplit4_S16(3MLIB), attributes(5)`
mlib_VideoColorSplit4(3MLIB)

Name  mlib_VideoColorSplit4 – color conversion (color channel split)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorSplit4(mlib_u8 *color1, mlib_u8 *color2,
mlib_u8 *color3, mlib_u8 *color4, const mlib_u8 *colors, mlib_s32 n);

Description  The mlib_VideoColorSplit4() function performs color channel split.

The elements of the colors array are selected in consecutive groups of four. As each group is
processed, the first element is stored in the color1 array; the second element, in the color2
array; and so on. This process is repeated until the end of the colors array is reached.

Parameters  The function takes the following arguments:

color1   Pointer to first color component row. color1 must be 8-byte aligned.
color2   Pointer to second color component row. color2 must be 8-byte aligned.
color3   Pointer to third color component row. color3 must be 8-byte aligned.
color4   Pointer to fourth color component row. color4 must be 8-byte aligned.

colors   Pointer to colors multi-component row. colors must be 8-byte aligned.

n   Length of color1, color2, color3, and color4 arrays. Length of colors must be 4*n.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_VideoColorMerge2(3MLIB), mlib_VideoColorMerge2_S16(3MLIB),
mlib_VideoColorMerge3(3MLIB), mlib_VideoColorMerge3_S16(3MLIB),
mlib_VideoColorMerge4(3MLIB), mlib_VideoColorMerge4_S16(3MLIB),
mlib_VideoColorSplit2(3MLIB), mlib_VideoColorSplit2_S16(3MLIB),
mlib_VideoColorSplit3(3MLIB), mlib_VideoColorSplit3_S16(3MLIB),
mlib_VideoColorSplit4_S16(3MLIB), attributes(5)
The `mlib_VideoColorSplit4_S16()` function performs color channel split. The elements of the colors array are selected in consecutive groups of four. As each group is processed, the first element is stored in the color1 array; the second element, in the color2 array; and so on. This process is repeated until the end of the colors array is reached.

### Parameters

- **`color1`** Pointer to first color component row. `color1` must be 8-byte aligned.
- **`color2`** Pointer to second color component row. `color2` must be 8-byte aligned.
- **`colors`** Pointer to colors multi-component row. `colors` must be 8-byte aligned.
- **`n`** Length of `color1`, `color2`, `color3`, and `color4` arrays. Length of `colors` must be `4*n`.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_VideoColorSplit2(3MLIB)`, `mlib_VideoColorSplit2_S16(3MLIB)`, `mlib_VideoColorSplit3(3MLIB)`, `mlib_VideoColorSplit3_S16(3MLIB)`, `mlib_VideoColorSplit4(3MLIB)`, `mlib_VideoColorSplit4_S16(3MLIB)`
mlib_VideoColorUYV444int_to_ABGRint

Name  mlib_VideoColorUYV444int_to_ABGRint – color convert UYV interleaved to ABGR interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorUYV444int_to_ABGRint(mlib_u32 *ABGR,
   const mlib_u8 *UYV, const mlib_u8 *A_array,
   mlib_u8 A_const, mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
   mlib_s32 slb, mlib_s32 alb);

Description  The UYV pixel stream is converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. All buffers have dimensions w and h.

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

The following equation is used:

\[
\begin{align*}
|R| &= 1.1644 \times 0.0000 + 1.5966 \times |Y| + 16.0000 \\
|G| &= 1.1644 \times -0.3920 - 0.8132 \times |U| - 128.0000 \\
|B| &= 1.1644 \times 2.0184 \times 0.0000 + 128.0000 \\
\end{align*}
\]

Parameters  The function takes the following arguments:

- ABGR Pointer to output buffer.
- UYV Pointer to input buffer.
- A_array Array of alpha values.
- A_const Constant alpha value.
- w Image width in pixels.
- h Image height in lines.
- dlb Linebytes for output buffer.
- slb Linebytes for input buffer.
- alb Linebytes for alpha buffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:
mlib_VideoColorUYV444int_to_ABGRint(3MLIB)

<table>
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</tbody>
</table>

See Also mlib_VideoColorYUV420seq_to_ARGBint(3MLIB), mlib_VideoColorYUV411seq_to_ARGBint(3MLIB), mlib_VideoColorYUV422seq_to_ARGBint(3MLIB), mlib_VideoColorYUV444seq_to_ARGBint(3MLIB), mlib_VideoColorYUV420seq_to_ABGRint(3MLIB), mlib_VideoColorYUV411seq_to_ABGRint(3MLIB), mlib_VideoColorYUV422seq_to_ABGRint(3MLIB), mlib_VideoColorYUV444seq_to_ABGRint(3MLIB), mlib_VideoColorUYV422int_to_ARGBint(3MLIB), mlib_VideoColorUYV444int_to_ARGBint(3MLIB), mlib_VideoColorUYV422int_to_ABGRint(3MLIB), mlib_VideoColorUYV444int_to_ABGRint(3MLIB), mlib_VideoColorUYV422int_to_ARGBint(3MLIB), mlib_VideoColorUYV444int_to_ARGBint(3MLIB), mlib_VideoColorUYV422int_to_ABGRint(3MLIB), mlib_VideoColorUYV444int_to_ABGRint(3MLIB), mlib_VideoColorUYV422int_to_ARGBint(3MLIB), mlib_VideoColorUYV444int_to_ARGBint(3MLIB), mlib_VideoColorUYV422int_to_ABGRint(3MLIB), mlib_VideoColorUYV444int_to_ABGRint(3MLIB), attributes(5)
mlib_VideoColorUYV444int_to_ARGBint – color convert UYV interleaved to ARGB interleaved

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
void mlib_VideoColorUYV444int_to_ARGBint(mlib_u32 *ARGB,
    const mlib_u8 *UYV, const mlib_u8 *A_array,
    mlib_u8 A_const, mlib_s32 w,
    mlib_s32 h, mlib_s32 dlb,
    mlib_s32 slb, mlib_s32 alb);

Description

The UYV pixel stream is converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. All buffers have dimensions \( w \) and \( h \).

The alpha values for this function work in the following fashion:

- If \( A_array \) pointer is not NULL, the values are taken from there. It has to have the same dimensions as the \( Y \) buffer.
- If \( A_array \) pointer is NULL, the alpha values for every pixel are set to \( A_const \).

The following equation is used:

\[
\begin{align*}
|R| &= 1.1644 \quad 0.0000 \quad 1.5966 \quad [ |Y| \quad 16.0000 ] \\
|G| &= 1.1644 \quad -0.3920 \quad -0.8132 \quad * \quad [ |U| \quad -128.0000 ] \\
|B| &= 1.1644 \quad 2.0184 \quad 0.0000 \quad [ |V| \quad 128.0000 ]
\end{align*}
\]

Parameters

The function takes the following arguments:

- **ARGB**: Pointer to output buffer.
- **UYV**: Pointer to input buffer.
- **A_array**: Array of alpha values.
- **A_const**: Constant alpha value.
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **dlb**: Linebytes for output buffer.
- **slb**: Linebytes for input buffer.
- **alb**: Linebytes for alpha buffer.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:
### ATTRIBUTE TYPE | ATTRIBUTE VALUE
--- | ---
Interface Stability | Committed
MT-Level | MT-Safe

See Also mlib_VideoColorYUV420seq_to_ARGBint(3MLIB), mlib_VideoColorYUV411seq_to_ARGBint(3MLIB), mlib_VideoColorYUV422seq_to_ARGBint(3MLIB), mlib_VideoColorYUV444seq_to_ARGBint(3MLIB), mlib_VideoColorYUV420seq_to_ABGRint(3MLIB), mlib_VideoColorYUV411seq_to_ABGRint(3MLIB), mlib_VideoColorYUV422seq_to_ABGRint(3MLIB), mlib_VideoColorYUV444seq_to_ABGRint(3MLIB), mlib_VideoColorYUVY422int_to_ARGBint(3MLIB), mlib_VideoColorYUVY422int_to_ABGRint(3MLIB), mlib_VideoColorUYVY422int_to_ARGBint(3MLIB), mlib_VideoColorUYVY422int_to_ABGRint(3MLIB), mlib_VideoColorUYV444int_to_ARGBint(3MLIB), mlib_VideoColorUYV444int_to_ABGRint(3MLIB), attributes(5)
**Synopsis**

```c
void mlib_VideoColorUYV444int_to_UYVY422int(mlib_u32 *UYVY, const mlib_u8 *UYV, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);
```

**Description**

The UYV pixel stream is broken apart and recombined into a UYVY pixel stream. All pixel components are 8-bit unsigned integers. The UYV buffer has dimensions \( w \) and \( h \). Dimension \( w \) is assumed to be a multiple of 2. Adjacent U and V values are averaged to get the output U and V values. The sequence of values in the input stream is \( U[r][c], Y[r][c], V[r][c], U[r][c+1], Y[r][c+1], V[r][c+1], \ldots \)

The following equation is used:

\[
UYVY[r][c/2] = (((U[r][c] + U[r][c+1]) / 2) << 24) | \\
(Y[r][c] << 16) | \\
(((V[r][c] + V[r][c+1]) / 2) << 8) | \\
(Y[r][c+1])
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

**Parameters**

The function takes the following arguments:
- **UYVY** Pointer to output buffer.
- **UYV** Pointer to input buffer.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for output buffer.
- **slb** Linebytes for input buffer.

**Return Values**

None.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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<tr>
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</tr>
</tbody>
</table>

**See Also**

- `mlib_VideoColorYUV444seq_to_YUYV422int(3MLIB)`
- `mlib_VideoColorYUV444int_to_YUYV422int(3MLIB)`
- `mlib_VideoColorYUV444seq_to_UYVY422int(3MLIB)`
mlib_VideoColorYUV444int_to_UYVY422int(3MLIB),
mlib_VideoColorUYV444int_to_YUYV422int(3MLIB), attributes(5)
The UYV pixel stream is broken apart and recombined into a YUYV pixel stream. All pixel components are 8-bit unsigned integers. The UYV buffer has dimensions $w$ and $h$. Dimension $w$ is assumed to be a multiple of 2. Adjacent U and V values are averaged to get the output U and V values. The sequence of values in the input stream is $U[r][c], Y[r][c], V[r][c], U[r][c+1], Y[r][c+1], V[r][c+1], ...$

The following equation is used:

$$\text{YUYV}[r][c/2] = (\text{Y}[r][c] << 24) \mid ((\text{U}[r][c] + \text{U}[r][c+1]) / 2) << 16) \mid (\text{Y}[r][c+1] << 8) \mid ((\text{V}[r][c] + \text{V}[r][c+1]) / 2))$$

where $r = 0, 1, 2, \ldots, h-1$; and $c = 0, 2, 4, \ldots, w-2$.

**Parameters**

- **YUYV** Pointer to output buffer.
- **UYV** Pointer to input buffer.
- $w$ Image width in pixels.
- $h$ Image height in lines.
- $dlb$ Linebytes for output buffer.
- $slb$ Linebytes for input buffer.

**Return Values**

None.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

mlib_VideoColorYUV444seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV444int_to_YUYV422int(3MLIB),
mlib_VideoColorYUV444seq_to_UYVY422int(3MLIB),
mlib_VideoColorYUV444int_to_UYVY422int(3MLIB),
mlib_VideoColorUYV444int_to_UYVY422int(3MLIB), attributes(5)
mlib_VideoColorUYVY422int_to_ABGRint–color convert UYVY interleaved to ABGR interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorUYVY422int_to_ABGRint(mlib_u32 *ABGR,
 const mlib_u32 *UYVY, const mlib_u8 *A_array,
 mlib_u8 A_const, mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
 mlib_s32 slb, mlib_s32 alb);

Description  The UYVY pixel stream is converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. The UYVY buffer has dimensions \( w/2 \) and \( h \). The ABGR buffer has dimensions \( w \) and \( h \). Dimension \( w \) is assumed to be even.

The alpha values for this function work in the following fashion:

- If \( A\_array \) pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If \( A\_array \) pointer is NULL, the alpha values for every pixel are set to \( A\_const \).

The following equation is used:

\[
[A] = \begin{bmatrix} 1.1644 & 0.0000 & 1.5966 \end{bmatrix} \begin{bmatrix} |R| & |G| & |B| \\ Y & U & V \end{bmatrix} + \begin{bmatrix} 16.0000 \end{bmatrix} \begin{bmatrix} 168.0000 \end{bmatrix}
\]

Parameters  The function takes the following arguments:

- \( ABGR \) Pointer to output buffer.
- \( UYVY \) Pointer to input buffer.
- \( A\_array \) Array of alpha values.
- \( A\_const \) Constant alpha value.
- \( w \) Image width in pixels.
- \( h \) Image height in lines.
- \( dlb \) Linebytes for output buffer.
- \( slb \) Linebytes for input buffer.
- \( alb \) Linebytes for alpha buffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:
### ATTRIBUTE TYPE | ATTRIBUTE VALUE
--- | ---
Interface Stability | Committed
MT-Level | MT-Safe

**See Also**
- `mlib_VideoColorYUV420seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV411seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV422seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV444seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV411seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV422seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV444seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUYV422int_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV444int_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUYV422int_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV444int_to_ABGRint(3MLIB)`
- `mlib_VideoColorUYVY422int_to_ARGBint(3MLIB)`
- `mlib_VideoColorUYV444int_to_ARGBint(3MLIB)`
- `attributes(5)`
Name  mlib_VideoColorUYVY422int_to_ARGBint – color convert UYVY interleaved to ARGB interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
        #include <mlib.h>

        void mlib_VideoColorUYVY422int_to_ARGBint(mlib_u32 *ARGB,
                        const mlib_u32 *UYVY, const mlib_u8 *A_array,
                        mlib_u8 A_const, mlib_s32 w, mlib_s32 h,
                        mlib_s32 dlbl, mlib_s32 slbl, mlib_s32 alb);

Description  The UYVY pixel stream is converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. The UYVY buffer has dimensions w/2 and h. The ARGB buffer has dimensions w and h. Dimension w is assumed to be even.

The alpha values for this function work in the following fashion:

■ If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
■ If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

The following equation is used:

\[
\begin{align*}
|R| & = \begin{bmatrix} 1.1644 & 0.0000 & 1.5966 \end{bmatrix} \begin{bmatrix} |Y| - 16.0000 \end{bmatrix} \\
|G| & = \begin{bmatrix} 1.1644 & -0.3920 & -0.8132 \end{bmatrix} \begin{bmatrix} |U| - 128.0000 \end{bmatrix} \\
|B| & = \begin{bmatrix} 1.1644 & 2.0184 & 0.0000 \end{bmatrix} \begin{bmatrix} |V| - 128.0000 \end{bmatrix}
\end{align*}
\]

Parameters  The function takes the following arguments:

ARGB  Pointer to output buffer.
UYVY  Pointer to input buffer.
A_array  Array of alpha values.
A_const  Constant alpha value.
w  Image width in pixels.
h  Image height in lines.
dlb  Linebytes for output buffer.
slb  Linebytes for input buffer.
alb  Linebytes for alpha buffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:
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</table>

See Also  
mlib_VideoColorUYVY422int_to_ARGBint(3MLIB),  
mlib_VideoColorUYVY444int_to_ARGBint(3MLIB),  
mlib_VideoColorUYVY422int_to_ABGRint(3MLIB),  
mlib_VideoColorUYVY444int_to_ABGRint(3MLIB),  
mlib_VideoColorUYVY422int_to_ARGBint(3MLIB),  
mlib_VideoColorUYVY444int_to_ARGBint(3MLIB),  
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mlib_VideoColorUYVY422int_to_ABGRint(3MLIB),  
mlib_VideoColorUYVY444int_to_ABGRint(3MLIB),  
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mlib_VideoColorUYVY444int_to_ARGBint(3MLIB),  
mlib_VideoColorUYVY444int_to_ABGRint(3MLIB),  
mlib_VideoColorUYVY444int_to_ABGRint(3MLIB), attributes(5)
Name  mlib_VideoColorXRGBint_to_ABGRint – convert XRGB interleaved to ABGR interleaved

Synopsis  
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorXRGBint_to_ABGRint(mlib_u32 *ABGR,
const mlib_u32 *XRGB, const mlib_u8 *A_array,
mlib_u8 A_const, mlib_s32 w, mlib_s32 h,
mlib_s32 db, mlib_s32 sb, mlib_s32 alb);
```

Description  Similar to mlib_VideoColorRGBXint_to_ABGRint except that the input component ordering is: R (bits 23-16), G (bits 15-8), and B (bits 7-0).

Parameters  The function takes the following arguments:
- **ABGR**: Pointer to output buffer (word-aligned).
- **XRGB**: Pointer to input buffer (word-aligned).
- **A_array**: Pointer to array of alpha values (byte-aligned).
- **A_const**: Constant alpha value (range = 0..255).
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **dlb**: Linebytes for output buffer.
- **slb**: Linebytes for input buffer.
- **alb**: Linebytes for alphabuffer.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorRGBseq_to_ABGRint(3MLIB),
mlib_VideoColorRGBint_to_ABGRint(3MLIB),
mlib_VideoColorBGRint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ARGBint(3MLIB),
mlib_VideoColorXRGBint_to_ARGBint(3MLIB), attributes(5)
Name mlib_VideoColorXRGBint_to_ARGBint – convert XRGB interleaved to ARGB interleaved

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorXRGBint_to_ARGBint(mlib_u32 *ARGB,
const mlib_u32 *XRGB, const mlib_u8 *A_array,
mlib_u8 A_const, mlib_s32 w, mlib_s32 h,
mlib_s32 dlb, mlib_s32 slb, mlib_s32 alb);

Description Similar to mlib_VideoColorRGBXint_to_ARGBint except that the input component ordering
is: R (bits 23-16), G (bits 15-8), and B (bits 7-0).

Parameters The function takes the following arguments:

ARGB Pointer to output buffer (word-aligned).
XRGB Pointer to input buffer (word-aligned).
A_array Pointer to array of alpha values (byte-aligned).
A_const Constant alpha value (range = 0..255).
w Image width in pixels.
h Image height in lines.
dlb Linebytes for output buffer.
slb Linebytes for input buffer.
alb Linebytes for alphabuffer.

Return Values None.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_VideoColorRGBseq_to_ABGRint(3MLIB),
mlib_VideoColorRGBint_to_ABGRint(3MLIB),
mlib_VideoColorBGRint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ABGRint(3MLIB),
mlib_VideoColorRGBXint_to_ARGBint(3MLIB),
mlib_VideoColorXRGBint_to_ARGBint(3MLIB), attributes(5)
# mlib_VideoColorYUV2ABGR411

## Synopsis

```
cc [ flag... ] file... -lmlib [ library...
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ABGR411(mlib_u8 *abgr, const mlib_u8 *y,
const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
mlib_s32 rgb_stride, mlib_s32 y_stride, mlib_s32 uv_stride);
```

## Description

The `mlib_VideoColorYUV2ABGR411()` function performs YUV to RGB color conversion used in digital video compression in the 4:1:1 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 4-to-1 in only the horizontal direction in respect to the luminance component.

## Parameters

The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
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</table>

## See Also

`mlib_VideoColorYUV2ABGR420(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB),
mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB),
mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB)`
mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
The `mlib_VideoColorYUV2ABGR420()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also:  
mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB),  
mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2ARGB4441(3MLIB),  
mlib_VideoColorYUV2ARGB420(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB),  
mlib_VideoColorYUV2ARGB444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB),
mlib_VideoColorYUV2ABGR420(3MLIB),
mlib_VideoColorYUV2RGB420(3MLIB),
mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
# Name
mlib_VideoColorYUV2ABGR420_W – YUV to RGB color conversion

## Synopsis
```
c c [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ABGR420_W(mlib_u8 *abgr, const mlib_u8 *y, const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height, mlib_s32 abgr_stride, mlib_s32 y_stride, mlib_s32 uv_stride, mlib_s32 left, mlib_s32 top, mlib_s32 right, mlib_s32 bottom);
```

## Description
The mlib_VideoColorYUV2ABGR420_W() function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence. It performs color conversion together with window clipping.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

## Parameters
The function takes the following arguments:

- **abgr**
  Pointer to the destination packed ABGR image. abgr must be 8-byte aligned.

- **y**
  Pointer to the source Y component. y must be 8-byte aligned.

- **u**
  Pointer to the source U component. u must be 4-byte aligned.

- **v**
  Pointer to the source V component. v must be 4-byte aligned.

- **width**
  Width of the image. width must be a multiple of 8.

- **height**
  Height of the image. height must be a multiple of 2.

- **abgr_stride**
  Stride, in bytes, between adjacent rows in the ABGR image. abgr_stride must be a multiple of 8.

- **y_stride**
  Stride, in bytes, between adjacent rows in the Y component image. y_stride must be a multiple of 8.

- **uv_stride**
  Stride, in bytes, between adjacent rows in the U and V component images. uv_stride must be a multiple of 8.

- **left**
  Left border of clipping window. 0 ≤ left < right ≤ width.

- **top**
  Top border of clipping window. 0 ≤ top < bottom ≤ height.

- **right**
  Right border of clipping window. 0 ≤ left < right ≤ width.

- **bottom**
  Bottom border of clipping window. 0 ≤ top < bottom ≤ height.
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_VideoColorYUV2ABGR420_WX2(3MLIB), mlib_VideoColorYUV2ABGR420_WX3(3MLIB), mlib_VideoColorYUV2ABGR420_X2(3MLIB), mlib_VideoColorYUV2ABGR420_X3(3MLIB), attributes(5)
# Name
mlib_VideoColorYUV2ABGR420_WX2 - YUV to RGB color conversion

# Synopsis
```
c - flag... file... -mlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ABGR420_WX2(mlib_u8 *abgr, const mlib_u8 *y,
const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
mlib_s32 abgr_stride, mlib_s32 y_stride, mlib_s32 uv_stride,
mlib_s32 left, mlib_s32 top, mlib_s32 right,
mlib_s32 bottom);
```

# Description
The `mlib_VideoColorYUV2ABGR420_WX2()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence. It performs color conversion together with window clipping and 2X zooming.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

# Parameters
The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image. `abgr` must be 8-byte aligned.
- `y` Pointer to the source Y component. `y` must be 8-byte aligned.
- `u` Pointer to the source U component. `u` must be 4-byte aligned.
- `v` Pointer to the source V component. `v` must be 4-byte aligned.
- `width` Width of the image. `width` must be a multiple of 8.
- `height` Height of the image. `height` must be a multiple of 2.
- `abgr_stride` Stride, in bytes, between adjacent rows in the ABGR image. `abgr_stride` must be a multiple of 8.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image. `y_stride` must be a multiple of 8.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images. `uv_stride` must be a multiple of 8.
- `left` Left border of clipping window. `0 ≤ left < right ≤ width`.
- `top` Top border of clipping window. `0 ≤ top < bottom ≤ height`.
- `right` Left border of clipping window. `0 ≤ left < right ≤ width`.
- `bottom` Bottom border of clipping window. `0 ≤ top < bottom ≤ height`.

Name, Synopsis, Description, Parameters
The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

**Attributes**
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</table>

**See Also**
mlib_VideoColorYUV2ABGR420_W(3MLIB), mlib_VideoColorYUV2ABGR420 WX3(3MLIB),
mlib_VideoColorYUV2ABGR420_X2(3MLIB), mlib_VideoColorYUV2ABGR420_X3(3MLIB),
attributes(5)
The `mlib_VideoColorYUV2ABGR420_WX3()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence. It performs color conversion together with window clipping and 3X zooming.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

The function takes the following arguments:

- `abgr`: Pointer to the destination packed ABGR image. `abgr` must be 8-byte aligned.
- `y`: Pointer to the source Y component. `y` must be 8-byte aligned.
- `u`: Pointer to the source U component. `u` must be 4-byte aligned.
- `v`: Pointer to the source V component. `v` must be 4-byte aligned.
- `width`: Width of the image. `width` must be a multiple of 8.
- `height`: Height of the image. `height` must be a multiple of 2.
- `abgr_stride`: Stride, in bytes, between adjacent rows in the ABGR image. `abgr_stride` must be a multiple of 8.
- `y_stride`: Stride, in bytes, between adjacent rows in the Y component image. `y_stride` must be a multiple of 8.
- `uv_stride`: Stride, in bytes, between adjacent rows in the U and V component images. `uv_stride` must be a multiple of 8.
- `left`: Left border of clipping window. `0 ≤ left < right ≤ width`.
- `top`: Top border of clipping window. `0 ≤ top < bottom ≤ height`.
- `right`: Left border of clipping window. `0 ≤ left < right ≤ width`.
- `bottom`: Bottom border of clipping window. `0 ≤ top < bottom ≤ height`.

```c
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ABGR420_WX3(mlib_u8 *abgr,
    const mlib_u8 *y, const mlib_u8 *u, const mlib_u8 *v,
    mlib_s32 width, mlib_s32 height,
    mlib_s32 abgr_stride, mlib_s32 y_stride,
    mlib_s32 uv_stride, mlib_s32 left,
    mlib_s32 top, mlib_s32 right, mlib_s32 bottom);
```
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoColorYUV2ABGR420_W(3MLIB), mlib_VideoColorYUV2ABGR420_WX2(3MLIB), mlib_VideoColorYUV2ABGR420_WX2(3MLIB), mlib_VideoColorYUV2ABGR420_WX3(3MLIB), attributes(5)
**Synopsis**

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ABGR420_X2(mlib_u8 *abgr, const mlib_u8 *y,
const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
mlib_s32 abgr_stride, mlib_s32 y_stride, mlib_s32 uv_stride);
```

**Description**

The `mlib_VideoColorYUV2ABGR420_X2()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence. It performs color conversion together with 2X zooming.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

**Parameters**

The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image. `abgr` must be 8-byte aligned.
- `y` Pointer to the source Y component. `y` must be 8-byte aligned.
- `u` Pointer to the source U component. `u` must be 4-byte aligned.
- `v` Pointer to the source V component. `v` must be 4-byte aligned.
- `width` Width of the image. `width` must be a multiple of 8.
- `height` Height of the image. `height` must be a multiple of 2.
- `abgr_stride` Stride, in bytes, between adjacent rows in the ABGR image. `abgr_stride` must be a multiple of 8.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image. `y_stride` must be a multiple of 8.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images. `uv_stride` must be a multiple of 8.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

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See Also  
mlib_VideoColorYUV2ABGR420_W(3MLIB), mlib_VideoColorYUV2ABGR420_WX2(3MLIB),
mlib_VideoColorYUV2ABGR420_WX3(3MLIB), mlib_VideoColorYUV2ABGR420_X3(3MLIB),
attributes(5)
The `mlib_VideoColorYUV2ABGR420_X3()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence. It performs color conversion together with 3X zooming.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image. `abgr` must be 8-byte aligned.
- `y` Pointer to the source Y component. `y` must be 8-byte aligned.
- `u` Pointer to the source U component. `u` must be 4-byte aligned.
- `v` Pointer to the source V component. `v` must be 4-byte aligned.
- `width` Width of the image. `width` must be a multiple of 8.
- `height` Height of the image. `height` must be a multiple of 2.
- `abgr_stride` Stride, in bytes, between adjacent rows in the ABGR image. `abgr_stride` must be a multiple of 8.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image. `y_stride` must be a multiple of 8.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images. `uv_stride` must be a multiple of 8.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoColorYUV2ABGR420_W(3MLIB), mlib_VideoColorYUV2ABGR420_WX2(3MLIB),  
mlib_VideoColorYUV2ABGR420_WX3(3MLIB), mlib_VideoColorYUV2ABGR420_X2(3MLIB),  
attributes(5)
The `mlib_VideoColorYUV2ABGR422()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:2 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in only the horizontal direction in respect to the luminance component.

