



Customer

Azure ML workshop 2

Date





Microsoft contacts

Serge Retkowsky

serge.retkowsky@microsoft.com

Agenda



Reminder: workshops overview



Azure ML overview



Azure ML Hands-on labs

Program overview

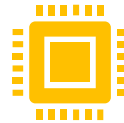
Workshop Prerequisites



Activate and Access an
[Azure Subscription](#)



Create an Azure Machine
Learning Workspace in the
Azure Portal : [LINK HERE](#)



Account for Azure DevOps
: [LINK HERE](#)



Prerequisites by Role

App Developers : VS Code, Python

ML Engineers : No prerequisites

Citizen Data Scientists : Python,
Jupyter Notebooks

Business Data Scientists : No
prerequisites

Enterprise Architects : Cloud
Policies and Security



**Recommended Azure ML
training on Microsoft
Learn**

ML with Code:

<https://docs.microsoft.com/en-us/learn/paths/build-ai-solutions-with-azure-ml-service>

ML with No Code / Low Code:

<https://docs.microsoft.com/en-us/learn/paths/create-no-code-predictive-models-azure-machine-learning>

ML at the Edge for IoT:

<https://docs.microsoft.com/en-us/learn/paths/ai-edge-engineer>

Workshop 1

Azure ML fundamentals

- Presentation and demo of Azure ML.
- Presentation of Azure documentation resources & certifications path.

Workshop 2

Azure ML fundamentals

- Hands-on labs:
 - Azure ML experimentations
 - AutoML with Azure ML Python SDK
 - Estimators with Azure ML Python SDK
 - Interpretation & Fairness of ML models
 - Hyperparameter tuning with Azure ML
 - Model deployment

Workshop 3

No Code with Azure ML

- Hands-on labs:
 - AutoML graphical user interface
 - Azure ML Designer interface for building no code pipelines
 - Use case: Anomaly detection with Azure ML Designer
 - PowerBI Integration

Workshop 4

Azure Computer Vision

- Introduction to Azure Cognitive Services.
- Deep dive on Azure Computer Vision presentation.
- Hands-on lab:
 - Training of a custom vision model
 - Validation and deployment of a custom vision model

Workshop 5

MLOps

- Introduction to MLOps
- Hands-on lab:
 - Implementing CI/CD pipeline using GitHub Action & Azure DevOps

Workshop 6

Azure Databricks

- Azure Databricks presentation
- Hands-on lab:
 - Data preparation
 - ML
 - Model deployment
 - Azure ML integration

Friday Sessions

- Goal of the first series of workshop will be focus on the upskilling around Azure Machine Learning + AI for Vision Recognition.
- Each workshop will last 2 to 3 hours mixing MS presentation + Hands-on Labs.
- All the presentation will be recorded.
- All workshops materials (presentations, notebooks, datasets...) will be shared into a Microsoft Teams place.

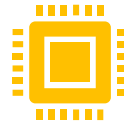
Workshop Prerequisites



Activate and Access an
[Azure Subscription](#)



Create an Azure Machine
Learning Workspace in the
Azure Portal : [LINK HERE](#)



Account for Azure DevOps
: [LINK HERE](#)



Prerequisites by Role

App Developers : VS Code, Python

ML Engineers : No prerequisites

Citizen Data Scientists : Python,
Jupyter Notebooks

Business Data Scientists : No
prerequisites

Enterprise Architects : Cloud
Policies and Security



**Recommended Azure ML
training on Microsoft
Learn**

ML with Code:

<https://docs.microsoft.com/en-us/learn/paths/build-ai-solutions-with-azure-ml-service>

ML with No Code / Low Code:

<https://docs.microsoft.com/en-us/learn/paths/create-no-code-predictive-models-azure-machine-learning>

ML at the Edge for IoT:

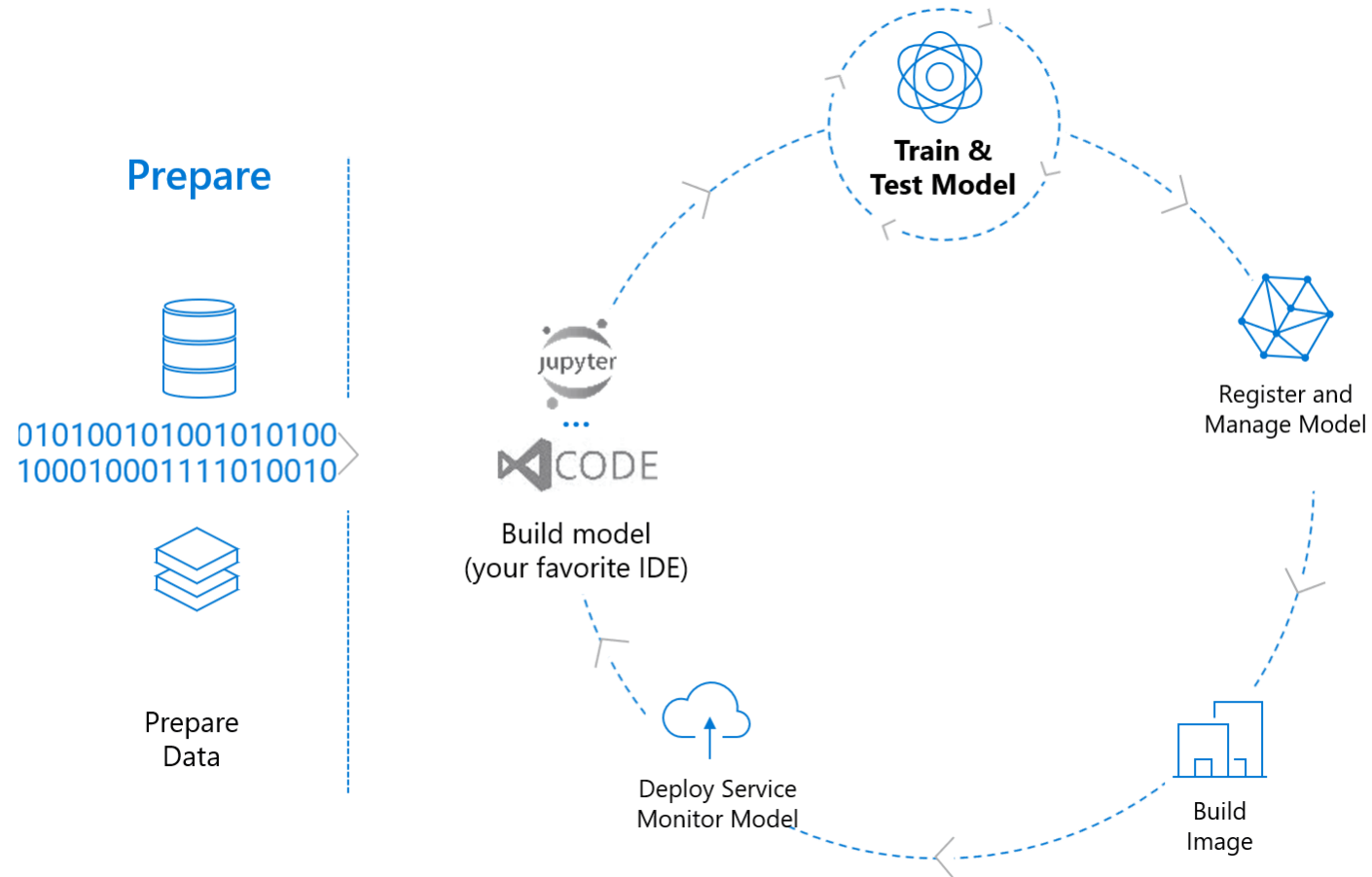
<https://docs.microsoft.com/en-us/learn/paths/ai-edge-engineer>

