

## Challenge #3

# Azure Machine Learning

### IN THIS CHALLENGE:

1. Azure Machine Learning
2. Azure ML Studio
3. Create your compute
4. Train your model
5. Analyze the results
6. Your turn
7. Check your subscription

2021

**Challenge #3.1**

**Azure Machine Learning**

Home - Microsoft Azure x + ▼ - □ X

portal.azure.com/#home ★

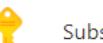
Microsoft Azure Upgrade Search resources, services, and docs (G+/-) ? ? ? ?

### Azure services

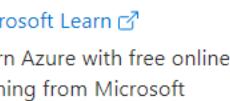
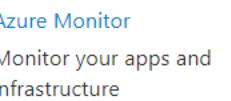
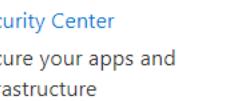
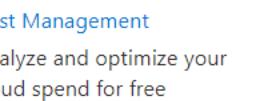
Create a resource  

 SQL databases  Subscriptions  Quickstart Center  Virtual machines  App Services  Storage accounts  Azure Cosmos DB  Kubernetes services  More services

### Navigate

 Subscriptions  Resource groups  All resources  Dashboard

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### Azure mobile app

<https://portal.azure.com/#home>

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portal.azure.com/#blade/Microsoft\_Azure\_Marketplace/GalleryItemDetailsBladeNopdl/product/%7B"displayName"%3A"Machine%20Learning"%2C"itemDisplayName"%3A"Machine%20Learn...

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# Machine Learning

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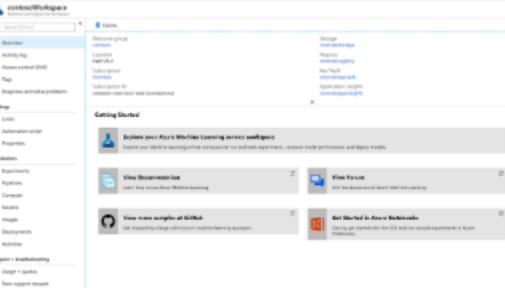
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Create

Overview Plans Usage Information + Support Reviews

Azure Machine Learning empowers developers and data scientists with a wide range of productive experiences for building, training, and deploying machine learning models. Create an Azure Machine Learning workspace to train, manage, and deploy machine-learning experiments and web services.

Media



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Machine learning - Microsoft Azu x +

portal.azure.com/#create/Microsoft.MachineLearningServices

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Home > Create a resource > Machine Learning >

## Machine learning

Create a machine learning workspace

Subscription: Free trial

Resource group: rg-caio-ai

Workspace details

Specify the name and region for the workspace.

Workspace name: machinelearning-caio

Region: Brazil South

Storage account: (new) machinelearnin0720013928

Key vault: (new) machinelearnin9082890833

Application insights: (new) machinelearnin1030589640

Container registry: None

A red curly bracket highlights the workspace name input field and its dropdown options. An orange arrow points from the right towards the workspace name input field.

Review + create < Previous Next : Networking

Define the name of your instance Azure Machine Learning

Machine learning - Microsoft Azure +

portal.azure.com/#create/Microsoft.MachineLearningServices

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## Machine learning

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**Review + create** 

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## Machine learning

Create a machine learning workspace

Validation passed

Basics Networking Advanced Tags Review + create

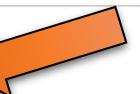
**Basics**

Subscription	Free Trial
Resource group	rg-caio-ai
Region	Brazil South
Workspace name	machinelearning-caio
Storage account	(new) machinelearnin0720013928
Key vault	(new) machinelearnin9082890833
Application insights	(new) machinelearnin1030589640
Container registry	None

**Networking**

Connectivity method	Public endpoint (all networks)
---------------------	--------------------------------

**Advanced**

**Create**  < Previous Next > Download a template for automation

Select CREATE

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Home > Microsoft.MachineLearningServices | Overview

Deployment

[Search \(Ctrl+ /\)](#)    [Delete](#)    [Cancel](#)    [Redeploy](#)    [Refresh](#)

We'd love your feedback! →

### Deployment is in progress

Deployment name: Microsoft.MachineLearningServices  
Subscription: Free Trial  
Resource group: rg-caio-ai

Start time: 6/14/2021, 3:49:16 PM  
Correlation ID: 4df1e076-db75-48ac-b314-b4c5509df773

Deployment details (Download)

Resource	Type	Status	Operation details
No results.			

Wait for the deployment process...

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Microsoft.MachineLearningService

portal.azure.com/#blade/HubsExtension/DeploymentDetailsBlade/overview/id/%2Fsubscriptions%2Ffbf350b48-f641-49a2-b7e4-598ce72df8ab%2FresourceGroups%2Frg-caio-ai%2Fproviders...

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Home > Microsoft.MachineLearningServices | Overview

Deployment

Search (Ctrl +/)

Delete Cancel Redeploy Refresh

We'd love your feedback! →

## Your deployment is complete

Deployment name: Microsoft.MachineLearningServices  
Subscription: Free Trial  
Resource group: rg-caio-ai

Start time: 6/14/2021, 3:49:16 PM  
Correlation ID: 4df1e076-db75-48ac-b314-b4c5509df773

Deployment details (Download)

Resource	Type	Status	Operation details
machinelearning-caio	Microsoft.MachineLearningService...	OK	Operation details
machinelearnin9082890833	Microsoft.KeyVault/vaults	OK	Operation details
machinelearnin0720013928	Microsoft.Storage/storageAccounts	OK	Operation details
machinelearnin1030589640	Microsoft.Insights/components	OK	Operation details

Next steps

Go to resource

Security Center

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portal.azure.com/#@caiogasparinegmail.onmicrosoft.com/resource/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourcegroups/rg-caio-ai/providers/Microsoft.MachineLearning...

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Home > Microsoft.MachineLearningServices >

# machinelearning-caio

Machine learning

Search (Ctrl+ /) Download config.json Delete

Overview Activity log Access control (IAM) Tags Diagnose and solve problems Events

Resource group : rg-caio-ai Location : Brazil South Subscription : Free Trial Subscription ID : bf350b48-f641-49a2-b7e4-598ce72df8ab

Studio web URL : <https://ml.azure.com/?tid=362067a6-2936-460f-ae05-bf263cebe940&wsi...> Storage : machinelearnin0720013928 Registry : ... Key Vault : machinelearnin9082890833 Application Insights : machinelearnin1030589640

JSON View

Manage your machine learning lifecycle

Use the Azure Machine Learning studio to build, train, evaluate, and deploy machine learning models. [Learn more](#)

Launch studio

Select LAUNCH STUDIO

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Microsoft Azure Machine Learnin

ml.azure.com/?tid=362067a6-2936-460f-ae05-bf263cebe940&wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourcegroups/rg-caio-ai/workspaces/machinelearning-caio

Microsoft Azure Machine Learning

Home

## Welcome to the Azure Machine Learning Studio

Create new

Notebooks

Code with Python SDK and run sample experiments.

Start now

Automated ML

Automatically train and tune a model using a target metric.

Start now

Designer

Drag-and-drop interface from prepping data to deploying models.