The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_VideoColorYUV2ABGR411(3MLIB)`, `mlib_VideoColorYUV2ABGR420(3MLIB)`, `mlib_VideoColorYUV2ABGR444(3MLIB)`, `mlib_VideoColorYUV2ARGB444(3MLIB)`, `mlib_VideoColorYUV2ARGB411(3MLIB)`, `mlib_VideoColorYUV2ARGB422(3MLIB)`.
mlib_VideoColorYUV2ABGR422(3MLIB)

mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
**mlib_VideoColorYUV2ABGR444** – YUV to RGB color conversion

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ABGR444(mlib_u8 *abgr, const mlib_u8 *y,
const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
mlib_s32 rgb_stride, mlib_s32 yuv_stride);
```

**Description**

The `mlib_VideoColorYUV2ABGR444()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:4:4 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components have the same resolution as the luminance component.

**Parameters**

The function takes the following arguments:

- `abgr` Pointer to the destination packed ABGR image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `yuv_stride` Stride, in bytes, between adjacent rows in the source image.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

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**See Also**

`mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR420(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB), mlib_VideoColorYUV2ARGB411(3MLIB), mlib_VideoColorYUV2ARGB420(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB), mlib_VideoColorYUV2RGB444(3MLIB), mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB), mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)`
The `mlib_VideoColorYUV2ARGB411()` function performs YUV to RGB color conversion used in digital video compression in the 4:1:1 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 4-to-1 in only the horizontal direction in respect to the luminance component.

### Parameters
- **argb**: Pointer to the destination packed ARGB image.
- **y**: Pointer to the source Y component.
- **u**: Pointer to the source U component.
- **v**: Pointer to the source V component.
- **width**: Width of the image.
- **height**: Height of the image.
- **rgb_stride**: Stride, in bytes, between adjacent rows in the destination image.
- **y_stride**: Stride, in bytes, between adjacent rows in the Y component image.
- **uv_stride**: Stride, in bytes, between adjacent rows in the U and V component images.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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### See Also
`mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR420(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB), mlib_VideoColorYUV2ABGR44(3MLIB), mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2ARGB420(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB), mlib_VideoColorYUV2ARGB44(3MLIB), mlib_VideoColorYUV2ARGB444(3MLIB), mlib_VideoColorYUV2ARGB411(3MLIB),`
mlib_VideoColorYUV2RGB411(3MLIB), mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB), mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
mlib_VideoColorYUV2ARGB420 – YUV to RGB color conversion

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ARGB420(mlib_u8 *argb, const mlib_u8 *y,
                        const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
                        mlib_s32 rgb_stride, mlib_s32 y_stride, mlib_s32 uv_stride);
```

Description

The `mlib_VideoColorYUV2ARGB420()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

Parameters

The function takes the following arguments:

- `argb` Pointer to the destination packed ARGB image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

- mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR420(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB), mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2ARGB411(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB), mlib_VideoColorYUV2ARGB444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB), mlib_VideoColorYUV2RGB444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB),
mlib_VideoColorYUV2ARGB420(3MLIB),
mlib_VideoColorYUV2RGB420(3MLIB),
mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
mlib_VideoColorYUV2ARGB422

**Name**
mlib_VideoColorYUV2ARGB422 – YUV to RGB color conversion

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_VideoColorYUV2ARGB422(mlib_u8 *argb, const mlib_u8 *y,  
const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,  
mlib_s32 rgb_stride, mlib_s32 y_stride, mlib_s32 uv_stride);
```

**Description**
The `mlib_VideoColorYUV2ARGB422()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:2 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in only the horizontal direction in respect to the luminance component.

**Parameters**
The function takes the following arguments:

- **argb** : Pointer to the destination packed ARGB image.
- **y** : Pointer to the source Y component.
- **u** : Pointer to the source U component.
- **v** : Pointer to the source V component.
- **width** : Width of the image.
- **height** : Height of the image.
- **rgb_stride** : Stride, in bytes, between adjacent rows in the destination image.
- **y_stride** : Stride, in bytes, between adjacent rows in the Y component image.
- **uv_stride** : Stride, in bytes, between adjacent rows in the U and V component images.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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</table>

**See Also**
mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR420(3MLIB),  
mlib_VideoColorYUV2ABGR422(3MLIB), mlib_VideoColorYUV2ABGR444(3MLIB),  
mlib_VideoColorYUV2ARGB411(3MLIB), mlib_VideoColorYUV2ARGB420(3MLIB),  
mlib_VideoColorYUV2ARGB444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB),
mlib_VideoColorYUV2RGB422(3MLIB)

mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
mlib_VideoColorYUV2ARGB444 – YUV to RGB color conversion

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2ARGB444(mlib_u8 *argb, const mlib_u8 *y,
const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
mlib_s32 rgb_stride, mlib_s32 yuv_stride);

Description

The mlib_VideoColorYUV2ARGB444() function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:4:4 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components have the same resolution as the luminance component.

Parameters

The function takes the following arguments:

argb Pointer to the destination packed ARGB image.
y Pointer to the source Y component.
u Pointer to the source U component.
v Pointer to the source V component.
width Width of the image.
height Height of the image.
rgb_stride Stride, in bytes, between adjacent rows in the destination image.
yuv_stride Stride, in bytes, between adjacent rows in the source image.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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</table>

See Also

mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR420(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB), mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2ARGB411(3MLIB), mlib_VideoColorYUV2ARGB420(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB), mlib_VideoColorYUV2ARGB444(3MLIB), mlib_VideoColorYUV2RGB411(3MLIB), mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB), attributes(5)
### Name
mlib_VideoColorYUV2RGB411 – YUV to RGB color conversion

### Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2RGB411(mlib_u8 *rgb, const mlib_u8 *y,
    const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
    mlib_s32 rgb_stride, mlib_s32 y_stride, mlib_s32 uv_stride);
```

### Description

The `mlib_VideoColorYUV2RGB411` function performs YUV to RGB color conversion used in digital video compression in the 4:1:1 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 4-to-1 in only the horizontal direction in respect to the luminance component.

### Parameters

The function takes the following arguments:

- `rgb` Pointer to the destination RGB image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- `mlib_VideoColorYUV2ABGR411(3MLIB)`, `mlib_VideoColorYUV2ABGR420(3MLIB)`,
- `mlib_VideoColorYUV2ABGR422(3MLIB)`, `mlib_VideoColorYUV2ABGR444(3MLIB)`,
- `mlib_VideoColorYUV2ARGB411(3MLIB)`, `mlib_VideoColorYUV2ARGB420(3MLIB)`,
- `mlib_VideoColorYUV2ARGB422(3MLIB)`, `mlib_VideoColorYUV2ARGB444(3MLIB)`,
mlib_VideoColorYUV2RGB411(3MLIB)

mlib_VideoColorYUV2RGB420(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
The `mlib_VideoColorYUV2RGB420()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:0 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in both the horizontal and vertical directions in respect to the luminance component.

The function takes the following arguments:

- `rgb` Pointer to the destination RGB image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_VideoColorYUV2ABGR420(3MLIB), mlib_VideoColorYUV2ABGR411(3MLIB), mlib_VideoColorYUV2ABGR422(3MLIB), mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2ARGB420(3MLIB), mlib_VideoColorYUV2ARGB411(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB), mlib_VideoColorYUV2ARGB444(3MLIB),`
mlib_VideoColorYUV2RGB411(3MLIB), mlib_VideoColorYUV2RGB422(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
### Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoColorYUV2RGB422(mlib_u8 *rgb, const mlib_u8 *y,
           const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height,
           mlib_s32 rgb_stride, mlib_s32 y_stride, mlib_s32 uv_stride);
```

### Description

The `mlib_VideoColorYUV2RGB422()` function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:2:2 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components are subsampled 2-to-1 in only the horizontal direction in respect to the luminance component.

### Parameters

The function takes the following arguments:

- `rgb` Pointer to the destination RGB image.
- `y` Pointer to the source Y component.
- `u` Pointer to the source U component.
- `v` Pointer to the source V component.
- `width` Width of the image.
- `height` Height of the image.
- `rgb_stride` Stride, in bytes, between adjacent rows in the destination image.
- `y_stride` Stride, in bytes, between adjacent rows in the Y component image.
- `uv_stride` Stride, in bytes, between adjacent rows in the U and V component images.

### Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See `attributes(5)` for descriptions of the following attributes:

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### See Also

- `mlib_VideoColorYUV2ABGR411(3MLIB)`, `mlib_VideoColorYUV2ABGR420(3MLIB)`, `mlib_VideoColorYUV2ABGR422(3MLIB)`, `mlib_VideoColorYUV2ABGR444(3MLIB)`, `mlib_VideoColorYUV2ARGB411(3MLIB)`, `mlib_VideoColorYUV2ARGB420(3MLIB)`, `mlib_VideoColorYUV2ARGB422(3MLIB)`, `mlib_VideoColorYUV2ARGB444(3MLIB)`
mlib_VideoColorYUV2RGB411(3MLIB), mlib_VideoColorYUV2RGB420(3MLIB),
mlib_VideoColorYUV2RGB444(3MLIB), attributes(5)
mlib_VideoColorYUV2RGB444 – YUV to RGB color conversion

#include <mlib.h>

mlib_status mlib_VideoColorYUV2RGB444(mlib_u8 *rgb, const mlib_u8 *y, const mlib_u8 *u, const mlib_u8 *v, mlib_s32 width, mlib_s32 height, mlib_s32 rgb_stride, mlib_s32 yuv_stride);

The mlib_VideoColorYUV2RGB444() function performs YUV to RGB color conversion used in MPEG1 and MPEG2 video compression in the 4:4:4 sequence.

The luminance component is stored in Y, the chrominance components are stored in U and V, respectively. The size of the chrominance image depends on the chroma format used by the sequence. In this sequence, the chrominance components have the same resolution as the luminance component.

The function takes the following arguments:

- rgb Pointer to the destination RGB image.
- y Pointer to the source Y component.
- u Pointer to the source U component.
- v Pointer to the source V component.
- width Width of the image.
- height Height of the image.
- rgb_stride Stride, in bytes, between adjacent rows in the destination image.
- yuv_stride Stride, in bytes, between adjacent rows in the source image.

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See attributes(5) for descriptions of the following attributes:

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See Also mlib_VideoColorYUV2BGR411(3MLIB), mlib_VideoColorYUV2BGR420(3MLIB), mlib_VideoColorYUV2BGR422(3MLIB), mlib_VideoColorYUV2ABGR444(3MLIB), mlib_VideoColorYUV2ARGB411(3MLIB), mlib_VideoColorYUV2ARGB420(3MLIB), mlib_VideoColorYUV2ARGB422(3MLIB), attributes(5)
mlib_VideoColorYUV411seq_to_ABGRint – color convert YUV sequential to ABGR interleaved

Synopsis

```c
#include <mlib.h>

void mlib_VideoColorYUV411seq_to_ABGRint(mlib_u32 *ABGR,
       const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V,
       const mlib_u8 *A_array, mlib_u8 A_const,
       mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
       mlib_s32 yalb, mlib_s32 uvlb);
```

Description

The Y, U, V pixel streams are converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions w and h. The U and V buffers have dimensions w/4 and h. Dimension w is assumed to be a multiple of 4. In each row, every 4 Y values use the same U and V values.

The alpha values for this function work in the following fashion:

- If `A_array` pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If `A_array` pointer is NULL, the alpha values for every pixel are set to `A_const`.

The following equation is used:

\[
\begin{align*}
|R| &= 1.1644 \times |Y| - 16.0000 \\
|G| &= 1.1644 \times |U| - 128.0000 \\
|B| &= 1.1644 \times |V| - 128.0000 
\end{align*}
\]

Parameters

The function takes the following arguments:

- **ABGR** Pointer to output buffer.
- **Y** Pointer to Y input buffer.
- **U** Pointer to U input buffer.
- **V** Pointer to V input buffer.
- **A_array** Array of alpha values.
- **A_const** Constant alpha value.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for output buffer.
- **yalb** Linebytes for Y and alpha buffers.
- **uvlb** Linebytes for U and V buffers.
Return Values None.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_VideoColorYUV420seq_to_ARGBint(3MLIB), mlib_VideoColorYUV411seq_to_ARGBint(3MLIB), mlib_VideoColorYUV422seq_to_ARGBint(3MLIB), mlib_VideoColorYUV444seq_to_ARGBint(3MLIB), mlib_VideoColorYUV420seq_to_ABGRint(3MLIB), mlib_VideoColorYUV422seq_to_ABGRint(3MLIB), mlib_VideoColorYUV444seq_to_ABGRint(3MLIB), mlib_VideoColorYUYV422int_to_ARGBint(3MLIB), mlib_VideoColorYUYV444int_to_ARGBint(3MLIB), mlib_VideoColorYUYV422int_to_ABGRint(3MLIB), mlib_VideoColorYUYV444int_to_ABGRint(3MLIB), mlib_VideoColorUYVY422int_to_ARGBint(3MLIB), mlib_VideoColorUYVY444int_to_ARGBint(3MLIB), mlib_VideoColorUYVY422int_to_ABGRint(3MLIB), mlib_VideoColorUYVY444int_to_ABGRint(3MLIB), mlib_VideoColorUYV444int_to_ABGRint(3MLIB), attributes(5)
**Name**  
mlib_VideoColorYUV411seq_to_ARGBint – color convert YUV sequential to ARGB interleaved

**Synopsis**  
cc [ flag...] file... -lmlib [ library...]  
#include <mlib.h>

```c
void mlib_VideoColorYUV411seq_to_ARGBint(mlib_u32 *ARGB,
    const mlib_u8 *Y, const mlib_u8 *U,
    const mlib_u8 *V, const mlib_u8 *A_array,
    mlib_u8 A_const, mlib_s32 w, mlib_s32 h, mlib_s32 dlb,  
    mlib_s32 yalb, mlib_s32 uvlb);
```

**Description**  
The Y, U, V pixel streams are converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/4 \) and \( h \). Dimension \( w \) is assumed to be a multiple of 4. In each row, every 4 Y values use the same U and V values.

The alpha values for this function work in the following fashion:

- If `A_array` pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If `A_array` pointer is NULL, the alpha values for every pixel are set to `A_const`.

The following equation is used:

\[
\begin{align*}
|R| &= |1.1644 \ 0.0000 \ 1.5966| \begin{bmatrix} Y \end{bmatrix} + 16.0000 | \\
|G| &= |1.1644 -0.3920 -0.8132| \begin{bmatrix} U \end{bmatrix} + 128.0000 | \\
|B| &= |1.1644 \ 2.0184 \ 0.0000| \begin{bmatrix} V \end{bmatrix} + 128.0000 |
\end{align*}
\]

**Parameters**  
The function takes the following arguments:

- **ARGB**  
  Pointer to output buffer.
- **Y**  
  Pointer to Y input buffer.
- **U**  
  Pointer to U input buffer.
- **V**  
  Pointer to V input buffer.
- **A_array**  
  Array of alpha values.
- **A_const**  
  Constant alpha value.
- **w**  
  Image width in pixels.
- **h**  
  Image height in lines.
- **dlb**  
  Linebytes for output buffer.
- **yalb**  
  Linebytes for Y and alpha buffers.
- **uvlb**  
  Linebytes for U and V buffers.
mib_VideoColorYUV411seq_to_ARGBint(3MLIB)

Return Values
None.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mib_VideoColorYUV420seq_to_ARGBint(3MLIB),
mib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mib_VideoColorYUV420seq_to_ABGRint(3MLIB),
mib_VideoColorYUV411seq_to_ABGRint(3MLIB),
mib_VideoColorYUV422seq_to_ABGRint(3MLIB),
mib_VideoColorYUV444seq_to_ABGRint(3MLIB),
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mib_VideoColorYUV444int_to_ARGBint(3MLIB),
mib_VideoColorYUYV422int_to_ABGRint(3MLIB),
mib_VideoColorYUV444int_to_ABGRint(3MLIB),
mib_VideoColorUYVY422int_to_ARGBint(3MLIB),
mib_VideoColorUYVY422int_to_ABGRint(3MLIB),
mib_VideoColorUYV444int_to_ARGBint(3MLIB),
mib_VideoColorUYV444int_to_ABGRint(3MLIB),
**Name**  
mlib_VideoColorYUV411seq_to_UYVY422int – convert YUV sequential to interleaved

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
void mlib_VideoColorYUV411seq_to_UYVY422int(mlib_u32 *UYVY,
    const mlib_u8 *Y, const mlib_u8 *U,
    const mlib_u8 *V, mlib_s32 w,
    mlib_s32 h, mlib_s32 dlb,
    mlib_s32 ylb, mlib_s32 uvlb);
```

**Description**  
The Y, U, V pixel streams are combined into a UYVY pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions w and h. The U and V buffers have dimensions w/4 and h. Dimension w is assumed to be a multiple of 4. In each row, every 4 Y values use the same U and V values.

The following equation is used:

\[
UYVY[r][c/2] = (U[r][c/4] \ll 24) | (Y[r][c] \ll 16) | (V[r][c/4] \ll 8) | (Y[r][c+1])
\]

\[
UYVY[r][c/2+1] = (U[r][c/4] \ll 24) | (Y[r][c+2] \ll 16) | (V[r][c/4] \ll 8) | (Y[r][c+3])
\]

where \( r = 0, 2, 4, \ldots, h-2; \) and \( c = 0, 2, 4, \ldots, w-2. \)

**Parameters**  
The function takes the following arguments:

- **UYVY**  
  Pointer to output buffer.
- **Y**  
  Pointer to Y input buffer.
- **U**  
  Pointer to U input buffer.
- **V**  
  Pointer to V input buffer.
- **w**  
  Image width in pixels.
- **h**  
  Image height in lines.
- **dlb**  
  Linebytes for UYVY buffer.
- **ylb**  
  Linebytes for Y buffer.
- **uvlb**  
  Linebytes for U and V buffers.
Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_VideoColorYUV420seq_to_UYVY422int(3MLIB),
mllib_VideoColorYUV411seq_to_UYVY422int(3MLIB),
mllib_VideoColorYUV422seq_to_UYVY422int(3MLIB),
mllib_VideoColorYUV420seq_to_UYVY422int(3MLIB),
mllib_VideoColorYUV422seq_to_UYVY422int(3MLIB), attributes(5)
mlib_VideoColorYUV411seq_to_YUYV422int – convert YUV sequential to interleaved

Synopsis

cc [ flag... ] file... -lmllib [ library... ]
#include <mlib.h>

void mlib_VideoColorYUV411seq_to_YUYV422int(mlib_u32 *YUYV,
const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V,
mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
mlib_s32 ylb, mlib_s32 uvlb);

Description

The Y, U, V pixel streams are combined into a YUYV pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions w and h. The U and V buffers have dimensions w/4 and h. Dimension w is assumed to be a multiple of 4. In each row, every 4 Y values use the same U and V values.

The following equation is used:

\[
YUYV[r][c/2] = (Y[r][c] << 24) | (U[r][c/4] << 16) | (Y[r][c+1] << 8) | (V[r][c/4])
\]

\[
YUYV[r][c/2+1] = (Y[r][c+2] << 24) | (U[r][c/4] << 16) | (Y[r][c+3] << 8) | (V[r][c/4])
\]

where \( r = 0, 2, 4, \ldots, h-2 \); and \( c = 0, 2, 4, \ldots, w-2 \).

Parameters

The function takes the following arguments:

- **YUYV**: Pointer to output buffer.
- **Y**: Pointer to Y input buffer.
- **U**: Pointer to U input buffer.
- **V**: Pointer to V input buffer.
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **dlb**: Linebytes for YUYV buffer.
- **ylb**: Linebytes for Y buffer.
- **uvlb**: Linebytes for U and V buffers.

Return Values

None.
Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_VideoColorYUV420seq_to_YUYV422int(3MLIB),
          mlib_VideoColorYUV422seq_to_YUYV422int(3MLIB),
          mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB),
          mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB),
          mlib_VideoColorYUV422seq_to_UYVY422int(3MLIB), attributes(5)
### mlib_VideoColorYUV420seq_to_ABGRint

**Name**
mlib_VideoColorYUV420seq_to_ABGRint – color convert YUV sequential to ABGR interleaved

**Synopsis**
```
#include <mlib.h>

void mlib_VideoColorYUV420seq_to_ABGRint(mlib_u32 *ABGR,
    const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V,
    const mlib_u8 *A_array, mlib_u8 A_const, mlib_s32 w, mlib_s32 h,
    mlib_s32 dlb, mlib_s32 yalb, mlib_s32 uvlb);
```

**Description**
The Y, U, V pixel streams are converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/2 \) and \( h/2 \). Dimensions \( w \) and \( h \) are assumed to be even. Successive rows of the output buffer ABGR use successive rows of Y and the same rows of U and V.

The alpha values for this function work in the following fashion:
- If \( A\_array \) pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If \( A\_array \) pointer is NULL, the alpha values for every pixel are set to \( A\_const \).

The following equation is used:

\[
\begin{bmatrix}
    R \\
    G \\
    B
\end{bmatrix} =
\begin{bmatrix}
    1.644 & 0.000 & 1.5966 \\
    -0.3920 & -0.8132 & 1.1644 \\
    2.0184 & 0.000 & 1.1644
\end{bmatrix}
\begin{bmatrix}
    Y \\
    U \\
    V
\end{bmatrix}
\begin{bmatrix}
    16.000 \\
    128.000 \\
    128.000
\end{bmatrix}
\]

**Parameters**
The function takes the following arguments:
- \( ABGR \) Pointer to output buffer.
- \( Y \) Pointer to Y input buffer.
- \( U \) Pointer to U input buffer.
- \( V \) Pointer to V input buffer.
- \( A\_array \) Array of alpha values.
- \( A\_const \) Constant alpha value.
- \( w \) Image width in pixels.
- \( h \) Image height in lines.
- \( dlb \) Linebytes for output buffer.
- \( yalb \) Linebytes for Y and alpha buffers.
- \( uvlb \) Linebytes for U and V buffers.
Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
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<td>Interface Stability</td>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_VideoColorYUV420seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUYV422int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),attributes(5)
mlib_VideoColorYUV420seq_to_ARGBint(3MLIB)

Name mlib_VideoColorYUV420seq_to_ARGBint – color convert YUV sequential to ARGB interleaved

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorYUV420seq_to_ARGBint(mlib_u32 *ARGB,
const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V,
const mlib_u8 *A_array, mlib_u8 A_const,
mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
mlib_s32 yalb, mlib_s32 uvlb);

Description The Y, U, V pixel streams are converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions $w$ and $h$. The U and V buffers have dimensions $w/2$ and $h/2$. Dimensions $w$ and $h$ are assumed to be even. Successive rows of the output buffer ARGB use successive rows of Y and the same rows of U and V.

The alpha values for this function work in the following fashion:

- If $A\_array$ pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If $A\_array$ pointer is NULL, the alpha values for every pixel are set to $A\_const$.

The following equation is used:

$$
\begin{bmatrix}
|R| & 1.1644 & 0.0000 & 1.5966 \\
|G| & 1.1644 & -0.3920 & -0.8132 \\
|B| & 1.1644 & 2.0184 & 0.0000
\end{bmatrix}
\times
\begin{bmatrix}
|Y| & 16.0000 \\
|U| & -128.0000 \\
|V| & 128.0000
\end{bmatrix}
$$

Parameters The function takes the following arguments:

- $ARGB$ Pointer to output buffer.
- $Y$ Pointer to Y input buffer.
- $U$ Pointer to U input buffer.
- $V$ Pointer to V input buffer.
- $A\_array$ Array of alpha values.
- $A\_const$ Constant alpha value.
- $w$ Image width in pixels.
- $h$ Image height in lines.
- $dlb$ Linebytes for output buffer.
- $yalb$ Linebytes for Y and alpha buffers.
- $uvlb$ Linebytes for U and V buffers.
Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

mlib_VideoColorYUV420seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV420seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV411seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV422seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV444seq_to_ABGRint(3MLIB),
mlib_VideoColorYUYV422int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUV422int_to_ABGRint(3MLIB),
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),
mlib_VideoColorUYVY422int_to_ARGBint(3MLIB),
mlib_VideoColorUYVY422int_to_ABGRint(3MLIB),
mlib_VideoColorUYV444int_to_ARGBint(3MLIB),
mlib_VideoColorUYV444int_to_ABGRint(3MLIB),
 attributes(5)
The Y, U, V pixel streams are combined into a UYVY pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/2 \) and \( h/2 \). Dimensions \( w \) and \( h \) are assumed to be even. Successive rows of the output buffer UYVY use successive rows of Y and the same rows of U and V.

The following equation is used:

\[
UYVY[r][c/2] = (U[r/2][c/2] << 24) | \\
(Y[r][c] << 16) | \\
(V[r/2][c/2] << 8) | \\
(Y[r][c+1])
\]

\[
UYVY[r+1][c/2] = (U[r/2][c/2] << 24) | \\
(Y[r+1][c] << 16) | \\
(V[r/2][c/2] << 8) | \\
(Y[r+1][c+1])
\]

where \( r = 0, 2, 4, \ldots, h-2 \); and \( c = 0, 2, 4, \ldots, w-2 \).

