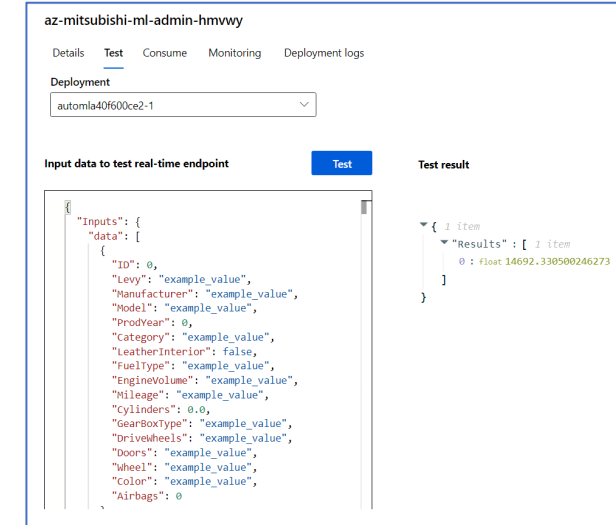
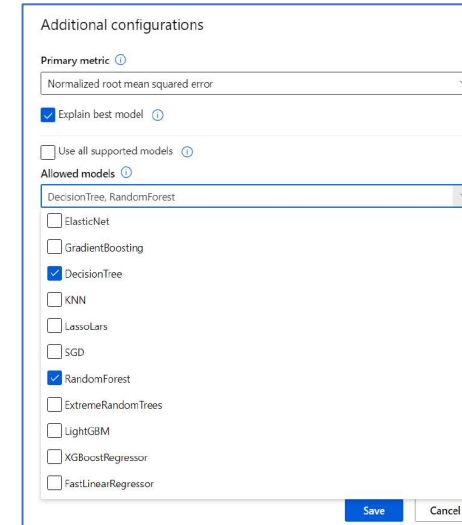
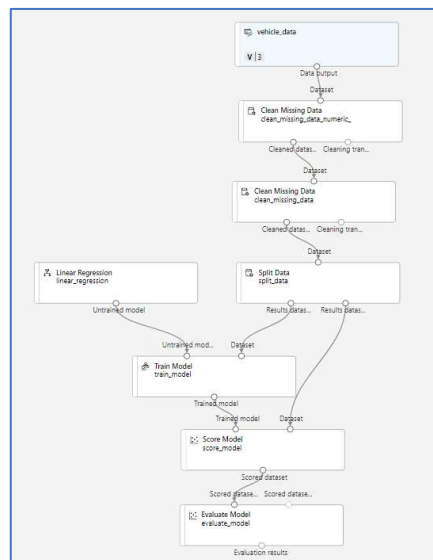
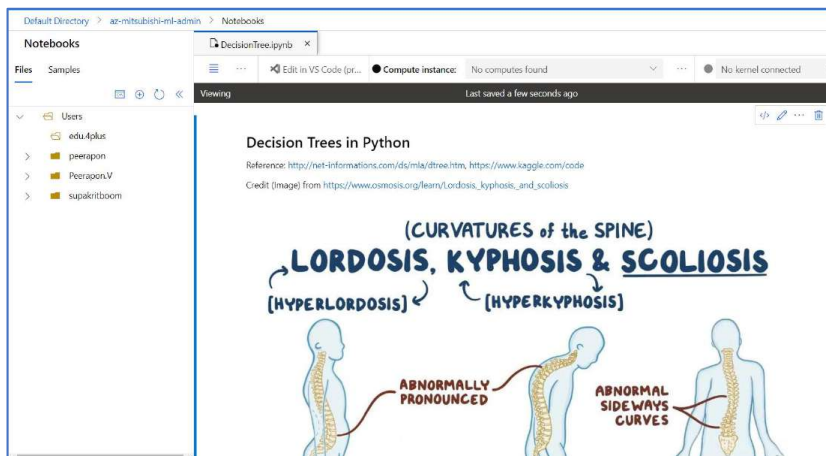


