Oracle® Cloud Oracle Machine Learning AutoML UI



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ORACLE

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Preface

This document describes how to use Oracle Machine Learning and provides references to related documentation.

- Audience
 This document is intended for data scientists, developers, and business users.
- Conventions
- Documentation Accessibility
- Related Resources
 For more information, see these related resources.

Audience

This document is intended for data scientists, developers, and business users.

Conventions

The following text conventions are used in this document.

Convention	Meaning	
boldface Boldface type indicates graphical user interface elements association, or terms defined in text or the glossary.		
italic	Italic type indicates book titles, emphasis, or placeholder variables for wh you supply particular values.	
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.	

Documentation Accessibility

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Access to Oracle Support

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Related Resources

For more information, see these related resources.

- Getting Started with Oracle Cloud Getting Started with Oracle Cloud
- Accessibility Guide for Oracle Cloud Services Accessibility Guide for Oracle Cloud Services

1

What's New in Oracle Machine Learning User Interface on Autonomous Database

Provides a summary of the latest enhancements and features for Oracle Machine Learning User Interface on Oracle Autonomous Database.

Table 1-1 New Features

Features	Description
Support for NVIDIA GPU compute capabilities in OML Notebooks	Oracle Machine Learning Notebooks offers support for NVIDIA GPUs (Graphics Processing Unit) compute capabilities. With the new GPU capabilities in OML Notebooks, you can run advanced machine learning algorithms such as deep learning models, transformers (embedding models) for generating vectors, and small LLMs. The GPU feature is enabled for Oracle Autonomous Data Warehouse Serverless or Oracle Autonomous Transaction Processing Serverless instances with 16 or more ECPUs specified for the OML application. Both the Licensed and the Bring Your Own Licence (BYOL) versions are available. For cost details, refer to the <i>Oracle PaaS and</i> <i>IaaS Universal Credits Service Descriptions</i> document available on the Oracle Cloud Services contracts page.
	Vote: GPU resources are available only on paid Oracle Autonomous Database Serverless instances. GPU resources are not available on Always Free Oracle Autonomous Database Serverless or Oracle Autonomous Database Serverless instances with fewer than 16 ECPUs allocated.
Oracle Machine Learning Notebooks Classic deprecated	OML Notebooks Classic has been deprecated since June 11, 2024. On October 29, 2024, you will no longer be able to create Classic notebooks, save them as templates, or select them for job scheduling. Existing Classic notebooks can be opened in read-only mode. You can continue to convert Classic notebooks to the new format using the Copy to OML Notebooks button on the Notebook Classic listing page. On December 31, 2024, Classic notebooks will no longer be available. The ADMIN user can access Classic notebooks in read-only mode and convert them to the new format. Jobs that still use Classic notebooks will show a status of Disabled. Associated job logs will not be accessible. On June 4, 2025, the ADMIN user will no longer have access to Classic notebooks, and any remaining notebooks will be deleted. If you have Classic notebooks or Classic template notebooks (personal or shared) that you wish to keep, you must convert these to the new format. If you have jobs that rely on Classic notebooks, these jobs must either be updated with a new notebook or recreated with a new notebook.

Table 1-1 (Cont.) New Features

Features	Description
Oracle Machine Learning Notebooks update	Oracle Machine Learning User Interface offers an enhanced notebook environment. Initially released as Notebooks EA (Early Adopter) in Oracle Autonomous Database Serverless, it is now accessed using Notebooks under the left navigation menu and home page. The enhanced notebook interface supports SQL, SQL Script, R, Python, Conda, and Markdown interpreters. You can write code, text, create rich visualizations, and perform data analytics including machine learning in the enhanced notebooks.
	Note: The original Zeppelin-based notebook interface is still available for a limited time under the left navigation menu item Notebooks Classic .
Support for model monitoring in Oracle Machine Learning User Interface	Oracle Machine Learning User Interface offers support for model monitoring. It allows you to create model monitors. The model monitors enable you to monitor the quality of model predictions over time, and provides you with insights on the underlying causes.
Support for data monitoring in Oracle Machine Learning User Interface	Oracle Machine Learning User Interface offers support for data monitoring. It allows you to monitor your data and evaluate how your data evolves over time. It helps you with insights on trends and multivariate dependencies in the data. It also provides you an early warning about data drift.