### Parameters

- **UYVY** Pointer to output buffer.
- **Y** Pointer to Y input buffer.
- **U** Pointer to U input buffer.
- **V** Pointer to V input buffer.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for UYVY buffer.
- **ylb** Linebytes for Y buffer.
- **uvlb** Linebytes for U and V buffers.

### Return Values

None.
Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>Attribute Type</th>
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<tbody>
<tr>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_VideoColorYUV420seq_to_UYVY422int(3MLIB),
           mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB),
           mlib_VideoColorYUV422seq_to_UYVY422int(3MLIB),
           mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB),
           mlib_VideoColorYUV422seq_to_UYVY422int(3MLIB), attributes(5)
void mlib_VideoColorYUV420seq_to_YUYV422int(mlib_u32 *YUYV, const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 ylb, mlib_s32 uvlb);

The Y, U, V pixel streams are combined into a YUYV pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/2 \) and \( h/2 \). Dimensions \( w \) and \( h \) are assumed to be even. Successive rows of the output buffer YUYV use successive rows of Y and the same rows of U and V.

The following equation is used:

\[
\begin{align*}
YUYV[r][c/2] &= (Y[r][c] \ll 24) | (U[r/2][c/2] \ll 16) | (Y[r][c+1] \ll 8) | (V[r/2][c/2]) \\
YUYV[r+1][c/2] &= (Y[r+1][c] \ll 24) | (U[r/2][c/2] \ll 16) | (Y[r+1][c+1] \ll 8) | (V[r/2][c/2])
\end{align*}
\]

where \( r = 0, 2, 4, \ldots, h-2 \); and \( c = 0, 2, 4, \ldots, w-2 \).

The function takes the following arguments:

- \( YUYV \) Pointer to output buffer.
- \( Y \) Pointer to Y input buffer.
- \( U \) Pointer to U input buffer.
- \( V \) Pointer to V input buffer.
- \( w \) Image width in pixels.
- \( h \) Image height in lines.
- \( dlb \) Linebytes for YUYV buffer.
- \( ylb \) Linebytes for Y buffer.
- \( uvlb \) Linebytes for U and V buffers.

None.
Attributes  See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_VideoColorYUV411seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV422seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV420seq_to_UYVY422int(3MLIB),
mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB),
mlib_VideoColorYUV422seq_to_UYVY422int(3MLIB), attributes(5)
The Y, U, V pixel streams are converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions w and h. The U and V buffers have dimensions w/2 and h. Dimensions w and h are assumed to be even. Similar to mlib_VideoColorYUV420seq_to_ABGRint() except U and V are not sampled in the h direction.

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

The following equation is used:

\[
\begin{align*}
|\text{R}| &= 1.1644 \cdot 0.0000 \cdot 1.5966 \cdot [Y] + 16.0000 \\
|\text{G}| &= 1.1644 \cdot -0.3920 \cdot -0.8132 \cdot [U] + 128.0000 \\
|\text{B}| &= 1.1644 \cdot 2.0184 \cdot 0.0000 \cdot [V] + 128.0000
\end{align*}
\]

The function takes the following arguments:

- **ABGR** Pointer to output buffer.
- **Y** Pointer to Y input buffer.
- **U** Pointer to U input buffer.
- **V** Pointer to V input buffer.
- **A_array** Array of alpha values.
- **A_const** Constant alpha value.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for output buffer.
- **yalb** Linebytes for Y and alpha buffers.
- **uvlb** Linebytes for U and V buffers.
Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
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<tr>
<th>ATTRIBUTETYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
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<tbody>
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<td>MT-Safe</td>
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</tbody>
</table>

See Also  mlib_VideoColorYUV422seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV420seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV420seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422int_to_ARGBint(3MLIB),
mlib_VideoColorYUV422int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUV422int_to_ABGRint(3MLIB),
mlib_VideoColorYUV422int_to_ABGRint(3MLIB),
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),
attributes(5)
**Name**
mlib_VideoColorYUV422seq_to_ARGBint – color convert YUV sequential to ARGB interleaved

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
void mlib_VideoColorYUV422seq_to_ARGBint(mlib_u32 *ARGB,
    const mlib_u8 *Y, const mlib_u8 *U,
    const mlib_u8 *V, const mlib_u8 *A_array,
    mlib_u8 A_const, mlib_s32 w,  
    mlib_s32 h, mlib_s32 dlb,
    mlib_s32 yalb, mlib_s32 uvlb);
```

**Description**
The Y, U, V pixel streams are converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/2 \) and \( h \). Dimensions \( w \) and \( h \) are assumed to be even. Similar to `mlib_VideoColorYUV420seq_to_ARGBint()` except U and V are not sampled in the h direction.

The alpha values for this function work in the following fashion:
- If `A_array` pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If `A_array` pointer is NULL, the alpha values for every pixel are set to `A_const`.

The following equation is used:

\[
\begin{bmatrix}
|R| & |Y| & 16.0000 \\
|G| & |U| & 128.0000 \\
|B| & |V| & 128.0000
\end{bmatrix}
\]

**Parameters**
The function takes the following arguments:

- `ARGB` Pointer to output buffer.
- `Y` Pointer to Y input buffer.
- `U` Pointer to U input buffer.
- `V` Pointer to V input buffer.
- `A_array` Array of alpha values.
- `A_const` Constant alpha value.
- `w` Image width in pixels.
- `h` Image height in lines.
- `dlb` Linebytes for output buffer.
- `yalb` Linebytes for Y and alpha buffers.
uvlb Linebytes for U and V buffers.

Return Values None.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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</tbody>
</table>

See Also mlib_VideoColorYUV420seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV420seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV411seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV444seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV422seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUYV422int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUYV422int_to_ABGRint(3MLIB),
mlib_VideoColorYUYV444int_to_ABGRint(3MLIB),
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mlib_VideoColorYUYV444int_to_ABGRint(3MLIB),
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),
mlib_VideoColorYUYV444int_to_ABGRint(3MLIB),
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),
attributes(5)
Name  mlib_VideoColorYUV422seq_to_UYVY422int – convert YUV sequential to interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
          #include <mlib.h>
          void mlib_VideoColorYUV422seq_to_UYVY422int(mlib_u32 *UYVY,
          const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V,
          mlib_s32 w, mlib_s32 h, mlib_s32 dlb,
          mlib_s32 ylb, mlib_s32 uvlb);

Description  The Y, U, V pixel streams are combined into a UYVY pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/2 \) and \( h \). Dimensions \( w \) and \( h \) are assumed to be even. Similar to mlib_VideoColorYUV420seq_to_UYVY422int() except U and V are not sampled in the h direction.

The following equation is used:

\[
UYVY[r][c/2] = (U[r][c/2] \ll 24) | (Y[r][c] \ll 16) | (V[r][c/2] \ll 8) | (Y[r][c+1])
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

Parameters  The function takes the following arguments:

- \( UYVY \)  Pointer to output buffer.
- \( Y \)  Pointer to Y input buffer.
- \( U \)  Pointer to U input buffer.
- \( V \)  Pointer to V input buffer.
- \( w \)  Image width in pixels.
- \( h \)  Image height in lines.
- \( dlb \)  Linebytes for UYVY buffer.
- \( ylb \)  Linebytes for Y buffer.
- \( uvlb \)  Linebytes for U and V buffers.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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<td>ATTRIBUTE TYPE</td>
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**See Also**  
`mlib_VideoColorYUV420seq_to_UYVY422int(3MLIB)`,  
`mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB)`,  
`mlib_VideoColorYUV422seq_to_UYVY422int(3MLIB)`,  
`mlib_VideoColorYUV420seq_to_UYVY422int(3MLIB)`,  
`mlib_VideoColorYUV411seq_to_UYVY422int(3MLIB)`,  
`attributes(5)`
Name  mlib_VideoColorYUV422seq_to_YUYV422int – convert YUV sequential to interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorYUV422seq_to_YUYV422int(mlib_u32 *YUYV, const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 ylb, mlib_s32 uvlb);

Description  The Y, U, V pixel streams are combined into a YUYV pixel stream. All pixel components are 8-bit unsigned integers. The Y buffer has dimensions \( w \) and \( h \). The U and V buffers have dimensions \( w/2 \) and \( h \). Dimensions \( w \) and \( h \) are assumed to be even. Similar to mlib_VideoColorYUV420seq_to_YUYV422int() except U and V are not sampled in the h direction.

The following equation is used:

\[
YUYV[r][c/2] = (Y[r][c] << 24) | (U[r][c/2] << 16) | (Y[r][c+1] << 8) | (V[r][c/2])
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

Parameters  The function takes the following arguments:

- **YUYV**  Pointer to output buffer.
- **Y**  Pointer to Y input buffer.
- **U**  Pointer to U input buffer.
- **V**  Pointer to V input buffer.
- **w**  Image width in pixels.
- **h**  Image height in lines.
- **dlb**  Linebytes for YUYV buffer.
- **ylb**  Linebytes for Y buffer.
- **uvlb**  Linebytes for U and V buffers.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
<th>ATTRIBUTE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Stability</td>
<td>Committed</td>
</tr>
</tbody>
</table>
### mlib_VideoColorYUV422seq_to_YUYV422int(3MLIB)

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

**See Also**
mlib_VideoColorYUV420seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV411seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV420seq_to_UYYV422int(3MLIB),
mlib_VideoColorYUV411seq_to_UYYV422int(3MLIB),
mlib_VideoColorYUV422seq_to_UYYV422int(3MLIB), attributes(5)
mlib_VideoColorYUV444int_to_ABGRint – color convert YUV interleaved to ABGR interleaved

Synopsis

cc [ flag...] file... -lmlib [ library...]  
#include <mlib.h>  

void mlib_VideoColorYUV444int_to_ABGRint(mlib_u32 *ABGR,  
const mlib_u8 *YUV, const mlib_u8 *A_array, mlib_u8 A_const,  
mlib_s32 w, mlib_s32 h, mlib_s32 dlb,  
mlib_s32 slb, mlib_s32 alb);

Description

The YUV pixel stream is converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. All buffers have dimensions w and h.

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

The following equation is used:

\[
\begin{bmatrix}
|R| & 1.644 & 0.000 & 1.5966 & \mid |Y| & 16.0000 |
\end{bmatrix}
\begin{bmatrix}
|G| & 1.644 & -0.3920 & -0.8132 & \mid |U| - 128.0000 |
\end{bmatrix}
\begin{bmatrix}
|B| & 1.644 & 2.0184 & 0.0000 & \mid |V| - 128.0000 |
\end{bmatrix}
\]

Parameters

The function takes the following arguments:

- **ABGR**: Pointer to output buffer.
- **YUV**: Pointer to Y input buffer.
- **A_array**: Array of alpha values.
- **A_const**: Constant alpha value.
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **dlb**: Linebytes for output buffer.
- **slb**: Linebytes for input buffer.
- **alb**: Linebytes for alpha buffer.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:
<table>
<thead>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

- `mlib_VideoColorYUV420seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV411seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV422seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV444seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV420seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV411seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV422seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV444seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUYV422int_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUYV444int_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUYV422int_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUYV444int_to_ABGRint(3MLIB)`, attributes(5)
The YUV pixel stream is converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. All buffers have dimensions \( w \) and \( h \).

The alpha values for this function work in the following fashion:

- If \( A\_array \) pointer is not NULL, the values are taken from there. It has to have the same dimensions as the \( Y \) buffer.
- If \( A\_array \) pointer is NULL, the alpha values for every pixel are set to \( A\_const \).

The following equation is used:

\[
\begin{align*}
|R| &= \begin{bmatrix} 1.644 & 0.000 & 1.956 \end{bmatrix} \begin{bmatrix} Y \end{bmatrix} + 16.000 \\text{| pixels|} \\
|G| &= \begin{bmatrix} 1.644 & -0.392 & -0.813 \end{bmatrix} \begin{bmatrix} U \end{bmatrix} - 128.000 \\text{| pixels|} \\
|B| &= \begin{bmatrix} 1.644 & 2.018 & 0.000 \end{bmatrix} \begin{bmatrix} V \end{bmatrix} + 128.000 \\text{| pixels|}
\end{align*}
\]

The function takes the following arguments:

- \( ARGB \): Pointer to output buffer.
- \( YUV \): Pointer to Y input buffer.
- \( A\_array \): Array of alpha values.
- \( A\_const \): Constant alpha value.
- \( w \): Image width in pixels.
- \( h \): Image height in lines.
- \( dlb \): Linebytes for output buffer.
- \( slb \): Linebytes for input buffer.
- \( alb \): Linebytes for alpha buffer.

None.

See attributes(5) for descriptions of the following attributes:
**mlib_VideoColorYUV444int_to_ARGBint(3MLIB)**

<table>
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See Also  
mlib_VideoColorYUV420seq_to_ARGBint(3MLIB),  
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),  
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),  
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),  
mlib_VideoColorYUV411seq_to_ABGRint(3MLIB),  
mlib_VideoColorYUV422seq_to_ABGRint(3MLIB),  
mlib_VideoColorYUV444seq_to_ABGRint(3MLIB),  
mlib_VideoColorYUV422int_to_ARGBint(3MLIB),  
mlib_VideoColorYUV422int_to_ABGRint(3MLIB),  
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),  
mlib_VideoColorUYVY422int_to_ARGBint(3MLIB),  
mlib_VideoColorUYVY422int_to_ABGRint(3MLIB),  
mlib_VideoColorUYV444int_to_ARGBint(3MLIB),  
mlib_VideoColorUYV444int_to_ABGRint(3MLIB), attributes(5)
mlib_VideoColorYUV444int_to_UYVY422int – convert YUV interleaved with subsampling

Synopsis

```c
void mlib_VideoColorYUV444int_to_UYVY422int(mlib_u32 *UYVY, const mlib_u8 *YUV, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);
```

Description

The YUV pixel stream is broken apart and recombined into a UYVY pixel stream. All pixel components are 8-bit unsigned integers. The YUV buffer has dimensions \( w \) and \( h \). Dimension \( w \) is assumed to be a multiple of 2. Adjacent U and V values are averaged to get the output U and V values. The sequence of values in the input stream is \( Y[r][c], U[r][c], V[r][c], Y[r][c+1], U[r][c+1], V[r][c+1], ... \)

The following equation is used:

\[
UYVY[r][c/2] = (((U[r][c] + U[r][c+1]) / 2) << 24) | (Y[r][c] << 16) | (((V[r][c] + V[r][c+1]) / 2) << 8) | (V[r][c+1])
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

Parameters

The function takes the following arguments:

- **UYVY**: Pointer to output buffer.
- **YUV**: Pointer to input buffer.
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **dlb**: Linebytes for output buffer.
- **slb**: Linebytes for input buffer.

Return Values

None.

Attributes

See attributes(5) for descriptions of the following attributes:

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</tr>
</tbody>
</table>

See Also

mlib_VideoColorYUV444seq_to_YUVY422int(3MLIB),
mlib_VideoColorYUV444int_to_YUVY422int(3MLIB),
mlib_VideoColorYUV444seq_to_UYVY422int(3MLIB),
mlib_VideoColorUYV444int_to_UYVY422int(3MLIB)

mlib_VideoColorUYV444int_to_UYVY422int(3MLIB),
mlib_VideoColorUYV444int_to_UYV422int(3MLIB), attributes(5)
mlib_VideoColorYUV444int_to_YUYV422int

**Name**
mlib_VideoColorYUV444int_to_YUYV422int – convert YUV interleaved with subsampling

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

```c
void mlib_VideoColorYUV444int_to_YUYV422int(mlib_u32 *YUYV, const mlib_u8 *YUV, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);
```

**Description**
The YUV pixel stream is broken apart and recombined into a YUYV pixel stream. All pixel components are 8-bit unsigned integers. The YUV buffer has dimensions \( w \) and \( h \). Dimension \( w \) is assumed to be a multiple of 2. Adjacent U and V values are averaged to get the output U and V values. The sequence of values in the input stream is \( Y[r][c], U[r][c], V[r][c], Y[r][c+1], U[r][c+1], V[r][c+1], \ldots \)

The following equation is used:
\[
YUYV[r][c/2] = (Y[r][c] \ll 24) | ((U[r][c] + U[r][c+1]) / 2) \ll 16 | (Y[r][c+1] \ll 8) | (((V[r][c] + V[r][c+1]) / 2))
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

**Parameters**
The function takes the following arguments:
- **YUYV**  Pointer to output buffer.
- **YUV**   Pointer to input buffer.
- **w**     Image width in pixels.
- **h**     Image height in lines.
- **dlb**   Linebytes for output buffer.
- **slb**   Linebytes for input buffers.

**Return Values**
None.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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</tbody>
</table>

**See Also**
mlib_VideoColorYUV444seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV444seq_to_UYVY422int(3MLIB),
mlib_VideoColorYUV444int_to_UYVY422int(3MLIB),
Name  mlib_VideoColorYUV444seq_to_ABGRint – color convert YUV sequential to ABGR interleaved

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorYUV444seq_to_ABGRint(mlib_u32 *ABGR,
const mlib_u8 *Y,
const mlib_u8 *U,
const mlib_u8 *V,
const mlib_u8 *A_array,
mlib_u8 A_const,
mlib_s32 w, mlib_s32 h, mlib_s32 dlbl, mlib_s32 slbl);

Description  The Y, U, V pixel streams are converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. All buffers have dimensions w and h.

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

The following equation is used:

\[
\begin{align*}
|R| &= \begin{bmatrix} 1.1644 & 0.0000 & 1.5966 \end{bmatrix} \begin{bmatrix} Y \end{bmatrix} + 16.0000 \\
|G| &= \begin{bmatrix} 1.1644 & -0.3920 & -0.8132 \end{bmatrix} \begin{bmatrix} U \end{bmatrix} - 128.0000 \\
|B| &= \begin{bmatrix} 1.1644 & 2.0184 & 0.0000 \end{bmatrix} \begin{bmatrix} V \end{bmatrix} + 128.0000
\end{align*}
\]

Parameters  The function takes the following arguments:

- ABGR  Pointer to output buffer.
- Y  Pointer to Y input buffer.
- U  Pointer to U input buffer.
- V  Pointer to V input buffer.
- A_array  Array of alpha values.
- A_const  Constant alpha value.
- w  Image width in pixels.
- h  Image height in lines.
- dlbl  Linebytes for output buffer.
- slbl  Linebytes for input buffers.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:
### ATTRIBUTE TYPE | ATTRIBUTE VALUE
--- | ---
Interface Stability | Committed
MT-Level | MT-Safe

**See Also**

- `mlib_VideoColorYUV420seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV411seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV422seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV444seq_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV420seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV411seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV422seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV444seq_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUYV422int_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUYV422int_to_ABGRint(3MLIB)`
- `mlib_VideoColorYUV444int_to_ARGBint(3MLIB)`
- `mlib_VideoColorYUV444int_to_ABGRint(3MLIB)`
- `mlib_VideoColorUYVY422int_to_ARGBint(3MLIB)`
- `mlib_VideoColorUYVY422int_to_ABGRint(3MLIB)`
- `mlib_VideoColorUYV444int_to_ARGBint(3MLIB)`
- `mlib_VideoColorUYV444int_to_ABGRint(3MLIB)`
- `attributes(5)`
### Name
mlib_VideoColorYUV444seq_to_ARGBint - color convert YUV sequential to ARGB interleaved

### Synopsis
```c
#include <mlib.h>

void mlib_VideoColorYUV444seq_to_ARGBint(mlib_u32 *ARGB,
const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V,
const mlib_u8 *A_array,
mlib_u8 A_const, mlib_s32 w, mlib_s32 h, mlib_s32 db, mlib_s32 slb);
```

### Description
The Y, U, V pixel streams are converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. All buffers have dimensions \( w \) and \( h \).

The alpha values for this function work in the following fashion:

- If \( A\_array \) pointer is not NULL, the values are taken from there. It has to have the same dimensions as the \( Y \) buffer.
- If \( A\_array \) pointer is NULL, the alpha values for every pixel are set to \( A\_const \).

The following equation is used:

\[
\begin{align*}
|R| &= \begin{bmatrix} 1.1644 & 0.0000 & 1.5966 \end{bmatrix} \cdot \begin{bmatrix} Y \end{bmatrix} - 16.0000 \\
|G| &= \begin{bmatrix} 1.1644 & -0.3920 & -0.8132 \end{bmatrix} \cdot \begin{bmatrix} U \end{bmatrix} - 128.0000 \\
|B| &= \begin{bmatrix} 1.1644 & 2.0184 & 0.0000 \end{bmatrix} \cdot \begin{bmatrix} V \end{bmatrix} - 128.0000
\end{align*}
\]

### Parameters
- **ARGB**: Pointer to output buffer.
- **Y**: Pointer to \( Y \) input buffer.
- **U**: Pointer to \( U \) input buffer.
- **V**: Pointer to \( V \) input buffer.
- **A_array**: Array of alpha values.
- **A_const**: Constant alpha value.
- **w**: Image width in pixels.
- **h**: Image height in lines.
- **db**: Linebytes for output buffer.
- **slb**: Linebytes for input buffers.

### Return Values
None.

### Attributes
See `attributes(5)` for descriptions of the following attributes:
## ATTRIBUTE TYPE

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</tr>
</tbody>
</table>

### See Also

- mlib_VideoColorYUV420seq_to_ARGBint(3MLIB)
- mlib_VideoColorYUV411seq_to_ARGBint(3MLIB)
- mlib_VideoColorYUV422seq_to_ARGBint(3MLIB)
- mlib_VideoColorYUV420seq_to_ABGRint(3MLIB)
- mlib_VideoColorYUV411seq_to_ABGRint(3MLIB)
- mlib_VideoColorYUV422seq_to_ABGRint(3MLIB)
- mlib_VideoColorYUYV422int_to_ARGBint(3MLIB)
- mlib_VideoColorYUYV422int_to_ABGRint(3MLIB)
- mlib_VideoColorYUV444seq_to_ABGRint(3MLIB)
- mlib_VideoColorYUV444int_to_ARGBint(3MLIB)
- mlib_VideoColorYUV444int_to_ABGRint(3MLIB)
- mlib_VideoColorUYVY422int_to_ARGBint(3MLIB)
- mlib_VideoColorUYVY422int_to_ABGRint(3MLIB)
- mlib_VideoColorUYV444int_to_ARGBint(3MLIB)
- mlib_VideoColorUYV444int_to_ABGRint(3MLIB), attributes(5)
Name  mlib_VideoColorYUV444seq_to_UYVY422int – convert YUV sequential to interleaved with subsampling

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorYUV444seq_to_UYVY422int(mlib_u32 *UYVY,
const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V, mlib_s32 w,
mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);

Description  The Y, U, V pixel streams are combined into a UYVY pixel stream. All pixel components are 8-bit unsigned integers. The Y, U, and V buffers have dimensions \( w \) and \( h \). Dimension \( w \) is assumed to be a multiple of 2. Adjacent U and V values are averaged to get the output U and V values.

The following equation is used:

\[
UYVY[r][c/2] = (((U[r][c] + U[r][c+1]) / 2) << 24) |
(Y[r][c] << 16) |
(((V[r][c] + V[r][c+1]) / 2) << 8) |
(Y[r][c+1])
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

Parameters  The function takes the following arguments:

- \( UYVY \) Pointer to output buffer.
- \( Y \) Pointer to Y input buffer.
- \( U \) Pointer to U input buffer.
- \( V \) Pointer to V input buffer.
- \( w \) Image width in pixels.
- \( h \) Image height in lines.
- \( dlb \) Linebytes for output buffer.
- \( slb \) Linebytes for input buffers.

Return Values  None.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  

mlib_VideoColorYUV444seq_to_UYVY422int(3MLIB),
mlib_VideoColorYUV444int_to_UYVY422int(3MLIB),
mlib_VideoColorYUV444int_to_UYVY422int(3MLIB), attributes(5)
mlib_VideoColorYUV444seq_to_YUYV422int – convert YUV sequential to interleaved with subsampling

Synopsis

```c
#include <mlib.h>

void mlib_VideoColorYUV444seq_to_YUYV422int(mlib_u32 *YUYV, const mlib_u8 *Y, const mlib_u8 *U, const mlib_u8 *V, mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb);
```

Description

The Y, U, V pixel streams are combined into a YUYV pixel stream. All pixel components are 8-bit unsigned integers. The Y, U, and V buffers have dimensions \( w \) and \( h \). Dimension \( w \) is assumed to be a multiple of 2. Adjacent U and V values are averaged to get the output U and V values.

The following equation is used:

\[
YUYV[r][c/2] = (Y[r][c] << 24) | \\
((U[r][c] + U[r][c+1]) / 2) << 16) | \\
(Y[r][c+1] << 8) | \\
((V[r][c] + V[r][c+1]) / 2)
\]

where \( r = 0, 1, 2, \ldots, h-1 \); and \( c = 0, 2, 4, \ldots, w-2 \).

Parameters

The function takes the following arguments:

- **YUYV** Pointer to output buffer.
- **Y** Pointer to Y input buffer.
- **U** Pointer to U input buffer.
- **V** Pointer to V input buffer.
- **w** Image width in pixels.
- **h** Image height in lines.
- **dlb** Linebytes for output buffer.
- **slb** Linebytes for input buffers.

Return Values

None.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also  