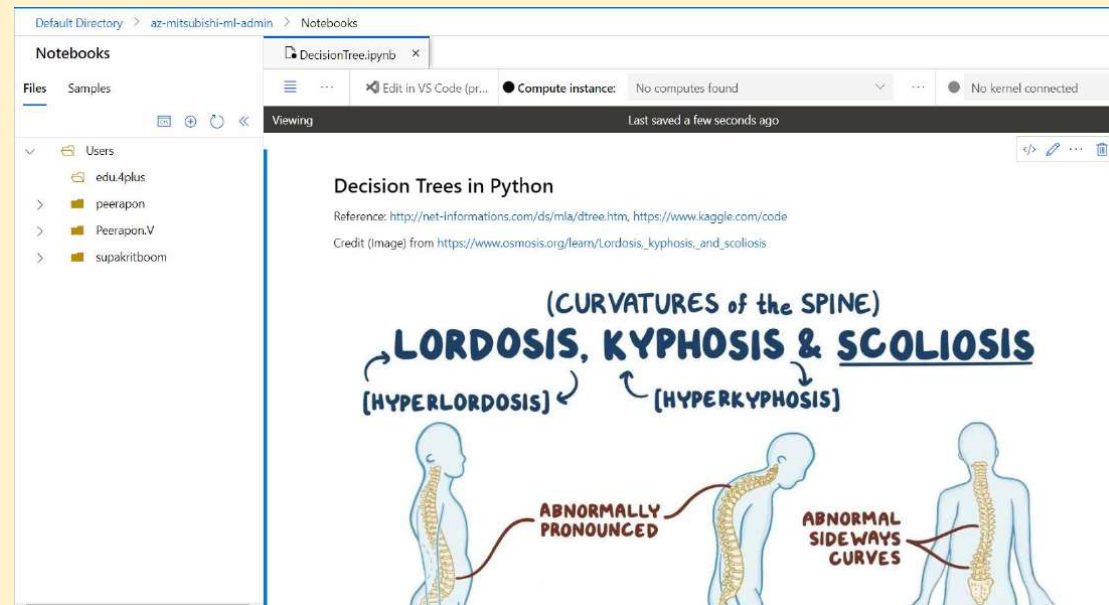
# Azure ML Labs

# Outline

- VM1: Compute Server
  - Lab1: Run Python notebook on Azure ML
  - Lab2: Azure ML via GUI (manually drag & drop)
  - Lab3: AutoML
- VM2: API End-point server
  - Lab4: AutoML Deployment & API



# Lab1: Run Python notebook on Azure ML



# Steps

- Create “Azure Machine Learning”
- Create “Compute Instance”
- Upload notebook “DecisionTree.ipynb” to Azure Machine Learning

# Create “Azure Machine Learning”

Basics   Networking   Advanced   Tags   Review + create

## Resource details

Every workspace must be assigned to an Azure subscription, which is where billing happens. You use resource groups like folders to organize and manage resources, including the workspace you're about to create.

[Learn more about Azure resource groups](#)

Subscription \* ⓘ

Azure subscription 1



Resource group \* ⓘ

Admin

[Create new](#)

## Workspace details

Configure your basic workspace settings like its storage connection, authentication, container, and more. [Learn more](#)

Workspace name \* ⓘ

mitsubishi-admin

Region \* ⓘ

Southeast Asia

Storage account \* ⓘ

(new) mitsubishiadmi4746563080

[Create new](#)

Key vault \* ⓘ

(new) mitsubishiadmi9042664255

[Create new](#)

Application insights \* ⓘ

(new) mitsubishiadmi2775649231

[Create new](#)

Container registry \* ⓘ

None

[Create new](#)

# Create “Compute Instance”

## Compute

The "Kubernetes clusters" tab is now where you can access previous versions of "Inference clusters" (also known as "AKS clusters") and "attached Kubernetes" compute types along with any previously created compute targets using those types. [Learn more](#) about Kubernetes clusters.

Compute instances   Compute clusters   Kubernetes clusters   Attached computes

New   Refresh   Start   Stop   Restart   Schedule   Delete   Edit columns   Reset view   |   View quota

Search	Show all instances    State     All filters    Clear all					
Name	☆	State	Applications	Size	Created on ↓	Assigned
azms-compute-admin		Stopped	JupyterLab Jupyter VS Code Terminal Notebook	STANDARD_D2S_V3	Mar 29, 2023 11:17 AM	Peerapon

## Virtual machine type

☒ CPU   ☐ GPU

## Virtual machine size

☐ Select from recommended options   ☒ Select from all options

Add filter

Showing 1 of 159 VM sizes | Current selection: Standard\_D2s\_v3

Name ↑	Category	Available quota	Cost
Standard_D2s_v3 2 cores, 8GB RAM, 16GB storage	General purpose	4 cores	\$0.12/hr