Start now

### My recent resources

Runs Compute Models Datasets

Run	Run ID	Experiment	Status	Submitted time	Submitted by	Run type



This is your Azure Machine Learning Studio Main Screen

Challenge #3.2

Azure ML Studio

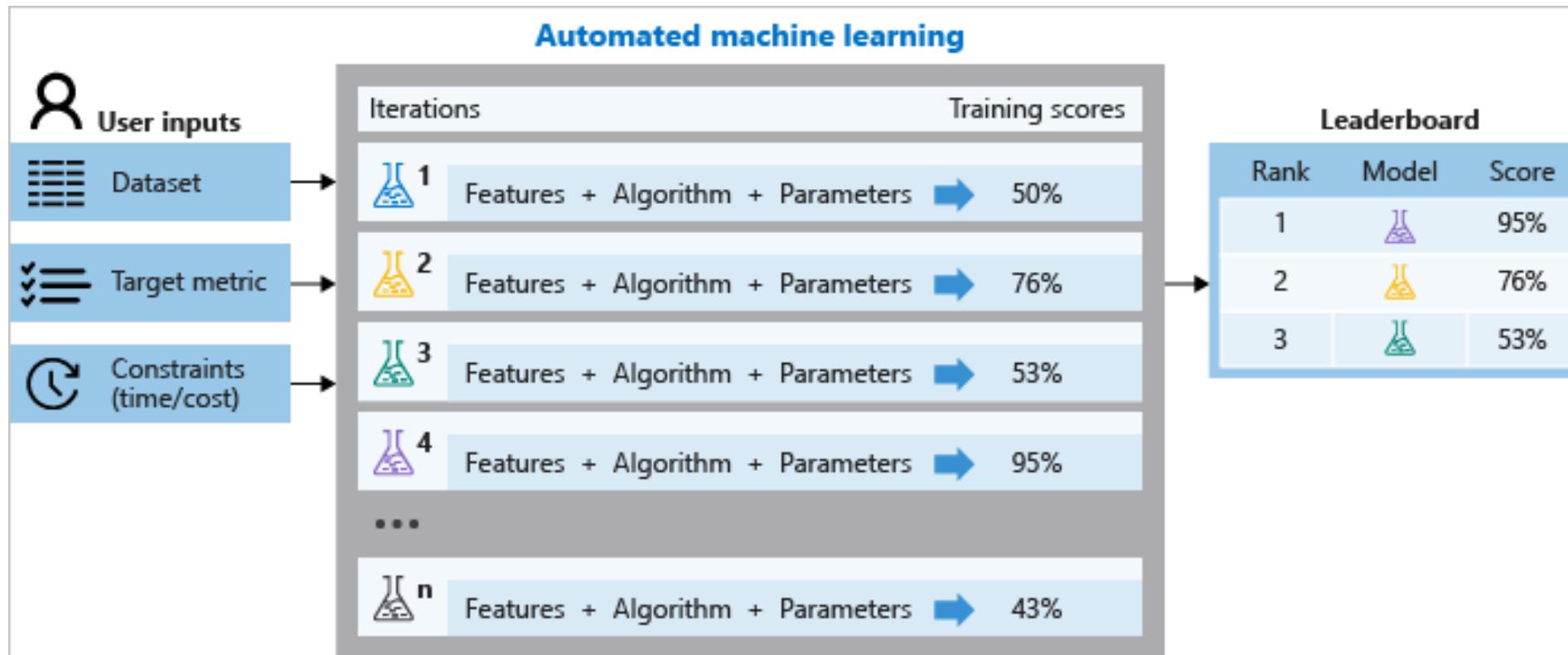
# How automated ML works

During training, Azure Machine Learning creates several pipelines in parallel that try different algorithms and parameters for you. The service iterates through ML algorithms paired with feature selections, where each iteration produces a model with a training score. The higher the score, the better the model is considered to "fit" your data. It will stop once it hits the exit criteria defined in the experiment.

Using Azure Machine Learning, you can design and run your automated ML training experiments with these steps:

1. Identify the ML problem to be solved: classification, forecasting, or regression
2. Choose whether you want to use the Python SDK or the studio web experience:
  1. For limited or no code experience, try the Azure Machine Learning studio web experience
  2. For Python developers, check out the Azure Machine Learning Python SDK
3. Specify the source and format of the labeled training data: Numpy arrays or Pandas dataframe
4. Configure the compute target for model training, such as your local computer, Azure Machine Learning Computes, remote VMs, or Azure Databricks.
5. Configure the automated machine learning parameters that determine how many iterations over different models, hyperparameter settings, advanced preprocessing/featurization, and what metrics to look at when determining the best model.
6. Submit the training run
7. Review the results

# How automated ML works



**Challenge #3.3**

**Create your compute**

Microsoft Azure Machine Learning



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- [Data Labeling](#)
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Home > Compute

## Compute

Compute instances

Compute clusters

Inference clusters

Attached computes



Get started with Azure Machine Learning notebooks and R scripts by creating a compute instance

Choose from a selection of CPU or GPU instances preconfigured with popular tools such as JupyterLab, Jupyter, and RStudio, ML packages, deep learning frameworks, and GPU drivers. [Learn more](#)

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### Compute

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Create compute instance

Select virtual machine

Compute instance is always created in the same location as the Machine Learning service workspace.

Virtual machine size you would like to use for your compute instance. Please note that a compute instance can not be shared. It can only be used by a single user. By default, it will be assigned to the creator and you can change this to a different user in the advanced settings section.

Virtual machine

Advanced Settings

**Location** (i) brazilsouth

**Virtual machine type** (i)

CPU  GPU

**Virtual machine size** (i)

Select from recommended options  Select from all options

Total available quota: 8 cores (i)

Name ↑	Category	Workload types	Available quota (i)	Cost (i)
<input checked="" type="radio"/> Standard_DS2_v2 2 cores, 7GB RAM, 14GB storage	General purpose	Development on Notebooks (or other IDE) and light weight testing	8 cores	\$0.17/hr
<input type="radio"/> Standard_DS3_v2	General purpose	Classical ML model training, AutoML runs, pipeline runs	8 cores	\$0.34/hr

Back Next Cancel

Select your COMPUTE options and select NEXT

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Microsoft Azure Machine Learning

Create compute instance

Virtual Machine

Advanced Settings

### Configure Settings

Configure compute instance settings for your selected virtual machine size.

Name	Category	Cores	Available quota	RAM	Storage	Cost/Hour
Standard_DS2_v2	General purpose	2	8 cores	7 GB	14 GB	\$0.17/hr

Compute name \*  

Enable SSH access 

[Show advanced settings](#)

[Back](#) [Create](#) [Download a template for automation](#) [Cancel](#)

Type your compute name and select CREATE

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## Compute

Compute instances Compute clusters Inference clusters Attached computes

+ New ⏪ Start ⏹ Stop ⏹ Restart 🗑 Delete ⏹ Refresh 📈 Edit columns ⏹ Reset view 📈 View quota

Search Show all instances State All filters Clear all

Name	State	Applications	Size	Created on	Assigned to
ml-compute	Creating	VS Code	STANDARD_DS2_V2	Jun 14, 2021 6:49 PM	caio gasparine



Compute CREATED!

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Search Show all instances State All filters Clear all

Name	State	Applications	Size	Created on	Assigned to
ml-compute	Running	JupyterLab Jupyter VS Code RStudio Terminal	STANDARD_DS2_V2	Jun 14, 2021 6:49 PM	caio gasparine



Compute UP and RUNNING!