Table 1-1 (Cont.) New Features

Features	Description
Support for enhanced notebooks in Autonomous Database - Serverless	Oracle Machine Learning User Interface offers a new enhanced notebook environment <i>Notebooks EA (Early Adopter)</i> in Autonomous Database - Serverless. The enhanced notebook supports SQL, SQL Script, R, Python, Conda, and Markdown interpreters. You can write code, text, create rich visualizations, and perform data analytics including machine learning in the enhanced notebooks.
	Note: The enhanced notebook is available in the Oracle Machine Learning Notebook Early Adopter release. During the Early Adopter release period, both Zeppelin and the enhanced notebooks will be available, after which all notebooks will be converted to the new notebook environment. During the Early Adopter phase, you can use both the original Zeppelin and new Early Adopter notebook interfaces. Notebooks in the original interface can be copied to the Early Adopter release.
	 The enhanced notebook interface in Oracle Autonomous Database Serverless provides the following enhanced features and user experiences: Rich and enhanced user experience: The enhanced notebook offers modern look and feel, and richer visualization with many charting options. This will benefit users to better visualize and understand their data. In addition, it offers some useful features like side-by-side versions comparison, option to add comments to paragraphs, full screen size mode for paragraphs, option to define paragraph dependency, and so on. High availability: The enhanced notebook, a multi-tenant application is deployed to the same middle-tier as Oracle Machine Learning server, and this requires no additional resources. Therefore, it is always running and readily available to render the new enhanced notebooks. High scalability: The enhanced notebook assures high scalability in production. To scale up due to increased user demands, additional notebook instances can be easily added. There are tools to monitor system loads, and if a system is consistently overloaded, additional instance can be easily added to mitigate risks related to scalability.
Support for Python and R third- party libraries	 Third-party libraries for Python and R are available on Oracle Machine Learning Notebooks. Oracle Machine Learning UI provides the Conda interpreter to install third- party Python and R libraries inside a notebook session. Conda is an open-source package and environment management system that enables the use of environments containing third-party Python and R libraries. Users with OML_SYS_ADMIN role can install Python and R third-party libraries and upload them to object storage for persistence. The user with OML_SYS_ADMIN role is the administrator, also known as the admin. Users with OML_DEVELOPER role can use the Conda interpreter to download and activate the third-party libraries using the Conda environment that are provisioned by the administrator. The user with OML_DEVELOPER role is the regular Oracle Machine Learning user.

Features	Description		
Support for R	Oracle Machine Learning for R is supported within Oracle Machine Learning Notebooks. By using Oracle Machine Learning for R, you can perform data exploration and machine learning modeling. OML4R is available through Oracle Machine Learning Notebooks on Oracle Autonomous Database Serverless, including Autonomous Data Warehouse, Autonomous Transaction Processing and Oracle Autonomous JSON Database services.		
Support for cross-region Autonomous Data Guard	Oracle Machine Learning Notebooks provide cross-region Autonomous Data Guard support in newly provisioned and migrated databases.		
Oracle Machine Learning repository migrated from Serverless database to each respective Oracle Autonomous Database instance	 The Oracle Machine Learning (OML) repository has been migrated from Serverless database to each respective Oracle Autonomous Database instance. The migration of the Oracle Machine Learning repository ensures: That all OML objects such as tables, jobs, stored procedures, and metadata are moved to the appropriate Oracle Autonomous Database instance. Provides support for Refreshable Clones, which enables cloning of the Oracle Machine Learning metadata as well. 		
	Note: The migration of the Oracle Machine Learning (OML) repository is expected to be completed over a period of 30 days.		
	The OML repository version is mentioned in About in the $$ drop-down list on the top right corner of your Oracle Machine Learning User Interface page. If the version is 1.0.0.0.0, it indicates that the OML metadata is still in the Serverless database. If the version is 22.x, it indicates that the OML repository has been migrated to your Oracle Autonomous Database instance.		
Oracle Machine Learning Notebook supported on all Oracle Autonomous Database clones	 Oracle Machine Learning Notebook is supported on all types of Oracle Autonomous Database - Serverless clones, including: Full Clone: a new database is created with the data in the source database and metadata. Refreshable Clone: a read-only full clone is created that can be easily refreshed with the data from the source database Metadata Clone: a new database is created that includes all of the source database schema metadata, but not the source database data. 		
	For a metadata clone, the Example Template notebooks are not supported.		

Table 1-1 (Cont.) New Features



2 Known Issues for AutoML UI

Learn about the issues you may encounter when using the Automated Machine Learning UI (AutoML UI) feature in Oracle Machine Learning on Autonomous Database and how to work around them.

- Deleted Workspace Remains in the Manage Workspace Dialog Initially
- Entries to Projects and Workspace are Reflected after Session is Refreshed
- Resize your Database to Handle Large Data
- AutoML UI Experiments and Maximum Run Duration Setting
- · Incorrect Status of Experiments may be Displayed if an Experiment is Stopped Manually

2.1 Deleted Workspace Remains in the Manage Workspace Dialog Initially

After you delete a workspace in the **Manage Workspace** dialog, the deleted workspace still remains in the dialog. You must close the **Manage Workspace** dialog, and open it again to see the refreshed list without the deleted workspace.

2.2 Entries to Projects and Workspace are Reflected after Session is Refreshed

Edits done to project and workspaces in the **Select Project** or **Manage Workspace** dialogs are not reflected immediately. The edits are reflected after you refresh the page.

2.3 Resize your Database to Handle Large Data

AutoML UI experiments with very large data may not work correctly if the database is not sufficiently sized. The status is displayed as Failed or Stopped for a specific failed stage. The detailed information about experiment stage failures is not available at this point in time.

Workaround

- Increase the compute resource on Compute Resources page. See Oracle Resources.
- Use Medium or High Resource Service Level for an experiment with large data.

2.4 AutoML UI Experiments and Maximum Run Duration Setting

AutoML UI experiments may run past the time entered in the Maximum Run Duration setting.



Workaround

Use Medium or High Resource Service Level for an experiment with large data.

2.5 Incorrect Status of Experiments may be Displayed if an Experiment is Stopped Manually

If you stop an experiment manually while it is running, then the status of the experiment may be displayed incorrectly in the detailed progress dialog.