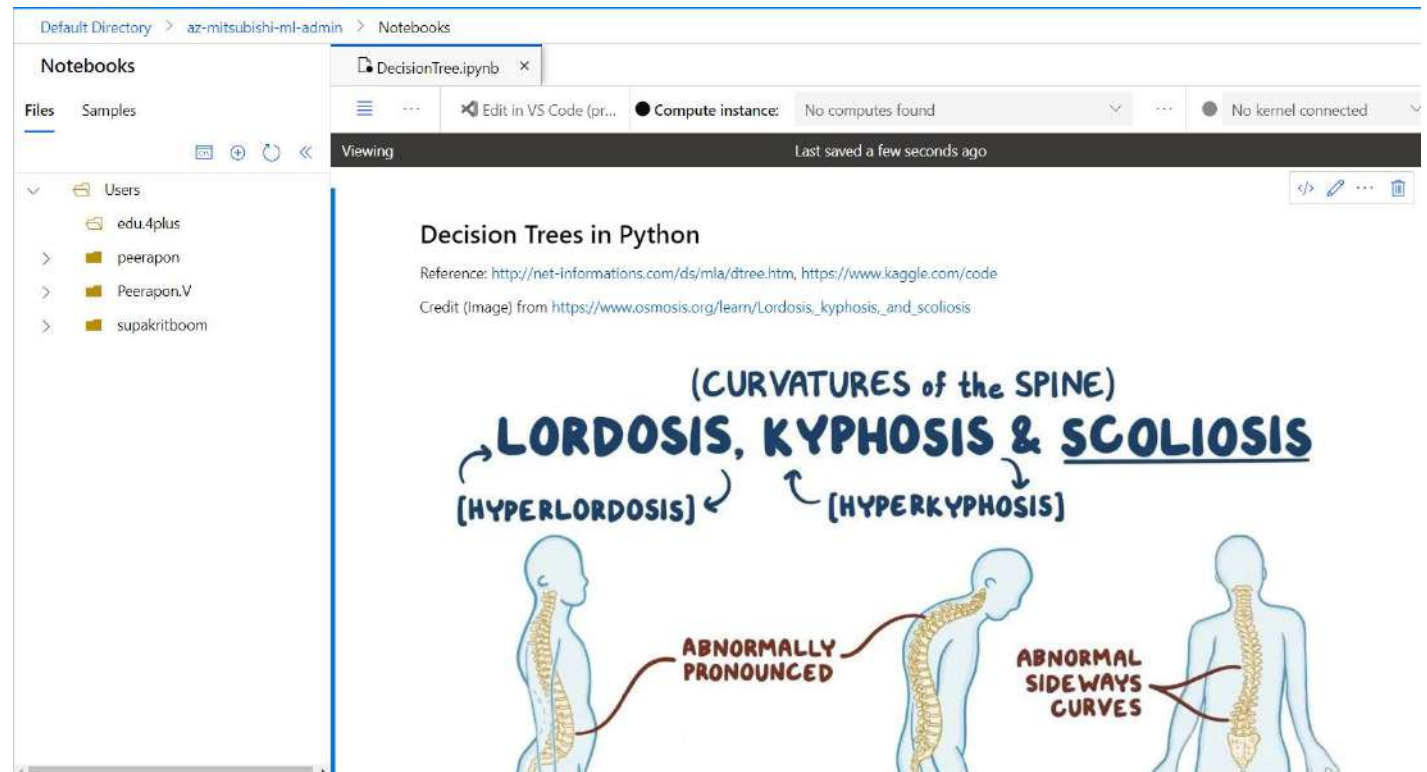
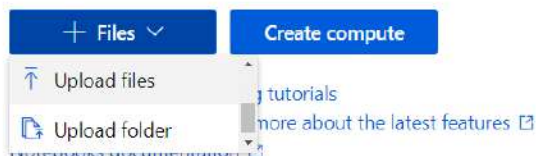
# Upload notebook “DecisionTree.ipynb” to Azure Machine Learning



Notebooks is your space to add, browse, and edit files.

You can add files of any type, including Jupyter Notebooks (.ipynb). The files you see here are stored in the workspace file share, and are accessible and shared within the workspace.

In order to run notebooks and scripts, you must connect to an Azure Machine Learning compute resource. Once a notebook or terminal is connected, you can access all workspace assets including experiment details, data, models, and more. [Learn more](#)

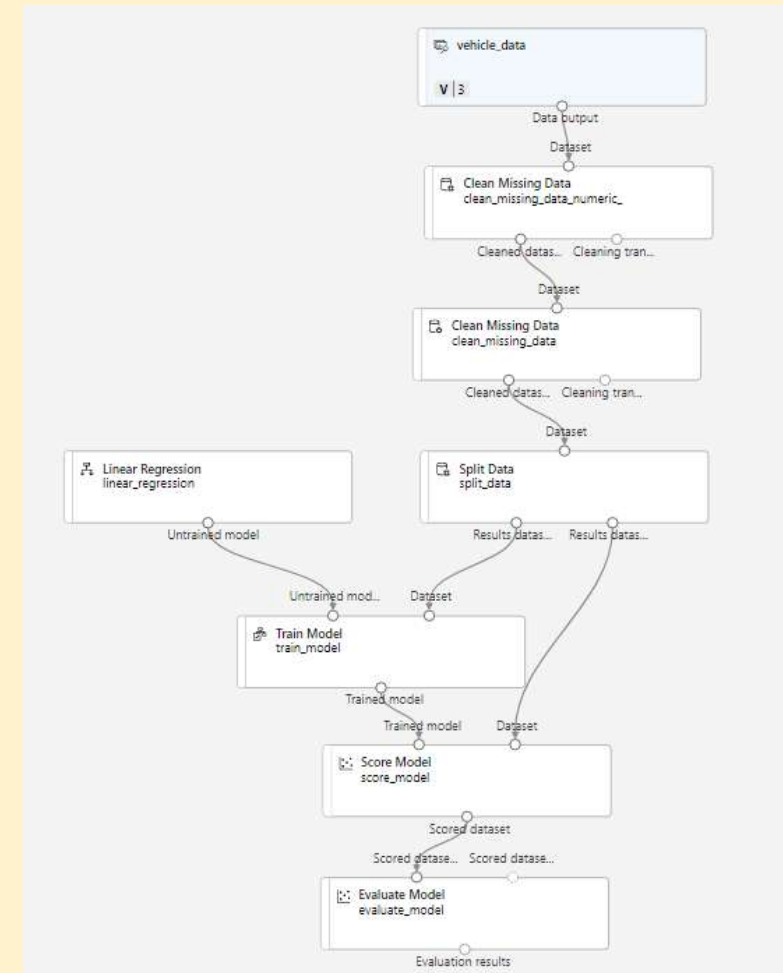


# Run the code

- Select compute that we created
- Run all code blocks



# Lab2: Azure ML via GUI (manually drag & drop)



# Steps

- Create “Pipeline”
- Import data “vehicle.csv”
- Generate (data) profile
- Create pipeline flow
- Run pipeline