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Microsoft Azure Machine Learning

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Compute instances Compute clusters Inference clusters Attached computes

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Search Show all instances State All filters Clear all

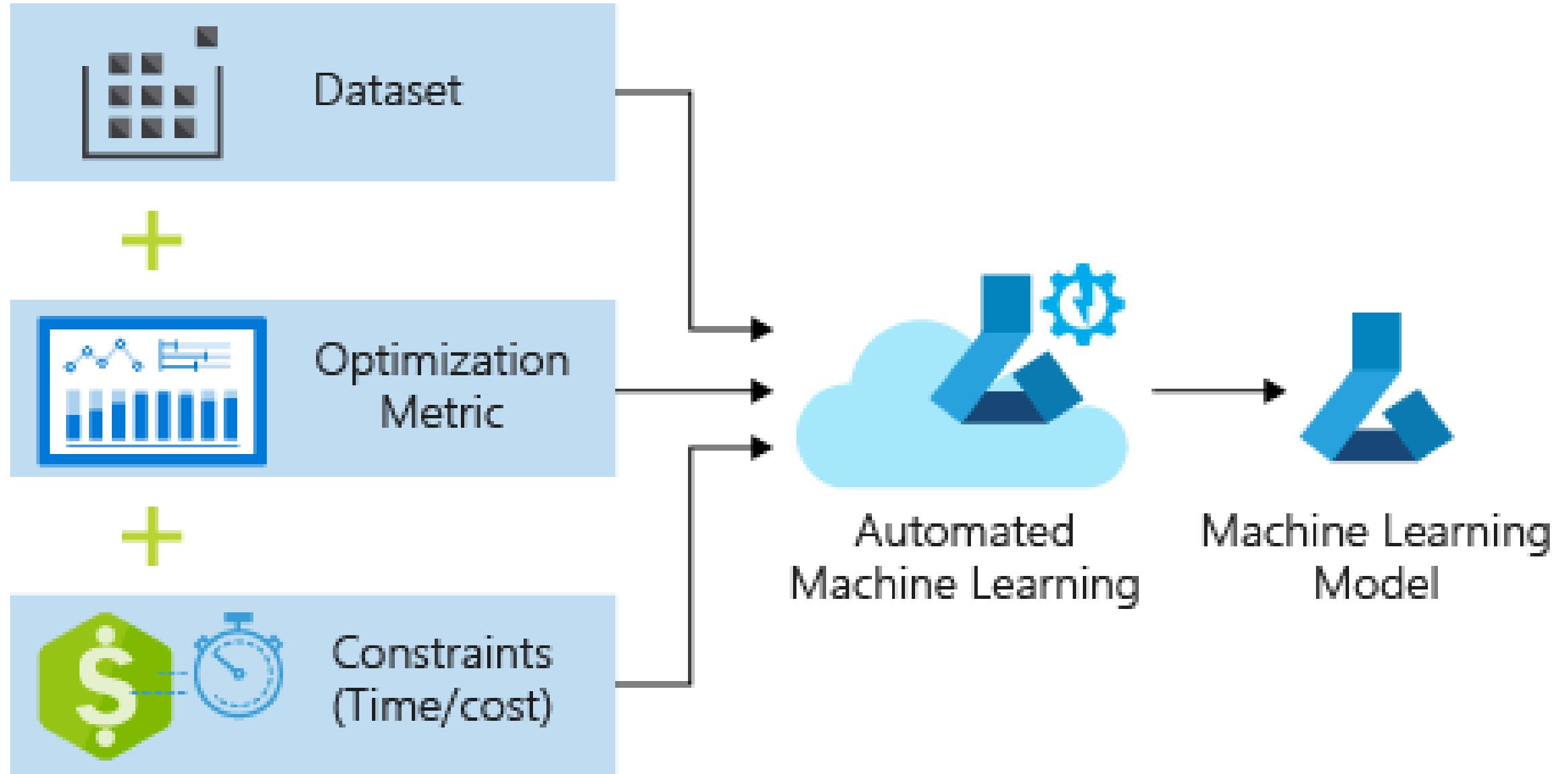
Name	State	Applications	Size	Created on	Assigned to
ml-compute	Running	JupyterLab Jupyter VS Code RStudio Terminal	STANDARD_DS2_V2	Jun 14, 2021 6:49 PM	caio gasparine

Compute UP and RUNNING!



## Challenge #3.4

Train a regression model  
with AutoML and Python



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ml.azure.com/?tid=362067a6-2936-460f-ae05-bf263cebe940&wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourcegroups/rg-caio-ai/workspaces/machinelearning-caio

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## Welcome to the Azure Machine Learning Studio

Author

- Notebooks
- Automated ML
- Designer

Assets

- Datasets
- Experiments
- Pipelines
- Models
- Endpoints

Manage

- Compute
- Environments (preview)
- Datastores
- Data Labeling
- Linked Services

Home

Create new +

**Notebooks**  
Code with Python SDK and run sample experiments.  
**Start now**

**Automated ML**  
Automatically train and tune a model using a target metric.  
**Start now**

**Designer**  
Drag-and-drop interface from prepping data to deploying models.  
**Start now**

My recent resources

Runs	Compute	Models	Datasets			
Run	Run ID	Experiment	Status	Submitted time	Submitted by	Run type

https://ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce7...

This is your Azure Machine Learning Studio Main Screen

## Microsoft Azure Machine Learning



Home > Notebooks

### Notebooks

Files Samples



Users

caiogasparine



Notebooks allow users to work with files, folders and Jupyter Notebooks directly in the workspace.

Browse your files and shared files with easy collaboration tools. You can also start with a Jupyter Notebook in the workspace with easy access to all workspace assets including experiment details, datasets, models and more. [Learn more](#)

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Terminal

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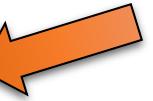
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ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourcegroups/rg-caio-ai/workspaces/machinelearning-caio&tid=362067a6-2936-460f-ae05-

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**Notebooks** 

**Samples**

Files Samples

Users caiogasparine





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Home > Notebooks

## Notebooks

Files Samples

Search to filter notebooks

- Samples
  - 1.28.0
    - how-to-use-azureml
  - tutorials
    - compute-instance-quickst...
    - create-first-ml-experiment
    - image-classification-mnist...
    - machine-learning-pipeline...
    - regression-automl-nyc-tax...

... README.md

Three orange arrows point from the bottom of the page towards the 'Samples' folder in the file tree, highlighting the path to the 'regression-automl-nyc-tax...' notebook.

