

Installer FCUBS Machine Learning Setup
Oracle FLEXCUBE Universal Banking
Release 12.87.06.0.0
[May] [2020]



Table of Contents

1	Glossary:	1
2	Introduction:	1
3	Application Compatibility:	1
3.1	Oracle FLEXCUBE Universal Banking.....	1
3.2	Oracle R Enterprise (ORE)	1
3.3	Machine Learning Database.....	1
4	Oracle FLEXCUBE Machine Learning Architecture.....	2
5	Pre-Installation Checklist:	2
5.1	FLEXCUBE Database Instance.....	2
5.2	Machine Learning Database Instance.....	2
5.3	Data Replication.....	3
6	Installation Steps:	3
6.1	Machine Learning Instance	4
6.1.1	Object Summary	4
6.1.2	User Creation and granting privileges	4
6.1.3	Installation of Database Objects	4
6.1.4	Install ORE objects	6
6.2	FLEXCUBE Instance	11
6.2.1	Object Summary	11
6.2.2	Login to FLEXCUBE Instance.....	11
6.2.3	Database Link	11
6.2.4	Execute the INSERT scripts	11
6.2.5	FLEXCUBE User Interfaces	11
6.3	Machine Learning Validation Checkpoints:.....	11
6.3.1	Validate Database Tables	11
6.3.2	Validate Views.....	12
6.3.3	Validate PL/SQL Objects:.....	13
6.3.4	Validate ORE scripts:.....	13
6.4	FLEXCUBE Validation Checkpoints:.....	14
6.4.1	Validate database link creation	14
6.4.2	Validate database link credentials	14
6.4.3	Validate FLEXCUBE menu	14

1 Glossary:

Abbreviation	Detailed Description
FCUBS	Oracle FLEXCUBE Universal Banking
ML	Machine Learning
LTV	Life Time Value
ORE	Oracle R Enterprise
IDE	Integrated Development Environment

2 Introduction:

This document contains detailed guidelines to install Oracle FLEXCUBE Machine Learning framework.

***Note:** Please refer Oracle FLEXCUBE Machine Learning User Manual for Model execution and control*

3 Application Compatibility:

3.1 Oracle FLEXCUBE Universal Banking

Version: 14.3.0.0.0.0

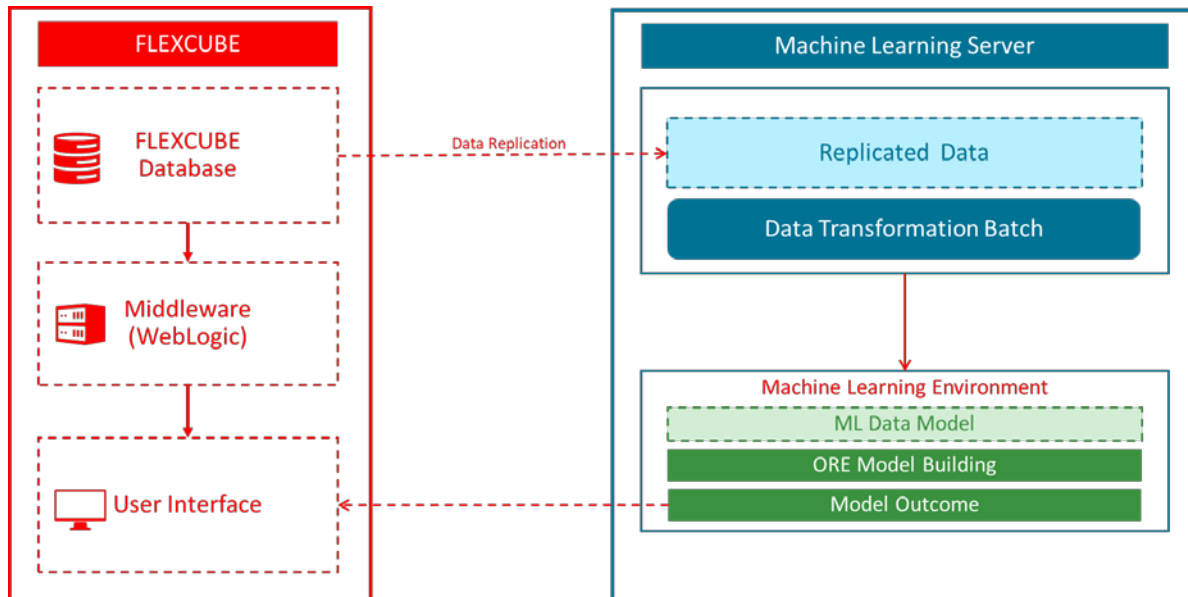
3.2 Oracle R Enterprise (ORE)