# Create “Pipeline”

## Designer

### New pipeline

Classic prebuilt

Custom

[Show more samples](#) ✓

This low-code option uses existing prebuilt components and earlier dataset types (tabular, file), and is best suited for data processing and traditional machine learning tasks like regression and classification. This option continues to be supported but will not have any new components added.



Create a new pipeline using classic prebuilt components ⓘ



Image Classification using DenseNet ⓘ



Binary Classification using Vowpal Wabbit Model - A... ⓘ




Wide & Deep based Recommendation - Restau... ⓘ








Regression - Automobile Price Prediction (Basic) ⓘ

# Import data “vehicle.csv”



## Data

**Data assets**   Datastores   Dataset monitors 


Data assets are references to your data. You can create data assets from datastores, local files, public URLs, or Open Datasets. Data assets can be versioned and easily referenced and reused for machine learning tasks. [Learn more about data assets](#) 

 Create    Refresh    Archive    Edit columns    Reset view   |   ☒ Show latest version only   ☐ Include archived

 Search

 All filters    Clear all


Showing 1-1 of 1 data assets

Page size: 25 

Name	☆	Version	Data source	Created on ↓	Modified on	Type	Properties	Created
<a href="#">vehicle_data</a>		3	<a href="#">workspaceblobstore</a>	Mar 29, 2023 11:50 AM	Mar 30, 2023 12:14 AM	Table		Pongsal

# Import data “vehicle.csv” (cont.)

## Set the name and type for your data asset

Name \* 

### Description

Data asset description

Type \* 

Tabular 

## Choose a source for your data asset

Choose the data source you want to create your asset from. A data source can be from a local storage location on your computer, from an attached datastore, from Azure publicly available web location.



### From Azure storage

Create a data asset from registered data storage services including Azure Blob Storage, Azure file share, and Azure Data Lake.



### From local files

Create a data asset by uploading files from your local drive.



### From SQL databases

Create a dataset from Azure SQL database and Azure PostgreSQL database.



### From web files

Create a data asset from a single file located at a public web URL.



### From Azure Open Datasets

Create a dataset with one-click from pre-made data sets. These data sets are created by the general public and published as Azure Open Datasets.

# Import data “vehicle.csv” (cont.)

---

## Choose a file or folder


Choose files or folders to upload from your local drive. If you upload multiple folders or files, they will be stored in a containing folder.


### Upload path

azureml://subscriptions/c646de2f-ac62-4d25-9a59-d6be737c880f/resourcegroups/Admin/workspaces...