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<https://github.com/Azure/MachineLearningNotebooks/tree/master/tutorials>

← → ⌂ ⌄ ⌅ ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourceGroups/rg-caio-ai/providers/Microsoft.MachineLearningServices/workspaces/machine... ⌋

## Microsoft Azure Machine Learning

Home > Notebooks

### Notebooks

Files Samples

Search to filter notebooks

- Samples
  - 1.28.0
    - how-to-use-azureml
    - tutorials
      - compute-instance-quickstarts
      - create-first-ml-experiment
      - image-classification-mnist-data
      - machine-learning-pipelines-advanced
    - regression-automl-nyc-taxi-data
      - regression-automated-ml.ipynb** (selected)
      - regression

Want to start editing?  Clone this notebook

Import the necessary packages. The Open Datasets package contains a class representing each data source ( `NycTlcGreen` for example) to easily filter date parameters before downloading.

```
[ ] 1 import pandas as pd  
2 from azureml.core import Dataset  
3 from datetime import datetime  
4 from dateutil.relativedelta import relativedelta
```

Begin by creating a dataframe to hold the taxi data. Then preview the data.

```
1 green_taxi_dataset = Dataset.Tabular.from_parquet_files(path="https://automl-samples-notebookdata.blob.core.windows.net/automl-sample-notebook-data/nyc-taxi-tripdata.parquet")  
2 green_taxi_df = green_taxi_dataset.to_pandas_dataframe()  
3 green_taxi_df.head(10)
```

Now that the initial data is loaded, define a function to create various time-based features from the pickup datetime field. This will create new fields for the month number, day of month, day of week, and hour of day, and will allow the model to factor in time-based seasonality.

Use the `apply()` function on the dataframe to iteratively apply the `build_time_features()` function to each row in the taxi data.



Microsoft Azure Machine Learning



Home > Notebooks

Notebooks

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Samples

1.28.0

how-to-use-azureml

tutorials

compute-instance-quickstarts

create-first-ml-experiment

image-classification-mnist-data

machine-learning-pipelines-advanced

regression-automl-nyc-taxi-data

regression-automated-ml.ipynb

regression-automated-ml.yml

README.md

regression-automat x

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Clone this notebook



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## Tutorial: Use automated machine learning to predict taxi fares

In this tutorial, you use automated machine learning in Azure Machine Learning service to create a regression model to predict NYC taxi fare prices. This process accepts training data and configuration settings, and automatically iterates through combinations of different feature normalization/standardization methods, models, and hyperparameter settings to arrive at the best model.

In this tutorial you learn the following tasks:

- Download, transform, and clean data using Azure Open Datasets
- Train an automated machine learning regression model
- Calculate model accuracy

If you don't have an Azure subscription, create a free account before you begin. Try the [free or paid version](#) of Azure Machine Learning service today.

### Prerequisites

- Complete the [setup tutorial](#) if you don't already have an Azure Machine Learning service workspace or notebook virtual machine.

Microsoft Azure Machine Learning

Home > Notebooks

Notebooks

Files Samples

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Samples

1.28.0

how-to-use-azureml

tutorials

compute-instance-quickstarts

create-first-ml-experiment

image-classification-mnist-data

machine-learning-pipelines-adv

regression-automl-nyc-taxi-data

regression-automated-ml.ipynb

regression-automated-ml.yml

README.md

regression-automat x

Want to start editing? [Clone this notebook](#)

Select target directory

User files

Users

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Please note that cloning this notebook will also clone the following files and folders

regression-automated-ml.yml

Clone

Cancel

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Prerequisites

- Complete the [setup tutorial](#) if you don't already have an Azure Machine Learning service workspace or notebook virtual machine.

Create a clone of the code

## Microsoft Azure Machine Learning

Home > Notebooks

Success: Successfully cloned 'Samples/1.28.0/tutorials/regression-automl-nyc-taxi-data' to 'Users/caiogasparine'

### Notebooks

Files Samples

Users  
caiogasparine  
regression-automl-nyc-taxi-data  
.amlignore  
**regression-automated-ml.ipynb**  
regression-a regression-automated-ml.ipynb  
.amlignore  
text-translator.ipynb

regression-automat x regression-automate x

Editors Compute: machinelearning-pc - Running Python 3.6 - AzureML Python 3.6.9

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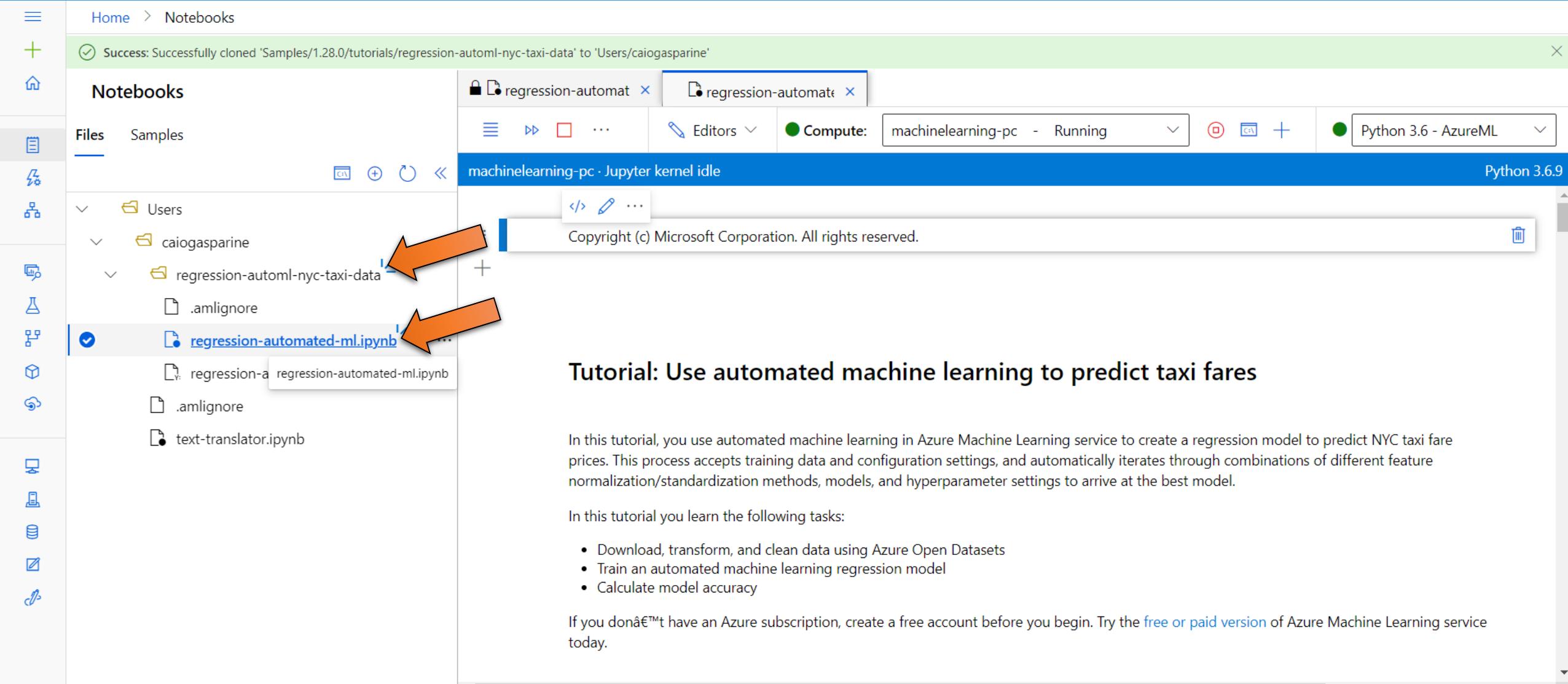
**Tutorial: Use automated machine learning to predict taxi fares**

In this tutorial, you use automated machine learning in Azure Machine Learning service to create a regression model to predict NYC taxi fare prices. This process accepts training data and configuration settings, and automatically iterates through combinations of different feature normalization/standardization methods, models, and hyperparameter settings to arrive at the best model.