3 AutoML UI

AutoML User Interface (AutoML UI) is an Oracle Machine Learning interface that provides you no-code automated machine learning modeling. When you create and run an experiment in AutoML UI, it performs automated algorithm selection, feature selection, and model tuning, thereby enhancing productivity as well as potentially increasing model accuracy and performance.

The following steps comprise a machine learning modeling workflow and are automated by the AutoML user interface:

- Algorithm Selection: Ranks algorithms likely to produce a more accurate model based on the dataset and its characteristics, and some predictive features of the dataset for each algorithm.
- 2. Adaptive Sampling: Finds an appropriate data sample. The goal of this stage is to speed up Feature Selection and Model Tuning stages without degrading the model quality.
- 3. Feature Selection: Selects a subset of features that are most predictive of the target. The goal of this stage is to reduce the number of features used in the later pipeline stages, especially during the model tuning stage to speed up the pipeline without degrading predictive accuracy.
- 4. Model Tuning: Aims at increasing individual algorithm model quality based on the selected metric for each of the shortlisted algorithms.
- 5. Feature Prediction Impact: This is the final stage in the AutoML UI pipeline. Here, the impact of each input column on the predictions of the final tuned model is computed. The computed prediction impact provides insights into the behavior of the tuned AutoML model.

Business users without extensive data science background can use AutoML UI to create and deploy machine learning models. Oracle Machine Learning AutoML UI provides two functional features:

- Create machine learning models
- Deploy machine learning models

AutoML UI Experiments

When you create an experiment in AutoML UI, it automatically runs all the steps involved in the machine learning workflow. In the Experiments page, all the experiments that you have created are listed. To view any experiment details, click an experiment. Additionally, you can perform the following tasks:



Figure 3-1 AutoML Experiments page

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AutoML Experi	ments				
🕂 Create 🥒 Edit	🗓 Delete 🗋 Duplicate	🛱 Move 📋 Copy 🕞 S	itart 🔻 🗌 Ste	ор	
				Filter	
🗌 Name ^	Comment 🗘	Created On 💲	Created By	Updated By	Status 🗘
OML4Py		1/11/23, 11:39 AM	OMLUSER	OMLUSER	Starting

- Create: Click Create to create a new AutoML UI experiment. The AutoML UI experiment that you create resides inside the project that you selected in the Project under the Workspace.
- Edit: Select any experiment that is listed here, and click Edit to edit the experiment definition.
- **Delete:** Select any experiment listed here, and click **Delete** to delete it. You cannot delete an experiment which is running. You must first stop the experiment to delete it.
- Duplicate: Select an experiment and click Duplicate to create a copy of it. The experiment
 is duplicated instantly and is in Ready status.
- **Move:** Select an experiment and click **Move** to move the experiment to a different project in the same or a different workspace. You must have either the Administrator or Developer privilege to move experiments across projects and workspaces.

Note:

An experiment cannot be moved if it is in RUNNING, STOPPING or STARTING states, or if an experiment already exists in the target project by the same name.

- Copy: Select an experiment and click Copy to copy the experiment to another project in the same or different workspace.
- Start: If you have created an experiment but have not run it, then click Start to run the
 experiment.
- **Stop:** Select an experiment that is running, and click **Stop** to stop the running of the experiment.
- Access AutoML UI You can access AutoML UI from Oracle Machine Learning UI home page.
- Create AutoML UI Experiment

To use the Oracle Machine Learning AutoML UI, you start by creating an experiment. An experiment is a unit of work that minimally specifies the data source, prediction target, and prediction type. After an experiment runs successfully, it presents you a list of machine learning models in order of model quality according to the metric selected. You can select any of these models for deployment or to generate a notebook. The generated notebook contains Python code using OML4Py and the specific settings AutoML used to produce the model.



• View an Experiment

In the AutoML UI Experiments page, all the experiments that you have created are listed. Each experiment will be in one of the following stages: Completed, Running, and Ready.

Related Topics

• Automatic Machine Learning

3.1 Access AutoML UI

You can access AutoML UI from Oracle Machine Learning UI home page.

To access AutoML UI, you must first sign in to Oracle Machine Learning from Autonomous Database:

- **1.** To sign in to Oracle Machine Learning from an Autonomous Database instance:
 - a. Select an Autonomous Database instance and on the Autonomous Database details page click **Database Actions.**

	Search resources, services, documentation, and mai	rketplace	US East (Ashburn) 🗸	540	۲	0
Overview » Autonomous Database »	Autonomous Database Details					^
ADW		Performance Hub	More Actions 💌			
AVAILABLE	Autonomous Database Information	Tools Tags				
	General Information Database Name: DB2 Workload Type: Data Warehouse	Infrastr Dedicated I	ucture			
	Compartment: ngreenbeorg (root) OCID:4zntnq <u>Show</u> <u>Copy</u> Created: Tue, Aug 24, 2021, 06:32:20 UTC		omous Data Guard (i) abled <u>Enable</u>		¢	Ð
	OCPU count: 2 OCPU auto scaling: Enabled (j) Storage: 1 TB Storage auto scaling: Disabled (j)		D Iatic Backup: Sun, Jun 12, 2022, 14:33:11 UTC ckup Store: Not Configured			

Figure 3-2 Database Actions

b. On the Database Actions page, go to the Development section and click **Oracle Machine Learning**.