- All the Machine Learning models were built using Oracle R Enterprise 1.5.1
- For installation and setup please refer to the guidelines received with the licensed version of Oracle R Enterprise Software.
- Oracle Enterprise Linux server 7.1 (x86 64 bit)

3.3 Machine Learning Database

- Oracle Database 18c

4 Oracle FLEXCUBE Machine Learning Architecture



Note:

- i. FLEXCUBE database and Machine learning database should be on two different servers
- ii. This is to ensure that the machine learning workload is not on the critical path of banking operations and hog critical server memory

5 Pre-Installation Checklist:

5.1 FLEXCUBE Database Instance

- FLEXCUBE database instance should be up and available.

5.2 Machine Learning Database Instance



Note: ORE database MUST be a separate instance from Oracle FLEXCUBE Instance. This is to ensure that the machine learning workload is not on the critical path of banking operations and hog critical server memory

Please follow the sequential steps are detailed below.

- 1) Install Oracle Database on the Machine Learning server. Refer to [3.3](#) for compatible database versions.

- 2) Oracle R Enterprise should be installed in Machine Learning database server. Please refer [3.2](#) for compatible ORE version.
- 3) For ORE installation and setup please refer to the guideline received with licensed version.
- 4) R Client needs to be installed to access Oracle R Enterprise server from client machine. R client could be open source R or Oracle R Distribution. Below are the links to install the same.
 - a. Open source R: <https://cran.r-project.org/bin/windows/base/>
 - b. Oracle R Distribution (ORD): <https://oss.oracle.com/ORD/>
- 5) Rstudio IDE can be installed for developer friendly environment. Below is the link to download Rstudio. Download the version based on the operating system in client machine
<https://www.rstudio.com/products/rstudio/download/#download>
- 6) Set up Oracle R Enterprise client in client machine. Please refer to the guideline received with licensed version.

5.3 Data Replication



Data replication from FLEXCUBE to the Machine learning server is outside the purview of this document.

Any data replication software could be deployed to replicate FLEXCUBE data to the Machine Learning database Instance

It is left to the bank/solution team to decide on the data Replication Software including the mode of replication and frequency of replication

Please ensure FLEXCUBE data is already replicated into the Machine Learning Schema, before proceeding ahead with the Installation

6 Installation Steps:

To proceed with the installation steps first check if all the checkpoints mentioned in section [Pre-Installation Checklist](#) are met. Follow below steps sequentially for the installation.

6.1 Machine Learning Instance

6.1.1 Object Summary

No.	OBJECT TYPE	COUNT
1	TABLES	21
2	VIEWS	06
3	INSERT SCRIPTS (INC)	02
4	SEQUENCE (SEQ)	01
5	PROCEDURE (PRC)	01
6	PACKAGE SPECIFICATION(SPC)	01
7	PACKAGE BODY (SQL)	01
8	FUNCTION (FNC)	01
9	R SCRIPTS (ORE)	05
	Total Object Count	39

6.1.2 User Creation and granting privileges

6.1.2.1 Create User

Log in to the Machine Learning database with SYSDBA credentials and execute below query to create a machine learning user.

```
CREATE USER <username> IDENTIFIED BY <password>;
```

If the user has been already created at the time of ORE installation, then proceed to next step

6.1.2.2 Give necessary privileges

Grant the below privileges to the machine learning user created in the previous step (7.1.1.1)