```
mlib_VideoColorYUV444seq_to_YUYV422int(3MLIB),
mlib_VideoColorYUV444int_to_YUYV422int(3MLIB),
mlib_VideoColorYUV444int_to_UYVY422int(3MLIB), attributes(5)
```
Name mlib_VideoColorYUYV422int_to_ABGRint – color convert YUYV interleaved to ABGR interleaved

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

void mlib_VideoColorYUYV422int_to_ABGRint(mlib_u32 *ABGR,
    const mlib_u32 *YUYV, const mlib_u8 *A_array, mlib_u8 A_const,
    mlib_s32 w, mlib_s32 h, mlib_s32 dlb, mlib_s32 slb, mlib_s32 alb);

Description The YUYV pixel stream is converted into an ABGR pixel stream. All pixel components are 8-bit unsigned integers. The YUYV buffer has dimensions w/2 and h. The ABGR buffer has dimensions w and h. Dimensions w is assumed to be even.

The alpha values for this function work in the following fashion:

- If A_array pointer is not NULL, the values are taken from there. It has to have the same dimensions as the Y buffer.
- If A_array pointer is NULL, the alpha values for every pixel are set to A_const.

The following equation is used:

\[
    \begin{bmatrix}
        |R| \\
        |G| \\
        |B|
    \end{bmatrix} = \begin{bmatrix}
        1.1644 & 0.0000 & 1.5966 \\
        1.1644 & -0.3920 & -0.8132 \\
        1.1644 & 2.0184 & 0.0000
    \end{bmatrix} \begin{bmatrix}
        |Y| - 16.0000 \\
        |U| - 128.0000 \\
        |V| - 128.0000
    \end{bmatrix}
\]

Parameters The function takes the following arguments:

- ABGR Pointer to output buffer.
- YUYV Pointer to Y input buffer.
- A_array Array of alpha values.
- A_const Constant alpha value.
- w Image width in pixels.
- h Image height in lines.
- dlb Line bytes for output buffer.
- slb Line bytes for input buffer.
- alb Line bytes for alpha buffer.

Return Values None.

Attributes See attributes(5) for descriptions of the following attributes:
mlib_VideoColorYUYV422int_to_ABGRint(3MLIB)

<table>
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<tr>
<th>ATTRIBUTE TYPE</th>
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<td>MT-Level</td>
<td>MT-Safe</td>
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</tbody>
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See Also

mlib_VideoColorYUV420seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV411seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV422seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV444seq_to_ARGBint(3MLIB),
mlib_VideoColorYUV420seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV411seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV422seq_to_ABGRint(3MLIB),
mlib_VideoColorYUV444seq_to_ABGRint(3MLIB),
mlib_VideoColorYUYV422int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ARGBint(3MLIB),
mlib_VideoColorYUV444int_to_ABGRint(3MLIB),
mlib_VideoColorUYVY422int_to_ARGBint(3MLIB),
mlib_VideoColorUYVY422int_to_ABGRint(3MLIB),
mlib_VideoColorUYV444int_to_ARGBint(3MLIB),
mlib_VideoColorUYV444int_to_ABGRint(3MLIB),
mlib_VideoColorUYV444int_to_ABGRint(3MLIB), attributes(5)
The YUYV pixel stream is converted into an ARGB pixel stream. All pixel components are 8-bit unsigned integers. The YUYV buffer has dimensions \( w \) and \( h \). The ABGR buffer has dimensions \( w \) and \( h \). Dimensions \( w \) is assumed to be even.

The alpha values for this function work in the following fashion:

- If \( A\_array \) pointer is not NULL, the values are taken from there. It has to have the same dimensions as the \( Y \) buffer.
- If \( A\_array \) pointer is NULL, the alpha values for every pixel are set to \( A\_const \).

The following equation is used:

\[
\begin{align*}
|R| &= |1.1644 \ 0.0000 \ 1.5966| \times |Y| \times \{16.0000\} \\
|G| &= |1.1644 \ -0.3920 \ -0.8132| \times |U| - \{128.0000\} \\
|B| &= |1.1644 \ 2.0184 \ 0.0000| \times |V| \times \{128.0000\}
\end{align*}
\]

**Parameters**

The function takes the following arguments:

- \( ARGB \) Pointer to output buffer.
- \( YUYV \) Pointer to \( Y \) input buffer.
- \( A\_array \) Array of alpha values.
- \( A\_const \) Constant alpha value.
- \( w \) Image width in pixels.
- \( h \) Image height in lines.
- \( dlb \) Linebytes for output buffer.
- \( slb \) Linebytes for input buffer.
- \( alb \) Linebytes for alpha buffer.

**Return Values** None.

**Attributes** See attributes(5) for descriptions of the following attributes:
### mlib_VideoColorYUYV422int_to_ARGBInt(3MLIB)

<table>
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**See Also**

- mlib_VideoColorYUV420seq_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV411seq_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV422seq_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV444seq_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV420seq_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV411seq_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV422seq_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV444seq_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV420int_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV411int_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV422int_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV444int_to_ARGBInt(3MLIB),
- mlib_VideoColorYUV420int_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV411int_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV422int_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV444int_to_ABGRInt(3MLIB),
- mlib_VideoColorYUV444int_to_ABGRInt(3MLIB), attributes(5)
Name  
mlib_VideoCopyRefAve_U8_U8_16x16, mlib_VideoCopyRefAve_U8_U8_16x8,  
mlib_VideoCopyRefAve_U8_U8_8x16, mlib_VideoCopyRefAve_U8_U8_8x8,  
mlib_VideoCopyRefAve_U8_U8_8x4 – copies and averages a block from the reference block  
to the current block.

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>  

mlib_status mlib_VideoCopyRefAve_U8_U8_16x16(mlib_u8 *curr_block,  
const mlib_u8 *ref_block, mlib_s32 stride);  
mlib_status mlib_VideoCopyRefAve_U8_U8_16x8(mlib_u8 *curr_block,  
const mlib_u8 *ref_block, mlib_s32 stride);  
mlib_status mlib_VideoCopyRefAve_U8_U8_8x16(mlib_u8 *curr_block,  
const mlib_u8 *ref_block, mlib_s32 stride);  
mlib_status mlib_VideoCopyRefAve_U8_U8_8x8(mlib_u8 *curr_block,  
const mlib_u8 *ref_block, mlib_s32 stride);  
mlib_status mlib_VideoCopyRefAve_U8_U8_8x4(mlib_u8 *curr_block,  
const mlib_u8 *ref_block, mlib_s32 stride);

Description  
Each of these functions copies and averages a block from the reference block to the current  
block. The stride applies to both the input reference block and the current block.

Parameters  
Each of the functions takes the following arguments:

- **curr_block**  
  Pointer to the current block. curr_block must be 8-byte aligned.

- **ref_block**  
  Pointer to the reference block.

- **stride**  
  Stride, in bytes, between adjacent rows in both the current block and the  
  reference block. stride must be a multiple of eight.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),  
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),  
mlib_VideoH263OverlappedMC_S16_U8(3MLIB), mlib_VideoH263OverlappedMC_U8_U8(3MLIB),  
mlib_VideoInterpAveX_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8_16x16(3MLIB),  
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),  
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB)

mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
Name  mlib_VideoCopyRefAve_U8_U8 – copies and averages a block from the reference block to the current block

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoCopyRefAve_U8_U8(mlib_u8 *curr_block,
    const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height,
    mlib_s32 stride);

Description  The mlib_VideoCopyRefAve_U8_U8() function copies and averages a block from the reference block to the current block. The stride applies to both the input reference block and the current block.

Parameters  The function takes the following arguments:

curr_block  Pointer to the current block. curr_block must be 8-byte aligned.
ref_block  Pointer to the reference block.
width  Width of the blocks
height  Height of the blocks.
stride  Stride, in bytes, between adjacent rows in both the current block and the reference block. stride must be a multiple of eight.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8_16x16(3MLIB),
mlib_VideoInterpX_S16_U8(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB)
mlib_VideoCopyRefAve_U8_U8(3MLIB)

mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
Name
mlib_VideoCopyRef_S16_U8_16x16, mlib_VideoCopyRef_S16_U8_16x8,
mlib_VideoCopyRef_S16_U8_8x16, mlib_VideoCopyRef_S16_U8_8x8,
mlib_VideoCopyRef_S16_U8_8x4 – copies a block from the reference block to the current
block.

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoCopyRef_S16_U8_16x16(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_S16_U8_16x8(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_S16_U8_8x16(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_S16_U8_8x8(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_S16_U8_8x4(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 stride);

Description
Each of these functions copies a block from the reference block to the motion-compensated
reference block. The stride applies to only the input reference block.

Parameters
Each of the functions takes the following arguments:

- mc_block  Pointer to the motion-compensated reference block. mc_block must be 8-byte
aligned.
- ref_block  Pointer to the reference block.
- stride  Stride, in bytes, between adjacent rows in the reference block. stride must be a
multiple of eight.

Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_U8_U8(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
mlib_VideoCopyRefAve_U8_U8(3MLIB), mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB)

mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpAveY_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_videoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_16x16(3MLIB), mlib_VideoInterpY_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
Name  
mlib_VideoCopyRef_S16_U8 – copies a block from the reference block to the current block

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_VideoCopyRef_S16_U8(mlib_s16 *mc_block,  
        const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height,  
        mlib_s32 stride);

Description  
The mlib_VideoCopyRef_S16_U8() function copies a block from the reference block to the motion-compensated reference block. The stride applies to only the input reference block.

Parameters  
The function takes the following arguments:

- mc_block  
  Pointer to the motion-compensated reference block. mc_block must be 8-byte aligned.

- ref_block  
  Pointer to the reference block.

- width  
  Width of the blocks.

- height  
  Height of the blocks.

- stride  
  Stride, in bytes, between adjacent rows in the reference block. stride must be a multiple of eight.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8_16x16(3MLIB),  
mlib_VideoCopyRef_U8_U8(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),  
mlib_VideoCopyRefAve_U8_U8(3MLIB), mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),  
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),  
mlib_VideoInterpAveX_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8_16x16(3MLIB),  
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),  
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),  
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_Y_S16_U8(3MLIB),  
mlib_VideoInterpX_Y_S16_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8(3MLIB),  
mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB),  
mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoCopyRef_S16_U8(3MLIB)

mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoCopyRef_U8_U8_16x16(3MLIB)

Name  
mlib_VideoCopyRef_U8_U8_16x16, mlib_VideoCopyRef_U8_U8_16x8,  
mlib_VideoCopyRef_U8_U8_8x16, mlib_VideoCopyRef_U8_U8_8x8,  
mlib_VideoCopyRef_U8_U8_8x4 – copies an 8x8 block from the reference block to the  
current block

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

mlib_status mlib_VideoCopyRef_U8_U8_16x16(mlib_u8 *curr_block,  
    const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_U8_U8_16x8(mlib_u8 *curr_block,  
    const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_U8_U8_8x16(mlib_u8 *curr_block,  
    const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_U8_U8_8x8(mlib_u8 *curr_block,  
    const mlib_u8 *ref_block, mlib_s32 stride);
mlib_status mlib_VideoCopyRef_U8_U8_8x4(mlib_u8 *curr_block,  
    const mlib_u8 *ref_block, mlib_s32 stride);

Description  
Each of these functions copies a block from the reference block to the current block. The stride  
applies to both the input reference block and the current block.

Parameters  
Each of the functions takes the following arguments:

curr_block  
    Pointer to the current block. curr_block must be 8-byte aligned.

ref_block  
    Pointer to the reference block.

stride  
    Stride, in bytes, between adjacent rows in both the current block and the  
    reference block. stride must be a multiple of eight.

Return Values  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),  
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),  
mlib_VideoCopyRefAve_U8_U8(3MLIB), mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),  
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),  
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),  
mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefU8_U8(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Decimate_U8(U8_16x16(3MLIB),
mlib_VideoP64DecimateY_U8_U8(3MLIB), mlib_VideoP64DecimateY_U8(3MLIB),
mlib_VideoP64DecimateY_U8_U8(3MLIB), mlib_VideoP64DecimateY_U8(3MLIB),
mlib_VideoP64DecimateY_U8_16x16(3MLIB), mlib_VideoP64DecimateY_U8_16x16(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_S16_U8_16x16(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
### Name
mlib_VideoCopyRef_U8_U8 – copies a block from the reference block to the current block.

### Synopsis
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoCopyRef_U8_U8(mlib_u8 *curr_block,
                                      const mlib_u8 *ref_block,
                                      mlib_s32 width, mlib_s32 height,
                                      mlib_s32 stride);
```

### Description
The `mlib_VideoCopyRef_U8_U8()` function copies a block from the reference block to the current block. The stride applies to both the input reference block and the current block.

### Parameters
The function takes the following arguments:
- **curr_block**: Pointer to the current block. `curr_block` must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **width**: Width of the blocks.
- **height**: Height of the blocks.
- **stride**: Stride, in bytes, between adjacent rows in both the current block and the reference block. `stride` must be a multiple of eight.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
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</tbody>
</table>

### See Also
- `mlib_VideoAddBlock_U8_S16(3MLIB)`, `mlib_VideoCopyRef_S16_U8(3MLIB)`, `mlib_VideoCopyRef_S16_U8_16x16(3MLIB)`, `mlib_VideoCopyRef_U8_S16_U8(3MLIB)`, `mlib_VideoCopyRef_U8_U8(3MLIB)`, `mlib_VideoCopyRef_U8_U8_16x16(3MLIB)`,
mlib_VideoCopyRef_U8_U8(3MLIB)

mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
Name  mlib_VideoDCT16x16_S16_S16 – forward Discrete Cosine Transform (DCT)

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDCT16x16_S16_S16(mlib_s16 coeffs[256],
const mlib_s16 block[256]);

Description The input to the DCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum. The source and destination buffer addresses must be 8-byte aligned.

Parameters The function takes the following arguments:

coeffs Pointer to the destination DCT coefficients. coeffs must be 8-byte aligned.

block Pointer to a 16x16 motion-compensated block that is the difference between the reference block and the current block. block must be 8-byte aligned.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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See Also mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_S16_LA(3MLIB), mlib_VideoDCT8x8_S16_U8(3MLIB), mlib_VideoDCT8x8_S16_U8_LA(3MLIB), mlib_VideoDCT16x16_S16_S16_B10(3MLIB), mlib_VideoDeQuantize_S16(3MLIB), mlib_VideoDeQuantizeInit_S16(3MLIB), attributes(5), mlib_VideoQuantize_S16(3MLIB), mlib_VideoQuantizeInit_S16(3MLIB)
The `mlib_VideoDCT16x16_S16_S16_B10()` function computes the forward DCT for the destination DCT coefficients of data type `mlib_s16` and source block of data type `mlib_s16`. The input to the DCT routine is the difference between the current block and the reference block. The difference pixel which can occupy 10 bits, is represented as a 16-bit data.

### Parameters
- **coeffs**  
  Pointer to the output DCT coefficients. Note that `coeffs` must be 8-byte aligned.
- **block**  
  Pointer to a 16x16 motion-compensated block which is the difference between the reference block and the current block. Note that `block` must be 8-byte aligned.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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### See Also
- `mlib_VideoDCT2x2_S16_S16(3MLIB)`
- `mlib_VideoDCT4x4_S16_S16(3MLIB)`
- `mlib_VideoDCT8x8_S16_S16(3MLIB)`
- `mlib_VideoDCT8x8_S16_S16_B12(3MLIB)`
- `mlib_VideoDCT8x8_S16_S16_NA(3MLIB)`
- `mlib_VideoDCT8x8_S16_U8(3MLIB)`
- `mlib_VideoDCT8x8_S16_U8_NA(3MLIB)`
- `mlib_VideoDCT16x16_S16_S16(3MLIB)`
- `mlib_VideoDeQuantize_S16(3MLIB)`
- `mlib_VideoDeQuantizeInit_S16(3MLIB)`
- `mlib_VideoQuantize_S16(3MLIB)`
- `mlib_VideoQuantizeInit_S16(3MLIB)`
- attributes(5)
mlib_VideoDCT2x2_S16_S16 – forward Discrete Cosine Transform (DCT)

Synopsis

```c
#include <mlib.h>
mlib_status mlib_VideoDCT2x2_S16_S16(mlib_s16 coeffs[4],
const mlib_s16 block[4]);
```

Description

The mlib_VideoDCT2x2_S16_S16() function computes the forward DCT for the destination DCT coefficients of data type mlib_s16 and a source block of data type mlib_s16. The input to the DCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum. The source and destination buffer addresses must be 8-byte aligned.

Parameters

The function takes the following arguments:

- `coeffs` Pointer to the destination DCT coefficients. coeffs must be 8-byte aligned.
- `block` Pointer to an 2x2 motion-compensated block that is the difference between the reference block and the current block. block must be 8-byte aligned.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

- mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB),
- mlib_VideoDCT8x8_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB),
- mlib_VideoDCT8x8_S16_S16_B10(3MLIB), mlib_VideoDCT8x8_S16_U8(3MLIB),
- mlib_VideoDCT8x8_S16_U8_B12(3MLIB), mlib_VideoDCT8x8_S16_U8_B10(3MLIB),
- mlib_VideoDCT16x16_S16_S16(3MLIB), mlib_VideoDeQuantize_S16(3MLIB),
- mlib_VideoDeQuantizeInit_S16(3MLIB), mlib_VideoQuantize_S16(3MLIB),
- mlib_VideoQuantizeInit_S16(3MLIB), attributes(5)
mlib_VideoDCT4x4_S16_S16 – forward Discrete Cosine Transform (DCT)

Synopsis

```
cc [ flag... ] file... -tlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDCT4x4_S16_S16(mlib_s16 coeffs[16],
const mlib_s16 block[16]);
```

Description

The `mlib_VideoDCT4x4_S16_S16()` function computes the forward DCT for the destination DCT coefficients of data type `mlib_s16` and a source block of data type `mlib_s16`. The input to the DCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum. The source and destination buffer addresses must be 8-byte aligned.

Parameters

The function takes the following arguments:

- `coeffs` Pointer to the destination DCT coefficients. `coeffs` must be 8-byte aligned.
- `block` Pointer to an 4x4 motion-compensated block that is the difference between the reference block and the current block. `block` must be 8-byte aligned.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDeQuantize_S16(3MLIB), mlib_VideoDeQuantizeInit_S16(3MLIB), mlib_VideoQuantize_S16(3MLIB), mlib_VideoQuantizeInit_S16(3MLIB), attributes(5)`
The `mlib_VideoDCT8x8Quantize_S16_S16_B12()` function computes the forward DCT and then quantizes the DCT coefficients. It’s a combination of `mlib_VideoDCT8x8_S16_S16_B12()` and `mlib_VideoQuantize_S16()` for better performance. The source to the DCT routine can occupy up to 12 bits for each of its elements, i.e., should be within the range of [-2048, 2047].

The source and destination buffer addresses must be 8-byte aligned.

This function can be used in JPEG with 12-bit precision, or in MPEG for the inter mode.

Parameters

- `coeffs`  Pointer to the quantized DCT coefficients. Note that `coeffs` must be 8-byte aligned.
- `block`    Pointer to an 8x8 block. Note that `block` must be 8-byte aligned.
- `dqtable`  Pointer to the quantization table generated by `mlib_VideoQuantizeInit_S16()`.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

- `mlib_VideoDCT8x8Quantize_S16_S16_B12 NA(3MLIB)`, `mlib_VideoDCT8x8Quantize_S16_U8(3MLIB)`, `mlib_VideoDCT8x8Quantize_S16_U8 NA(3MLIB)`, `mlib_VideoQuantizeInit_S16(3MLIB)`, `attributes(5)`
The `mlib_VideoDCT8x8Quantize_S16_S16_B12_NA()` function computes the forward DCT and then quantizes the DCT coefficients. It's a combination of `mlib_VideoDCT8x8_S16_S16_B12_NA()` and `mlib_VideoQuantize_S16()` for better performance. The source to the DCT routine can occupy up to 12 bits for each of its elements, i.e., should be within the range of [-2048, 2047].

This function requires no special address alignment.

This function can be used in JPEG with 12-bit precision, or in MPEG for the inter mode.

**Parameters**
The function takes the following arguments:

- `coeffs` Pointer to the quantized DCT coefficients.
- `block` Pointer to an 8x8 block.
- `dqtable` Pointer to the quantization table generated by `mlib_VideoQuantizeInit_S16()`.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- `mlib_VideoDCT8x8Quantize_S16_S16_B12(3MLIB)`
- `mlib_VideoDCT8x8Quantize_S16_U8(3MLIB)`
- `mlib_VideoDCT8x8Quantize_S16_U8_NA(3MLIB)`
- `mlib_VideoQuantizeInit_S16(3MLIB)`
- attributes(5)
mlib_VideoDCT8x8Quantize_S16_U8 – forward Discrete Cosine Transform (DCT) and quantization

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDCT8x8Quantize_S16_U8(
    mlib_s16 coeffs[64],
    const mlib_u8 *block,
    const mlib_d64 dqtable[64], mlib_s32 stride);

Description
The `mlib_VideoDCT8x8Quantize_S16_U8()` function computes the forward DCT and then quantizes the DCT coefficients. It's a combination of `mlib_VideoDCT8x8_S16_U8()` and `mlib_VideoQuantize_S16()` for better performance.

The source and destination buffer addresses must be 8-byte aligned.

This function can be used in JPEG with 8-bit precision, or in MPEG for the intra mode.

Parameters
The function takes the following arguments:

- **coeffs** Pointer to the quantized DCT coefficients. Note that `coeffs` must be 8-byte aligned.
- **block** Pointer to an 8x8 block. Note that `block` must be 8-byte aligned.
- **dqtable** Pointer to the quantization table generated by `mlib_VideoQuantizeInit_S16()`.
- **stride** Stride in bytes between adjacent rows in the block. Note that `stride` must be a multiple of eight.

Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes
See `attributes(5)` for descriptions of the following attributes:

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See Also
`mlib_VideoDCT8x8Quantize_S16_S16_B12(3MLIB)`, `mlib_VideoDCT8x8Quantize_S16_S16_B12_NA(3MLIB)`, `mlib_VideoDCT8x8Quantize_S16_U8_NA(3MLIB)`, `mlib_VideoQuantizeInit_S16(3MLIB)`, `attributes(5)`. 
Name  mlib_VideoDCT8x8Quantize_S16_U8_NA – forward Discrete Cosine Transform (DCT) and quantization

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDCT8x8Quantize_S16_U8_NA(
    mlib_s16 coeffs[64], const mlib_u8 *block,
    const mlib_d64 dqtable[64], mlib_s32 stride);

Description  The mlib_VideoDCT8x8Quantize_S16_U8_NA() function computes the forward DCT and then quantizes the DCT coefficients. It’s a combination of mlib_VideoDCT8x8_S16_U8_NA() and mlib_VideoQuantize_S16() for better performance.

This function requires no special address alignment.

This function can be used in JPEG with 8-bit precision, or in MPEG for the intra mode.

Parameters  The function takes the following arguments:

coeffs  Pointer to the quantized DCT coefficients.
block  Pointer to an 8x8 block.
dqtable  Pointer to the quantization table generated by mlib_VideoQuantizeInit_S16().
stride  Stride in bytes between adjacent rows in the block.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoDCT8x8Quantize_S16_S16_B12(3MLIB),
mlib_VideoDCT8x8Quantize_S16_S16_B12_NA(3MLIB),
mlib_VideoDCT8x8Quantize_S16_U8(3MLIB), mlib_VideoQuantizeInit_S16(3MLIB),
attributes(5)
The `mlib_VideoDCT8x8_S16_S16_B10()` function computes the forward DCT for the destination DCT coefficients of data type `mlib_s16` and a source block of data type `mlib_s16`. The input to the DCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum.

The source and destination buffer addresses must be 8-byte aligned.

Since mediaLib 2.5, `mlib_VideoDCT8x8_S16_S16()` has been renamed to `mlib_VideoDCT8x8_S16_S16_B10()`. Now `mlib_VideoDCT8x8_S16_S16()` is an alias of `mlib_VideoDCT8x8_S16_S16_B10()`.

The function takes the following arguments:

- `coeffs` Pointer to the destination DCT coefficients. `coeffs` must be 8-byte aligned.
- `block` Pointer to an 8x8 motion-compensated block that is the difference between the reference block and the current block. `block` must be 8-byte aligned.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_VideoDCT2x2_S16_S16(3MLIB)`, `mlib_VideoDCT4x4_S16_S16(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_B10 NA(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_B12(3MLIB)`, `mlib_VideoDCT8x8_S16_UB(3MLIB)`, `mlib_VideoDCT8x8_S16_UB NA(3MLIB)`, `mlib_VideoDCT16x16_S16_S16(3MLIB)`, `mlib_VideoDCT16x16_S16_S16_B10(3MLIB)`, attributes(5)
The `mlib_VideoDCT8x8_S16_S16_B10_NA()` function computes the forward DCT for the destination DCT coefficients of data type `mlib_s16` and a source block of data type `mlib_s16`. The input to the DCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum.

This function requires no special address alignment.

Since mediaLib 2.5, `mlib_VideoDCT8x8_S16_S16_B10_NA()` has been renamed to `mlib_VideoDCT8x8_S16_S16_B10_NA()`. Now `mlib_VideoDCT8x8_S16_S16_B10_NA()` is an alias of `mlib_VideoDCT8x8_S16_S16_B10_NA()`.

The function takes the following arguments:

- `coeffs` Pointer to the destination DCT coefficients.
- `block` Pointer to an 8x8 motion-compensated block that is the difference between the reference block and the current block.

The function returns `MLIB_SUCCESS` if successful. Otherwise, it returns `MLIB_FAILURE`.

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See Also `mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16_B10(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_U8(3MLIB), mlib_VideoDCT8x8_S16_U8_NA(3MLIB), mlib_VideoDCT16x16_S16_S16(3MLIB), mlib_VideoDCT16x16_S16_S16_B10(3MLIB), attributes(5)`. 
Name  mlib_VideoDCT8x8_S16_S16_B12 – forward Discrete Cosine Transform (DCT)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
         #include <mlib.h>
         
         mlib_status mlib_VideoDCT8x8_S16_S16_B12( 
             mlib_s16 coeffs[64], const mlib_s16 block[64]);

Description  This function computes the forward DCT for the destination DCT coefficients of data type mlib_s16 and source block of data type mlib_s16. The source to the DCT routine can occupy up to 12 bits for each of its elements.

The source and destination buffer addresses must be 8-byte aligned.

This function can be used in JPEG with 12-bit precision.