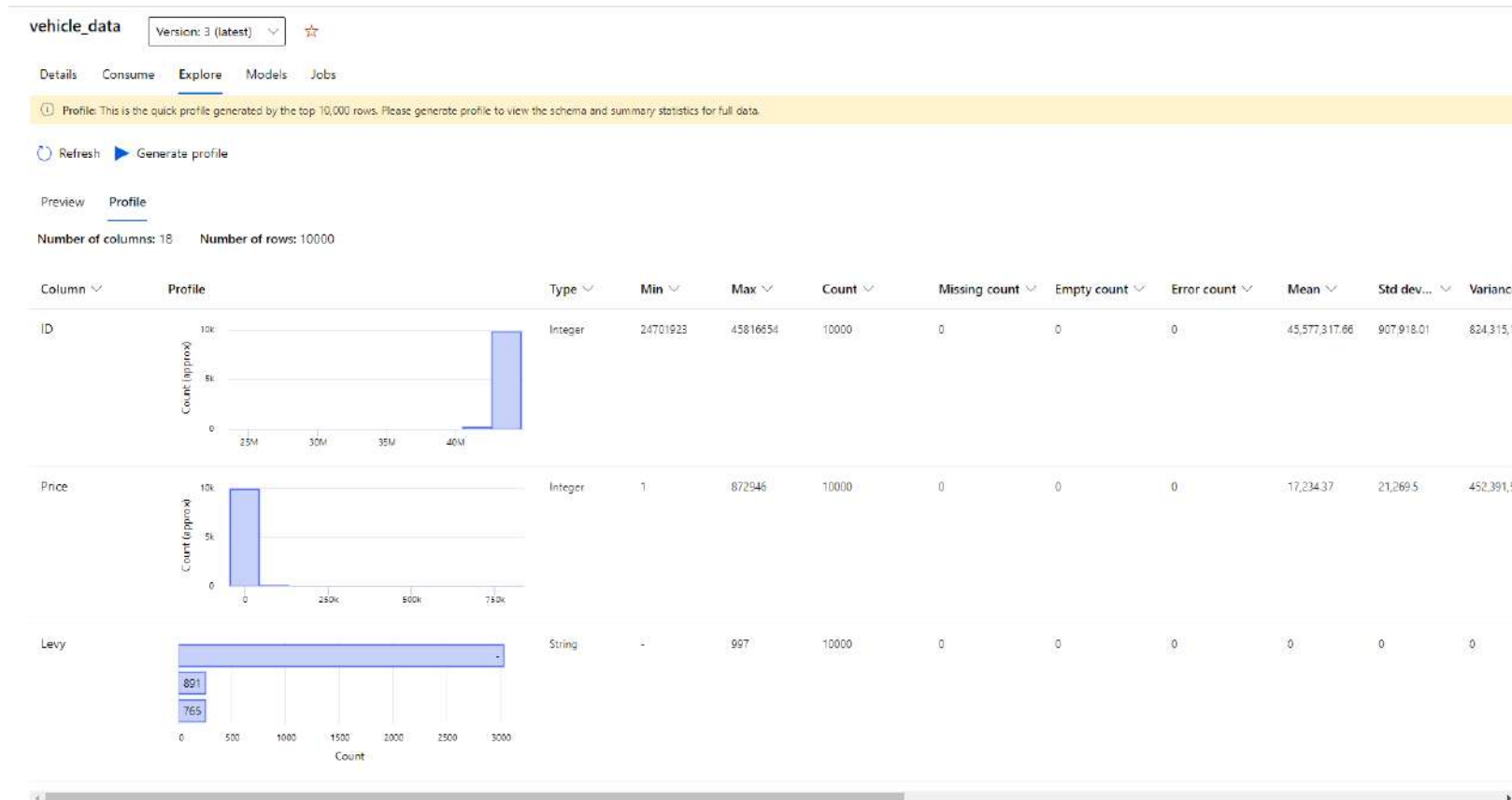


Upload 

 Upload files

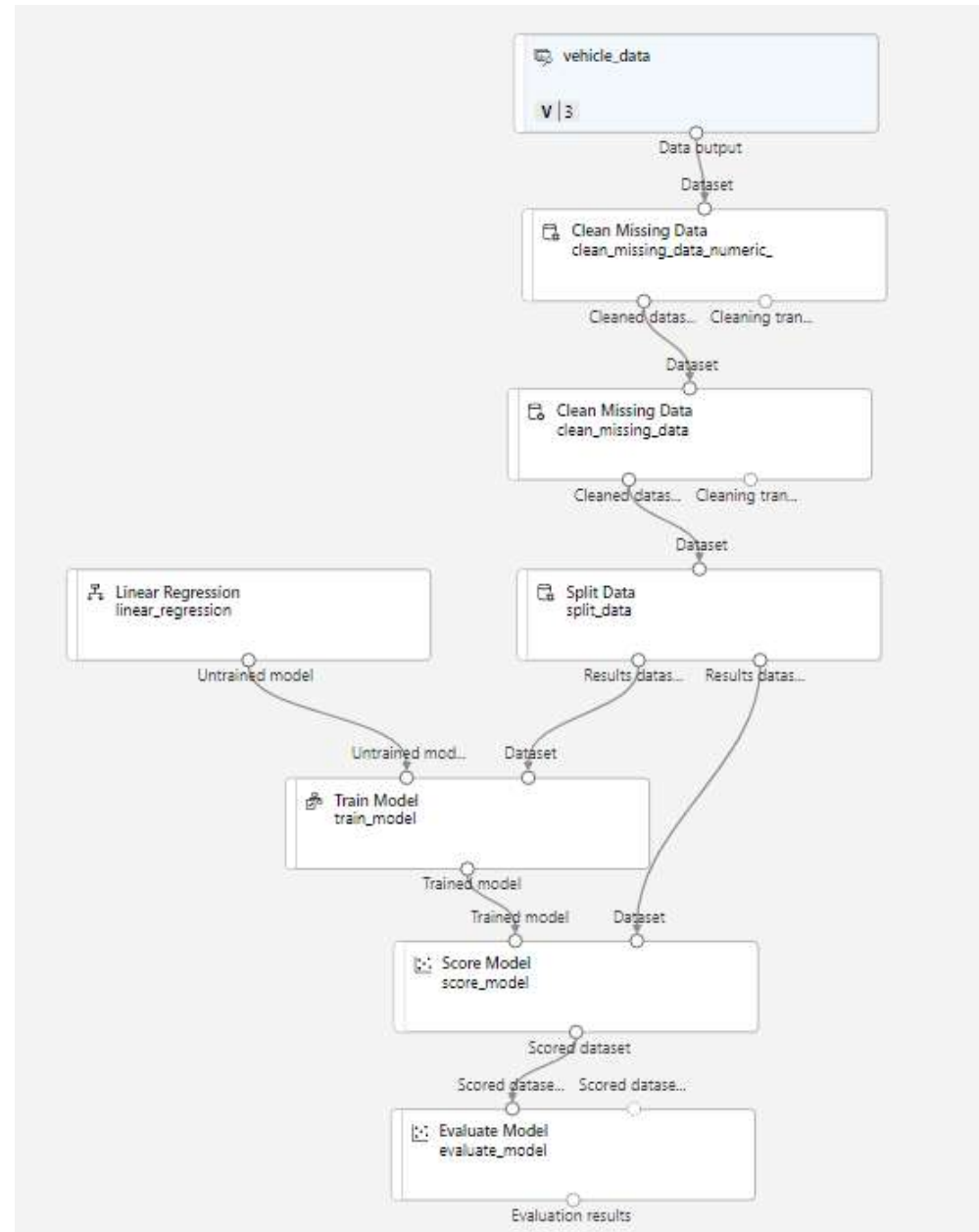
 Upload folder

# Generate (data) profile