In this tutorial you learn the following tasks:

- Download, transform, and clean data using Azure Open Datasets
- Train an automated machine learning regression model
- Calculate model accuracy

If you don't have an Azure subscription, create a free account before you begin. Try the [free or paid version](#) of Azure Machine Learning service today.



Code clone created!

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourceGroups/rg-caio-ai/providers/Microsoft.MachineLearningServices/workspaces/machine... ☆

## Microsoft Azure Machine Learning

Home > Notebooks

Success: Successfully cloned 'Samples/1.28.0/tutorials/regression-automl-nyc-taxi-data' to 'Users/caiogasparine'

### Notebooks

Files Samples

Users  
caiogasparine  
regression-automl-nyc-taxi-data  
.amlignore  
regression-automated-ml.ipynb  
regression-a regression-automated-ml.ipynb  
.amlignore  
text-translator.ipynb

regression-automat x regression-automate x

Editors Compute: machinelearning-pc - Running + Python 3.6 - AzureML Python 3.6.9

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## Tutorial: Use automated machine learning to predict taxi fares

In this tutorial, you use automated machine learning in Azure Machine Learning service to create a regression model to predict NYC taxi fare prices. This process accepts training data and configuration settings, and automatically iterates through combinations of different feature normalization/standardization methods, models, and hyperparameter settings to arrive at the best model.

In this tutorial you learn the following tasks:

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- Calculate model accuracy

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machinelearning-caio - Microsoft

Notebooks - Microsoft Azure Ma

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourceGroups/rg-caio-ai/providers/Microsoft.MachineLearningServices/workspaces/machine...

Microsoft Azure Machine Learning

Home > Notebooks

Success: Successfully cloned 'Samples/1.28.0/tutorials/regression-automl-nyc-taxi-data' to 'Users/caiogasparine'

Notebooks

Files Samples

Search to filter notebooks

Samples

1.28.0

how-to-use-azureml

tutorials

compute-instance-quickstarts

create-first-ml-experiment

image-classification-mnist-data

machine-learning-pipelines-advanced

regression-automl-nyc-taxi-data

regression-automated-ml.ipynb

regression-automated-ml.yml

README.md

Restart kernel and run all cells

Editors

Compute: machinelearning-pc - Running

Python 3.6 - AzureML

Python 3.6.9

machinelearning-pc · Jupyter kernel busy

[1]

```
1 import pandas as pd
2 from azureml.core import Dataset
3 from datetime import datetime
4 from dateutil.relativedelta import relativedelta
```

✓ 2 sec

Begin by creating a dataframe to hold the taxi data. Then preview the data.

[2]

```
1 green_taxi_dataset = Dataset.Tabular.from_parquet_files(path="https://automl-samples-notebookdata.blob.core.windows.net/aut
2 green_taxi_df = green_taxi_dataset.to_pandas_dataframe()
3 green_taxi_df.head(10)
```

✓ 7 sec

	vendorID	lpepPickupDatetime	lpepDropoffDatetime	passengerCount	tripDistance	puLocationId
0	2	1970-01-01 00:23:42.643089	1970-01-01 00:23:42.644509	1	1.88	None
1	1	1970-01-01 00:23:41.536899	1970-01-01 00:23:41.537716	1	2.70	None

This is your Azure Machine Learning Studio Main Screen

A machinelearning-caio - Microsoft Edge Experiments - Microsoft Azure M +

ml.azure.com/experiments?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourceGroups/rg-caio-ai/providers/Microsoft.MachineLearningServices/workspaces/machinelear...

Microsoft Azure Machine Learning

Home > Experiments

## Experiments

All experiments All runs

Refresh Archive experiment View archived experiments

Search

Experiment	Latest run	Last submitted ↓	Created	Created by
Tutorial-NYCTaxi	1	Jun 14, 2021 4:26 PM	Jun 14, 2021 4:25 PM	caio gasparine

Navigation menu:

- New
- Home
- Author
- Notebooks
- Automated ML
- Designer
- Assets
- Datasets
- Experiments** (highlighted)
- Pipelines
- Models
- Endpoints
- Manage
- Compute
- Environments (preview)
- Datastores
- Data Labeling
- Linked Services



<https://ml.azure.com/runs?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/resourceGroups/rg-caio-ai/providers/Microsoft.MachineLearningServices/workspaces/machinelearning-ai1006&tid=362067a6-2936-460f-ae05-bf263cebe940>

This is your Azure Machine Learning Studio Main Screen

Microsoft Azure Machine Learning

Home > Experiments > Tutorial-NYCTaxi

## Tutorial-NYCTaxi

Edit columns Refresh Add chart | Current view: default Save view Edit view Share view

Search Add filter | Include child runs View only my runs

Run status	Completed
Running	1
Failed	0
Canceled	0
Queued	0
Other	0

normalized\_median\_absolute\_error mean\_absolute\_percentage\_error

No data available. Select runs with data to see the chart.

No data available. Select runs with data to see the chart.

Show only selected rows (1 selected)

Page Size: 25

Run	Run ID	Status	Submitted time	Duration	Submitted by	Compute target	Run type	Last(normal...	Last(mean...	Tags
Run 1	AutoML_6cfdb811-51f2-46be-9a0f-4	Running	Jun 14, 2021 4:26 PM	1m 24s	caio gasparine	local	Automate...			

Select the RUN ID to see the details...

machinelearning-caio - Microsoft | Run 1 - Microsoft Azure Machine | ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598c... | 🔍 | ☆

# Microsoft Azure Machine Learning

Run 1 Running

Refresh Mark as canceled

Details Data guardrails Models Outputs + logs Child runs Snapshot

**Properties**

**Status**  
Running

**Created**  
Jun 14, 2021 4:26 PM

**Started**  
Jun 14, 2021 4:26 PM

**Compute target**  
local

**Run ID**  
AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5

**Script name**  
--

**Created by**  
caio gasparine

**Input datasets**  
None

**Output datasets**  
None

**Run summary**

**Task type**  
Regression View configuration settings

**Featurization**  
Auto

**Primary metric**  
Spearman correlation

**Experiment name**  
Tutorial-NYCTaxi

Details...

Microsoft Azure Machine Learning

Home > Experiments > Tutorial-NYCTaxi

## Tutorial-NYCTaxi

Edit columns Refresh Add chart Current view: default Save view Edit view Share view

Search Add filter Include child runs View only my runs

Run status	Completed
Running	1
Failed	0
Canceled	0
Queued	0
Other	0

normalized\_median\_absolute\_error mean\_absolute\_percentage\_error

No data available. Select runs with data to see the chart.

No data available. Select runs with data to see the chart.

Show only selected rows (1 selected)

Page Size: 25

Run	Run ID	Status	Submitted time	Duration	Submitted by	Compute target	Run type	Last(normal...	Last(mean_...	Tags
Run 1	AutoML_6cfdb811-51f2-46be-9a0f-488...	Running	14, 2021 4:26 PM	1m 24s	caio gasparine	local	Automate...			

Your process is running...