RACLE Database Actions Launchpace		Search Database (Ctrl+K)	
Pinned & Recently Visited	Development Data Studio Administration Downloads	Monitoring Related Services	
Ba SQL	SQL		\$
回 Data Modeler	The SQL worksheet is where most of your work will be perforn browsing objects, loading data, exporting data to CSV or JSO the SQL interface.		
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0 (\$3 0 10:40:24 AM - REST call resolved succes			Q Pow

Figure 3-3 Oracle Machine Learning option in Database Actions Launchpad



The Oracle Machine Learning sign in page opens.

c. Enter your username and password, and click Sign in.

This opens the Oracle Machine Learning Notebooks home page.

2. On your Oracle Machine Learning Notebooks home page, click AutoML.

Figure 3-4 AutoML options on Oracle Machine Learning home page and Left Navigation menu

🛆 Home	ORACLE Machine Learning					
♂ Project ~ ○ Project ~	> How Do I?					
AutoML Experiments Models Monitoring ~	✓ Quick Actions Quick Actions Quick Actions AutoML Create and run AutoML Experiment Models Machine Learning Models	Data Monitors Model Monitors Monitor Data Drift Monitor Model Dr	Scratchpad ift Run Scratchpad	E Notebooks The place for data discovery and analytics	Jobs Schedule notebooks to run at certain times	
전 Data 전 Models 聞 Templates		Examples Check out some examples				
ee . ee Jobs	Recent Activities					

Alternatively, you can click the Cloud menu and click AutoML under Projects.

3.2 Create AutoML UI Experiment

To use the Oracle Machine Learning AutoML UI, you start by creating an experiment. An experiment is a unit of work that minimally specifies the data source, prediction target, and prediction type. After an experiment runs successfully, it presents you a list of machine learning models in order of model quality according to the metric selected. You can select any of these models for deployment or to generate a notebook. The generated notebook contains Python code using OML4Py and the specific settings AutoML used to produce the model.

To create an experiment, specify the following:

1. In the Name field, enter a name for the experiment.



		OMLUSER F	Project [OMLUSER Works 🔻	OMLUSER	•
Create Experiment			▷ Start ▼	Cancel 🖺 Sa	ave
Name					
CUSTOMERS360					
Comments					
Data Source *		Predict *			
OMLUSER.CUSTOMERS360	Q	AFFINITY_CARD			•
Prediction Type *		Case ID			
Classification	•	CUST_ID		-	岡

Figure 3-5 Create an AutoML Experiment

- 2. In the **Comments** field, enter comments, if any.
- 3. In the **Data Source** field, select the schema and a table or view in that schema. Click the search icon to open the Select Table dialog box. Browse and select a schema, and then select a table from the schema list, which is the data source of your AutoML UI experiment.

Figure 3-6 Select Table dialog

	ne Learning	OMIL: OMIL:	OMLUSER Project OMLUSER Workspace OMLUSER			
Create Experiment	Select Table			🖺 Save		
Name	Search	Search				
Customer 360						
	Schema 🗘	Table 🗘	Access			
Comments	DWONG	CUSTOMERS360	Ø			
	GGADMIN					
Data Source	OMLUSER					
	RMAN\$VPC			×		
Prediction Type			Cancel			
Select Prediction Type			0	-		

a. In the Schema column, select a schema.

Note:

While you select the data source, statistics are displayed in the Features grid at the bottom of the experiment page. Busy status is indicated until the computation is complete. The target column that you select in Predict is highlighted in the Features grid.



b. Depending on the selected schema, the available tables are listed in the Table column. Select the table and click **OK**.

Note:

To create an AutoML experiment for a table or view present in the schema of another user, ensure that you have explicit privileges to access that table or view in the schema. Request the Database Administrator or the owner of the schema to provide you with the privileges to access the table or view. For example:

grant select on to <user>

- 4. In the **Predict** drop-down list, select the column from the selected table. This is the target for your prediction.
- 5. In the Prediction Type field, the prediction type is automatically selected based on your data definition. However, you can override the prediction type from the drop-down list, if data type permits. Supported Prediction Types are:
 - **Classification:** For non-numeric data type, Classification is selected by default.
 - **Regression:** For numeric data type, Regression is selected by default.
- 6. The **Case ID** helps in data sampling and dataset split to make the results reproducible between experiments. It also aids in reducing randomness in the results. This is an optional field.
- 7. In the Additional Settings section, you can define the following:



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laximu	m Run D	uration (Ho	urs)				
8				~	^		
atabas	e Service	Level				_	
Low					•		
1odel N	/letric					_	
Bala	nced Ao	curacy			•		
lgoritł	nms						
Ξ	Name	\$					
~	Decisio	on Tree					
~	Genera	lized Linea	ar Model				
~	Genera	lized Linea	ar Model	(Ridg	e Regr	ression)	
~	Neural	Network					
	Rando	m Forest					

Figure 3-7 Additional Settings for AutoML Experiments

- a. Reset: Click Reset to reset the settings to the default values.
- **b.** Maximum Top Models: Select the maximum number of top models to create. The default is 5 models. You can reduce the number of top models to 2 or 3 since tuning models to get the top one for each algorithm requires additional time. If you want to get the initial results even faster, consider the top recommended algorithm. For this, set the Maximum Top Models to 1. This will tune the model for that algorithm.

