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Oracle Machine Learning Services Technical Brief

A common framework for machine learning model management and deployment supporting application development with a REST interface.

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Purpose statement

This document provides an overview of Oracle Machine Learning Services for Oracle Autonomous Database. It is intended solely to help you assess the business benefits of Oracle Machine Learning Services and to plan your data science and I.T. projects.

Intended Audience

Data Scientists, Database Analysts, Application Developers and anyone interested in model management and real-time scoring of in-database machine learning models as well as third-party ONNX-format models.

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Introduction

Oracle Machine Learning (OML) in Oracle Autonomous Database provides in-database capabilities for data exploration and preparation, and machine learning model building, data scoring, and deployment. OML Services supports model deployment and model management for both in-database OML models and third-party Open Neural Networks Exchange (ONNX) machine learning models via REST APIs—supporting application development with REST endpoints to deployed machine learning models..

The REST API for Oracle Machine Learning Services provides REST endpoints hosted through Oracle Autonomous Database – enabling the storage of in-database machine learning models along with their metadata, and the creation of scoring endpoints. Third-party classification or regression models exported in ONNX format from such packages as Scikit-learn and TensorFlow, among others benefit from same environment.

In addition, OML Services supports proprietary cognitive text capabilities, including topic discovery, keywords, summary, sentiment, and similarity. The initial languages supported include English, Spanish, and French, with sentiment supported for English. Cognitive text is enabled using an OML-provided pre-built model based on millions of Wikipedia articles. OML Services also allows the import of third-party ONNX-format cognitive image models for the scoring of images and tensors.

Solution:

Oracle Machine Learning Services REST APIs included in Autonomous Database

- Store, version, list, delete, and deploy machine learning models
- Retrieve model metadata and content
- Organize models within namespaces
- Create, list, delete model endpoints
- Score data using REST endpoints for OML and third party ONNX-format models from popular frameworks

What's different about Oracle Machine Learning Services?

OML Services provide a REST API that enables data scientists and application developers to leverage the power and scalability of Oracle Cloud Infrastructure for fast scoring and ease of model management and deployment. Users access these features through a simplified interface. Data scientists build models using in-database algorithms or those from third-party tools and then easily deploy them in the scalable Oracle Autonomous Database environment. Developers then readily use them to build applications and dashboards via REST endpoints. This common respository facilitates collaborations across the data science team.

Oracle Machine Learning Services:

- Enables model management, which plays an important role in the overall MLOps strategy
- Increases collaboration between data scientists and application developers, working from a unified repository
- Enables the use of models produced from in-database and third-party tool algorithms, which can include cognitive image and text models
- Provides built-in cognitive text models for topic discovery, keywords, summary, and similarity for English, Spanish, and French text, and sentiment analysis for English text
- Supports organizing models within namespaces, and retrieving and managing model metadata and content

With the ease of deployment provided through OML Services, users can focus on improving their models and deriving value from their data, instead of focusing on how to deploy, version, and manage the models themselves. With Oracle Machine Learning Services, enterprises can speed the time-to-value of machine learning models by providing scalable, real-time inference that is readily consumed by developers for application development.

Oracle Machine Learning Services Features for Users

OML Services was specifically designed to work with Oracle Autonomous Database but to also include Oracle Machine Learning models (created from Oracle Database in the Cloud or on premises), and third-party models built using machine learning algorithms beyond those already provided by Oracle Machine Learning.

The core features of OML Services by user role are:

Data scientists

- Manage and deploy in-database OML models produced using one of the OML language interfaces, as well as OML AutoML UI or Oracle Data Miner
- Manage and deploy models produced by third-party tools and exported in ONNX format from popular frameworks like SciKit-Learn, TensorFlow, and others

Business and data analysts

- Leverage OML models or third-party models in ONNX-format directly from REST endpoints, with real-time scoring performance for individual small batch scoring
- Enhance analyses and reports by discovering new insights using built-in cognitive text models

DBAs and IT professionals

- Manage and deploy machine learning models that can serve the community
- Maintain the same Oracle Database data management platform and security standards

Application developers

- More easily build applications that embed machine learning insights and predictions
- Collaborate with the broader data science team while automating and disseminating results

Supported Use Cases for OML Services

Deploy Machine Learning Models

The Oracle Machine Learning Services REST API supports the following functions for Oracle Machine Learning in-database and third-party ONNX-format models:

- Store, delete, and list deployed models
- Retrieve model metadata and content
- Organize models within namespaces
- Create, delete, and list model endpoints
- Get model APIs and Swagger document
- Score single records or mini batches of records using model deployment endpoints

Supported types of Oracle Machine Learning Models

The OML Services REST API supports models from the following types of machine learning techniques:

- Classification
- Regression
- Clustering
- Feature Extraction

Note: OML partitioned models are also supported. OML Services supports numeric columns, categorical columns, text columns and nested columns. Prediction details are supported for numeric and categorical columns.