Parameters  The function takes the following arguments:

coeffs    Pointer to the output DCT coefficients. Note that coeffs must be 8-byte aligned.

block     Pointer to an 8x8 block. Note that block must be 8-byte aligned.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB),
           mlib_VideoDCT8x8_S16_S16_B10(3MLIB), mlib_VideoDCT8x8_S16_S16_B10_NA(3MLIB),
           mlib_VideoDCT8x8_S16_U8(3MLIB), mlib_VideoDCT8x8_S16_U8_NA(3MLIB),
           mlib_VideoDCT16x16_S16_S16(3MLIB), mlib_VideoDCT16x16_S16_S16_B10(3MLIB),
           attributes(5)
mlib_VideoDCT8x8_S16_U8 – forward Discrete CosineTransform (DCT)

**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDCT8x8_S16_U8(mlib_s16 coeffs[64],
const mlib_u8 *block, mlib_s32 stride);
```

**Description**

The `mlib_VideoDCT8x8_S16_U8()` function computes the forward DCT for the destination DCT coefficients of data type `mlib_s16` and source block of data type `mlib_u8`. The stride applies to the block that is part of the frame currently being encoded.

The source and destination buffer addresses must be 8-byte aligned.

This function can be used in JPEG with 8-bit precision, or in MPEG for the intra mode.

**Parameters**

The function takes the following arguments:

- `coeffs` Pointer to the destination DCT coefficients. Note that `coeffs` must be 8-byte aligned.
- `block` Pointer to an 8x8 block in the current frame. Note that `block` must be 8-byte aligned.
- `stride` Stride in bytes between adjacent rows in the block. Note that `stride` must be a multiple of eight.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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**See Also**

- `mlib_VideoDCT2x2_S16_S16(3MLIB)`, `mlib_VideoDCT4x4_S16_S16(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_B10(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_B10 NA(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_B12(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_U8 NA(3MLIB)`, `mlib_VideoDCT16x16_S16_S16(3MLIB)`, `mlib_VideoDCT16x16_S16_S16_B10(3MLIB)`, `mlib_VideoDeQuantize_S16(3MLIB)`, `mlib_VideoDeQuantizeInit_S16(3MLIB)`, `mlib_VideoQuantize_S16(3MLIB)`, `mlib_VideoQuantizeInit_S16(3MLIB)`
Name  mlib_VideoDCT8x8_S16_U8_NA – forward Discrete Cosine Transform (DCT)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDCT8x8_S16_U8_NA(mlib_s16 coeffs[64],
           const mlib_u8 *block, mlib_s32 stride);

Description  The mlib_VideoDCT8x8_S16_U8_NA() function computes the forward DCT for the
destination DCT coefficients of data type mlib_s16 and source block of data type mlib_u8. The
stride applies to the block that is part of the frame currently being encoded.

This function requires no special address alignment.

This function can be used in JPEG with 8-bit precision, or in MPEG for the intra mode.

Parameters  The function takes the following arguments:

coeffs  Pointer to the destination DCT coefficients.
block  Pointer to an 8x8 block in the current frame.
stride  Stride in bytes between adjacent rows in the block.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<tbody>
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<td>MT-Level</td>
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</table>

See Also  mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB),
          mlib_VideoDCT8x8_S16_S16_B10(3MLIB), mlib_VideoDCT8x8_S16_S16_B10 NA(3MLIB),
          mlib_VideoDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDCT8x8_S16_S16_B12 NA(3MLIB),
          mlib_VideoDCT16x16_S16_S16(3MLIB), mlib_VideoDCT16x16_S16_S16_B10(3MLIB),
          mlib_VideoDeQuantize_S16(3MLIB), mlib_VideoDeQuantizeInit_S16(3MLIB),
          mlib_VideoQuantize_S16(3MLIB), mlib_VideoQuantizeInit_S16(3MLIB), attributes(5)
The `mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12()` function dequantizes the quantized DCT coefficients and then computes the inverse DCT. It’s a combination of `mlib_VideoDeQuantize_S16()` and `mlib_VideoIDCT8x8_S16_S16_B12()` for better performance. The output of this function should be within the range of [-2048, 2047] if `coeffs` is obtained from the corresponding `mlib_VideoDCT8x8Quantize_S16_S16_B12()` function.

The source and destination buffer addresses must be 8-byte aligned. This function can be used in JPEG with 12-bit precision, or in MPEG for the inter mode.

The function takes the following arguments:
- `block`: Pointer to an 8x8 block. Note that `block` must be 8-byte aligned.
- `coeffs`: Pointer to the input quantized DCT coefficients. Note that `coeffs` must be 8-byte aligned.
- `dqtable`: Pointer to the dequantization table generated by `mlib_VideoDeQuantizeInit_S16()`.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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</table>

See Also `mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12_NA(3MLIB)`, `mlib_VideoDeQuantizeIDCT8x8_U8_S16(3MLIB)`, `mlib_VideoDeQuantizeIDCT8x8_U8_S16_NA(3MLIB)`, `mlib_VideoDeQuantizeInit_S16(3MLIB)`, attributes(5)
The mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12_NA() function dequantizes the quantized DCT coefficients and then computes the inverse DCT. It’s a combination of mlib_VideoDeQuantize_S16() and mlib_VideoIDCT8x8_S16_S16_B12_NA() for better performance. The output of this function should be within the range of [-2048, 2047] if coeffs is obtained from the corresponding mlib_VideoDCT8x8Quantize_S16_S16_B12_NA() function.

This function requires no special address alignment.

This function can be used in JPEG with 12-bit precision, or in MPEG for the inter mode.

The function takes the following arguments:

- **block**: Pointer to an 8x8 block.
- **coeffs**: Pointer to the input quantized DCT coefficients.
- **dqtable**: Pointer to the dequantization table generated by mlib_VideoDeQuantizeInit_S16().

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

See also mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDeQuantizeIDCT8x8_U8_S16(3MLIB), mlib_VideoDeQuantizeIDCT8x8_U8_S16_NA(3MLIB), mlib_VideoDeQuantizeInit_S16(3MLIB), attributes(5)
Name  mlib_VideoDeQuantizeIDCT8x8_U8_S16 – dequantization and inverse Discrete Cosine Transform (IDCT)

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
    #include <mlib.h>

    mlib_status mlib_VideoDeQuantizeIDCT8x8_U8_S16(
        mlib_u8 *block, const mlib_s16 coeffs[64],
        const mlib_d64 dqtable[64], mlib_s32 stride);

Description  The mlib_VideoDeQuantizeIDCT8x8_U8_S16() function dequantizes the quantized DCT coefficients and then computes the inverse DCT. It's a combination of mlib_VideoDeQuantize_S16() and mlib_VideoIDCT8x8_U8_S16() for better performance.

The source and destination buffer addresses must be 8-byte aligned.

This function can be used in JPEG with 8-bit precision, or in MPEG for the intra mode.

Parameters  The function takes the following arguments:

    block  Pointer to an 8x8 block. Note that block must be 8-byte aligned.

    coeffs  Pointer to the input quantized DCT coefficients. Note that coeffs must be 8-byte aligned.

    dqtable  Pointer to the dequantization table generated by mlib_VideoDeQuantizeInit_S16().

    stride  Stride in bytes between adjacent rows in the block. Note that stride must be a multiple of eight.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12(3MLIB),
mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12_NA(3MLIB),
mlib_VideoDeQuantizeIDCT8x8_U8_S16_NA(3MLIB),
mlib_VideoDeQuantizeInit_S16(3MLIB), attributes(5)
mlib_VideoDeQuantizeIDCT8x8_U8_S16_NA – dequantization and inverse Discrete Cosine Transform (IDCT)

Synopsis

```
c { flag... } file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDeQuantizeIDCT8x8_U8_S16 NA{
    mlib_u8 *block, const mlib_s16 coeffs[64],
    const mlib_d64 dqtable[64], mlib_s32 stride);
```

Description

The `mlib_VideoDeQuantizeIDCT8x8_U8_S16_NA()` function dequantizes the quantized DCT coefficients and then computes the inverse DCT. It's a combination of `mlib_VideoDeQuantize_S16()` and `mlib_VideoIDCT8x8_U8_S16_NA()` for better performance.

This function requires no special address alignment.

This function can be used in JPEG with 8-bit precision, or in MPEG for the intra mode.

Parameters

The function takes the following arguments:

- `block` Pointer to an 8x8 block.
- `coeffs` Pointer to the input quantized DCT coefficients.
- `dqtable` Pointer to the dequantization table generated by `mlib_VideoDeQuantizeInit_S16()`.
- `stride` Stride in bytes between adjacent rows in the block.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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See Also

`mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12(3MLIB), mlib_VideoDeQuantizeIDCT8x8_S16_S16_B12 NA(3MLIB), mlib_VideoDeQuantizeIDCT8x8_U8_S16(3MLIB), mlib_VideoDeQuantizeInit_S16(3MLIB), attributes(5)`
The `mlib_VideoDeQuantizeInit_S16()` function initializes the dequantization table.

The following equation is used:

\[ dqtable[i] = iqtable[i]; \quad 0 \leq i < 64 \]

The function takes the following arguments:

- `dqtable` Pointer to dequantizer table coefficients.
- `iqtable` Pointer to original quantizer table coefficients:
  \[ 0 < iqtable[i] < 128 \]

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also: `attributes(5)` for descriptions of the following attributes:
The `mlib_VideoDeQuantize_S16()` function performs dequantization on DCT coefficients.

The following equation is used:

\[ \text{icoeffs}[i] = \text{icoeffs}[i] \times \text{dqtable}[i]; \quad 0 \leq i < 64 \]

**Parameters**

- `icoeffs` Pointer to the output DCT coefficients:
  
  \[-2048 < \text{icoeffs}[i] < 2048\]
  
  Note that `icoeffs` must be 8-byte aligned.

- `dqtable` Pointer to dequantizer table coefficients.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

- `mlib_VideoDeQuantize()`, `mlib_VideoDeQuantizeInit()`, `mlib_VideoQuantize()`
mlib_VideoDownSample420

**Name**  
mllib_VideoDownSample420 – downsampling rate conversion in JFIF

**Synopsis**  
`cc [ flag... ] file... -lmlib [ library... ]`  
#include <mlib.h>

```
mlib_status mlib_VideoDownSample420(mlib_u8 *dst, const mlib_u8 *src0,
                                     const mlib_u8 *src1, mlib_s32 n);
```

**Description**  
The `mlib_VideoDownSample420()` function performs downsampling rate conversion used in JPEG File Interchange Format (JFIF).

**Parameters**  
The function takes the following arguments:

- `dst`  
  Pointer to destination row. `dst` must be 8-byte aligned.

- `src0`  
  Pointer to upper source row. `src0` must be 8-byte aligned.

- `src1`  
  Pointer to middle source row. `src1` must be 8-byte aligned.

- `n`  
  Length of source rows. `n` must be greater than 1.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**  
mlib_VideoDownSample420_S16(3MLIB), mlib_VideoDownSample422(3MLIB),
mlib_VideoDownSample422_S16(3MLIB), mlib_VideoUpSample420(3MLIB),
mlib_VideoUpSample420_Nearest(3MLIB),
mlib_VideoUpSample420_Nearest_S16(3MLIB), mlib_VideoUpSample422(3MLIB),
mlib_VideoUpSample422_S16(3MLIB), mlib_VideoUpSample422_Nearest(3MLIB),
mlib_VideoUpSample422_Nearest_S16(3MLIB), attributes(5)
mlib_VideoDownSample420_S16 – down sampling rate conversion in JFIF

Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDownSample420_S16(mlib_s16 *dst,
                        const mlib_s16 *src0, const mlib_s16 *src1, mlib_s32 n);
```

Description

The `mlib_VideoDownSample420_S16()` function performs down sampling rate conversion used in JPEG File Interchange Format (JFIF).

Parameters

The function takes the following arguments:
- `dst`: Pointer to destination row. `dst` must be 8-byte aligned.
- `src0`: Pointer to upper source row. `src0` must be 8-byte aligned.
- `src1`: Pointer to middle source row. `src1` must be 8-byte aligned.
- `n`: Length of source rows. `n` must be greater than 1.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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</table>

See Also

- `mlib_VideoDownSample420(3MLIB)`, `mlib_VideoDownSample422(3MLIB)`, `mlib_VideoDownSample422_S16(3MLIB)`, `mlib_VideoUpSample420(3MLIB)`, `mlib_VideoUpSample420_Nearest(3MLIB)`, `mlib_VideoUpSample420_Nearest_S16(3MLIB)`, `mlib_VideoUpSample422(3MLIB)`, `mlib_VideoUpSample422_S16(3MLIB)`, `mlib_VideoUpSample422_Nearest(3MLIB)`, `mlib_VideoUpSample422_Nearest_S16(3MLIB)`
The `mlib_VideoDownSample422()` function performs downsampling rate conversion used in JPEG File Interchange Format (JFIF).

### Parameters
The function takes the following arguments:

- `dst` Pointer to destination row. `dst` must be 8-byte aligned.
- `src` Pointer to source row. `src` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</table>

### See Also
`mlib_VideoDownSample420(3MLIB)`, `mlib_VideoDownSample420_S16(3MLIB)`, `mlib_VideoDownSample422_S16(3MLIB)`, `mlib_VideoDownSample422(3MLIB)`, `mlib_VideoUpSample420(3MLIB)`, `mlib_VideoUpSample420_Nearest(3MLIB)`, `mlib_VideoUpSample420_Nearest_S16(3MLIB)`, `mlib_VideoUpSample422(3MLIB)`, `mlib_VideoUpSample422_Nearest(3MLIB)`, `mlib_VideoUpSample422_Nearest_S16(3MLIB)`, attributes(5)
mlib_VideoDownSample422_S16 – down sampling rate conversion in JFIF

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoDownSample422_S16(mlib_s16 *dst, const mlib_s16 *src, mlib_s32 n);

Description

The mlib_VideoDownSample422_S16() function performs down sampling rate conversion used in JPEG File Interchange Format (JFIF).

Parameters

The function takes the following arguments:

- dst Pointer to destination row. dst must be 8-byte aligned.
- src Pointer to source row. src must be 8-byte aligned.
- n Length of source rows. n must be greater than 1.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also

mlib_VideoDownSample420(3MLIB), mlib_VideoDownSample420_S16(3MLIB), mlib_VideoDownSample422(3MLIB), mlib_VideoUpSample420(3MLIB), mlib_VideoUpSample420_Nearest(3MLIB), mlib_VideoUpSample420_S16(3MLIB), mlib_VideoUpSample422(3MLIB), mlib_VideoUpSample422_Nearest(3MLIB), mlib_VideoUpSample422_Nearest_S16(3MLIB), mlib_VideoUpSample422_S16(3MLIB), mlib_VideoUpSample422_Nearest_S16(3MLIB), attributes(5)
mlib_VideoH263OverlappedMC_S16_U8() – generates the 8x8 luminance prediction block in the Advanced Prediction Mode for H.263 codec

Synopsis

cc [ flag... ] file... -tlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoH263OverlappedMC_S16_U8(mlib_s16 *mc_block[64],
const mlib_u8 *ref_frame, mlib_s32 mch, mlib_s32 mcv, mlib_s32 mah,
mlib_s32 mav, mlib_s32 mbh, mlib_s32 mbv, mlib_s32 mlh, mlib_s32 mlv,
mlib_s32 mrh, mlib_s32 mrv, mlib_s32 ref_stride);

Description

The mlib_VideoH263OverlappedMC_S16_U8() function generates an 8x8 luminance prediction block (motion-compensated block) in the Advanced Prediction Mode for H.263 codec. The reference frame in this function is an interpolated frame. The output of this function must be added to the IDCT output in order to reconstruct the block in the current frame.

The following equation is used:

for x = 0, 1, 2, 3; y = 0, 1, 2, 3
mc(x, y) = (ref(2x + mch, 2y + mcv)*H0(x, y) +
ref(2x + mah, 2y + mav)*H1(x, y) +
ref(2x + mlh, 2y + mlv)*H2(x, y)) / 8;

for x = 4, 5, 6, 7; y = 0, 1, 2, 3
mc(x, y) = (ref(2x + mch, 2y + mcv)*H0(x, y) +
ref(2x + mah, 2y + mav)*H1(x, y) +
ref(2x + mrh, 2y + mrv)*H2(x, y)) / 8;

for x = 0, 1, 2, 3; y = 4, 5, 6, 7
mc(x, y) = (ref(2x + mch, 2y + mcv)*H0(x, y) +
ref(2x + mbh, 2y + mbv)*H1(x, y) +
ref(2x + mlh, 2y + mlv)*H2(x, y)) / 8;

for x = 4, 5, 6, 7; y = 4, 5, 6, 7
mc(x, y) = (ref(2x + mch, 2y + mcv)*H0(x, y) +
ref(2x + mbh, 2y + mbv)*H1(x, y) +
ref(2x + mrh, 2y + mrv)*H2(x, y)) / 8;

where

\[
H_0 = \begin{bmatrix}
4 & 5 & 5 & 5 & 5 & 5 & 4 \\
5 & 5 & 5 & 5 & 5 & 5 & 5 \\
5 & 5 & 6 & 6 & 6 & 5 & 5 \\
\end{bmatrix}
\]
The function takes the following arguments:

- **mc_block**: Pointer to the motion-compensated block.
- **ref_frame**: Pointer to the interpolated reference frame.
- **mch**: Horizontal coordinate of the motion vector for the current block.
- **mcv**: Vertical coordinate of the motion vector for the current block.
- **mah**: Horizontal coordinate of the motion vector for the block above the current block.
- **mav**: Vertical coordinate of the motion vector for the block above the current block.
- **mbh**: Horizontal coordinate of the motion vector for the block below the current block.
- **mbv**: Vertical coordinate of the motion vector for the block below the current block.
- **mlh**: Horizontal coordinate of the motion vector for the block to the left of the current block.
- **mlv**: Vertical coordinate of the motion vector for the block to the left of the current block.
- **mrh**: Horizontal coordinate of the motion vector for the block to the right of the current block.
- **mrv**: Vertical coordinate of the motion vector for the block to the right of the current block.

**Parameters**
ref_stride        Stride, in bytes, between adjacent rows in the interpolated reference frame.

Return Values    The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes       See attributes(5) for descriptions of the following attributes:

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See Also          mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
                   mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
                   mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB), mlib_VideoH263OverlappedMC_U8_U8(3MLIB),
                   mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB),
                   mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
                   mlib_VideoInterpAveXY_U8_U8(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
                   mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
                   mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_S16_U8(3MLIB),
                   mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
                   mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),
                   mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
/**
 * @file...
 * @brief...
 * @include <mlib.h>
 *
 * mlib_VideoH263OverlappedMC_U8_U8
 *
 * The mlib_VideoH263OverlappedMC_U8_U8() function generates an 8x8 luminance prediction block (motion-compensated block) in the Advanced Prediction Mode for H.263 codec. The reference frame in this function is an interpolated frame.
 *
 * The following equation is used:
 *
 * \[
 * \text{curr}(x, y) = \frac{\text{ref}(2x + mch, 2y + mcv) \cdot H_0(x, y) + \text{ref}(2x + mah, 2y + mav) \cdot H_1(x, y) + \text{ref}(2x + mlh, 2y + mlv) \cdot H_2(x, y)}{8};
 * \]
 *
 * for \(x = 0, 1, 2, 3; y = 0, 1, 2, 3\)
 *
 * \[
 * \text{curr}(x, y) = \frac{\text{ref}(2x + mch, 2y + mcv) \cdot H_0(x, y) + \text{ref}(2x + mah, 2y + mav) \cdot H_1(x, y) + \text{ref}(2x + mrh, 2y + mrv) \cdot H_2(x, y)}{8};
 * \]
 *
 * for \(x = 4, 5, 6, 7; y = 0, 1, 2, 3\)
 *
 * \[
 * \text{curr}(x, y) = \frac{\text{ref}(2x + mch, 2y + mcv) \cdot H_0(x, y) + \text{ref}(2x + mbh, 2y + mbv) \cdot H_1(x, y) + \text{ref}(2x + mrh, 2y + mrv) \cdot H_2(x, y)}{8};
 * \]
 *
 * for \(x = 0, 1, 2, 3; y = 4, 5, 6, 7\)
 *
 * \[
 * \text{curr}(x, y) = \frac{\text{ref}(2x + mch, 2y + mcv) \cdot H_0(x, y) + \text{ref}(2x + mbh, 2y + mbv) \cdot H_1(x, y) + \text{ref}(2x + mlh, 2y + mlv) \cdot H_2(x, y)}{8};
 * \]
 *
 * for \(x = 4, 5, 6, 7; y = 4, 5, 6, 7\)
 *
 * \[
 * \text{curr}(x, y) = \frac{\text{ref}(2x + mch, 2y + mcv) \cdot H_0(x, y) + \text{ref}(2x + mbh, 2y + mbv) \cdot H_1(x, y) + \text{ref}(2x + mrh, 2y + mrv) \cdot H_2(x, y)}{8};
 * \]
 *
 * where
 *
 * \[
 * H_0 = \begin{bmatrix}
 * 4 & 5 & 5 & 5 & 5 & 5 & 5 & 4 \\
 * 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 \\
 * 5 & 5 & 6 & 6 & 6 & 5 & 5 & 5 \\
 * 5 & 5 & 6 & 6 & 6 & 5 & 5 & 5 \\
 * \end{bmatrix}
 * \]
 *
 * \[
 * H_0 = \begin{bmatrix}
 * 5 & 5 & 6 & 6 & 6 & 5 & 5 & 5 \\
 * 5 & 5 & 6 & 6 & 6 & 5 & 5 & 5 \\
 * 5 & 5 & 6 & 6 & 6 & 5 & 5 & 5 \\
 * 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 \\
 * \end{bmatrix}
 * \]
 */
The function takes the following arguments:

- **curr_block**: Pointer to the current block.
- **ref_frame**: Pointer to the interpolated reference frame.
- **mch**: Horizontal coordinate of the motion vector for the current block.
- **mcv**: Vertical coordinate of the motion vector for the current block.
- **mah**: Horizontal coordinate of the motion vector for the block above the current block.
- **mav**: Vertical coordinate of the motion vector for the block above the current block.
- **mbh**: Horizontal coordinate of the motion vector for the block below the current block.
- **mbv**: Vertical coordinate of the motion vector for the block below the current block.
- **mlh**: Horizontal coordinate of the motion vector for the block to the left of the current block.
- **mlv**: Vertical coordinate of the motion vector for the block to the left of the current block.
- **mrh**: Horizontal coordinate of the motion vector for the block to the right of the current block.
- **mrv**: Vertical coordinate of the motion vector for the block to the right of the current block.
curr_stride  Stride, in bytes, between adjacent rows in the current frame.

ref_stride  Stride, in bytes, between adjacent rows in the interpolated reference frame.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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<tr>
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<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also  mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB), mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB),
mlib_VideoInterpX_S16_U8(3MLIB), mlib_VideoInterpX_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpX_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8(3MLIB),
mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
The `mlib_VideoIDCT8x8_S16_S16_B12()` function computes the inverse DCT (called IDCT) for the output IDCT block of data type `mlib_s16` and input DCT coefficients of data type `mlib_s16`. This function is not guaranteed to be IEEE-1180-compliant. The output of the IDCT routine should be within the range of \([-2048, 2047]\) if `coeffs` is obtained from the corresponding forward DCT function `mlib_VideoDCT8x8_S16_S16_B12()`.

The source and destination buffer addresses must be 8-byte aligned.

This function can be used in JPEG with 12-bit precision.

For MPEG, the output, which is really the difference between the current block and the reference block, can occupy nine bits and is represented as a 16-bit datum. The output must be added to the motion-compensated reference block in order to reconstruct the current block.

Since mediaLib 2.5, `mlib_VideoIDCT8x8_S16_S16()` has been renamed to `mlib_VideoIDCT8x8_S16_S16_B12()`. Now `mlib_VideoIDCT8x8_S16_S16()` is an alias of `mlib_VideoIDCT8x8_S16_S16_B12()`.

### Parameters
The function takes the following arguments:

- `block` Pointer to an 8x8 block in the current frame or motion-compensated reference block. `block` must be 8-byte aligned.
- `coeffs` Pointer to the source DCT coefficients. `coeffs` must be 8-byte aligned.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

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</table>
mlib_VideoIDCT8x8_S16_S16_B12(3MLIB)

See Also  mlib_VideoIDCT_IEEE_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16_B12_NA(3MLIB), mlib_VideoIDCT8x8_S16_S16_DC(3MLIB), mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB), mlib_VideoIDCT8x8_S16_S16_Q1_Mismatch(3MLIB), mlib_VideoIDCT8x8_U8_S16(3MLIB), mlib_VideoIDCT8x8_U8_S16_DC(3MLIB), mlib_VideoIDCT8x8_U8_S16_NA(3MLIB), mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB), attributes(5)
The `mlib_VideoIDCT8x8_S16_S16_B12_NA()` function computes the inverse DCT (called IDCT) for the output IDCT block of data type `mlib_s16` and input DCT coefficients of data type `mlib_s16`. This function is not guaranteed to be IEEE-1180-compliant. The output of the IDCT routine should be within the range of \([-2048, 2047]\] if `coeffs` is obtained from the corresponding forward DCT function `mlib_VideoDCT8x8_S16_S16_B12_NA()`.

This function requires no special address alignment.

This function can be used in JPEG with 12-bit precision.

For MPEG, the output, which is really the difference between the current block and the reference block, can occupy nine bits and is represented as a 16-bit datum. The output must be added to the motion-compensated reference block in order to reconstruct the current block.

Since mediaLib 2.5, `mlib_VideoIDCT8x8_S16_S16_B12_NA()` has been renamed to `mlib_VideoIDCT8x8_S16_S16_B12_NA()`. Now `mlib_VideoIDCT8x8_S16_S16_B12_NA()` is an alias of `mlib_VideoIDCT8x8_S16_S16_B12_NA()`.

The function takes the following arguments:

- `block`  
  Pointer to an 8x8 block in the current frame or motion-compensated reference block. `block` need not be 8-byte aligned.

- `coeffs`  
  Pointer to the source DCT coefficients. `coeffs` need not be 8-byte aligned.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoIDCT_IEEE_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16_B12(3MLIB),
mlib_VideoIDCT8x8_S16_S16_DC(3MLIB), mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB),
mlib_VideoIDCT8x8_S16_S16_Q1_Mismatch(3MLIB), mlib_VideoIDCT8x8_U8_S16(3MLIB),
mlib_VideoIDCT8x8_U8_S16_DC(3MLIB), mlib_VideoIDCT8x8_U8_S16_NA(3MLIB),
mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB), attributes(5)
mlib_VideoIDCT8x8_S16_S16_DC

Name  mlib_VideoIDCT8x8_S16_S16_DC – inverse Discrete Cosine Transform

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoIDCT8x8_S16_S16_DC(mlib_s16 *block,
const mlib_s16 *coeffs);

Description  The mlib_VideoIDCT8x8_S16_S16_DC() function can be used only when \( F(0,0) \) is nonzero. It computes the inverse DCT (called IDCT) for the output IDCT block of data type mlib_s16 and input DCT coefficients of data type mlib_s16. This function is not guaranteed to be IEEE-1180-compliant. The output of the IDCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum. The output must be added to the motion-compensated reference block in order to reconstruct the current block.