- i. **grant CONNECT,ODMRUSER,RQADMIN TO <username>;**
- ii. **grant CREATE SESSION to <username>;**
- iii. **grant CREATE TABLE to <username>;**
- iv. **grant CREATE VIEW to <username>;**
- v. **grant CREATE DATABASE LINK to <username>;**
- vi. **grant CREATE MINING MODEL to <username>;**
- vii. **grant CREATE PROCEDURE to <username>;**

6.1.3 Installation of Database Objects

6.1.3.1 Login to the Machine Learning schema

Connect using the user credentials defined in step (7.1.1.1)

6.1.3.2 Execute DDL scripts

Execute the DDL scripts mentioned in section [Machine Learning Data Model](#) . Below are the DDL scripts (21 Tables)

1. MLTB_BRN_RISK.ddl
2. MLTB_BRN_SEGMENT.ddl
3. MLTB_CUST_ACQ_COST.ddl
4. MLTB_CUST_CHRN_LTV_SEG.ddl
5. MLTB_CUST_ICCF_INCOME.ddl
6. MLTB_DEBUG.ddl
7. MLTB_ENT_RISK.ddl
8. MLTB_ENT_SEGMENT.ddl
9. MLTB_MODEL_PERF_LOG.ddl
10. MLTB_PARAM.ddl
11. MLTB_PROC_STAT_DETAIL.ddl
12. MLTB_PROC_STAT_DETAIL_HIST.ddl
13. MLTB_PROC_STAT_MASTER.ddl
14. MLTB_PROC_STAT_MASTER_HIST.ddl
15. MLTB_RETAIL_CUST_ENG.ddl
16. MLTB_RETAIL_CUST_ENG_HIST.ddl
17. MLTB_RETAIL_CUST_TXN_TREND.ddl
18. MLTB_STAT_DETAIL_PREV_RUN.ddl
19. MLTB_STAT_MASTER_PREV_RUN.ddl
20. MLTG_TREND_TXN_DATES.DDL
21. MLTM_STG_RETAIL_CUST_PROFILE.ddl

6.1.3.3 Execute the VIEW scripts

Execute the VW scripts mentioned in section [Machine Learning Data Model](#) . Below are the VW scripts (6 Views)

1. mlvw_brn_seg.vw
2. mlvw_brn_seg_det.vw
3. mlvw_cust_ltv_bank.vw
4. mlvw_cust_ltv_seg.vw
5. mlvw_ent_seg.vw
6. mlvw_ent_seg_det.vw

6.1.3.4 Execute the INSERT Scripts

Execute the INC scripts mentioned in section [Machine Learning Data Model](#) . Below are the INC scripts (2 INCs)

1. MLTB_PARAM.INC
2. MLTB_CUST_ACQ_COST.INC

6.1.3.5 Execute Sequence Scripts

Execute the SQL scripts mentioned in section *Machine Learning Data Model* . Below are the SEQ scripts (One)

1. SEQ_ML_DEBUG.SQL

6.1.3.6 Create PROCEDURE

Compile the SQL script(s) mentioned in section *Machine Learning Data Model* . Below are the SQL script(s) for creating procedure(s) (one SQL)

1. PR_ML_DEBUG.SQL

6.1.3.7 Create PACKAGES

Compile the SQL script(s) mentioned in section *Machine Learning Data Model* . Below are the SQL script(s) for creating package specification(s) and body (One SPC and one SQL)

1. MLPKS_DATA_TRANSFORMATION.SPC
2. MLPKS_DATA_TRANSFORMATION.SQL

6.1.3.8 Create FUNCTION

Compile the SQL script(s) mentioned in section *Machine Learning Data Model* . Below are the SQL script(s) for creating function(s) (one SQL)