Supported types of ONNX Models

Open Neural Network Exchange, or ONNX, is an open standard format for machine learning models. You can deploy and score models exported in ONNX format using OML Services REST API.

The Oracle Machine Learning Services REST API supports models in ONNX-format for deployment through REST endpoints for:

- Classification models (both non-image models and image models)
- Regression models

Note: OML Services supports ONNX Runtime 1.4.0.

Supported Cognitive Text Functions

OML Services supports the following cognitive text endpoints through a REST API:

- Topic detection or topic discovery
- Keyword identification
- Summary
- Sentiment analysis
- Feature extraction
- Similarity

Note: Supported languages for cognitive text include English, Spanish, and French, with sentiment analysis for English.

Working with OML Services

OML Services works with any of the popular REST API tools, like Postman, SoapUI, Tricentis, among others. Such interfaces allow users to run and validate REST endpoints easily through a user interface without having to write cURL code explicitly.

In addition, users can easily deploy in-database models to OML Services using the OML AutoML UI, which provides a no-code user interface supporting automated machine learning. OML AutoML UI supports both data scientist productivity and non-expert user access to powerful in-database algorithms for classification and regression.

Any REST API client tool or programming language can be used to invoke the REST endpoints available through OML Services. The OML Services REST API supports the following functions for Oracle Machine Learning models.

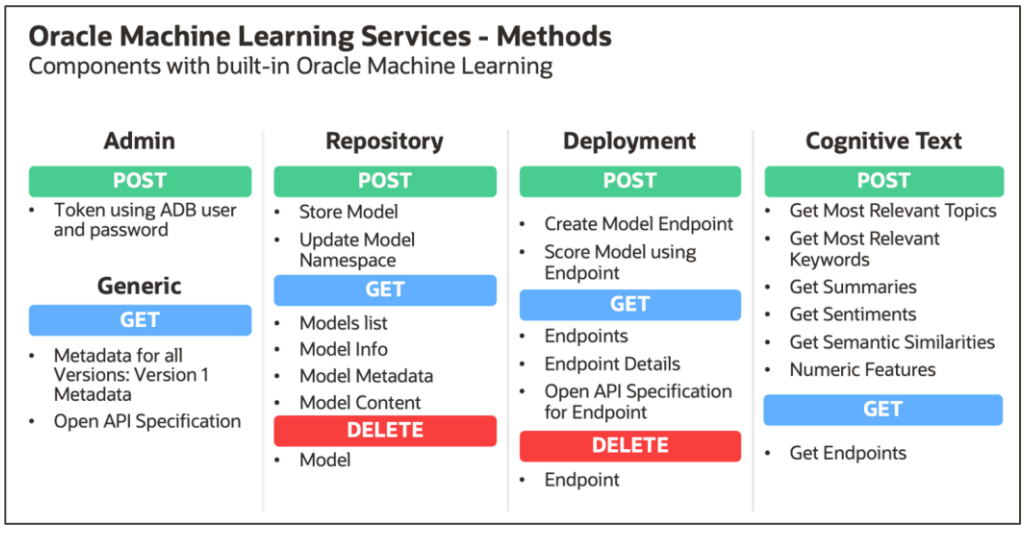

Figure 1: REST API capabilities provided by Oracle Machine Learning Services

As an example, a user in Postman can pass input data in JSON format to the URI REST endpoint of a deployed model and get access to the scoring results in sub-second response time.