Parameters  The function takes the following arguments:

block  Pointer to the current block. block must be 8-byte aligned.
coeffs  Pointer to the source DCT coefficients. coeffs must be 8-byte aligned.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoIDCT_IEEE_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16(3MLIB),
mlib_VideoIDCT8x8_S16_S16_NA(3MLIB), mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB),
mlib_VideoIDCT8x8_U8_S16(3MLIB), mlib_VideoIDCT8x8_U8_S16_DC(3MLIB),
mlib_VideoIDCT8x8_U8_S16_NA(3MLIB), mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB),
attributes(5)
**mlib_VideoIDCT8x8_S16_S16_Q1** – inverse Discrete Cosine Transform

**Synopsis**
```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoIDCT8x8_S16_S16_Q1(mlib_s16 block[64],
const mlib_s16 coeffs[64]);
```

**Description**
The `mlib_VideoIDCT8x8_S16_S16_Q1()` function can be used only when \( F(u,v) \) are nonzero for \( 0 \leq u < 4 \) and \( 0 \leq v < 4 \).

**Parameters**
The function takes the following arguments:
- `block` Pointer to the current block. Block must be 8-byte aligned.
- `coeffs` Pointer to the source DCT coefficients. Coeffs must be 8-byte aligned.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
`mlib_VideoIDCT_IEEE_S16_S16(3MLIB)`, `mlib_VideoIDCT8x8_S16_S16(3MLIB)`, `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`, `mlib_VideoIDCT8x8_S16_S16_NA(3MLIB)`, `mlib_VideoIDCT8x8_U8_S16(3MLIB)`, `mlib_VideoIDCT8x8_U8_S16_DC(3MLIB)`, `mlib_VideoIDCT8x8_U8_S16_NA(3MLIB)`, `mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB)`, `attributes(5)`
# mlib_VideoIDCT8x8_S16_S16_Q1_Mismatch

## Synopsis

```c
#include <mlib.h>

mlib_status mlib_VideoIDCT8x8_S16_S16_Q1_Mismatch(
    mlib_s16 block[64],
    const mlib_s16 coeffs[64]);
```

## Description

The `mlib_VideoIDCT8x8_S16_S16_Q1_Mismatch()` function computes the inverse IDCT in the inter mode.

This function is similar to `mlib_VideoIDCT8x8_S16_S16_Q1()` which should only be used when `coeffs[u][v]` (\(u, v = 0 \ldots 7\)) are non-zero only for \(u\) and \(v\) less then 4. However, this function also allows element `coeffs[7][7]` to be non-zero. The primary benefit of this modification is that it can handle situations where `coeffs[7][7]` has been made non-zero by MPEG mismatch-control, allowing a simplified version of the IDCT to be undertaken for a much larger number of situations.

## Parameters

The function takes the following arguments:

- `block`: Pointer to an 8x8 motion-compensated block which is the difference between the reference block and current block. `block` must be 8-byte aligned.
- `coeffs`: Pointer to the input DCT coefficients. `coeffs` must be 8-byte aligned. `coeffs` should be in S12 range or it should be obtained from the corresponding forward DCT.

## Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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</table>

## See Also

- `mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB)`, `attributes(5)`
Name  mlib_VideoIDCT8x8_U8_S16 – inverse Discrete Cosine Transform

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoIDCT8x8_U8_S16(mlib_u8 *block,
const mlib_s16 coeffs[64], mlib_s32 stride);

Description  The mlib_VideoIDCT8x8_U8_S16() function computes the inverse DCT (called IDCT) for
the destination IDCT block of data type mlib_u8 and source DCT coefficients of data type
mlib_s16.

The stride applies to the block that is part of the frame currently being reconstructed.

Parameters  The function takes the following arguments:

block  Pointer to an 8x8 block in the current frame. block must be 8-byte aligned.
coeffs  Pointer to the source DCT coefficients. coeffs must be 8-byte aligned.
stride  Stride, in bytes, between adjacent rows in a block. stride must be a multiple of eight.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoIDCT_IEEE_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16(3MLIB),
mlib_VideoIDCT8x8_S16_DC(3MLIB), mlib_VideoIDCT8x8_S16_S16_NA(3MLIB),
mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB), mlib_VideoIDCT8x8_U8_S16_DC(3MLIB),
mlib_VideoIDCT8x8_U8_S16_NA(3MLIB), mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB),
attributes(5)
mlib_VideoIDCT8x8_U8_S16_DC – inverse Discrete Cosine Transform

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_VideoIDCT8x8_U8_S16_DC(mlib_u8 *block,
const mlib_s16 *coeffs, mlib_s32 stride);
```

**Description**
The `mlib_VideoIDCT8x8_U8_S16_DC()` function can be used only when \( F(0, 0) \) is nonzero. It computes the inverse DCT (called IDCT) for the destination IDCT block of data type `mlib_u8` and source DCT coefficients of data type `mlib_s16`. This function is not guaranteed to be IEEE-1180-compliant. The output of the IDCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum. The output must be added to the motion-compensated reference block in order to reconstruct the current block.

**Parameters**
The function takes the following arguments:
- `block` Pointer to the current block. `block` must be 8-byte aligned.
- `coeffs` Pointer to the source DCT coefficients. `coeffs` must be 8-byte aligned.
- `stride` Stride, in bytes, between adjacent rows in a block. `stride` must be a multiple of eight.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_VideoIDCT_IEEE_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16_DC(3MLIB), mlib_VideoIDCT8x8_S16_S16_NA(3MLIB), mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB), mlib_VideoIDCT8x8_U8_S16(3MLIB), mlib_VideoIDCT8x8_U8_S16_NA(3MLIB), mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB), attributes(5)
The `mlib_VideoIDCT8x8_U8_S16_NA()` function computes the inverse DCT (called IDCT) for the destination IDCT block of data type `mlib_u8` and source DCT coefficients of data type `mlib_s16`.

The `stride` applies to the block that is part of the frame currently being reconstructed.

This function requires no special address alignment.

The function takes the following arguments:

- `block` Pointer to the current block.
- `coeffs` Pointer to the source DCT coefficients.
- `stride` Stride, in bytes, between adjacent rows in the block.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `attributes(5)` for descriptions of the following attributes:

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See Also

- `mlib_VideoIDCT8x8_U8_S16(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`
- `attributes(5)`
mlib_VideoIDCT8x8_U8_S16_Q1

**Name**
mlib_VideoIDCT8x8_U8_S16_Q1 – inverse Discrete Cosine Transform

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoIDCT8x8_U8_S16_Q1(mlib_u8 *block,
const mlib_s16 coeffs[64], mlib_s32 stride);
```

**Description**
The `mlib_VideoIDCT8x8_U8_S16_Q1()` function can be used only when \( F(u, v) \) are nonzero and only when \( 0 \leq u < 4 \) and \( 0 \leq v < 4 \). The stride applies to the block that is part of the frame currently being reconstructed.

**Parameters**
The function takes the following arguments:
- `block` Pointer to the current block. block must be 8-byte aligned
- `coeffs` Pointer to the source DCT coefficients. coeffs must be 8-byte aligned.
- `stride` Stride, in bytes, between adjacent rows in a block. stride must be a multiple of eight.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_VideoIDCT_IEEE_S16_S16(3MLIB), mlib_VideoIDCT8x8_S16_S16(3MLIB),
mlib_VideoIDCT8x8_S16_S16_DC(3MLIB), mlib_VideoIDCT8x8_S16_S16_NA(3MLIB),
mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB), mlib_VideoIDCT8x8_U8_S16(3MLIB),
mlib_VideoIDCT8x8_U8_S16_DC(3MLIB), mlib_VideoIDCT8x8_U8_S16_NA(3MLIB),
attributes(5)
The `mlib_VideoIDCT_IEEE_S16_S16()` function computes the inverse DCT (called IDCT) for the output IDCT block of data type `mlib_s16` and input DCT coefficients of data type `mlib_s16`. This function is guaranteed to be IEEE-1180-compliant. The output of the IDCT routine is the difference between the current block and the reference block. The difference pixel can occupy nine bits and is represented as a 16-bit datum. The output must be added to the motion-compensated reference block in order to reconstruct the current block.

The function takes the following arguments:

- `block` Pointer to an 8x8 motion-compensated block that is the difference between the reference block and the current block. `block` need not be 8-byte aligned.
- `coeffs` Pointer to the source DCT coefficients. `coeffs` need not be 8-byte aligned.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
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### See Also
- `mlib_VideoIDCT8x8_S16_S16(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_DC(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_NA(3MLIB)`
- `mlib_VideoIDCT8x8_S16_S16_Q1(3MLIB)`
- `mlib_VideoIDCT8x8_U8_S16(3MLIB)`
- `mlib_VideoIDCT8x8_U8_S16_DC(3MLIB)`
- `mlib_VideoIDCT8x8_U8_S16_NA(3MLIB)`
- `mlib_VideoIDCT8x8_U8_S16_Q1(3MLIB)`
- `attributes(5)`
Each of these functions performs half-pixel interpolation in the X direction and averaging for a reference block of data type mlib_u8 and a current block of data type mlib_u8. The stride applies to both the input reference block and the current block.

### Parameters
Each of the functions takes the following arguments:

- **curr_block**: Pointer to the current block. curr_block must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **frm_stride**: Stride, in bytes, between adjacent rows in a frame in both the current block and the reference block. frm_stride must be a multiple of eight.
- **fld_stride**: Stride, in bytes, between adjacent rows in a field in both the current block and reference block. fld_stride must be a multiple of eight.

### Return Values
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

### Attributes
See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpAveY_U8_U8(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB),
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpX_U8_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8(3MLIB),
mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
The `mlib_VideoInterpAveX_U8_U8()` function performs half-pixel interpolation in the X direction and averaging for a reference block of data type `mlib_u8` and a current block of data type `mlib_u8`. The stride applies to both the input reference block and the current block.

### Parameters
- **`curr_block`**
  Pointer to the current block. `curr_block` must be 8-byte aligned.
- **`ref_block`**
  Pointer to the reference block.
- **`width`**
  Width of the blocks.
- **`height`**
  Height of the blocks.
- **`frm_stride`**
  Stride, in bytes, between adjacent rows in a frame in both the current block and the reference block. `frm_stride` must be a multiple of eight.
- **`fld_stride`**
  Stride, in bytes, between adjacent rows in a field in both the current block and reference block. `fld_stride` must be a multiple of eight.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also
- `mlib_VideoAddBlock_U8_S16(3MLIB)`, `mlib_VideoCopyRef_S16_U8(3MLIB)`, `mlib_VideoCopyRef_S16_U8_16x16(3MLIB)`, `mlib_VideoCopyRef_U8_U8(3MLIB)`, `mlib_VideoCopyRef_U8_U8_16x16(3MLIB)`, `mlib_VideoCopyRefAve_U8_U8(3MLIB)`, `mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB)`, `mlib_VideoCopyRefAve_S16_16x16(3MLIB)`, `mlib_VideoCopyRefAveXY_U8_U8(3MLIB)`, `mlib_VideoCopyRefAveXY_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpX_S16_U8(3MLIB)`, `mlib_VideoInterpX_S16_U8_16x16(3MLIB)`, `mlib_VideoInterpX_U8_U8(3MLIB)`, `mlib_VideoInterpX_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveX_S16_U8(3MLIB)`, `mlib_VideoInterpAveX_U8_U8(3MLIB)`, `mlib_VideoInterpAveX_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveY_S16_U8(3MLIB)`, `mlib_VideoInterpAveY_U8_U8(3MLIB)`, `mlib_VideoInterpAveY_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveXY_S16_U8(3MLIB)`, `mlib_VideoInterpAveXY_U8_U8(3MLIB)`, `mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveY_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB)`
mlib_VideoInterpAveX_U8_U8(3MLIB)

mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
Each of these functions performs half-pixel interpolation in the X and Y directions and averaging for a reference block of data. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

**Parameters**

Each of the functions takes the following arguments:

- `curr_block`  
  Pointer to the current block. `curr_block` must be 8-byte aligned.
- `ref_block`  
  Pointer to the reference block.
- `frm_stride`  
  Stride, in bytes, between adjacent rows in a frame in both the current block and the reference block. `frm_stride` must be a multiple of eight.
- `fld_stride`  
  Stride, in bytes, between adjacent rows in a field in both the current block and reference block. `fld_stride` must be a multiple of eight.

**Return Values**

Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
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mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB),
mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpAveXY_U8_U8

Name
mlib_VideoInterpAveXY_U8_U8 – half-pixel interpolation in the X and Y directions and averaging for reference block

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpAveXY_U8_U8(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height,
mlib_s32 frm_stride, mlib_s32 fld_stride);

Description
The mlib_VideoInterpAveXY_U8_U8() function performs half-pixel interpolation in the X and Y directions and averaging for a reference block of data type mlib_u8 and a current block of data type mlib_u8. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

Parameters
The function takes the following arguments:

  curr_block          Pointer to the current block. curr_block must be 8-byte aligned.
  ref_block           Pointer to the reference block.
  width               Width of the blocks.
  height              Height of the blocks.
  frm_stride          Stride, in bytes, between adjacent rows in a frame in both the current block and the reference block. frm_stride must be a multiple of eight.
  fld_stride          Stride, in bytes, between adjacent rows in a field in both the current block and reference block. fld_stride must be a multiple of eight.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
See attributes(5) for descriptions of the following attributes:

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See Also
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
mlib_VideoInterpAveXY_U8_U8(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8(3MLIB)

mlib_VideoInterpAveXY_U8_U8(3MLIB), mlib_VideoInterpXY_S16_U8_U8(3MLIB), mlib_VideoInterpY_S16_U8_U8(3MLIB), mlib_VideoInterpY_S16_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_U8(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB), attributes(5)
Each of these functions performs half-pixel interpolation in the Y direction and averaging for a reference block of data type mlib_u8 and a current block of data type mlib_u8. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

**Parameters**
Each of the functions takes the following arguments:

- **curr_block**: Pointer to the current block. curr_block must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **frm_stride**: Stride, in bytes, between adjacent rows in a frame in both the current block and the reference block. frm_stride must be a multiple of eight.
- **fld_stride**: Stride, in bytes, between adjacent rows in a field in both the current block and reference block. fld_stride must be a multiple of eight.

**Return Values**
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**
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See Also mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoInterpolateAveX_U8_U8(3MLIB), mlib_VideoInterpolateAveX_U8_U8_16x16(3MLIB),
mlib_VideoInterpolateAveXY_U8_U8(3MLIB), mlib_VideoInterpolateAveXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpolateX_S16_U8(3MLIB), mlib_VideoInterpolateX_U8_U8(3MLIB),
mlib_VideoInterpolateX_U8_U8_16x16(3MLIB), mlib_VideoInterpolateY_S16_U8(3MLIB),
mlib_VideoInterpolateY_U8_U8(3MLIB), mlib_VideoInterpolateY_U8_U8_16x16(3MLIB),
mlib_VideoInterpolateY_U8_U8_16x16(3MLIB), mlib_VideoInterpolateXY_U8_U8(3MLIB),
mlib_VideoInterpolateXY_U8_U8_16x16(3MLIB), mlib_VideoInterpolateXY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpAveY_U8_U8 – half-pixel interpolation in the Y direction and averaging for reference block

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpAveY_U8_U8(mlib_u8 *curr_block,
            const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height,
            mlib_s32 frm_stride, mlib_s32 fld_stride);

Description

The mlib_VideoInterpAveY_U8_U8() function performs half-pixel interpolation in the Y direction and averaging for a reference block of data type mlib_u8 and a current block of data type mlib_u8. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

Parameters

The function takes the following arguments:

curr_block Pointer to the current block. curr_block must be 8-byte aligned.
ref_block Pointer to the reference block.
width Width of the blocks.
height Height of the blocks.
frm_stride Stride, in bytes, between adjacent rows in a frame in both the current block and the reference block. frm_stride must be a multiple of eight.
fld_stride Stride, in bytes, between adjacent rows in a field in both the current block and reference block. fld_stride must be a multiple of eight.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

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</tr>
</tbody>
</table>

See Also

mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
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mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpX_S16_U8_16x16, mlib_VideoInterpX_S16_U8_16x8, mlib_VideoInterpX_S16_U8_8x16, mlib_VideoInterpX_S16_U8_8x8, mlib_VideoInterpX_S16_U8_8x4 – half-pixel interpolation in the X direction

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpX_S16_U8_16x16(mlib_s16 *mc_block,
    const mlib_u8 *ref_block, mlib_s32 frm_stride,
    mlib_s32 fld_stride);

mlib_status mlib_VideoInterpX_S16_U8_16x8(mlib_s16 *mc_block,
    const mlib_u8 *ref_block, mlib_s32 frm_stride,
    mlib_s32 fld_stride);

mlib_status mlib_VideoInterpX_S16_U8_8x16(mlib_s16 *mc_block,
    const mlib_u8 *ref_block, mlib_s32 frm_stride,
    mlib_s32 fld_stride);

mlib_status mlib_VideoInterpX_S16_U8_8x8(mlib_s16 *mc_block,
    const mlib_u8 *ref_block, mlib_s32 frm_stride,
    mlib_s32 fld_stride);

mlib_status mlib_VideoInterpX_S16_U8_8x4(mlib_s16 *mc_block,
    const mlib_u8 *ref_block, mlib_s32 frm_stride,
    mlib_s32 fld_stride);

Description

Each of these functions performs half-pixel interpolation in the X direction for a reference block of data type mlib_u8 and a current block of data type mlib_s16. In this mode, the output of this function must be added to the IDCT output to reconstruct the block in the current frame. Thus, the stride applies only to the input reference block.

Parameters

Each of the functions takes the following arguments:

- **mc_block**: Pointer to the motion-compensated reference block. mc_block must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **frm_stride**: Stride, in bytes, between adjacent rows in a frame in the reference block. frm_stride must be a multiple of eight.
- **fld_stride**: Stride, in bytes, between adjacent rows in a field in the reference block. fld_stride must be a multiple of eight.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:
### mlib_VideoInterpX_S16_U8_16x16(3MLIB)

<table>
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</table>

**See Also**

- mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
- mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
- mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
- mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
- mlib_VideoCopyRefAve_U8_U8(3MLIB),
- mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
- mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
- mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
- mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
- mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
- mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
- mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
- mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
- mlib_VideoInterpX_U8_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8(3MLIB),
- mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB),
- mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8(3MLIB),
- mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),
- mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
The `mlib_VideoInterpX_S16_U8()` function performs half-pixel interpolation in the X direction for a reference block of data type `mlib_u8` and a current block of data type `mlib_s16`. In this mode, the output of this function must be added to the IDCT output to reconstruct the block in the current frame. Thus, the stride applies only to the input reference block.

### Parameters
- **mc_block**: Pointer to the motion-compensated reference block. `mc_block` must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **width**: Width of the blocks.
- **height**: Height of the blocks.
- **frm_stride**: Stride, in bytes, between adjacent rows in a frame in the reference block. `frm_stride` must be a multiple of eight.
- **fld_stride**: Stride, in bytes, between adjacent rows in a field in the reference block. `fld_stride` must be a multiple of eight.

### Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes
See `attributes(5)` for descriptions of the following attributes:

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### See Also
- `mlib_VideoAddBlock_U8_S16(3MLIB)`, `mlib_VideoCopyRef_S16_U8(3MLIB)`,
- `mlib_VideoCopyRef_S16_U8_16x16(3MLIB)`, `mlib_VideoCopyRef_U8_U8(3MLIB)`,
- `mlib_VideoCopyRef_U8_U8_16x16(3MLIB)`, `mlib_VideoCopyRefAve_U8_U8(3MLIB)`,
- `mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB)`,
- `mlib_VideoH263OverlappedMC_S16_U8(3MLIB)`,
- `mlib_VideoH263OverlappedMC_U8_U8(3MLIB)`,
- `mlib_VideoInterpAveX_U8_U8(3MLIB)`,
- `mlib_VideoInterpAveX_U8_U8_16x16(3MLIB)`,
- `mlib_VideoInterpAveXY_U8_U8(3MLIB)`,
- `mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB)`,
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpX_U8_U8_16x16, mlib_VideoInterpX_U8_U8_16x8,
mlib_VideoInterpX_U8_U8_8x16, mlib_VideoInterpX_U8_U8_8x8,
mlib_VideoInterpX_U8_U8_8x4 – half-pixel interpolation in the X direction

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpX_U8_U8_16x16(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpX_U8_U8_16x8(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpX_U8_U8_8x16(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpX_U8_U8_8x8(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpX_U8_U8_8x4(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

Description Each of these functions performs half-pixel interpolation in the X direction for a reference
block of data type mlib_u8 and a current block of data type mlib_u8. In this mode, the
motion-compensated reference block becomes the current block. Thus, the stride applies to
both the input reference block and the current block.

Parameters Each of the functions takes the following arguments:

curr_block Pointer to the current block. curr_block must be 8-byte aligned.
ref_block Pointer to the reference block.
frm_stride Stride, in bytes, between adjacent rows in a frame in both the current block and
reference block. frm_stride must be a multiple of eight.
fld_stride Stride, in bytes, between adjacent rows in a field in both the current block and
reference block. fld_stride must be a multiple of eight.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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</tr>
<tr>
<td>ATTRIBUTE TYPE</td>
<td>ATTRIBUTE VALUE</td>
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<tr>
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<td>-----------------</td>
</tr>
<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
</tr>
</tbody>
</table>

See Also

`mlib_VideoAddBlock_U8_S16(3MLIB)`, `mlib_VideoCopyRef_S16_U8(3MLIB)`,
`mlib_VideoCopyRef_U8_U8(3MLIB)`, `mlib_VideoCopyRef_U8_U8_16x16(3MLIB)`,
`mlib_VideoCopyRefAve_U8_U8(3MLIB)`,
`mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB)`,
`mlib_VideoH263OverlappedMC_S16_U8(3MLIB)`,
`mlib_VideoH263OverlappedMC_U8_U8(3MLIB)`,
`mlib_VideoInterpAveX_U8_U8(3MLIB)`,
`mlib_VideoInterpAveXY_U8_U8(3MLIB)`,
`mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB)`,
`mlib_VideoInterpAveY_U8_U8(3MLIB)`,
`mlib_VideoInterpAveY_U8_U8_16x16(3MLIB)`,
`mlib_VideoInterpX_S16_U8(3MLIB)`,
`mlib_VideoInterpX_U8_U8(3MLIB)`,
`mlib_VideoInterpXY_S16_U8(3MLIB)`,
`mlib_VideoInterpXY_U8_U8(3MLIB)`,
`mlib_VideoInterpXY_U8_U8_16x16(3MLIB)`,
`mlib_VideoInterpY_S16_U8(3MLIB)`,
`mlib_VideoInterpY_U8_U8(3MLIB)`,
`mlib_VideoInterpY_U8_U8_16x16(3MLIB)`,
`mlib_VideoP64Decimate_U8_U8(3MLIB)`,
`mlib_VideoP64DecimateS16_U8_U8(3MLIB)`,
`mlib_VideoP64Loop_U8_U8(3MLIB)`,
`mlib_VideoP64Loop_S16_U8(3MLIB)`,
attributes(5)
The `mlib_VideoInterpX_U8_U8()` function performs half-pixel interpolation in the X direction for a reference block of data type `mlib_u8` and a current block of data type `mlib_u8`. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

The function takes the following arguments:

- `curr_block`: Pointer to the current block. `curr_block` must be 8-byte aligned.
- `ref_block`: Pointer to the reference block.
- `width`: Width of the blocks.
- `height`: Height of the blocks.
- `frm_stride`: Stride, in bytes, between adjacent rows in a frame in both the current block and reference block. `frm_stride` must be a multiple of eight.
- `fld_stride`: Stride, in bytes, between adjacent rows in a field in both the current block and reference block. `fld_stride` must be a multiple of eight.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

### Attributes

See attributes(5) for descriptions of the following attributes:

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<td>MT-Safe</td>
</tr>
</tbody>
</table>

### See Also

- `mlib_VideoAddBlock_U8_S16(3MLIB)`, `mlib_VideoCopyRef_S16_U8(3MLIB)`,
- `mlib_VideoCopyRef_S16_U8_16x16(3MLIB)`, `mlib_VideoCopyRef_U8_U8(3MLIB)`,
- `mlib_VideoCopyRef_U8_U8_16x16(3MLIB)`, `mlib_VideoCopyRefAve_U8_U8(3MLIB)`,
- `mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB)`, `mlib_VideoH263OverlappedMC_S16_U8(3MLIB)`,
- `mlib_VideoH263OverlappedMC_U8_U8(3MLIB)`, `mlib_VideoInterpAveX_U8_U8(3MLIB)`,
- `mlib_VideoInterpAveX_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB)`,
- `mlib_VideoInterpAveY_U8_U8_U8_16x16(3MLIB)`, `mlib_VideoInterpAveY_U8_U8_U8_16x16(3MLIB)`,
- `mlib_VideoInterpAveY_U8_U8_U8_U8_U8(3MLIB)`, `mlib_VideoInterpX_S16_U8(3MLIB)`,
- `mlib_VideoInterpX_U8_U8_U8(3MLIB)`, `mlib_VideoInterpX_U8_U8_U8_16x16(3MLIB)`,
- `mlib_VideoInterpXY_S16_U8(3MLIB)`, `mlib_VideoInterpXY_S16_U8_16x16(3MLIB)`,
- `mlib_VideoInterpXY_U8_U8_U8_U8_U8(3MLIB)`, `mlib_VideoInterpXY_U8_U8_U8_U8_U8_16x16(3MLIB)`
mlib_VideoInterpX_U8_U8(3MLIB)

mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB),
attributes(5)
mlib_VideoInterpXY_S16_U8_16x16, mlib_VideoInterpXY_S16_U8_16x8,
mlib_VideoInterpXY_S16_U8_8x16, mlib_VideoInterpXY_S16_U8_8x8,
mlib_VideoInterpXY_S16_U8_8x4 – half-pixel interpolation in the X and Y directions for
motion compensation

#include <mlib.h>

mlib_status mlib_VideoInterpXY_S16_U8_16x16(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpXY_S16_U8_16x8(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpXY_S16_U8_8x16(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpXY_S16_U8_8x8(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpXY_S16_U8_8x4(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

Each of these functions performs half-pixel interpolation in the X and Y directions for a
reference block of data type mlib_u8 and a current block of data type mlib_s16. In this mode,
the output of this function must be added to the IDCT output to reconstruct the block in the
current frame. Thus, the stride applies only to the input reference block.