**Challenge #3.5**

**Analyzing the results...**

Microsoft Azure Machine Learning

Home > Experiments > Tutorial-NYCTaxi

## Tutorial-NYCTaxi

Edit columns Refresh Add chart | Current view: default Save view Edit view Share view

Search Add filter | Include child runs View only my runs

Run status	Completed
Running	1
Failed	0
Canceled	0
Queued	0
Other	0

normalized\_median\_absolute\_error mean\_absolute\_percentage\_error

No data available. Select runs with data to see the chart.

No data available. Select runs with data to see the chart.

Show only selected rows (1 selected)

Page Size: 25

Run	Run ID	Status	Submitted time	Duration	Submitted by	Compute target	Run type	Last(normal...	Last(mean...	Tags
Run 1	AutoML_6cfdb811-51f2-46be-9a0f-48	Running	Jun 14, 2021 4:26 PM	1m 24s	caio gasparine	local	Automate...			

machinelearning-ai1006 - Micros x Run 1 - Microsoft Azure Machine x + ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598c... ? ☆

### Microsoft Azure Machine Learning

Home > Experiments > Tutorial-NYCTaxi > Run 1

Run 1 ✓ Completed

Refresh Cancel

Details Data guardrails Models Outputs + logs Child runs Snapshot

**Properties**

Status ✓ Completed

Created Jun 14, 2021 4:26 PM

Started Jun 14, 2021 4:26 PM

Duration 20m 5.042s

Compute target local

Run ID AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5

Script name --

Created by caio gasparine

Input datasets None

Output datasets

**Best model summary**

Algorithm name VotingEnsemble

Ensemble details [View ensemble details](#)

Spearman correlation 0.94487 [View all other metrics](#)

Sampling 100.00 % [i](#)

Registered models No registration yet

Deploy status No deployment yet

**Run summary**

Task type Regression [View configuration settings](#)

Featurization Auto

Primary metric

Visualize the details

machinelearning-ai1006 - Micros x Run 1 - Microsoft Azure Machine x + ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598c... ? ☆

## Microsoft Azure Machine Learning

Run 1 Completed

Refresh Cancel

Details Data guardrails Models Outputs + logs Child runs Snapshot

Data guardrails are run by Automated ML when automatic featurization is enabled. This is a sequence of checks over the input data to ensure high quality data is being used to train model.

Type	Status	Description
Missing feature values imputation	Passed	No feature missing values were detected in the training data. <a href="#">Learn more about missing value imputation.</a>
High cardinality feature detection	Passed	Your inputs were analyzed, and no high cardinality features were detected. <a href="#">Learn more about high cardinality feature detection.</a>

Visualize the details

machinelearning-ai1006 - Micros x Run 1 - Microsoft Azure Machine x +

ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598c... ? ☆

### Microsoft Azure Machine Learning

Home Experiments Tutorial-NYCTaxi Run 1

Run 1 Completed

Refresh Cancel

Details Data guardrails Models Outputs + logs Child runs Snapshot

Deploy Download Explain model

Search

Submitted time All filters Clear all

Showing 1-25 of 31 models

Page size: 25

Algorithm name	Explained	Spearman corr...	Sampling	Submitted time	Duration	Hyperparameter
VotingEnsemble	<a href="#">View explanation</a>	0.94487	100.00 %	Jun 14, 2021 4:44 PM	38s	algorithm : ['ElasticNet', 'ElasticN
StackEnsemble		0.94486	100.00 %	Jun 14, 2021 4:45 PM	38s	algorithm : ['ElasticNet', 'ElasticN
TruncatedSVDWrapper, ElasticNet		0.94480	100.00 %	Jun 14, 2021 4:41 PM	24s	alpha : 0.6845263157894736
StandardScalerWrapper, ElasticNet		0.94478	100.00 %	Jun 14, 2021 4:43 PM	23s	alpha : 0.05357894736842105
StandardScalerWrapper, ElasticNet		0.94478	100.00 %	Jun 14, 2021 4:31 PM	24s	alpha : 0.05357894736842105
StandardScalerWrapper, ElasticNet		0.94474	100.00 %	Jun 14, 2021 4:38 PM	23s	alpha : 0.05357894736842105
MaxAbsScaler, ElasticNet		0.94472	100.00 %	Jun 14, 2021 4:36 PM	49s	alpha : 0.001   I1_ratio : 1   nor

Page 1 of 2

[https://en.wikipedia.org/wiki/Spearman%27s\\_rank\\_correlation\\_coefficient](https://en.wikipedia.org/wiki/Spearman%27s_rank_correlation_coefficient)

An orange arrow points to the "Models" tab in the navigation bar, which is highlighted with a red box.

# Spearman's rank correlation coefficient

In statistics, **Spearman's rank correlation coefficient** or Spearman's  $\rho$ , named after Charles Spearman and often denoted by the Greek letter, is a nonparametric measure of rank correlation (statistical dependence between the rankings of two variables). It assesses how well the relationship between two variables can be described using a monotonic function.

The Spearman correlation between two variables is equal to the Pearson correlation between the rank values of those two variables; while Pearson's correlation assesses linear relationships, Spearman's correlation assesses monotonic relationships (whether linear or not). If there are no repeated data values, a perfect Spearman correlation of +1 or -1 occurs when each of the variables is a perfect monotone function of the other.

Intuitively, the Spearman correlation between two variables will be high when observations have a similar (or identical for a correlation of 1) rank (i.e. relative position label of the observations within the variable: 1st, 2nd, 3rd, etc.) between the two variables, and low when observations have a dissimilar (or fully opposed for a correlation of -1) rank between the two variables.

Spearman's coefficient is appropriate for both continuous and discrete ordinal variables.

Both Spearman's and Kendall's can be formulated as special cases of a more general correlation coefficient.

A machinelearning-ai1006 - Micros x Run 1 - Microsoft Azure Machine x + ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598c... ? ☆

## Microsoft Azure Machine Learning

Run 1 Completed

Refresh Cancel Word wrap

Details Data guardrails Models Outputs + logs Child runs Snapshot

Outputs

File Explorer Pane

Visualize the details

machinelearning-ai1006 - Micros x Run 1 - Microsoft Azure Machine x + ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598c... ? ☆

### Microsoft Azure Machine Learning

New Home Author Notebooks Automated ML Designer Assets Datasets Experiments Pipelines Models Endpoints Manage Compute Environments (preview) Datastores Data Labeling Linked Services

Home > Experiments > Tutorial-NYCTaxi > Run 1

Run 1 ✓ Completed

Refresh Cancel

Run	Run ID	Status	Submitted time	Duration	Submitted by	Compute target	Run type	Tags
Run 32	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:45 PM	38s	caio gasparine			
Run 31	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:44 PM	38s	caio gasparine			model_explanatio ...
Run 30	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:44 PM	49s	caio gasparine			
Run 29	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:43 PM	23s	caio gasparine			
Run 28	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:41 PM	1m 45s	caio gasparine			
Run 27	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:41 PM	24s	caio gasparine			
Run 26	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:40 PM	1m 10s	caio gasparine			
Run 25	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:39 PM	30s	caio gasparine			
Run 24	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:39 PM	37s	caio gasparine			
Run 23	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:38 PM	23s	caio gasparine			
Run 22	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:38 PM	24s	caio gasparine			
Run 21	AutoML_6cfdb811-51f2-46be-9a0f-488...	✓ Completed	Jun 14, 2021 4:37 PM	25s	caio gasparine			

Visualize the details

Details Data guardrails Models Outputs + logs Child runs Snapshot

Run 32 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:45 PM 38s caio gasparine

Run 31 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:44 PM 38s caio gasparine model\_explanatio ...