1. FN_MODELCONEX.SQL

6.1.4 Install ORE objects

6.1.4.1 Download ML source codes:

Download all the machine learning sources in a local folder

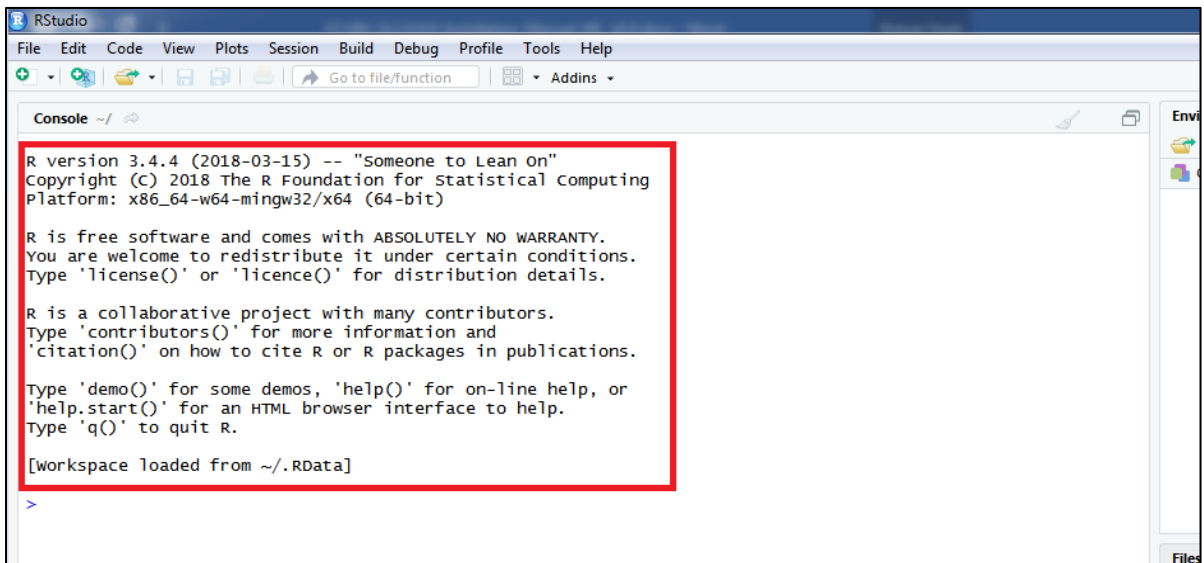
E.g. D:\ML\Sources

6.1.4.2 Launch R Studio

1. Launch Rstudio IDE.
2. The default screen will be displayed as shown below.

3. If open source R is installed, then it will show the version of Open Source R

Open source R:



```
R version 3.4.4 (2018-03-15) -- "Someone to Lean On"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

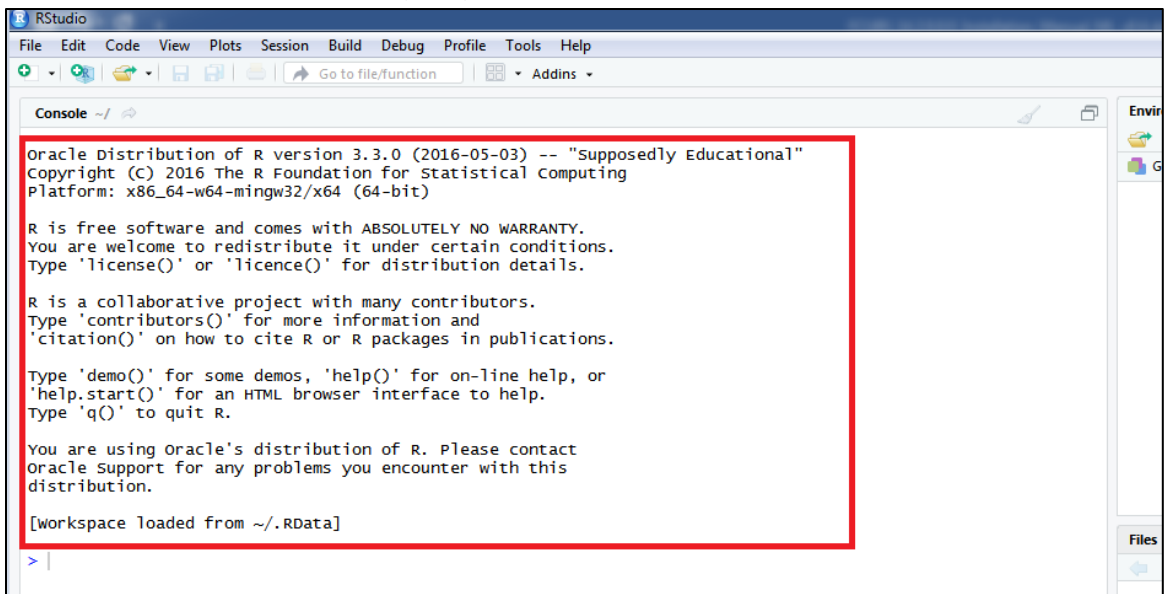
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[workspace loaded from ~/.RData]

>
```