Parameters Each of the functions takes the following arguments:

mc_block Pointer to the motion-compensated reference block. mc_block must be 8-byte
aligned.

ref_block Pointer to the reference block.

frm_stride Stride, in bytes, between adjacent rows in a frame in the reference block.
frm_stride must be a multiple of eight.

fld_stride Stride, in bytes, between adjacent rows in a field in the reference block.
fld_stride must be a multiple of eight.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:
mlib_VideoInterpXY_S16_U8_16x16(3MLIB)

<table>
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</table>

See Also
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB), mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB), mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB), mlib_VideoH263OverlappedMC_S16_U8(3MLIB), mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB), mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Decimate_U8_U8_16x16(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
The mlib_VideoInterpXY_S16_U8() function performs half-pixel interpolation in the X and Y directions for a reference block of data type mlib_u8 and a current block of data type mlib_s16. In this mode, the output of this function must be added to the IDCT output to reconstruct the block in the current frame. Thus, the stride applies only to the input reference block.

### Parameters

- **mc_block**
  Pointer to the motion-compensated reference block. mc_block must be 8-byte aligned.

- **ref_block**
  Pointer to the reference block.

- **width**
  Width of the blocks.

- **height**
  Height of the blocks.

- **frm_stride**
  Stride, in bytes, between adjacent rows in a frame in the reference block. frm_stride must be a multiple of eight.

- **fld_stride**
  Stride, in bytes, between adjacent rows in a field in the reference block. fld_stride must be a multiple of eight.

### Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

### Attributes

See attributes(5) for descriptions of the following attributes:

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### See Also

- mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB), mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8 UB(3MLIB), mlib_VideoCopyRef_U8 UB_16x16(3MLIB), mlib_VideoCopyRefAve_U8 UB(3MLIB), mlib_VideoCopyRefAve_U8 UB_16x16(3MLIB), mlib_VideoH263OverlappedMC_S16 UB(3MLIB), mlib_VideoH263OverlappedMC UB UB(3MLIB), mlib_VideoInterpAveX_U8 UB(3MLIB), mlib_VideoInterpAveX UB UB_16x16(3MLIB), mlib_VideoInterpAveXY UB UB(3MLIB), mlib_VideoInterpAveXY UB UB_16x16(3MLIB),
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB),
mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB),
mlib_VideoInterpY_S16_U8_16x16(3MLIB),
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mlib_VideoInterpY_U8_U8(3MLIB),
mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpXY_U8_U8_16x16, mlib_VideoInterpXY_U8_U8_16x8, mlib_VideoInterpXY_U8_U8_8x16, mlib_VideoInterpXY_U8_U8_8x8, mlib_VideoInterpXY_U8_U8_8x4 – half-pixel interpolation in the X and Y directions

Synopsis

c c [ flag ] file ... -lmlib [ library ]

#include "mlib.h"

mlib_status mlib_VideoInterpXY_U8_U8_16x16(mlib_u8 *curr_block, const mlib_u8 *ref_block, mlib_s32 frm_stride, mlib_s32 fli_stride);

mlib_status mlib_VideoInterpXY_U8_U8_16x8(mlib_u8 *curr_block, const mlib_u8 *ref_block, mlib_s32 frm_stride, mlib_s32 fli_stride);

mlib_status mlib_VideoInterpXY_U8_U8_8x16(mlib_u8 *curr_block, const mlib_u8 *ref_block, mlib_s32 frm_stride, mlib_s32 fli_stride);

mlib_status mlib_VideoInterpXY_U8_U8_8x8(mlib_u8 *curr_block, const mlib_u8 *ref_block, mlib_s32 frm_stride, mlib_s32 fli_stride);

mlib_status mlib_VideoInterpXY_U8_U8_8x4(mlib_u8 *curr_block, const mlib_u8 *ref_block, mlib_s32 frm_stride, mlib_s32 fli_stride);

Description

Each of these functions performs half-pixel interpolation in the X and Y directions for a reference block of data type mlib_u8 and a current block of data type mlib_u8. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

Parameters

Each of the functions takes the following arguments:

- curr_block Pointer to the current block. curr_block must be 8-byte aligned.
- ref_block Pointer to the reference block.
- frm_stride Stride, in bytes, between adjacent rows in a frame in both the current block and reference block. frm_stride must be a multiple of eight.
- fli_stride Stride, in bytes, between adjacent rows in a field in both the current block and reference block. fli_stride must be a multiple of eight.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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mlib_VideoInterpXY_U8_U8_16x16(3MLIB)

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB), mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB), mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB), mlib_VideoH263OverlappedMC_S16_U8(3MLIB), mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), attributes(5)
**mlib_VideoInterpXY_U8_U8** – half-pixel interpolation in the X and Y directions

**Synopsis**
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpXY_U8_U8(mlib_u8 *curr_block, 
const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height, 
mlib_s32 frm_stride, mlib_s32 fld_stride);
```

**Description**
The `mlib_VideoInterpXY_U8_U8()` function performs half-pixel interpolation in the X and Y directions for a reference block of data type `mlib_u8` and a current block of data type `mlib_u8`. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

**Parameters**
The function takes the following arguments:
- **curr_block**: Pointer to the current block. `curr_block` must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **width**: Width of the blocks.
- **height**: Height of the blocks.
- **frm_stride**: Stride, in bytes, between adjacent rows in a frame in both the current block and reference block. `frm_stride` must be a multiple of eight.
- **fld_stride**: Stride, in bytes, between adjacent rows in a field in both the current block and reference block. `fld_stride` must be a multiple of eight.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise, it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- mlib_VideoAddBlock_U8_S16_U8(3MLIB)
- mlib_VideoCopyRef_S16_U8(3MLIB)
- mlib_VideoCopyRef_16x16_U8(3MLIB)
- mlib_VideoCopyRefAve_U8_U8(3MLIB)
- mlib_VideoCopyRefAveX_U8_U8(3MLIB)
- mlib_VideoCopyRefAveY_U8_U8(3MLIB)
- mlib_VideoInterpAveX_U8_U8(3MLIB)
- mlib_VideoInterpAveY_U8_U8(3MLIB)
- mlib_VideoInterpAveXY_U8_U8(3MLIB)
- mlib_VideoInterpX_S16_U8_U8(3MLIB)
- mlib_VideoInterpX_16x16_U8(3MLIB)
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoDecimate_U8_U8(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
**Name**  
mlib_VideoInterpX_Y_XY_U8_U8 – half-pixel interpolation in both X and Y directions for replenishment mode

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>

```c
mlib_status mlib_VideoInterpX_Y_XY_U8_U8(mlib_u8 *outputX,
mlib_u8 *outputY, mlib_u8 *outputXY, const mlib_u8 *image,
mlib_s32 stride, mlib_s32 width, mlib_s32 height);
```

**Description**  
The `mlib_VideoInterpX_Y_XY_U8_U8()` function performs half-pixel interpolation in both X and Y directions for the replenishment mode.

**Parameters**  
The function takes the following arguments:

- `outputX`  
  Pointer to the output of X-interpolation. `outputX` must be 8-byte aligned.

- `outputY`  
  Pointer to the output of Y-interpolation. `outputY` must be 8-byte aligned.

- `outputXY`  
  Pointer to the output of XY-interpolation. `outputXY` must be 8-byte aligned.

- `image`  
  Pointer to the image data. `image` must be 8-byte aligned

- `stride`  
  Stride, in bytes, between adjacent rows in the image. `stride` must be a multiple of eight.

- `width`  
  Width of the image. `width` must be a multiple of eight.

- `height`  
  Height of the image. `height` must be a multiple of two.

**Return Values**  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  
See `attributes(5)` for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<tr>
<td>MT-Level</td>
<td>MT-Safe</td>
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</table>

**See Also**  
`mlib_VideoInterpX_U8_U8(3MLIB)`, `mlib_VideoInterpXY_U8_U8(3MLIB)`, `mlib_VideoInterpY_U8_U8(3MLIB)`, `attributes(5)`
mlib_VideoInterpY_S16_U8_16x16, mlib_VideoInterpY_S16_U8_16x8,
mlib_VideoInterpY_S16_U8_8x16, mlib_VideoInterpY_S16_U8_8x8,
mlib_VideoInterpY_S16_U8_8x4 – half-pixel interpolation in the Y direction

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpY_S16_U8_16x16(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpY_S16_U8_16x8(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpY_S16_U8_8x16(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpY_S16_U8_8x8(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);
mlib_status mlib_VideoInterpY_S16_U8_8x4(mlib_s16 *mc_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

Description  Each of these functions performs half-pixel interpolation in the Y direction for a reference
block of data type mlib_u8 and a current block of data type mlib_s16. In this mode, the output
of this function must be added to the IDCT output to reconstruct the block in the current
frame. Thus, the stride applies only to the input reference block.

Parameters  Each of the functions takes the following arguments:

mc_block  Pointer to the motion-compensated reference block. mc_block must be 8-byte aligned.
ref_block  Pointer to the reference block.
frm_stride  Stride, in bytes, between adjacent rows in a frame in the reference block.
frm_stride must be a multiple of eight.
fld_stride  Stride, in bytes, between adjacent rows in a field in the reference block.
fld_stride must be a multiple of eight.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:
See Also

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mlib_VideoInterpY_S16_U8_16x16(3MLIB)

See Also

mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_U8_U8(3MLIB),
mlib_VideoInterpY_U8_16x16(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpY_S16_U8(3MLIB)

Name mlib_VideoInterpY_S16_U8 — half-pixel interpolation in the Y direction

Synopsis cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpY_S16_U8(mlib_s16 *mc_block,
    const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height,
    mlib_s32 frm_stride, mlib_s32 fld_stride);

Description The mlib_VideoInterpY_S16_U8() function performs half-pixel interpolation in the Y
direction for a reference block of data type mlib_u8 and a current block of data type mlib_s16.
In this mode, the output of this function must be added to the IDCT output to reconstruct the
block in the current frame. Thus, the stride applies only to the input reference block.

Parameters The function takes the following arguments:

- **mc_block** Pointer to the motion-compensated reference block. mc_block must be 8-byte aligned.
- **ref_block** Pointer to the reference block.
- **width** Width of the blocks.
- **height** Height of the blocks.
- **frm_stride** Stride, in bytes, between adjacent rows in a frame in the reference block.
  frm_stride must be a multiple of eight.
- **fld_stride** Stride, in bytes, between adjacent rows in a field in the reference block.
  fld_stride must be a multiple of eight.

Return Values The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:

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</table>

See Also mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpAveY_U8_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8(3MLIB),
mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
mlib_VideoInterpY_U8_U8_16x16, mlib_VideoInterpY_U8_U8_16x8,
mlib_VideoInterpY_U8_U8_8x16, mlib_VideoInterpY_U8_U8_8x8,
mlib_VideoInterpY_U8_U8_8x4 – half-pixel interpolation in the Y direction

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoInterpY_U8_U8_16x16(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

mlib_status mlib_VideoInterpY_U8_U8_16x8(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

mlib_status mlib_VideoInterpY_U8_U8_8x16(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

mlib_status mlib_VideoInterpY_U8_U8_8x8(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

mlib_status mlib_VideoInterpY_U8_U8_8x4(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 frm_stride,
mlib_s32 fld_stride);

Description

Each of these functions performs half-pixel interpolation in the Y direction for a reference
block of data type mlib_u8 and a current block of data type mlib_u8. In this mode, the
motion-compensated reference block becomes the current block. Thus, the stride applies to
both the input reference block and the current block.

Parameters

Each of the functions takes the following arguments:

- curr_block Pointer to the current block. curr_block must be 8-byte aligned.
- ref_block Pointer to the reference block.
- frm_stride Stride, in bytes, between adjacent rows in a frame in both the current block and
  reference block. frm_stride must be a multiple of eight.
- fld_stride Stride, in bytes, between adjacent rows in a field in both the current block and
  reference block. fld_stride must be a multiple of eight.

Return Values

Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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mlib_VideoInterpY_U8_U8_16x16(3MLIB)

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),  
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8(3MLIB),  
mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_U8_U8(3MLIB),  
mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB), mlib_VideoH263OverlappedMC_S16_U8(3MLIB),  
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),  
mlib_VideoInterpAveX_U8_U8_16x16(3MLIB), mlib_VideoInterpAveXY_U8_U8(3MLIB),  
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mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpX_S16_U8(3MLIB),  
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),  
mlib_VideoInterpXY_U8_U8(3MLIB), mlib_VideoInterpXY_U8_U8_16x16(3MLIB),  
mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),  
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoP64Decimate_U8_U8(3MLIB),  
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
The `mlib_VideoInterpY_U8_U8()` function performs half-pixel interpolation in the Y direction for a reference block of data type `mlib_u8` and a current block of data type `mlib_u8`. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

**Parameters**

- `curr_block`  
  Pointer to the current block. `curr_block` must be 8-byte aligned.
- `ref_block`  
  Pointer to the reference block.
- `width`  
  Width of the blocks.
- `height`  
  Height of the blocks.
- `frm_stride`  
  Stride, in bytes, between adjacent rows in a frame in both the current block and reference block. `frm_stride` must be a multiple of eight.
- `fld_stride`  
  Stride, in bytes, between adjacent rows in a field in both the current block and reference block. `fld_stride` must be a multiple of eight.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See the `attributes(5)` for descriptions of the following attributes:

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**See Also**

- `mlib_VideoAddBlock_U8_S16(3MLIB)`
- `mlib_VideoCopyRef_S16_U8(3MLIB)`
- `mlib_VideoCopyRef_U8_U8(3MLIB)`
- `mlib_VideoCopyRef_U8_U8_16x16(3MLIB)`
- `mlib_VideoCopyRefAve_U8_U8(3MLIB)`
- `mlib_VideoCopyRefAve_U8_U8_16x16(3MLIB)`
- `mlib_VideoH263OverlappedMC_S16_U8(3MLIB)`
- `mlib_VideoH263OverlappedMC_U8_U8(3MLIB)`
- `mlib_VideoInterpAveX_U8_U8(3MLIB)`
- `mlib_VideoInterpAveX_U8_U8_16x16(3MLIB)`
- `mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB)`
- `mlib_VideoInterpAveY_U8_U8_16x16(3MLIB)`
- `mlib_VideoInterpX_S16_U8(3MLIB)`
- `mlib_VideoInterpX_U8_U8(3MLIB)`
mlib_VideoInterpXY_S16_U8
mlib_VideoInterpXY_S16_U8_16x16
mlib_VideoInterpXY_U8_U8
mlib_VideoInterpXY_U8_U8_16x16
mlib_VideoInterpY_S16_U8
mlib_VideoInterpY_S16_U8_16x16
mlib_VideoInterpY_U8_U8_16x16
mlib_VideoP64Decimate_U8_U8
mlib_VideoP64Loop_S16_U8
mlib_VideoP64Loop_U8_U8
attributes(5)
The `mlib_VideoP64Decimate_U8_U8()` function averages the source raster image over 2x2 blocks and writes the results to the destination raster image. This function is used when the remote side is only capable of QCIF and our scanned image is source to the encoder in CIF format.

The function takes the following arguments:

- **`dst`**: Pointer to the destination raster image.
- **`src`**: Pointer to the source raster image.
- **`width`**: Width of the image.
- **`height`**: Height of the image.
- **`dst_stride`**: Stride, in bytes, between adjacent rows in the destination image.
- **`src_stride`**: Stride, in bytes, between adjacent rows in the source image.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See also `mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB), mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_S16_U8_U8_16x16(3MLIB), mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB), mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB), mlib_VideoCopyRefAve_S16_U8_U8_16x16(3MLIB).`
mlib_VideoP64Decimate_U8_U8(3MLIB)

mlib_VideoInterpY_S16_U8(3MLIB), mlib_VideoInterpY_S16_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
mlib_VideoP64Loop_U8_U8(3MLIB), attributes(5)
Name  
mlib_VideoP64Loop_S16_U8 - applies a 2-dimensional (2D) 3x3 spatial filter on the reference block

Synopsis  
cc [ flag... ] file... -/mlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoP64Loop_S16_U8(mlib_s16 *mc_block[64],
const mlib_u8 *ref_block, mlib_s32 stride);

Description  
The mlib_VideoP64Loop_S16_U8() function applies a 2-dimensional (2D) 3x3 spatial filter on the reference block. The filter is separable into 1D horizontal and vertical functions, where the filter coefficients are 0.25, 0.5, 0.25, except at the block edges where the coefficients are 0, 1, 0. In this mode, the output must be added to the IDCT output to reconstruct the block in the current frame. Thus, the stride applies only to the input reference block. This function requires the motion-compensated block to be 8-bit aligned.

Parameters  
The function takes the following arguments:

- mc_block  Pointer to the motion-compensated reference block.
- ref_block  Pointer to the reference block.
- stride     Stride, in bytes, between adjacent rows in the reference block.

Return Values  
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  
See attributes(5) for descriptions of the following attributes:

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See Also  
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
mlib_VideoInterpAve_U8_U8_16x16(3MLIB), mlib_VideoInterpAveX_S16_U8_16x16(3MLIB),
mlib_VideoInterpAveY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8_16x16(3MLIB),
mlib_VideoInterpX_S16_U8_16x16(3MLIB), mlib_VideoInterpX_U8_U8_16x16(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8_U8_16x16(3MLIB),
mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_U8_U8_U8_16x16(3MLIB),
mlib_VideoInterpY_U8_U8_U8_16x16(3MLIB),
mlib_VideoP64Loop_S16_U8(3MLIB)

mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_U8_U8(3MLIB),
attributes(5)
mlib_VideoP64Loop_U8_U8 – applies a 2-dimensional (2D) 3x3 spatial filter on the reference block

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoP64Loop_U8_U8(mlib_u8 *curr_block,
const mlib_u8 *ref_block, mlib_s32 stride);

Description
The mlib_VideoP64Loop_U8_U8() function applies a 2-dimensional (2D) 3x3 spatial filter on the reference block. The filter is separable into 1D horizontal and vertical functions, where the filter coefficients are 0.25, 0.5, 0.25, except at the block edges where the coefficients are 0, 1, 0. In this mode, the motion-compensated reference block becomes the current block. Thus, the stride applies to both the input reference block and the current block.

Parameters
The function takes the following arguments:
- curr_block: Pointer to the current block.
- ref_block: Pointer to the reference block.
- stride: Stride, in bytes, between adjacent rows in both the current block and the reference block.

Return Values
The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes
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See Also
mlib_VideoAddBlock_U8_S16(3MLIB), mlib_VideoCopyRef_S16_U8(3MLIB),
mlib_VideoCopyRef_S16_U8_16x16(3MLIB), mlib_VideoCopyRef_U8_U8_16x16(3MLIB),
mlib_VideoH263OverlappedMC_S16_U8(3MLIB),
mlib_VideoH263OverlappedMC_U8_U8(3MLIB), mlib_VideoInterpAveX_U8_U8(3MLIB),
mlib_VideoInterpAveXY_U8_U8_16x16(3MLIB), mlib_VideoInterpAveY_U8_U8(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_S16_U8(3MLIB),
mlib_VideoInterpXY_S16_U8_16x16(3MLIB), mlib_VideoInterpXY_U8_U8(3MLIB),
mlib_VideoInterpXY_U8_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB),
mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB),
mlib_VideoInterpY_S16_U8_16x16(3MLIB), mlib_VideoInterpY_S16_U8(3MLIB).
mlib_VideoInterpY_U8_U8(3MLIB), mlib_VideoInterpY_U8_U8_16x16(3MLIB),
mlib_VideoP64Decimate_U8_U8(3MLIB), mlib_VideoP64Loop_S16_U8(3MLIB),
attributes(5)
mlib_VideoQuantizeInit_S16 – quantization of forward Discrete Cosine Transform (DCT) coefficients

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoQuantizeInit_S16(mlib_d64 dqtable[64],
const mlib_s16 iqtable[64]);

Description

The mlib_VideoQuantizeInit_S16() function initializes the quantization table. The following equation is used:

dqtable[i] = 1.0 / iqtable[i]; 0 ≤ i < 64

Parameters

The function takes the following arguments:

dqtable Pointer to quantizer table coefficients.
iqtable Pointer to original quantizer table coefficients:

0 < iqtable[i] < 128

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

<table>
<thead>
<tr>
<th>ATTRIBUTE TYPE</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>MT-Level</td>
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</tr>
</tbody>
</table>

See Also

mlib_VideoDCT2x2_S16_S16(3MLIB), mlib_VideoDCT4x4_S16_S16(3MLIB),
mlib_VideoDCT8x8_S16_S16(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB),
mlib_VideoDCT8x8_S16_S16_B16(3MLIB), mlib_VideoDCT8x8_S16_S16_B12(3MLIB),
mlib_VideoDCT8x8_S16_S16_B10(3MLIB), mlib_VideoDeQuantize_S16(3MLIB),
mlib_VideoDeQuantizeInit_S16(3MLIB), attributes(5)
mlib_VideoQuantize_S16 - quantization of forward Discrete Cosine Transform (DCT) coefficients

Synopsis