- c. Maximum Run Duration: This is the maximum time for which the experiment will be allowed to run. If you do not enter a time, then the experiment will be allowed to run for up to the default, which is 8 hours.
- d. Database Service Level: This is database connection service level and query parallelism level. Default is Low. This results in no parallelism and sets a high runtime limit. You can create many connections with Low database service level. You can also change your database service level to Medium or High.
 - High level gives the greatest parallelism but significantly limits the number of concurrent jobs.
 - Medium level enables some parallelism but allows greater concurrency for job processing.

Note:

Changing the database service level setting on the *Always Free Tier* will have no effect since there is a 1 OCPU limit. However, if you increase the OCPUs allocated to your autonomous database instance, you can increase the **Database Service Level** to Medium or High.

Note:

The **Database Service Level** setting has no effect on AutoML container level resources.

- Model Metric: Select a metric to choose the winning models. The following metrics are supported by AutoML UI:
 - For Classification, the supported metrics are:
 - Balanced Accuracy
 - ROC AUC
 - F1 (with weighted options). The weighted options are weighted, binary, micro and macro.
 - * Micro-averaged: Here, all samples equally contribute to the final averaged metric
 - Macro-averaged: Here, all classes equally contribute to the final averaged metric
 - * Weighted-averaged: Here, each class' contribution to the average is weighted by its size
 - Precision (with weighted options)
 - Recall (with weighted options)
 - For Regression, the supported metrics are:
 - R2 (default)
 - Negative mean squared error
 - Negative mean absolute error
 - Negative median absolute error



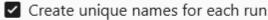
- f. Algorithm: The supported algorithms depend on Prediction Type that you have selected. Click the corresponding checkbox against the algorithms to select it. By default, all the candidate algorithms are selected for consideration as the experiment runs. The supported algorithms for the two Prediction Types:
 - For Classification, the supported algorithms are:
 - Decision Tree
 - Generalized Linear Model
 - Generalized Linear Model (Ridge Regression)
 - Neural Network
 - Random Forest
 - Support Vector Machine (Gaussian)
 - Support Vector Machine (Linear)
 - For Regression, the supported algorithms are:
 - Generalized Linear Model
 - Generalized Linear Model (Ridge Regression)
 - Neural Network
 - Support Vector Machine (Gaussian)
 - Support Vector Machine (Linear)

Note:

You can remove algorithms from being considered if you have preferences for particular algorithms, or have specific requirements. For example, if model transparency is essential, then excluding models such as Neural Network would make sense. Note that some algorithms are more compute intensive than others. For example, Naïve Bayes and Decision Tree are normally faster than Support Vector Machine or Neural Network.

g. Model Name Handling: Here, you have the option to retain the original model name or generate unique model names everytime you run an experiment. By default, this option is deselected.

Model name handling





• Create unique names for each run: Select this option to generate model names that are unique. Selecting this option also gives you the choice to select or deselect the option Drop models from the previous run.



- Drop models from the previous run: Select this option to drop the models that were generated in the prior experiment runs. Deselect this option to retain the models that were generated in the prior runs. These models are available in the user schema.
- 8. Expand the **Features** grid to view the statistics of the selected table. The supported statistics are Distinct Values, Minimum, Maximum, Mean, and Standard Deviation. The supported data sources for Features are tables, views and analytic views. The target column that you selected in Predict is highlighted here. After an experiment run is completed, the Features grid displays an additional column **Importance**. Feature Importance indicates the overall level of sensitivity of prediction to a particular feature.

	ing					OMLUSER Project OMLUSER Workspace	▼ ② OMLUSER ▼
✓ Features							
🕐 Refresh						Filter	
Name 🗘	Importance 🗘	Туре 🗘	Distinct Values 💲	Min 🗘	Max 🗘	Mean 🗘	Std Dev ≎
HOUSEHOLD_SIZE	0.23	VARCHAR2	6				
OCCUPATION		VARCHAR2	15				
CUST_MARITAL_STATUS		VARCHAR2	7				
YRS_RESIDENCE		NUMBER	15	0	14	4.02	1.97
CUST_YEAR_OF_BIRTH		NUMBER	67	1913	1986	1964.62	13.78
Y_BOX_GAMES		NUMBER	2	0	1	0.31	0.66
EDUCATION		VARCHAR2	16				
CUST_GENDER	1	CHAR	2				
CUST_CREDIT_LIMIT		NUMBER	8	1500	15000	7924.22	4264.23

Figure 3-8 Features

You can perform the following tasks:

- **Refresh:** Click Refresh to fetch all columns and statistics for selected data source.
- View Importance: Hover your cursor over the horizontal bar under Importance to view the value of Feature Importance for the variables. The value is always depicted in the range 0 to 1, with values closer to 1 being more important.
- 9. When you complete defining the experiment, the **Start** and **Save** buttons are enabled.

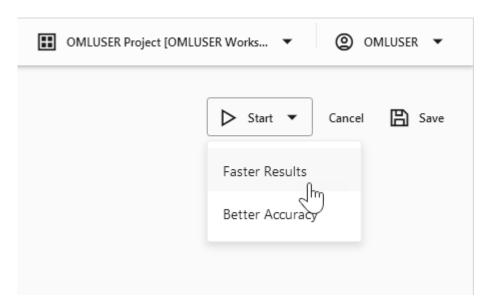


Figure 3-9 Start Experiment options

- Click **Start** to run the experiment and start the AutoML UI workflow, which is displayed in the progress bar. Here, you have the option to select:
 - a. **Faster Results:** Select this option if you want to get candidate models sooner, possibly at the expense of accuracy. This option works with a smaller set of the hyperparamter combinations, and hence yields faster result.
 - **b. Better Accuracy:** Select this option if you want more pipeline combinations to be tried for possibly more accurate models. A pipeline is defined as an algorithm, selected data feature set, and set of algorithm hyperparameters.