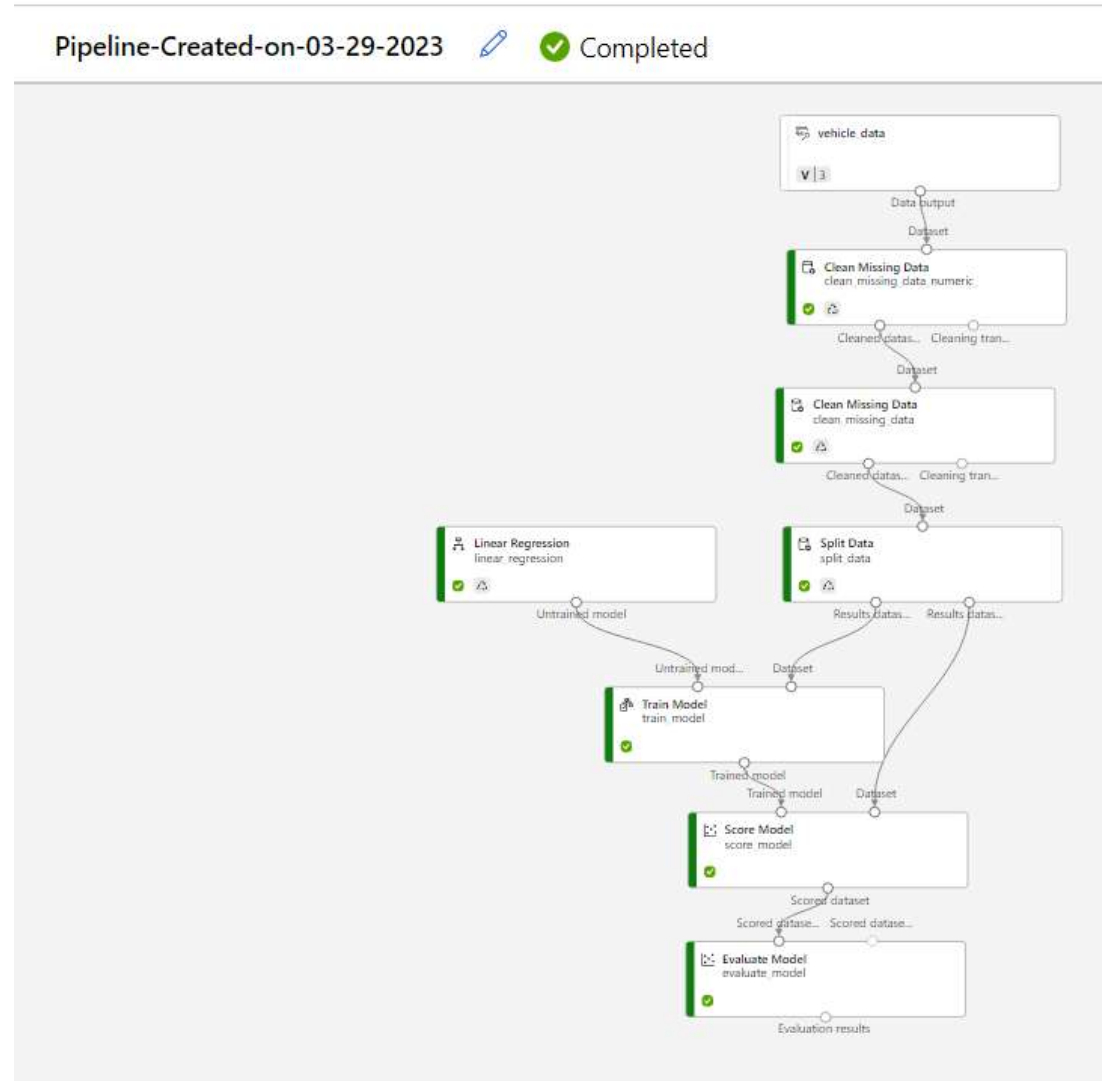
# Create pipeline flow

- Import data
- Clean missing data
- Split data
- Linear Regression
- Train Model
- Score Model
- Evaluate Model