Run 30 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:44 PM 49s caio gasparine

Run 29 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:43 PM 23s caio gasparine

Run 28 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:41 PM 1m 45s caio gasparine

Run 27 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:41 PM 24s caio gasparine

Run 26 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:40 PM 1m 10s caio gasparine

Run 25 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:39 PM 30s caio gasparine

Run 24 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:39 PM 37s caio gasparine

Run 23 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:38 PM 23s caio gasparine

Run 22 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:38 PM 24s caio gasparine

Run 21 AutoML\_6cfdb811-51f2-46be-9a0f-488... ✓ Completed Jun 14, 2021 4:37 PM 25s caio gasparine

Microsoft Azure Machine Learning

Home > Experiments > Tutorial-NYCTaxi > Run 1

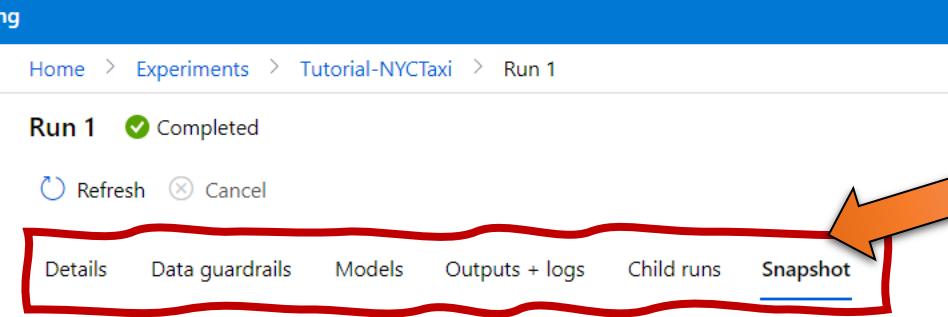
Run 1 ✓ Completed

Refresh Cancel

Details Data guardrails Models Outputs + logs Child runs Snapshot

There are no snapshots for this run

A snapshot is a record of everything needed to reproduce a run. Snapshots can be downloaded and shared. Learn more about logging and snapshots.



Visualize the details

machinelearning-ai1006 - Micros x Run 1 - Microsoft Azure Machine x + ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df... ☆

## Microsoft Azure Machine Learning

Run 1 Completed

Refresh Cancel

Details Data guardrails Models Outputs + logs Child runs Snapshot

Deploy Download Explain model

Search Submitted time All filters Clear all

Showing 1-25 of 31 models Page size: 25

Algorithm name	Explained	Spearman corr...	Sampling	Submitted time	Duration	Hyp...
VotingEnsemble	<a href="#">View explanation</a>	0.94487	100.00 %	Jun 14, 2021 4:44 PM	38s	algo...
AutoML_6cfdb811-51f2-46be-9a0f-4882ad1151d5_25		0.94486	100.00 %	Jun 14, 2021 4:45 PM	38s	algo...
<a href="#">TruncatedSVDWrapper, ElasticNet</a>		0.94480	100.00 %	Jun 14, 2021 4:41 PM	24s	alp...
StandardScalerWrapper, ElasticNet		0.94478	100.00 %	Jun 14, 2021 4:43 PM	23s	alp...
StandardScalerWrapper, ElasticNet		0.94478	100.00 %	Jun 14, 2021 4:31 PM	24s	alp...

ml.azure.com/experiments/id/.../AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5\_25?wsid...

Visualize the details

machinelearning-ai1006 - Micros x Run 31 - Microsoft Azure Machin x +

ml.azure.com/experiments/id/2795be59-3d23-43b4-9ab8-95ab26728eb2/runs/AutoML\_6cfdb811-51f2-46be-9a0f-4882ad1151d5\_29?wsid=/subscriptions/bf350b48-f641-49a2-b7e4-5... ? ☆

## Microsoft Azure Machine Learning

Run 31 Completed

Refresh Deploy Download Explain model Cancel

Metrics Data transformation (preview) Outputs + logs Images Child runs Snapshot Monitoring (preview)

Select a metric to see a visualization or table of the data.

View as:  Chart  Table

	explained_variance	mean_absolute_error	mean_absolute_percentage_e...	median_absolute_error	normalized_mean_absolute_e...
	0.857	2.101	68.827	1.283	0.011

Search

- explained\_variance
- mean\_absolute\_error
- mean\_absolute\_percentage\_error
- median\_absolute\_error
- normalized\_mean\_absolute\_error
- normalized\_median\_absolute\_error
- normalized\_root\_mean\_squared\_error
- normalized\_root\_mean\_squared\_error
- predicted\_true
- r2\_score
- residuals
- root\_mean\_squared\_error

Visualize the details

Microsoft Azure Machine Learning

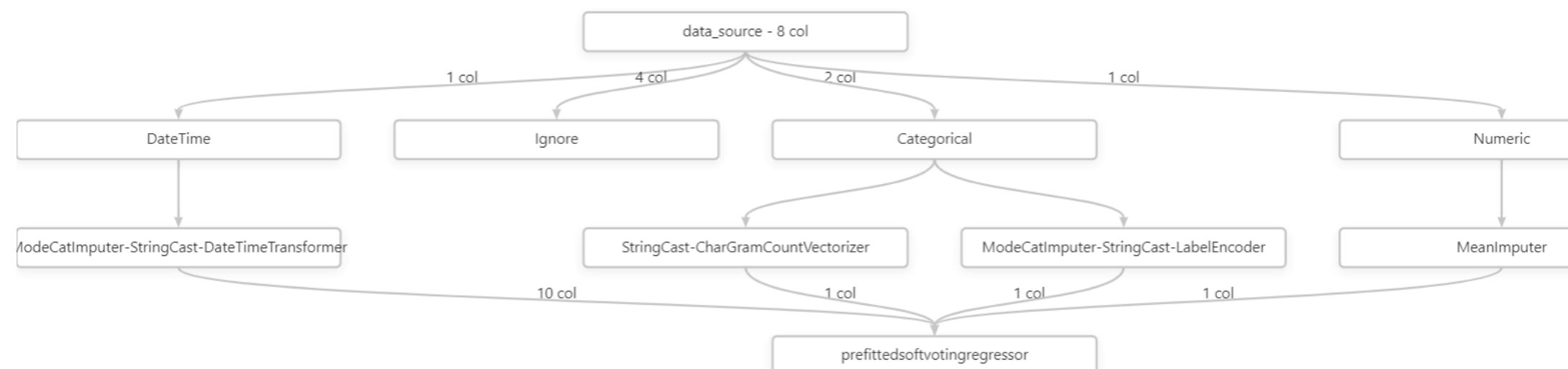
    

Home > Experiments > Tutorial-NYCTaxi > Run 1 > Run

Run 31  Complete

Refresh Deploy Download Explain model Cancel

The following diagram illustrates the data preprocessing, feature engineering, scaling techniques, and the machine learning algorithm that Automated ML applied to generate this particular model.