Note:

This option works with the broader set of hyperparameter options recommended by the internal meta-learning model. Selecting **Better Accuracy** will take longer to run your experiment, but may provide models with more accuracy.

Once you start an experiment, the progress bar appears displaying different icons to indicate the status of each stage of the machine learning workflow in the AutoML experiment. The progress bar also displays the time taken to complete the experiment run. To view the message details, click on the respective message icons.

- Click Save to save the experiment, and run it later.
- Click **Cancel** to cancel the experiment creation.

Supported Data Types for AutoML UI Experiments

When creating an AutoML experiment, you must specify the data source and the target of the experiment. This topic lists the data types for Python and SQL that are supported by AutoML experiments.



3.2.1 Supported Data Types for AutoML UI Experiments

When creating an AutoML experiment, you must specify the data source and the target of the experiment. This topic lists the data types for Python and SQL that are supported by AutoML experiments.

Data Types	SQL Data Types	Python Data Types
Numerical	• NUMBER	• INTEGER
	• INTEGER	• FLOAT (NUMBER)
	• FLOAT	 FLOAT (BINARY_DOUBLE)
	• NUMERICALS	 FLOAT (BINARY_FLOAT)
	 BINARY_DOUBLE 	
	• BINARY_FLOAT	
Categorical	• CHAR	• STRING (VARCHAR2)
	• VARCHAR2	• STRING (CHAR)
	• CATEGORICALS	• STRING (CLOB)
Unstructured Text	• CHAR	• BYTES (RAW, BLOB)
	• VARCHAR2	
	• CLOB	
	• BLOB	
	• BFILE	

Table 3-1 Supported Data Types by AutoML Experiments

3.3 View an Experiment

In the AutoML UI Experiments page, all the experiments that you have created are listed. Each experiment will be in one of the following stages: Completed, Running, and Ready.

To view an experiment, click the experiment name. The Experiment page displays the details of the selected experiment. It contains the following sections:

Edit Experiment

In this section, you can edit the selected experiment. Click **Edit** to make edits to your experiment.

Note:

You cannot edit an experiment that is running.

Metric Chart

The Model Metric Chart depicts the best metric value over time as the experiment runs. It shows improvement in accuracy as the running of the experiment progresses. The display name depends on the selected model metric when you create the experiment.



Leader Board

When an experiment runs, it starts to show the results in the Leader Board. The Leader Board displays the top performing models relative to the model metric selected along with the algorithm and accuracy. You can view the model details and perform the following tasks:

Figure 3-10 Leader Board

Balanced Accuracy	
0.80	
0.75	
0.70	
0.65	
0.60	
0.55	
0.50	

Leader Board

Deploy Rename Create Notebook Metrics		
Algorithm 1↓	Model Name 1↓	Balanced Accuracy $~\downarrow~$
Generalized Linear Model	GLM_0AB2AD0485	0.8023
Support Vector Machine (Gaussian)	SVMG_B81DE322E8	0.7983
Naive Bayes	NB_A112C3D9CB	0.7917
Random Forest	RF_3BB9277CAE	0.7838
Support Vector Machine (Linear)	SVML_307EAF1ABB	0.7671

- View Model Details: Click on the Model Name to view the details. The model details are displayed in the Model Details dialog box. You can click multiple models on the Leader Board, and view the model details simultaneously. The Model Details window depicts the following:
 - Prediction Impact: Displays the importance of the attributes in terms of the target prediction of the models.
 - Confusion Matrix: Displays the different combination of actual and predicted values by the algorithm in a table. Confusion Matrix serves as a performance measurement of the machine learning algorithm.
- **Deploy:** Select any model on the Leader Board and click **Deploy** to deploy the selected model. **Deploy Model**.
- **Rename:** Click **Rename** to change the name of the system generated model name. The name must be alphanumeric (not exceeding 123 characters) and must not contain any blank spaces.
- Create Notebook: Select any model on the Leader Board and click Create Notebooks from AutoML UI Models to recreate the selected model from code.
- Metrics: Click Metrics to select additional metrics to display in the Leader Board. The additional metrics are:
 - For Classification



- * Accuracy: Calculates the proportion of correctly classifies cases both Positive and Negative. For example, if there are a total of TP (True Positives)+TN (True Negatives) correctly classified cases out of TP+TN+FP+FN (True Positives+True Negatives+False Positives+False Negatives) cases, then the formula is: Accuracy
 = (TP+TN) / (TP+TN+FP+FN)
- * Balanced Accuracy: Evaluates how good a binary classifier is. It is especially useful when the classes are imbalanced, that is, when one of the two classes appears a lot more often than the other. This often happens in many settings such as Anomaly Detection etc.
- * Recall: Calculates the proportion of actual Positives that is correctly classified.
- * Precision: Calculates the proportion of predicted Positives that is True Positive.
- * F1 Score: Combines precision and recall into a single number. F1-score is computed using harmonic mean which is calculated by the formula: F1-score = 2 × (precision × recall)/(precision + recall)
- For Regression:
 - * R2 (Default): A statistical measure that calculates how close the data are to the fitted regression line. In general, the higher the value of R-squared, the better the model fits your data. The value of R2 is always between 0 to 1, where:
 - * 0 indicates that the model explains none of the variability of the response data around its mean.
 - * 1 indicates that the model explains all the variability of the response data around its mean.
 - * Negative Mean Squared Error: This is the mean of the squared difference of predicted and true targets.
 - * Negative Mean Absolute Error: This is the mean of the absolute difference of predicted and true targets.
 - * Negative Median Absolute Error: This is the median of the absolute difference between predicted and true targets.