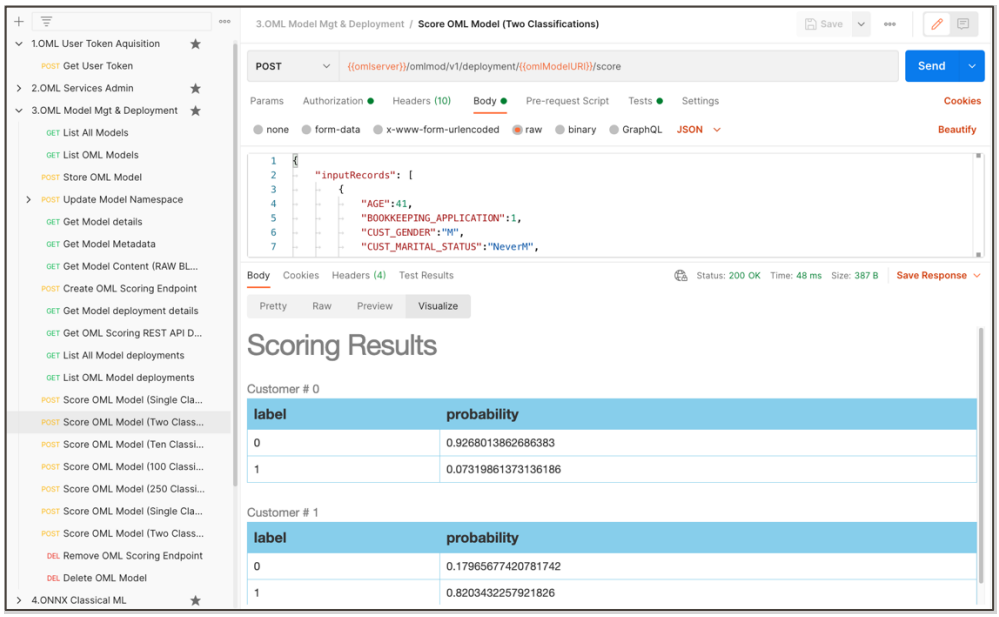

Figure 2: Postman receiving a scoring result from an OML Model via REST

Another option is to deploy models using the OML AutoML UI. As shown below, running an OML AutoML UI experiment produces a leaderboard showing models with their corresponding performance. Users can select models for deployment with a simple click. Users can also deploy models directly from the main OML Models interface and review current deployments to OML Services under the *Deployments* section.

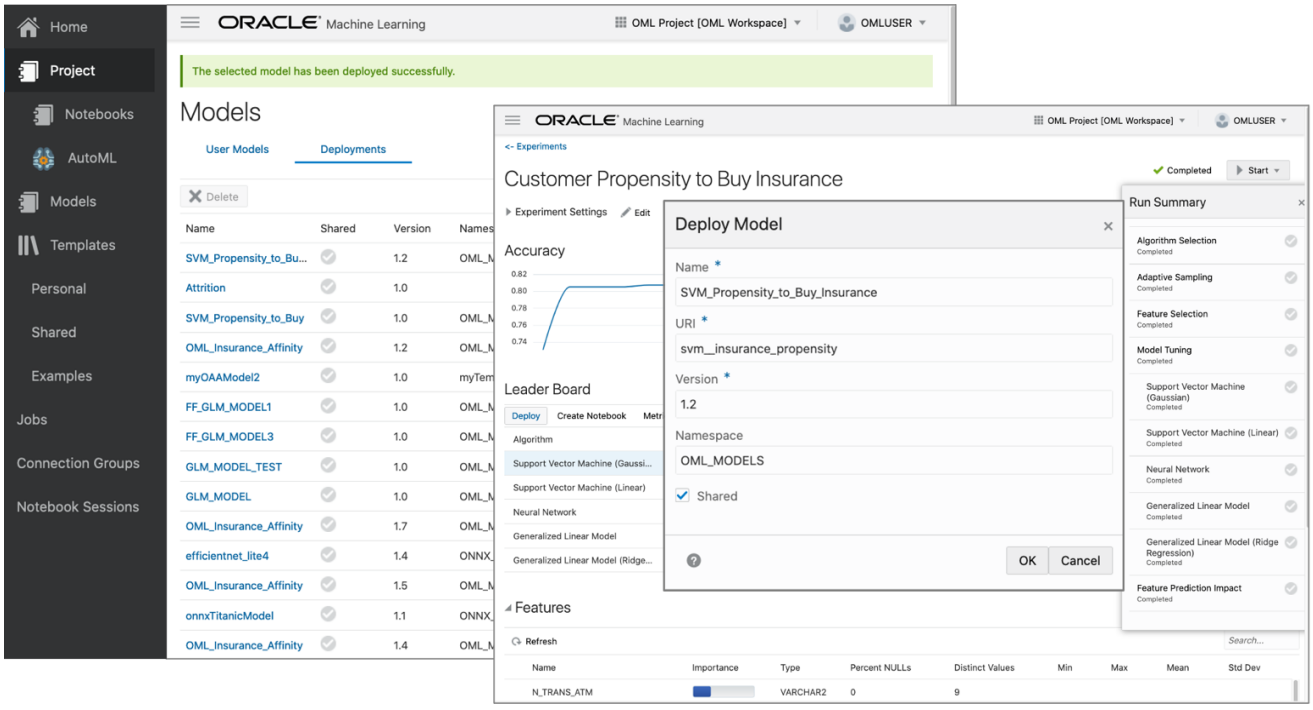

Figure 3: OML Models section and OML AutoML UI leader board section enables immediate model deployment to OML Services immediately, for use via REST APIs.

Conclusion

OML Services enables application development by providing REST endpoints to deployed machine learning models. OML Services extends OML functionality to support model deployment and management of in-database OML models and Open Neural Networks Exchange (ONNX) format, third-party models via REST APIs.

In-database OML models can be deployed from any standard REST tool using the OML Services REST APIs, or using the OML AutoML UI interface, with an easy one-click action on either the Model Leaderboard or the OML Models interface.

Users can deploy third-party classification or regression models in ONNX format via OML Services REST API. This includes third-party frameworks like Scikit-learn and TensorFlow.

In addition, OML Services provides proprietary cognitive text capabilities for topic discovery, keywords, summary, sentiment, feature extraction and similarity.

For Further Reading

See https://oracle.com/machine-learning and Oracle Machine Learning Services User's Guide.