# Run pipeline



# Lab3: AutoML

Additional configurations

Primary metric ⓘ

Normalized root mean squared error

☒ Explain best model ⓘ

☐ Use all supported models ⓘ

Allowed models ⓘ

DecisionTree, RandomForest

☐ ElasticNet

☐ GradientBoosting

☒ DecisionTree

☐ KNN

☐ LassoLars

☐ SGD

☒ RandomForest

☐ ExtremeRandomTrees

☐ LightGBM

☐ XGBoostRegressor

☐ FastLinearRegressor

Save

Cancel

# Steps

- Create “Automated ML”
- View AutoML Models
- View Model Explanation

# Create “Automated ML”

## Data asset

vehicle\_data ([View data asset](#))

## Experiment name

☒ Select existing ☐ Create new

## Existing experiment \*

vehicle\_automl 

## Target column \*

Price (Integer) 

## Select compute type

Compute instance 

## Select Azure ML compute instance \*

azms-compute-admin - Running 

[+ New](#) [↻ Refresh computes](#)

# Create “Automated ML” (cont.)

## Select task and settings

Select the machine learning task type for the experiment. To fine tune the experiment, choose additional configuration or featurization settings.



### Classification

To predict one of several categories in the target column. yes/no, blue, red, green.



### Regression

To predict continuous numeric values.




## Additional configurations




### Primary metric

Normalized root mean squared error



☒ Explain best model 

☐ Use all supported models 

### Allowed models

DecisionTree, RandomForest



☐ ElasticNet

☐ GradientBoosting

☒ DecisionTree

☐ KNN

☐ LassoLars

☐ SGD

☒ RandomForest

☐ ExtremeRandomTrees

☐ LightGBM

☐ XGBoostRegressor

☐ FastLinearRegressor

Save

Cancel

# Create “Automated ML” (cont.)

## Select the validation and test type

You can choose a validation type and select a test data asset as an optional step. Providing your own validation and test data assets are currently preview features.

Validation type ⓘ

k-fold cross validation




Number of cross validations \* ⓘ

5











Test data asset (preview) ⓘ




No test data asset required

# View AutoML Models


**boring\_train\_7wyr5814**    Completed

[Overview](#) [Data guardrails](#) [Models](#) [Outputs + logs](#) [Child jobs](#)




 Refresh  Edit and submit (preview)  Register model  Cancel  Delete |  Deploy  Download  Explain model  View generated code  Edit columns ...

Created on   All filters  Clear all










Showing 1-18 of 18 models Page size: 25

Algorithm name	Explained	Normalized ro... 	Sampling	Created on	Duration	Hyperparam
<a href="#">MaxAbsScaler, XGBoostRegressor</a>	<a href="#">View explanation</a>	0.00424	100.00 %	Mar 29, 2023 11:14 PM	38s	tree_methc
<a href="#">VotingEnsemble</a>		0.00424	100.00 %	Mar 29, 2023 11:46 PM	1m 1s	algorithm :
<a href="#">StandardScalerWrapper, XGBoostRegressor</a>		0.00425	100.00 %	Mar 29, 2023 11:15 PM	36s	booster : g
<a href="#">StackEnsemble</a>		0.00436	100.00 %	Mar 29, 2023 11:47 PM	1m 2s	algorithm :
<a href="#">MaxAbsScaler, RandomForest</a>		0.00439	100.00 %	Mar 29, 2023 11:14 PM	15m 25s	bootstrap
<a href="#">TruncatedSVDWrapper, RandomForest</a>		0.00442	100.00 %	Mar 29, 2023 11:15 PM	4m 44s	bootstrap :
<a href="#">StandardScalerWrapper, XGBoostRegressor</a>		0.00443	100.00 %	Mar 29, 2023 11:14 PM	45s	booster : g
<a href="#">MaxAbsScaler, RandomForest</a>		0.00443	100.00 %	Mar 29, 2023 11:15 PM	1m 45s	bootstrap

# View Model **Explanation**

lemon\_soursop\_7y6ptp8w    Completed

Overview Model **Explanations (preview)** Metrics Data transformation (preview) Test results (preview) Outputs + logs Images Child jobs Code Monitoring


 Refresh  Deploy  Download  Explain model  View generated code  Test model (preview)  Register model  Cancel  Delete