4. Or, if Oracle R Distribution (ORD) is used, it will show the version of ORD.

Oracle R Distribution (ORD):



```
Oracle Distribution of R version 3.3.0 (2016-05-03) -- "Supposedly Educational"
Copyright (C) 2016 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

You are using Oracle's distribution of R. Please contact
Oracle support for any problems you encounter with this
distribution.

[workspace loaded from ~/.RData]

>
```

6.1.4.3 Loading ORE Library

1. From Rstudio console execute below command

```
> library(ORE)
```

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins
Console ~/
R version 3.4.4 (2018-03-15) -- "Someone to Lean On"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
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'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[workspace loaded from ~/.RData]
> library(ORE)
```

2. Once executed, it will show the following output in console

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins
Console ~/
R version 3.4.4 (2018-03-15) -- "Someone to Lean On"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
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'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

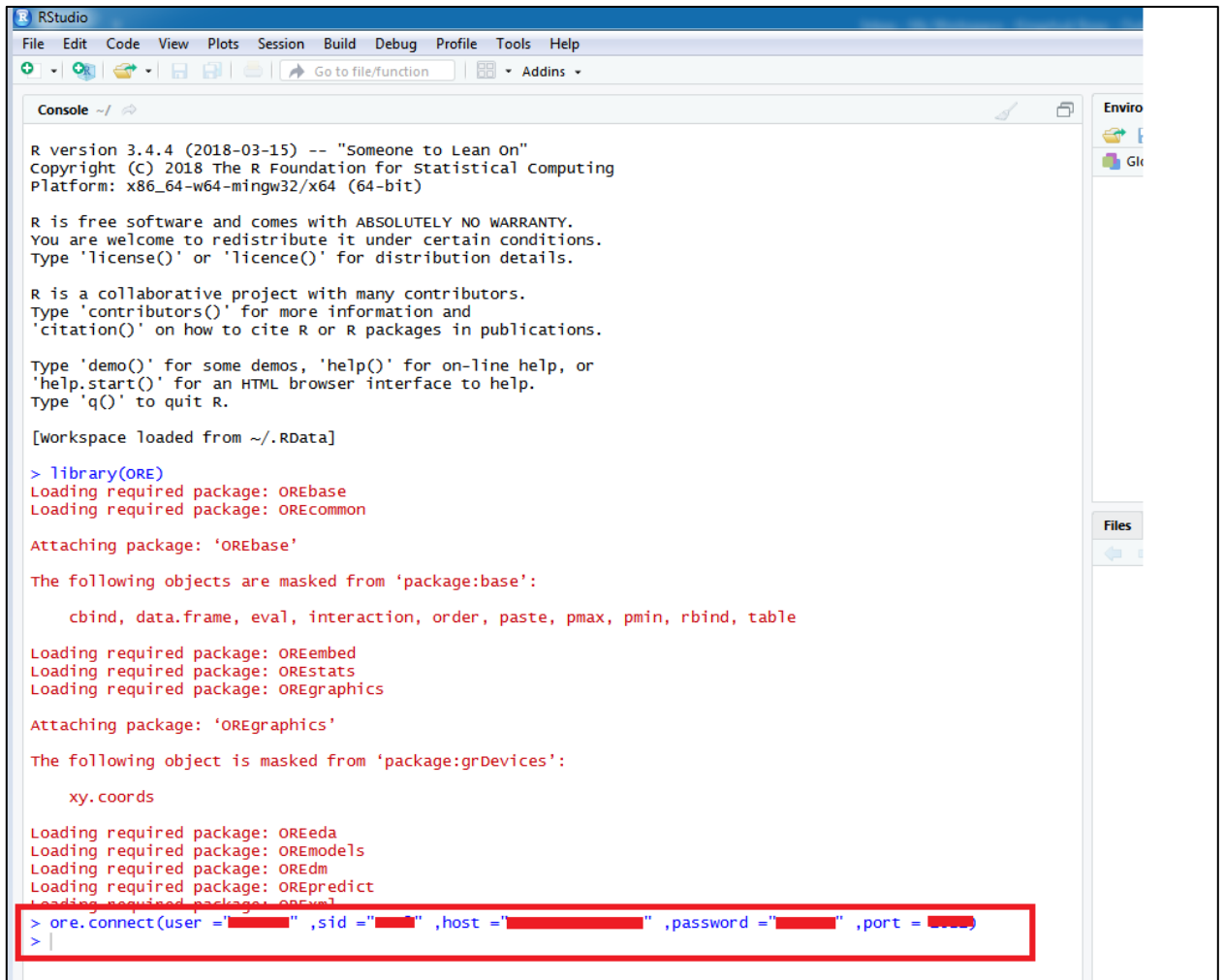
[workspace loaded from ~/.RData]
> library(ORE)
Loading required package: OREbase
Loading required package: OREcommon
Attaching package: 'OREbase'
The following objects are masked from 'package:base':
  cbind, data.frame, eval, interaction, order, paste, pmax, pmin, rbind, table
Loading required package: OREembed
Loading required package: OREstats
Loading required package: OREgraphics
Attaching package: 'OREgraphics'
The following object is masked from 'package:grDevices':
  xy.coords
Loading required package: OREeda
Loading required package: OREmodels
Loading required package: OREdm
Loading required package: OREpredict
Loading required package: ORExml
>
```