Features

The **Features** grid displays the statistics of the selected table for the experiment. The supported statistics are Distinct Values, Minimum, Maximum, Mean, and Standard Deviation. The supported data sources for Features are tables, views and analytic views. The target column that you selected in Predict is highlighted here. After an experiment run is completed, the Features grid displays an additional column **Importance**. Feature Importance indicates the overall level of sensitivity of prediction to a particular feature. Hover your cursor over the graph to view the value of **Importance**. The value is always depicted in the range 0 to 1, with values closer to 1 being more important.

Figure 3-11 Features

	ning					OMLUSER Project OMLUSER Workspace	▼ Ø OMLUSER
√ Features							
🕐 Refresh						Filter	
Name 🗘	Importance \$	Туре 🗘	Distinct Values 💲	Min ≎	Max 🗘	Mean 🗘	Std Dev 🗘
HOUSEHOLD_SIZE	0.23	VARCHAR2	6				
OCCUPATION		VARCHAR2	15				
CUST_MARITAL_STATUS		VARCHAR2	7				
YRS_RESIDENCE		NUMBER	15	0	14	4.02	1.97
CUST_YEAR_OF_BIRTH		NUMBER	67	1913	1986	1964.62	13.78
Y_BOX_GAMES		NUMBER	2	0	1	0.31	0.66
EDUCATION		VARCHAR2	16				
CUST_GENDER	1	CHAR	2				
CUST_CREDIT_LIMIT		NUMBER	8	1500	15000	7924.22	4264.23

Create Notebooks from AutoML UI Models

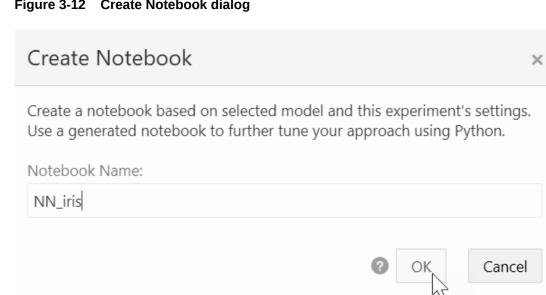
You can create notebooks using OML4Py code that will recreate the selected model using the same settings. It also illustrates how to score data using the model. This option is helpful if you want to use the code to re-create a similar machine learning model.

3.3.1 Create Notebooks from AutoML UI Models

You can create notebooks using OML4Py code that will recreate the selected model using the same settings. It also illustrates how to score data using the model. This option is helpful if you want to use the code to re-create a similar machine learning model.

To create a notebook from an AutoML UI model:

1. Select the model on the Leader Board based on which you want to create your notebook, and click Create Notebook. The Create Notebook dialog opens.







2. In the Notebook Name field, enter a name for your notebook.

The REST API endpoint derives the experiment metadata, and determines the following settings as applicable:

- Data Source of the experiment (schema.table)
- Case ID. If the Case ID for the experiment is not available, then the appropriate message is displayed.
- A unique model name based on the current model name is generated
- Information related to scoring paragraph:
 - Case ID: If available, then it merges the Case ID column into the scoring output table
 - Generate unique predict output table name based on build data source and unique suffix
 - Prediction column name: PREDICTION
 - Prediction probability column name: PROBABILITY (applicable only for Classification)
- Click OK. The generated notebook is listed in the Notebook page. Click to open the notebook

The generated notebook displays paragraph titles for each paragraph along with the python codes. Once you run the notebook, it displays information related to the notebook as well as the AutoML experiment such as the experiment name, workspace and project in which the notebook is present, the user, data, prediction type and prediction target, algorithm, and the time stamp when the notebook is generated.

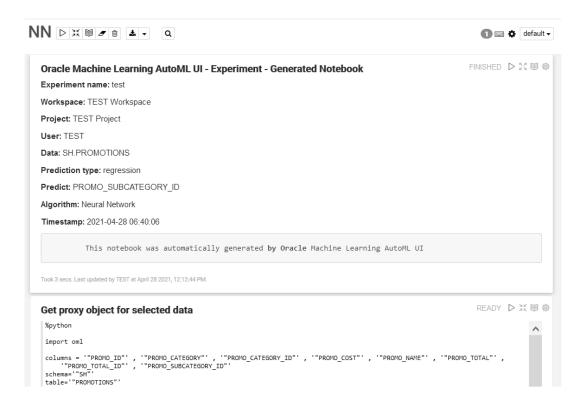


Figure 3-13 AutoML UI Generated notebook



4 Models

The Models page displays the user models and the list of deployed models. User Model lists the models in a user's schema, and Deployments lists the models deployed to Oracle Machine Learning Services.