Explanation ID >>

bffcec55

efe6e04d

+ New cohort

 Edit cohort

DATA STATISTICS

Regressor

5000 datapoints

17 features

DATASET COHORTS

All data

5000 datapoints

0 filters

Model performance

Dataset explorer

**Aggregate feature importance**

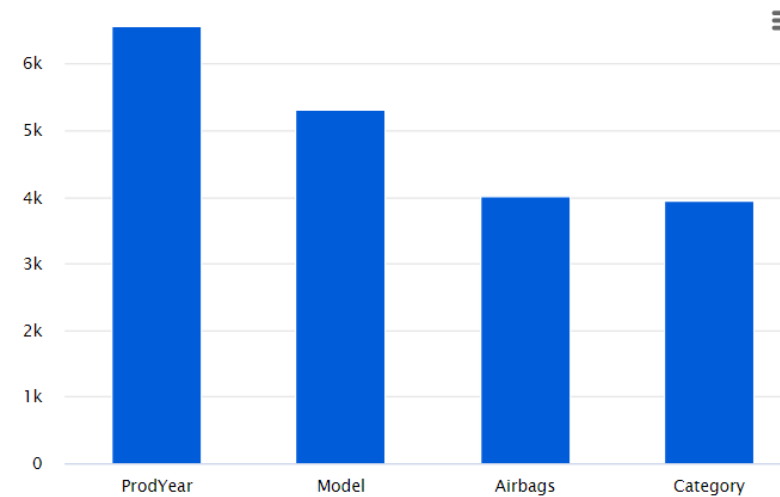
Individual feature importance

Explore the top-k important features that impact your overall model predictions (a.k.a. global explanation). Use the slider to show descending feature importances. All cohorts' feature importances are shown side by side and can be toggled off by selecting the cohort in the legend. Click on any of the features in the graph to see a density plot below of how values of the selected feature affect prediction.

Top 4 features by their importance



Aggregate feature importance



Sort by cohort

All data

Chart type

☒ Bar

☐ Box



# Lab4: AutoML Deployment & API

az-mitsubishi-ml-admin-hmvwy

Details **Test** Consume Monitoring Deployment logs

Deployment  
automla40f600ce2-1

Input data to test real-time endpoint Test Test result




```
{
  "Inputs": {
    "data": [
      {
        "ID": 0,
        "Levy": "example_value",
        "Manufacturer": "example_value",
        "Model": "example_value",
        "ProdYear": 0,
        "Category": "example_value",
        "LeatherInterior": false,
        "FuelType": "example_value",
        "EngineVolume": "example_value",
        "Mileage": "example_value",
        "Cylinders": 0.0,
        "GearBoxType": "example_value",
        "DriveWheels": "example_value",
        "Doors": "example_value",
        "Wheel": "example_value",
        "Color": "example_value",
        "Airbags": 0
      }
    ]
  }
}
```

```
{
  "Results": [
    {
      0: float 14692.330500246273
    }
  ]
}
```







# Steps

- Create “Deploy Real-Time Endpoint” from AutoML
- Test endpoint
- Run “deploy.ipynb”

# Create “Deploy Real-Time Endpoint” from AutoML

lemon\_soursop\_7y6ptp8w    Completed

Overview **Model** Explanations (preview) Metrics Data transformation (preview) Test n

 Refresh  Deploy  Download  Explain model  View generated code  Test n

## Real-time endpoint

Deploy the model using the real-time endpoint wizard

### Model summary

#### Algorithm

MaxAbsScaler, XGBoostRegressor


#### Hyperparameters

 [View hyperparameters](#)

#### Normalized root mean squared error

0.00424  [View all other metrics](#)

#### Sampling

100.00 % 

#### Registered models

No registration yet

#### Deploy status


No deployment yet

Deploy AutoMLa40f600ce1:1 

For the selected model, the scoring script and environment are auto generated for you.

[Learn More](#) 

#### Virtual machine \*

 “Standard\_DS1\_v2” and “Standard\_F2s\_v2” may be too small for bigger models and may lead to container termination due to insufficient memory, not enough space on the disk, or probe failure as it takes too long to initialize the container. [Learn more](#)

Standard\_DS1\_v2 1 Core, 3.5 GB (RAM), 7 GB (Disk), \$0.08/hr 


#### Instance count \*


1

#### Endpoint

☒ New ☐ Existing

#### Endpoint name \*

az-mitsubishi-ml-admin-jnkgb 

 An endpoint URL will be generated after creating an endpoint.

<https://az-mitsubishi-ml-admin-jnkgb.southeastasia.inference.ml.azure.com/score>

[Learn how to consume](#) 

#### Deployment name \*

automla40f600ce1-1 

Deploy

Cancel

[More options](#)

# Test endpoint

az-mitsubishi-ml-admin-hmvwy

Details **Test** Consume Monitoring Deployment logs

Deployment

automla40f600ce2-1

Input data to test real-time endpoint

Test

Test result

```
{
  "Inputs": {
    "data": [
      {
        "ID": 0,
        "Levy": "example_value",
        "Manufacturer": "example_value",
        "Model": "example_value",
        "ProdYear": 0,
        "Category": "example_value",
        "LeatherInterior": false,
        "FuelType": "example_value",
        "EngineVolume": "example_value",
        "Mileage": "example_value",
        "Cylinders": 0.0,
        "GearBoxType": "example_value",
        "DriveWheels": "example_value",
        "Doors": "example_value",
        "Wheel": "example_value",
        "Color": "example_value",
        "Airbags": 0
      }
    ]
  }
}
```

```
{ 1 item
  "Results": [ 1 item
    0 : float 14692.330500246273
  ]
}
```

# Run “deploy.ipynb”

- Edit these fields
  - Data
  - API URL
  - API Key
- Edit parameters and run the script