6.1.4.4 Connecting to the ORE Server

1. To connect ORE server from the client machine, execute below command

```
ore.connect (user = <username>, sid =<sid>, host =<hostname>, password=<password>, port = <port>)
```

Note: *The credential created in step 7.1.1.1*



```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins
Console ~/
R version 3.4.4 (2018-03-15) -- "Someone to Lean On"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
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R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[workspace loaded from ~/.RData]
> library(ORE)
Loading required package: OREbase
Loading required package: OREcommon
Attaching package: 'OREbase'

The following objects are masked from 'package:base':

  cbind, data.frame, eval, interaction, order, paste, pmax, pmin, rbind, table

Loading required package: OREembed
Loading required package: OREstats
Loading required package: OREgraphics
Attaching package: 'OREgraphics'

The following object is masked from 'package:grDevices':

  xy.coords

Loading required package: OREeda
Loading required package: OREmodels
Loading required package: OREdm
Loading required package: OREpredict
Loading required package: OREvis
> ore.connect(user = "██████████", sid = "██████████", host = "██████████", password = "██████████", port = 5555)
> |
```

6.1.4.5 Testing the ORE Connection:

1. To check if ORE client is connected to ORE server, execute below command from Rstudio console.
`ore.is.connected()`
2. It should return TRUE if ORE connection is successful, otherwise it will return FALSE.

6.2 FLEXCUBE Instance

6.2.1 Object Summary

No.	OBJECT TYPE	COUNT
1	Database Link	01
2	INC	02
3	Function IDs	04
	Total Object Count	07

6.2.2 Login to FLEXCUBE Instance

Connect to the FLEXCUBE Database using the required credentials

6.2.3 Database Link

1. The database link FCUBSML must point to the machine learning user
2. Edit the database link script FCUBSML.SQL with the machine learning user credentials created as part of section 7.1.1.1
3. Execute the modified script FCUBSML.SQL



Note: Do not change the Database link name FCUBSML

6.2.4 Execute the INSERT scripts

Execute the INC scripts mentioned in section FLEXCUBE database objects, under section 5.1.2 below is the INC script(s) (one INC)

1. SMTB_FUNCTION_DESCRIPTION.INC
2. ERTB_MSGS.INC

6.2.5 FLEXCUBE User Interfaces

Please refer the standard Oracle FLEXCUBE Installation Manual for deploying these new user interface screens