## Visualize the details

# Challenge #3.6

**Now it is your turn!**

- (1) Select your preferred dataset**
- (2) Run the AutoML process**
- (3) Analyse and compare the results**
- (4) Tell me your conclusions**

## Challenge #3.7

Check your subscription

Home - Microsoft Azure X

portal.azure.com/#home

**Left Menu:**

- Create a resource
- Home
- Dashboard
- All services
- FAVORITES**
- All resources
- Resource groups
- App Services
- Function App
- SQL databases
- Azure Cosmos DB
- Virtual machines
- Load balancers
- Storage accounts
- Virtual networks
- Azure Active Directory
- Monitor
- Advisor
- Security Center
- Cost Management + Billing** (highlighted with a red box and orange arrow)
- Help + support

**Header:**

Upgrade  X ? ! ⚙️ ? 😊

**Azure services:**

- Create a resource
- Cost Management ...
- Subscriptions
- All resources
- Data factories
- SQL databases
- Quickstart Center
- Virtual machines
- App Services
- More services

**Recent resources:**

Type	Last Viewed
Subscription	a few seconds ago
SQL database	39 minutes ago
Storage account	4 days ago
Synapse workspace	7 days ago
Resource group	7 days ago
Data factory (V2)	2 weeks ago

**Useful links:**

- View
- Get started
- Documentation
- Training Videos

[https://portal.azure.com/#blade/Microsoft\\_Azure\\_GTM/ModernBillingMenuBlade](https://portal.azure.com/#blade/Microsoft_Azure_GTM/ModernBillingMenuBlade)

Left Menu, select Cost Management + Billing...

Home >

## Cost Management + Billing | Overview

Default Directory

Search (Ctrl+/)

Essentials

Account admin : caiogasparine@gmail.com

Currency : BRL

Notification email : caiogasparine@gmail.com

Billing country/region : BR

Billing account type : Microsoft Online Services Program

### My subscriptions

[View all my subscriptions >](#)

You have billing access for the subscriptions listed below. To view subscriptions for which you have access to manage Azure resources. [Click here.](#)

Subscription name	Subscription ID	Status	Last billed amount	Due date	Current Cost	...
Free Trial	bf350b48-f641-49a2-84-598ce72df8ab	Active	Not available	Not available	R\$11.15	...

### Billing

Subscriptions

Invoices

Payment methods

### Settings

Properties

### Support + troubleshooting

New support request

Select your subscription...

Free Trial - Microsoft Azure x Compute - Microsoft Azure Mach x | +

portal.azure.com/#@caiogasparinegmail.onmicrosoft.com/resource/subscriptions/bf350b48-f641-49a2-b7e4-598ce72df8ab/overview

Microsoft Azure Upgrade Search resources, services, and docs (G+/-) ⌂ ⌄ ⓘ ? ⌂

Home > Cost Management + Billing >

Free Trial ...

Subscription

Search (Ctrl+ /)

Upgrade Cancel subscription Rename Change directory Transfer billing ownership Feedback

Your free credit expires in 4 days. Upgrade to keep going with your account.

Parent management group : ---

Costs by resource View details >

sql-caio-ai1 13.52 BRL

sql-caio-ai1 9.94 BRL

df-caio-001 0.28 BRL

Others 0.03 BRL

Spending rate and forecast View details >

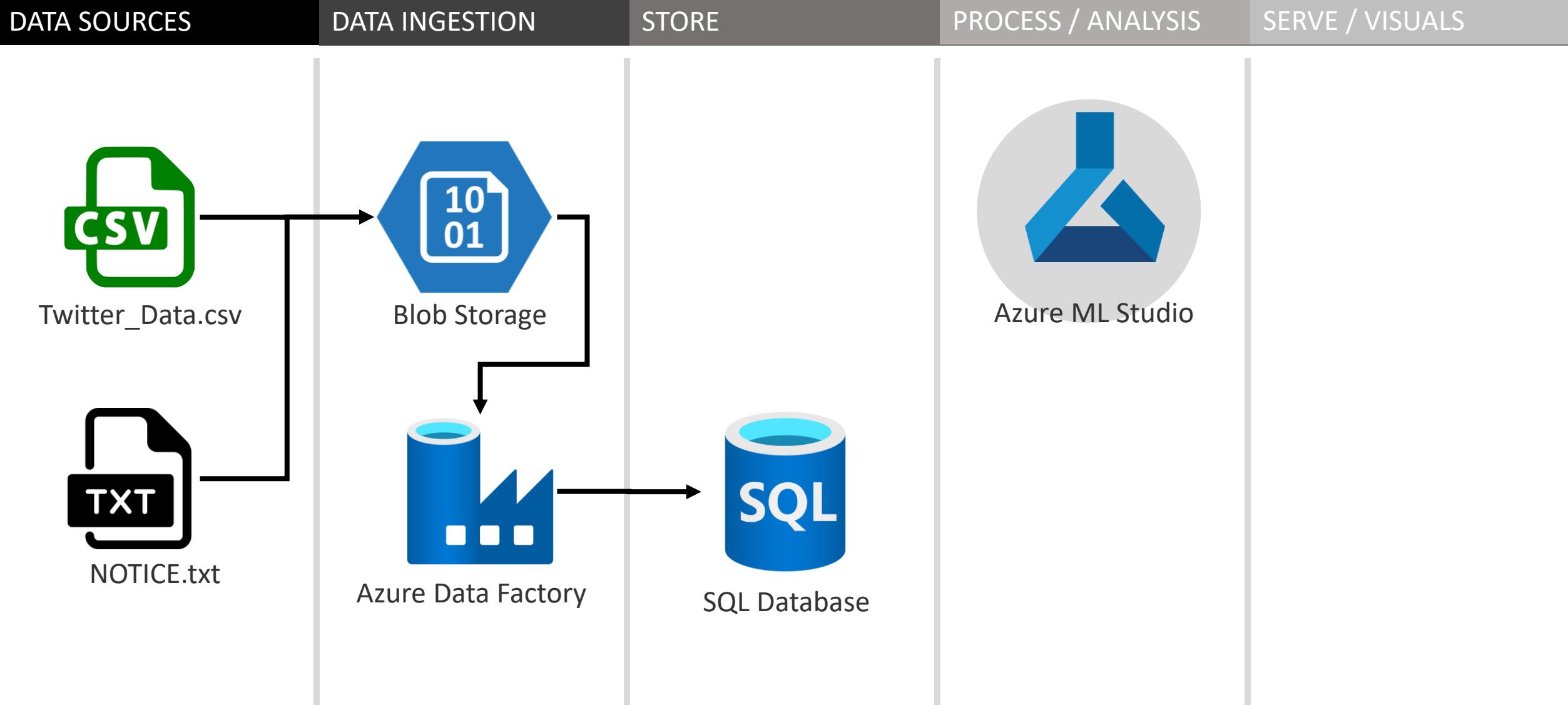
1,000  
900  
800  
700  
600  
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300  
200  
100  
0

Starting credit 980 BRL Credit remaining 955.42 BRL Forecast 29.57 BRL

Free services for 12 months ⓘ

Visualize your subscription costs and forecast.

# Data Architecture so far...



# Thank you! ;-)

Please e-mail me the screenshots of your final steps for each component / service to validate your bonus points.