```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoQuantize_S16(mlib_s16 icoeffs[64],
       const mlib_d64 dqtable[64]);
```

Description

The `mlib_VideoQuantize_S16()` function performs quantization on DCT coefficients.

The following equation is used:

\[ icoeffs[i] = icoeffs[i] \times dqtable[i]; \quad 0 \leq i < 64 \]

Parameters

The function takes the following arguments:

- `icoeffs` Pointer to the output DCT coefficients:
  
  \[-2048 < icoeffs[i] < 2048\]

  Note that `icoeffs` must be 8-byte aligned.

- `dqtable` Pointer to quantizer table coefficients.

Return Values

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes

See `attributes(5)` for descriptions of the following attributes:

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</tbody>
</table>

See Also

- `mlib_VideoDCT2x2_S16_S16(3MLIB)`, `mlib_VideoDCT4x4_S16_S16(3MLIB)`, `mlib_VideoDCT8x8_S16_S16(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_B12(3MLIB)`, `mlib_VideoDCT8x8_S16_S16_NA(3MLIB)`, `mlib_VideoDCT8x8_S16_U8(3MLIB)`, `mlib_VideoDCT8x8_S16_U8_NA(3MLIB)`, `mlib_VideoDCT16x16_S16_S16(3MLIB)`, `mlib_VideoDCT16x16_S16_S16_B10(3MLIB)`, `mlib_VideoDeQuantize_S16(3MLIB)`, `mlib_VideoDeQuantizeInit_S16(3MLIB)`
Each of the functions provides support to reversible wavelet transformation. It is for reversible color space conversion.

Parameters Each of the functions takes the following arguments:

- $y$ Pointer to destination Y component.
- $u$ Pointer to destination U component.
- $v$ Pointer to destination V component.
- $r$ Pointer to source R component.
- $g$ Pointer to source G component.
- $b$ Pointer to source B component.
- $n$ Length of data.
- $depth$ Number of bit planes required to store the original R, G, and B components.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:
## mlib_VideoReversibleColorRGB2YUV_U8_U8(3MLIB)

<table>
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<tr>
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</table>

See Also  mlib_VideoReversibleColorYUV2RGB_U8_U8(3MLIB), attributes(5)
mlib_VideoReversibleColorYUV2RGB_U8_U8,
mlib_VideoReversibleColorYUV2RGB_U8_S16,
mlib_VideoReversibleColorYUV2RGB_S16_S16,
mlib_VideoReversibleColorYUV2RGB_S16_S32 – reversible color space conversion for
wavelet transformation

cc [ flag... ] file... -Lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoReversibleColorYUV2RGB_U8_U8(mlib_u8 *r,
mlib_u8 *g, mlib_u8 *b, const mlib_u8 *y, const mlib_u8 *u,
const mlib_u8 *v, mlib_s32 n, mlib_s32 depth);

mlib_status mlib_VideoReversibleColorYUV2RGB_U8_S16(mlib_u8 *r,
mlib_u8 *g, mlib_u8 *b, const mlib_s16 *y, const mlib_s16 *u,
const mlib_s16 *v, mlib_s32 n, mlib_s32 depth);

mlib_status mlib_VideoReversibleColorYUV2RGB_S16_S16(mlib_s16 *r,
mlib_s16 *g, mlib_s16 *b, const mlib_s16 *y, const mlib_s16 *u,
const mlib_s16 *v, mlib_s32 n, mlib_s32 depth);

mlib_status mlib_VideoReversibleColorYUV2RGB_S16_S32(mlib_s16 *r,
mlib_s16 *g, mlib_s16 *b, const mlib_s32 *y, const mlib_s32 *u,
const mlib_s32 *v, mlib_s32 n, mlib_s32 depth);

Description Each of the functions provides support to reversible wavelet transformation. It is for reversible
color space conversion.

Parameters Each of the functions takes the following arguments:

\[ r \] Pointer to destination R component.
\[ g \] Pointer to destination G component.
\[ b \] Pointer to destination B component.
\[ y \] Pointer to source Y component.
\[ u \] Pointer to source U component.
\[ v \] Pointer to source V component.
\[ n \] Length of data.
\[ depth \] Number of bit planes required to store the original R, G, and B components.

Return Values Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes See attributes(5) for descriptions of the following attributes:
mlib_VideoReversibleColorYUV2RGB_U8_U8(3MLIB)

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</table>

See Also  mlib_VideoReversibleColorRGB2YUV_U8_U8(3MLIB), attributes(5)
The `mlib_VideoSignMagnitudeConvert_S16()` function converts data between standard 2's complement signed integer representation and sign-magnitude representation.

**Parameters**
- `dst` Pointer to destination data array.
- `src` Pointer to source data array.
- `srcdst` Pointer to source and destination data array.
- `n` Array size.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See `attributes(5)` for descriptions of the following attributes:

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**See Also**
- `mlib_VideoSignMagnitudeConvert_S16_S16(3MLIB)`,
- `mlib_VideoSignMagnitudeConvert_S32_S32(3MLIB)`,
- `attributes(5)`
Name  mlib_VideoSignMagnitudeConvert_S16_S16 – wavelet transformation, sign-magnitude conversion

Synopsis  
```
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoSignMagnitudeConvert_S16_S16(mlib_s16 *dst,
const mlib_s16 *src, mlib_s32 n);
```

Description  The `mlib_VideoSignMagnitudeConvert_S16_S16()` function converts data between standard 2s complement signed integer representation and sign-magnitude representation.

Parameters  The function takes the following arguments:
- `dst` Pointer to destination data array.
- `src` Pointer to source data array.
- `srcdst` Pointer to source and destination data array.
- `n` Array size.

Return Values  The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  `mlib_VideoSignMagnitudeConvert_S16(3MLIB),`  
`mlib_VideoSignMagnitudeConvert_S32(3MLIB),`  
`mlib_VideoSignMagnitudeConvert_S32_S32(3MLIB), attributes(5)`
The `mlib_VideoSignMagnitudeConvert_S32()` function converts data between standard 2's complement signed integer representation and sign-magnitude representation.

The function takes the following arguments:
- `dst` Pointer to destination data array.
- `src` Pointer to source data array.
- `srcdst` Pointer to source and destination data array.
- `n` Array size.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See also `mlib_VideoSignMagnitudeConvert_S16(3MLIB)`, `mlib_VideoSignMagnitudeConvert_S16_S16(3MLIB)`, `mlib_VideoSignMagnitudeConvert_S32_S32(3MLIB)`, `attributes(5)`
**Name**
mlib_VideoSignMagnitudeConvert_S32_S32 – wavelet transformation, sign-magnitude conversion

**Synopsis**
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoSignMagnitudeConvert_S32_S32(mlib_s32 *dst,
const mlib_s32 *src, mlib_s32 n);

**Description**
The `mlib_VideoSignMagnitudeConvert_S32_S32()` function converts data between standard 2s complement signed integer representation and sign-magnitude representation.

**Parameters**
The function takes the following arguments:
- `dst` Pointer to destination data array.
- `src` Pointer to source data array.
- `srcdst` Pointer to source and destination data array.
- `n` Array size.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
mlib_VideoSignMagnitudeConvert_S16(3MLIB),
mlib_VideoSignMagnitudeConvert_S16_S16(3MLIB),
mlib_VideoSignMagnitudeConvert_S32(3MLIB), attributes(5)
#include <mlib.h>

mlib_s32 mlib_VideoSumAbsDiff(mlib_u8 *curr_block, const mlib_u8 *ref_block, mlib_s32 width, mlib_s32 height, mlib_s32 stride);

## Description

The `mlib_VideoSumAbsDiff()` function computes the sum of absolute differences between the pixels in the current block and the corresponding pixels in the reference block. Both the current block and the reference block belong to frames with the same dimension. (The stride is applicable to both.) Motion estimation computes the sum of the absolute differences between the current block and reference blocks at different locations in the reference frame, choosing the best fit (least sum of absolute difference) to calculate the motion vector.

## Parameters

- **curr_block**: Pointer to the current block. `curr_block` must be 8-byte aligned.
- **ref_block**: Pointer to the reference block.
- **width**: Width of the block.
- **height**: Height of the block.
- **stride**: Stride, in bytes, between adjacent rows in a block. `stride` must be a multiple of eight.

## Return Values

The function returns a value of type `mlib_s32`.

## Attributes

See `attributes(5)` for descriptions of the following attributes:

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## See Also

`attributes(5)`
The `mlib_VideoUpSample420()` function performs up sampling rate conversion used in JPEG File Interchange Format (JFIF).

**Parameters**
- `dst0` Pointer to upper destination row. `dst0` must be 8-byte aligned.
- `dst1` Pointer to lower destination row. `dst1` must be 8-byte aligned.
- `src0` Pointer to upper source row. `src0` must be 8-byte aligned.
- `src1` Pointer to middle source row. `src1` must be 8-byte aligned.
- `src2` Pointer to lower source row. `src2` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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**See Also**
- `mlib_VIDEOUPSAMPLE420(3MLIB)`, `mlib_VIDEOUPSAMPLE420_S16(3MLIB)`,
- `mlib_VIDEOUPSAMPLE422(3MLIB)`, `mlib_VIDEOUPSAMPLE422_S16(3MLIB)`,
- `mlib_VIDEOUPSAMPLE420_NEAREST(3MLIB)`,
- `mlib_VIDEOUPSAMPLE420_NEAREST_S16(3MLIB)`,
- `mlib_VIDEOUPSAMPLE422(3MLIB)`, `mlib_VIDEOUPSAMPLE422_S16(3MLIB)`,
- `mlib_VIDEOUPSAMPLE422_NEAREST(3MLIB)`,
- `mlib_VIDEOUPSAMPLE422_NEAREST_S16(3MLIB)`, attributes(5)
The `mlib_VideoUpSample420_Nearest()` function performs upsampling rate conversion used in JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- `dst0` Pointer to upper destination row. `dst0` must be 8-byte aligned.
- `dst1` Pointer to lower destination row. `dst1` must be 8-byte aligned.
- `src` Pointer to source row. `src` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

The function returns `MLIB_SUCCESS` if successful. Otherwise, it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:

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See Also: `mlib_VideoDownSample420(3MLIB)`, `mlib_VideoDownSample420_S16(3MLIB)`, `mlib_VideoDownSample422(3MLIB)`, `mlib_VideoDownSample422_S16(3MLIB)`, `mlib_VideoUpSample420(3MLIB)`, `mlib_VideoUpSample420_Nearest_S16(3MLIB)`, `mlib_VideoUpSample422(3MLIB)`, `mlib_VideoUpSample422_S16(3MLIB)`, `mlib_VideoUpSample422_Nearest(3MLIB)`, `mlib_VideoUpSample422_Nearest_S16(3MLIB)`, attributes(5)
# mlib_VideoUpSample420_Nearest_S16

## Name
mlib_VideoUpSample420_Nearest_S16 – up sampling rate conversion in JFIF

## Synopsis

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoUpSample420_Nearest_S16(mlib_s16 *dst0,
                                           mlib_s16 *dst1, const mlib_s16 *src, mlib_s32 n);
```

## Description
The `mlib_VideoUpSample420_Nearest_S16()` function performs up sampling rate conversion used in JPEG File Interchange Format (JFIF).

## Parameters
The function takes the following arguments:
- `dst0` Pointer to upper destination row. `dst0` must be 8-byte aligned.
- `dst1` Pointer to lower destination row. `dst1` must be 8-byte aligned.
- `src` Pointer to source row. `src` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

## Return Values
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

## Attributes
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</table>

## See Also
- mlib_VideoDownSample420(3MLIB), mlib_VideoDownSample420_S16(3MLIB), mlib_VideoDownSample422(3MLIB), mlib_VideoDownSample422_S16(3MLIB), mlib_VideoUpSample420(3MLIB), mlib_VideoUpSample420_Nearest(3MLIB), mlib_VideoUpSample420_S16(3MLIB), mlib_VideoUpSample422(3MLIB), mlib_VideoUpSample422_S16(3MLIB), mlib_VideoUpSample422_Nearest(3MLIB), mlib_VideoUpSample422_Nearest_S16(3MLIB), attributes(5)
**Synopsis**

```c
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_VideoUpSample420_S16(mlib_s16 *dst0,
    mlib_s16 *dst1, const mlib_s16 *src0, const mlib_s16 *src1,
    const mlib_s16 *src2, mlib_s32 n);
```

**Description**

The `mlib_VideoUpSample420_S16()` function performs up sampling rate conversion used in JPEG File Interchange Format (JFIF).

**Parameters**

- `dst0` Pointer to upper destination row. `dst0` must be 8-byte aligned.
- `dst1` Pointer to lower destination row. `dst1` must be 8-byte aligned.
- `src0` Pointer to upper source row. `src0` must be 8-byte aligned.
- `src1` Pointer to middle source row. `src1` must be 8-byte aligned.
- `src2` Pointer to lower source row. `src2` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

**Return Values**

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**

See attributes(5) for descriptions of the following attributes:

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</table>

**See Also**

- `mlib_VideoDownSample420(3MLIB)`, `mlib_VideoDownSample420_S16(3MLIB)`,
- `mlib_VideoDownSample422(3MLIB)`, `mlib_VideoDownSample422_S16(3MLIB)`,
- `mlib_VideoUpSample420(3MLIB)`, `mlib_VideoUpSample420_Nearest(3MLIB)`,
- `mlib_VideoUpSample420_Nearest_S16(3MLIB)`, `mlib_VideoUpSample422(3MLIB)`,
- `mlib_VideoUpSample422_Nearest(3MLIB)`, `mlib_VideoUpSample422_Nearest_S16(3MLIB)`
The `mlib_VideoUpSample422()` function performs up sampling rate conversion used in JPEG File Interchange Format (JFIF).

**Parameters**
The function takes the following arguments:

- `dst` Pointer to destination row. `dst` must be 8-byte aligned.
- `src` Pointer to source row. `src` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

**Return Values**
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
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**See Also**
mlib_VideoDownSample420(3MLIB), mlib_VideoDownSample420_S16(3MLIB), mlib_VideoDownSample422(3MLIB), mlib_VideoDownSample422_S16(3MLIB), mlib_VideoUpSample420(3MLIB), mlib_VideoUpSample420_Nearest(3MLIB), mlib_VideoUpSample420_Nearest_S16(3MLIB), mlib_VideoUpSample422(3MLIB), mlib_VideoUpSample422_S16(3MLIB), mlib_VideoUpSample422_Nearest(3MLIB), mlib_VideoUpSample422_Nearest_S16(3MLIB), attributes(5)
mlib_VideoUpSample422_Nearest() function performs up-sampling rate conversion used in JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- **dst**: Pointer to destination row. dst must be 8-byte aligned.
- **src**: Pointer to source row. src must be 8-byte aligned.
- **n**: Length of source rows. n must be greater than 1.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

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See Also
- mlib_VideoDownSample420(3MLIB), mlib_VideoDownSample420_S16(3MLIB), mlib_VideoDownSample422(3MLIB), mlib_VideoDownSample422_S16(3MLIB), mlib_VideoUpSample420(3MLIB), mlib_VideoUpSample420_Nearest(3MLIB), mlib_VideoUpSample420_Nearest_S16(3MLIB), mlib_VideoUpSample422(3MLIB), mlib_VideoUpSample422_S16(3MLIB), mlib_VideoUpSample422_Nearest(3MLIB), attributes(5)
mlib_VideoUpSample422_Nearest_S16(3MLIB)

Name  mlib_VideoUpSample422_Nearest_S16 – up sampling rate conversion in JFIF

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VideoUpSample422_Nearest_S16(mlib_s16 *dst,
    const mlib_s16 *src, mlib_s32 n);

Description  The mlib_VideoUpSample422_Nearest_S16() function performs up sampling rate conversion used in JPEG File Interchange Format (JFIF).

Parameters  The function takes the following arguments:

- *dst*  Pointer to destination row. *dst* must be 8-byte aligned.
- *src*  Pointer to source row. *src* must be 8-byte aligned.
- *n*  Length of source rows. *n* must be greater than 1.

Return Values  The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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</table>

See Also  mlib_VideoDownSample420(3MLIB), mlib_VideoDownSample420_S16(3MLIB),
mlib_VideoDownSample422(3MLIB), mlib_VideoDownSample422_S16(3MLIB),
mlib_VideoUpSample420(3MLIB), mlib_VideoUpSample420_Nearest(3MLIB),
mlib_VideoUpSample420_Nearest_S16(3MLIB), mlib_VideoUpSample420_S16(3MLIB),
mlib_VideoUpSample422(3MLIB), mlib_VideoUpSample422_S16(3MLIB),
mlib_VideoUpSample422_Nearest(3MLIB), attributes(5)
The `mlib_VideoUpSample422_S16()` function performs up sampling rate conversion used in JPEG File Interchange Format (JFIF).

The function takes the following arguments:

- `dst` Pointer to destination row. `dst` must be 8-byte aligned.
- `src` Pointer to source row. `src` must be 8-byte aligned.
- `n` Length of source rows. `n` must be greater than 1.

The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

See attributes(5) for descriptions of the following attributes:
Name  mlib_VideoWaveletForwardTwoTenTrans,
      mlib_VideoWaveletForwardTwoTenTrans_S16_U8,
      mlib_VideoWaveletForwardTwoTenTrans_S16_S16,
      mlib_VideoWaveletForwardTwoTenTrans_S32_S16,
      mlib_VideoWaveletForwardTwoTenTrans_S32_S32 – wavelet transformation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

    mlib_status mlib_VideoWaveletForwardTwoTenTrans_S16_U8(mlib_s16 *dst,
                                   const mlib_u8 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);
    mlib_status mlib_VideoWaveletForwardTwoTenTrans_S16_S16(mlib_s16 *dst,
                                   const mlib_s16 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);
    mlib_status mlib_VideoWaveletForwardTwoTenTrans_S32_S16(mlib_s32 *dst,
                                   const mlib_s16 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);
    mlib_status mlib_VideoWaveletForwardTwoTenTrans_S32_S32(mlib_s32 *dst,
                                   const mlib_s32 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);

Description  Each of the functions provides support to reversible wavelet transformation. It is for a forward two-ten transformation.

Parameters  Each of the functions takes the following arguments:

    dst    Pointer to TT-transform coefficients.
    src    Pointer to source image.
    width  Width of image.
    height Height of image.
    level  Pointer to the number of decomposition levels. It returns the processed decomposition levels value.

Return Values  Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes  See attributes(5) for descriptions of the following attributes:

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See Also  mlib_VideoWaveletInverseTwoTenTrans(3MLIB), attributes(5)
**Name**  
mlib_VideoWaveletInverseTwoTenTrans,  
mlib_VideoWaveletInverseTwoTenTrans_U8_S16,  
mlib_VideoWaveletInverseTwoTenTrans_S16_S16,  
mlib_VideoWaveletInverseTwoTenTrans_S16_S32,  
mlib_VideoWaveletInverseTwoTenTrans_S32_S32 — wavelet transformation

**Synopsis**  
cc [ flag... ] file... -lmlib [ library... ]  
#include <mlib.h>  
mlib_status mlib_VideoWaveletInverseTwoTenTrans_U8_S16(mlib_u8 *dst,  
const mlib_s16 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);  
mlib_status mlib_VideoWaveletInverseTwoTenTrans_S16_S16(mlib_s16 *dst,  
const mlib_s16 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);  
mlib_status mlib_VideoWaveletInverseTwoTenTrans_S16_S32(mlib_s16 *dst,  
const mlib_s32 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);  
mlib_status mlib_VideoWaveletInverseTwoTenTrans_S32_S32(mlib_s32 *dst,  
const mlib_s32 *src, mlib_s32 width, mlib_s32 height, mlib_s32 *level);

**Description**  
Each of the functions provides support to reversible wavelet transformation. It is for an inverse two-ten transformation.

**Parameters**  
Each of the functions takes the following arguments:

- **dst**  
  Pointer to destination image.

- **src**  
  Pointer to TT-transform coefficients.

- **width**  
  Width of image.

- **height**  
  Height of image.

- **level**  
  Pointer to the number of decomposition levels. It returns the processed decomposition levels value.

**Return Values**  
Each of the functions returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

**Attributes**  
See attributes(5) for descriptions of the following attributes:

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**See Also**  
mlib_VideoWaveletForwardTwoTenTrans(3MLIB), attributes(5)
mlib_VolumeFindMaxBMask_U8, mlib_VolumeFindMaxBMask_S16 – maximum intensity searching

Synopsis

cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VolumeFindMaxBMask_U8(mlib_u8 *max,
const mlib_rays *rays, const mlib_u8 *bmask);

mlib_status mlib_VolumeFindMaxBMask_S16(mlib_s16 *max,
const mlib_rays *rays, const mlib_u8 *bmask);

Description

Each function performs maximum intensity searching. It uses the following equation:

max[i] = MAX{ rays->results[j][i]
  \quad j = 0, 1, ..., rays->nsteps[i]; bmask[j] = 1 }

where i = 0, 1, ..., rays->nrays - 1.

Parameters

The function takes the following arguments:

max   Pointer to an array of rays->nrays maximum values of the samples in each ray.
rays  Pointer to an mlib_rays structure. The data rays->results are organized with ray number (rather than ray step) varying fastest. Ray number and ray step are the output of the ray casting functions. The data might have values beyond the maximum step on a ray. For example, rays->results[rays->nsteps[i]][i] on ray i might not equal 0.
bmask  Pointer to a 1-bit mask array. Eight mask bits are packed into one byte. A 1 corresponds to the data in the step to be considered.

Return Values

The function returns MLIB_SUCCESS if successful. Otherwise it returns MLIB_FAILURE.

Attributes

See attributes(5) for descriptions of the following attributes:

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See Also mlib_VolumeFindMax_U8(3MLIB), mlib_VolumeFindMaxBMask_U8(3MLIB), attributes(5)
Name  mlib_VolumeFindMaxCMask_U8, mlib_VolumeFindMaxCMask_S16 – maximum intensity searching

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VolumeFindMaxCMask_U8(mlib_u8 *max,
    const mlib_rays *rays, const mlib_u8 *cmask, mlib_s32 thresh);

mlib_status mlib_VolumeFindMaxCMask_S16(mlib_s16 *max,
    const mlib_rays *rays, const mlib_u8 *cmask, mlib_s32 thresh);

Description  Each function performs maximum intensity searching.

It uses the following equation:

\[
\text{max}[i] = \max \{ \text{rays->results}[j][i] \\
    \text{where } j = 0, 1, \ldots, \text{rays->nsteps}[i]; \text{cmask}[j] > \text{thresh} \}
\]

Parameters  The function takes the following arguments:

max  Pointer to an array of \text{rays->nrays} maximum values of the samples in each ray.

rays  Pointer to an \text{mlib_rays} structure. The data \text{rays->results} are organized with ray number (rather than ray step) varying fastest. Ray number and ray step are the output of the ray casting functions. The data might have values beyond the maximum step on a ray. For example, \text{rays->results[rays->nsteps[i]]}[i] on ray \text{i} might not equal 0.

cmask  Pointer to an unsigned 8-bit mask array. If \text{cmask}[j] > \text{thresh}, then data in step \text{j}, \text{rays->results}[j], are considered.

thresh  Threshold.

Return Values  The function returns \text{MLIB_SUCCESS} if successful. Otherwise it returns \text{MLIB_FAILURE}.

Attributes  See \text{attributes(5)} for descriptions of the following attributes:

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See Also  \text{mlib_VolumeFindMaxCMask_U8(3MLIB), mlib_VolumeFindMaxCMask_S16(3MLIB), attributes(5)}
Name  
mlib_VolumeFindMax_U8, mlib_VolumeFindMax_S16 – maximum intensity searching

Synopsis  
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VolumeFindMax_U8(mlib_u8 *max,
       const mlib_rays *rays);
mlib_status mlib_VolumeFindMax_S16(mlib_s16 *max,
       const mlib_rays *rays);

Description  
Each function performs maximum intensity searching.

It uses the following equation:

```
max[i] = MAX{ rays->results[j][i]
    j = 0, 1, ..., rays->nsteps[i] }
```

where i = 0, 1, ..., rays->nrays - 1.

Parameters  
The function takes the following arguments:

- `max`  
  Pointer to an array of `rays->nrays` maximum values of the samples in each ray.

- `rays`  
  Pointer to an `mlib_rays` structure. The data `rays->results` are organized with ray number (rather than ray step) varying fastest. Ray number and ray step are the output of the ray casting functions. The data might have values beyond the maximum step on a ray. For example, `rays->results[rays->nsteps[i]][i]` on ray i might not equal 0.

Return Values  
The function returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

Attributes  
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See Also  
mlib_VolumeFindMaxBMask_U8(3MLIB), mlib_VolumeFindMaxCMask_U8(3MLIB), attributes(5)
mlib_VolumeRayCast_Blocked(3MLIB)

Name  mlib_VolumeRayCast_Blocked, mlib_VolumeRayCast_Blocked_Parallel_Nearest_U8_U8, mlib_VolumeRayCast_Blocked_Parallel_Nearest_S16_S16, mlib_VolumeRayCast_Blocked_Parallel_Trilinear_U8_U8, mlib_VolumeRayCast_Blocked_Parallel_Trilinear_S16_S16, mlib_VolumeRayCast_Blocked_Divergent_Nearest_U8_U8, mlib_VolumeRayCast_Blocked_Divergent_Nearest_S16_S16, mlib_VolumeRayCast_Blocked_Divergent_Trilinear_U8_U8, mlib_VolumeRayCast_Blocked_Divergent_Trilinear_S16_S16 – cast a ray (or rays) through a 3D data set

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>
mlib_status mlib_VolumeRayCast_Blocked_Parallel_Nearest_U8_U8 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Parallel_Nearest_S16_S16 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Parallel_Trilinear_U8_U8 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Parallel_Trilinear_S16_S16 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Divergent_Nearest_U8_U8 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Divergent_Nearest_S16_S16 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Divergent_Trilinear_U8_U8 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);
mlib_status mlib_VolumeRayCast_Blocked_Divergent_Trilinear_S16_S16 (mlib_rays *rays, const mlib_blkvolume *blk, void *buffer);

Description  Each of these functions casts a ray (or rays) through a three-dimensional (3D) data set, then computes and returns the interpolated samples at each step along the way.

In trilinear interpolation, the value at point P is computed from its eight surrounding neighbors based on the equation below.

\[ P = (1-a)*(1-b)*(1-c)*P_0 + a*(1-b)*(1-c)*Px + (1-a)*b*(1-c)*Py + (1-a)*(1-b)*c*Pz + a*b*(1-c)*Pxy + a*(1-b)*c*Pxz + (1-a)*b*c*Pyz + a*b*c*Pxyz \]

where a, b, and c are the fractional parts of the coordinates of point P.

The trilinear interpolation is represented by the following figure:
In nearest neighbor operation, the sample value at point P is replaced by the value of the nearest neighbor voxel.

**Parameters**  Each of the functions takes the following arguments:

- `rays`  Casting rays.
- `blk`  Volume data in the blocked format.
- `buffer`  Working buffer.

**Return Values**  Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**  See `attributes(5)` for descriptions of the following attributes:

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**See Also**  `mlib_VolumeRayCast_General(3MLIB), attributes(5)`
mlib_VolumeRayCast_General(3MLIB)

Name
mlib_VolumeRayCast_General, mlib_VolumeRayCast_General_Parallel_Nearest_U8_Bit,
mlib_VolumeRayCast_General_Parallel_Nearest_U8_U8,
mlib_VolumeRayCast_General_Parallel_Nearest_S16_S16,
mlib_VolumeRayCast_General_Parallel_Trilinear_U8_U8,
mlib_VolumeRayCast_General_Parallel_Trilinear_S16_S16,
mlib_VolumeRayCast_General_Divergent_Nearest_U8_Bit,
mlib_VolumeRayCast_General_Divergent_Nearest_U8_U8,
mlib_VolumeRayCast_General_Divergent_Nearest_S16_S16,
mlib_VolumeRayCast_General_Divergent_Trilinear_U8_U8,
mlib_VolumeRayCast_General_Divergent_Trilinear_S16_S16

Synopsis
cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VolumeRayCast_General_Parallel_Nearest_U8_Bit(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Parallel_Nearest_U8_U8(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Parallel_Nearest_S16_S16(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Parallel_Trilinear_U8_U8(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Parallel_Trilinear_S16_S16(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Divergent_Nearest_U8_Bit(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Divergent_Nearest_U8_U8(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Divergent_Nearest_S16_S16(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Divergent_Trilinear_U8_U8(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);
mlib_status mlib_VolumeRayCast_General_Divergent_Trilinear_S16_S16(
    mlib_rays *rays, const mlib_genvolume *vol, void *buffer);

Description
Each of these functions casts a ray (or rays) through a three-dimensional (3D) data set, then
computes and returns the interpolated samples at each step along the way.

In trilinear interpolation, the value at point P is computed from its eight surrounding
neighbors based on the equation below.

P = (1-a)*(1-b)*(1-c)*P0 +
a*(1-b)*(1-c)*Px + (1-a)*b*(1-c)*Py + (1-a)*(1-b)*c*Pz +
where a, b, and c are the fractional parts of the coordinates of point P.

The trilinear interpolation is represented by the following figure:

In nearest neighbor operation, the sample value at point P is replaced by the value of the nearest neighbor voxel.

**Parameters**
Each of the functions takes the following arguments:
- `rays` Casting rays.
- `vol` Volume data that consists of slices.
- `buffer` Working buffer.

**Return Values**
Each of the functions returns `MLIB_SUCCESS` if successful. Otherwise it returns `MLIB_FAILURE`.

**Attributes**
See attributes(5) for descriptions of the following attributes:

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See Also  

mlib_VolumeRayCast_Blocked(3MLIB), attributes(5)
Name  mlib_VolumeWindowLevel – window-level operation

Synopsis  cc [ flag... ] file... -lmlib [ library... ]
#include <mlib.h>

mlib_status mlib_VolumeWindowLevel(mlib_u8 *dst,
    const mlib_s16 *src, mlib_s32 window, mlib_s32 level,
    mlib_s32 gmax, mlib_s32 gmin, mlib_s32 len);

Description  The mlib_VolumeWindowLevel() function performs a window-level operation by using the following equation:

\[
\begin{align*}
X &= x(i) \quad i = 0, 1, ..., n - 1 \\
Z &= z(i) \quad i = 0, 1, ..., n - 1 \\
\begin{cases}
  g_{\text{min}} & x(i) < l - \frac{w}{2} \\
  \frac{x(i) - \left(l - \frac{w}{2}\right)}{w} + g_{\text{min}} & l - \frac{w}{2} \leq x(i) < l + \frac{w}{2} \\
  g_{\text{max}} & x(i) \geq l + \frac{w}{2}
\end{cases}
\end{align*}
\]

The window-level operation is represented by the following figure:
The function takes the following arguments:

- **dst**: Pointer to the output or destination array.
- **src**: Pointer to the input or source array.
- **window**: Width of the window.
- **level**: Center of the window.
- **gmax**: Maximum grayscale in the destination array.
- **gmin**: Minimum grayscale in the destination array.
- **len**: Length of the data array.

The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Parameters

- **dst**: Pointer to the output or destination array.
- **src**: Pointer to the input or source array.
- **window**: Width of the window.
- **level**: Center of the window.
- **gmax**: Maximum grayscale in the destination array.
- **gmin**: Minimum grayscale in the destination array.
- **len**: Length of the data array.

### Return Values

- **MLIB_SUCCESS**: The function returns **MLIB_SUCCESS** if successful. Otherwise it returns **MLIB_FAILURE**.

### Attributes

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### See Also

attributes(5)