1. STDASHBC
2. STDASHAB
3. STDASHCD
4. STDDRMBE

6.3 Machine Learning Validation Checkpoints:

6.3.1 Validate Database Tables

1. Log in to the Machine Learning schema and run below SQL query

```

Select owner, object_name, object_type, status, created from all_objects
where object_name in
('MLTB_BRN_RISK','MLTB_BRN_SEGMENT','MLTB_CUST_ACQ_COST',
'MLTB_CUST_CHRN_LTV_SEG','MLTB_CUST_ICCF_INCOME','MLTB_DEBUG',
'MLTB_ENT_RISK','MLTB_ENT_SEGMENT','MLTB_MODEL_PERF_LOG','MLTB_PARAM',
'MLTB_RETAIL_CUST_ENG','MLTB_RETAIL_CUST_ENG_HIST',
'MLTB_RETAIL_CUST_TXN_TREND','MLTG_TREND_TXN_DATES',
'MLTM_STG_RETAIL_CUST_PROFILE','MLTB_PROC_STAT_DETAIL',
'MLTB_PROC_STAT_DETAIL_HIST','MLTB_PROC_STAT_MASTER',
'MLTB_PROC_STAT_MASTER_HIST','MLTB_STAT_DETAIL_PREV_RUN',
'MLTB_STAT_MASTER_PREV_RUN')
order by object_name;

```

2. The SQL query should return 21 rows with the following details.

OWNER	OBJECT NAME	OBJECT TYPE	STATUS	CREATED
< Schema name >	MLTB_BRN_RISK	TABLE	VALID	Creation Date
< Schema name >	MLTB_BRN_SEGMENT	TABLE	VALID	Creation Date
< Schema name >	MLTB_CUST_ACQ_COST	TABLE	VALID	Creation Date
< Schema name >	MLTB_CUST_CHRN_LTV_SEG	TABLE	VALID	Creation Date
< Schema name >	MLTB_CUST_ICCF_INCOME	TABLE	VALID	Creation Date
< Schema name >	MLTB_DEBUG	TABLE	VALID	Creation Date
< Schema name >	MLTB_ENT_RISK	TABLE	VALID	Creation Date
< Schema name >	MLTB_ENT_SEGMENT	TABLE	VALID	Creation Date
< Schema name >	MLTB_MODEL_PERF_LOG	TABLE	VALID	Creation Date
< Schema name >	MLTB_PARAM	TABLE	VALID	Creation Date
< Schema name >	MLTB_PROC_STAT_DETAIL	TABLE	VALID	Creation Date
< Schema name >	MLTB_PROC_STAT_DETAIL_HIST	TABLE	VALID	Creation Date
< Schema name >	MLTB_PROC_STAT_MASTER	TABLE	VALID	Creation Date
< Schema name >	MLTB_PROC_STAT_MASTER_HIST	TABLE	VALID	Creation Date
< Schema name >	MLTB_RETAIL_CUST_ENG	TABLE	VALID	Creation Date
< Schema name >	MLTB_RETAIL_CUST_ENG_HIST	TABLE	VALID	Creation Date
< Schema name >	MLTB_RETAIL_CUST_TXN_TREND	TABLE	VALID	Creation Date
< Schema name >	MLTB_STAT_DETAIL_PREV_RUN	TABLE	VALID	Creation Date
< Schema name >	MLTB_STAT_MASTER_PREV_RUN	TABLE	VALID	Creation Date
< Schema name >	MLTG_TREND_TXN_DATES	TABLE	VALID	Creation Date
< Schema name >	MLTM_STG_RETAIL_CUST_PROFILE	TABLE	VALID	Creation Date

6.3.2 Validate Views

1. Log in to the Machine Learning schema and run below SQL query

```

Select owner, object_name, object_type, status, created from all_objects

```

```

where object_name in
('MLVW_BRN_SEG','MLVW_BRN_SEG_DET','MLVW_CUST_LTV_BANK',
'MLVW_CUST_LTV_SEG','MLVW_ENT_SEG','MLVW_ENT_SEG_DET')
order by object_name;