Under Models, the model information and model deployment are available under:

- **User Models:** Lists all the models that are created in a database schema. In the Models view, you can browse, view, deploy and delete models.
- Deployments: Lists all the deployed models. In the Deployments view, you can view the model metadata and the REST API URI of the deployed models.

User Models

In the User Models view, you can browse, view, and deploy models. The User Models view lists the models that are available in the database schema:

			OMLUSER Project [OMLUSER Works OMLUSE OMLUSE OMLUSE		
Moe Use	r Models Deployments				
1	eploy 🛍 Delete			Filter	
Ξ	Name 1	Owner Î↓	Algorithm 1	Creation Date 1↓	
	GLM_0AB2AD0485	OMLUSER	Generalized Linear Model	1/24/22 12:19 PM	
	GLM_F4863D038D	OMLUSER	Generalized Linear Model	1/24/22 12:30 PM	
	GLMR_48A360FDD8	OMLUSER	Generalized Linear Model	1/24/22 12:32 PM	
	NB_CUSTOMER360	OMLUSER	Naive Bayes	1/24/22 12:15 PM	
	RF_3BB9277CAE	OMLUSER	Random Forest	1/24/22 12:16 PM	
	RF_686668F810	OMLUSER	Random Forest	1/24/22 12:28 PM	
	SVMG_B81DE322E8	OMLUSER	Support Vector Machines	1/24/22 12:18 PM	
	SVML_307EAF1ABB	OMLUSER	Support Vector Machines	1/24/22 12:15 PM	

Figure 4-1 User Models

- Name: Displays the model name. Model names can be any valid database object name.
- Owner: Displays the user who built the model.
- Algorithm: Displays the name of the algorithm used.
- Creation Date: Displays the date on which the model is built.
- Target: Displays the prediction target selected when the experiment is created.

You can perform the following tasks:



- **Deploy:** To deploy a model, select the model and click **Deploy.**
- Delete: To delete a model, select the model and click Delete.

Deployments

In the Deployments view, you can view the list of all the deployed models. Here, you can view the model metadata, view the REST API URI of the deployed models, and also delete any deployed model.

To delete a deployed model, select the model and click **Delete.**

Figure 4-2 Deployed Models

	9				OMLUSER Project [OMLUSER Wo	orks 👻 🕘 OMLUSER 👻
Model Repository						
User Models Deployments						
ඕ Delete						Filter
□ Name 1↓	Shared 11	Version ↑↓	Namespace 14	Owner 1↓	Deployed Date 11 URI 11	
NaiveBayes_CUST360	æ	1.0	DEMO	OMLUSER	1/24/22 11:46 nb_cust360	

The following information are displayed for each deployed model:

- Name: The name of the deployed model.
- Shared: Allows users in the same PDB to use the model.
- Version: Displays the model version.
- **Namespace:** Displays the model namespace.
- **Owner:** The name of the user who deployed the model.
- **Deployed Date:** Displays the date of model deployment.

Note:

You cannot re-deploy the same model. However, you can create a new version of the model and deploy it. You can then track the model based on the version.

URI: Displays the URI name. Click on the URI link to view the REST API URI of the model.

	ng	OMLUSER Project [OMLUSER Works 🔻
Model Repository	Open API Specification for NaiveBayes_CUST360	×
User Models Deployments	("openapi": "3.0.1", "ipfo": (
Delete	"till": "NaireBayes_CUBIS60", "YorInom": "1.0"], "aervez#": [Filter
□ Name 1↓	"url": "http://slci7rhe.us.oracle.com:8081/omlmod/v1/deployment"	te 11 URI 11
NaiveBayes_CUST360], "security": [{ "BearcrAuth": [] }	1:46 nb_cust360
	"patha": { "/nb_ural360/score": { "post": { "post": { "popertion12": { "socreModel", "requestbody": { "content": { "socher: {	
	"\$ref": "#/components/schemas/NaiveBayes_CUST360_INFUT_TIPE" } / / / / / / / / / / / / / / / / / /	

Figure 4-3 REST API Specification of a Deployed Model

Deploy Model

When you deploy a model, you create an Oracle Machine Learning Services endpoint for scoring.

4.1 Deploy Model

When you deploy a model, you create an Oracle Machine Learning Services endpoint for scoring.

In the Deploy Model dialog, you can define the model deployment in the context of your AutoML UI experiment. To deploy a model, define the following:

Figure 4-4 Deploy Model dialog

Deploy Model	×
Name *	
nn_e05246b433	
URI *	
iris_1	
Version *	
1.0	
Namespace	
Flower	
Shared	
0	OK Cancel

- In the Name field, the system generated model name is displayed here by default. You can edit this name. The model name must be a unique alphanumeric name with maximum 50 characters.
- 2. In the **URI** field, enter a name for the model URI. The URI must be alphanumeric, and the length must be max 200 characters.
- 3. In the **Version** field, enter a version of the model. The version must be in the format xx.xx where x is a number.
- 4. In the **Namespace** field, enter a name for the model namespace.
- 5. Click **Shared** to allow users with access to the database schema to view and deploy the model.
- 6. Click OK. After a model is successfully deployed, it is listed in the Deployments page.
- 7. You can view the following details:
 - Model Metadata Select a deployed model and click the model name to view model metadata such as the model name, mining function, algorithm, attributes and so on.
 - REST API Select a deployed model and click the link under URI to view the REST API URI of the model.