```

2. The SQL query should return 6 rows with the following details.

OWNER	OBJECT NAME	OBJECT TYPE	STATUS	CREATED
< Schema name>	MLVW_BRN_SEG	VIEW	VALID	Creation Date
< Schema name>	MLVW_BRN_SEG_DET	VIEW	VALID	Creation Date
< Schema name>	MLVW_CUST_LTV_BANK	VIEW	VALID	Creation Date
< Schema name>	MLVW_CUST_LTV_SEG	VIEW	VALID	Creation Date
< Schema name>	MLVW_ENT_SEG	VIEW	VALID	Creation Date
< Schema name>	MLVW_ENT_SEG_DET	VIEW	VALID	Creation Date

6.3.3 Validate PL/SQL Objects:

1. Log in to the Machine Learning schema and run below SQL query

```

select owner,object_name,object_type,status,created
from all_objects where object_name in
('MLPKS_DATA_TRANSFORMATION','PR_ML_DEBUG','FN_MODELCONEX')
order by object_name

```

2. The SQL query should produce following result

OWNER	OBJECT NAME	OBJECT TYPE	STATUS	CREATED
<Schema name>	MLPKS_DATA_TRANSFORMATION	PACKAGE	VALID	Creation Date
<Schema name>	MLPKS_DATA_TRANSFORMATION	PACKAGE BODY	VALID	Creation Date
<Schema name>	PR_ML_DEBUG	PROCEDURE	VALID	Creation Date
<Schema name>	FN_MODELCONEX	FUNCTION	VALID	Creation Date

6.3.4 Validate ORE scripts:

1. Log in to the Machine Learning schema and run below SQL query

```

select * from user_rq_scripts order by name;

```

2. The SQL query should produce following result

NAME	SCRIPT
GENERIC_FUNCTIONS	<CLOB content>
ML_FCUBS_CUSCRN_ORE_BLD	<CLOB content>

NAME	SCRIPT
ML_FCUBS_CUSCRN_ORE_EXEC	<CLOB content>
ML_FCUBS_CUSLTV_MARKOV_ORE	<CLOB content>
ML_FCUBS_CUSSEG_ORE_BLD	<CLOB content>

6.4 FLEXCUBE Validation Checkpoints:

6.4.1 Validate database link creation

1. Log in to the Machine Learning schema and run below SQL query

```
select DB_LINK,USERNAME, HOST, CREATED from user_db_links where DB_LINK='FCUBSML'
```

2. The SQL query should produce following result

DB_LINK	USERNAME	HOST	CREATED
FCUBSML.IN.ORACLE.COM	<username>	<connection string>	Creation Date

6.4.2 Validate database link credentials

1. Execute the following SQL query in FLEXCUBE database

```
select param_name, param_val from MLTB_PARAM@FCUBSML
```

2. It should produce following result

PARAM_NAME	PARAM_VAL
LOG_REQD	N

6.4.3 Validate FLEXCUBE menu

1. Execute the following SQL query in FLEXCUBE database

```
select LANG_CODE,FUNCTION_ID,MAIN_MENU,SUB_MENU_1,SUB_MENU_2 ,
RAD_FUNCTION_ID
from smtb_function_description where function_id in
('STDASHBC','STDASHAB','STDASHCD','STDDRMBE')
```

2. It should produce following result

LANG_CODE	FUNCTION_ID	MAIN_MENU	SUB_MENU_1	SUB_MENU_2	RAD_FUNCTION_ID
ENG	STDASHBC	Machine Learning Retail	Customer	Enterprise Dashboard	STDASHBC
ENG	STDASHAB	Machine Learning Retail	Customer	Branch Dashboard	STDASHAB
ENG	STDASHCD	Machine Learning Retail	Customer	Customer Query Board	STDASHCD
ENG	STDDRMBE	Machine Learning Retail	Customer	Model Execution and Control	STDDRMBE



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[May] [2020]
Version 12.87.06.0.0

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Fax: +91 22 6718 3001
<https://www.oracle.com/industries/financial-services/index.html>

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