Reminder

Azure Machine Learning overview

Machine Learning

Typical E2E Process



Azure Machine Learning



**Set of Azure
Cloud Services**



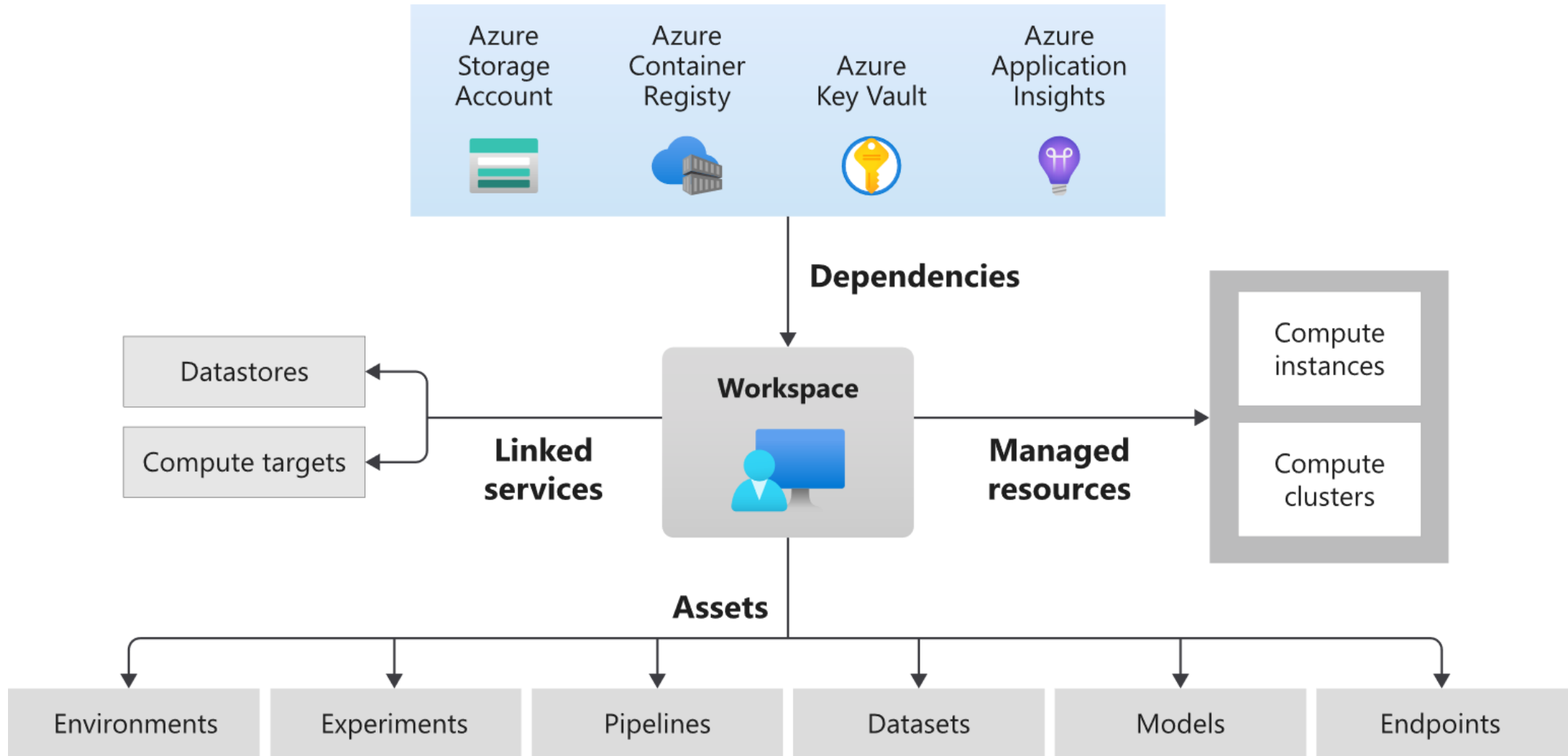
**Python & R SDK,
Visual Interfaces,
Command line interface**

That enables you to:

- ✓ Prepare Data
- ✓ Build Models
- ✓ Train Models

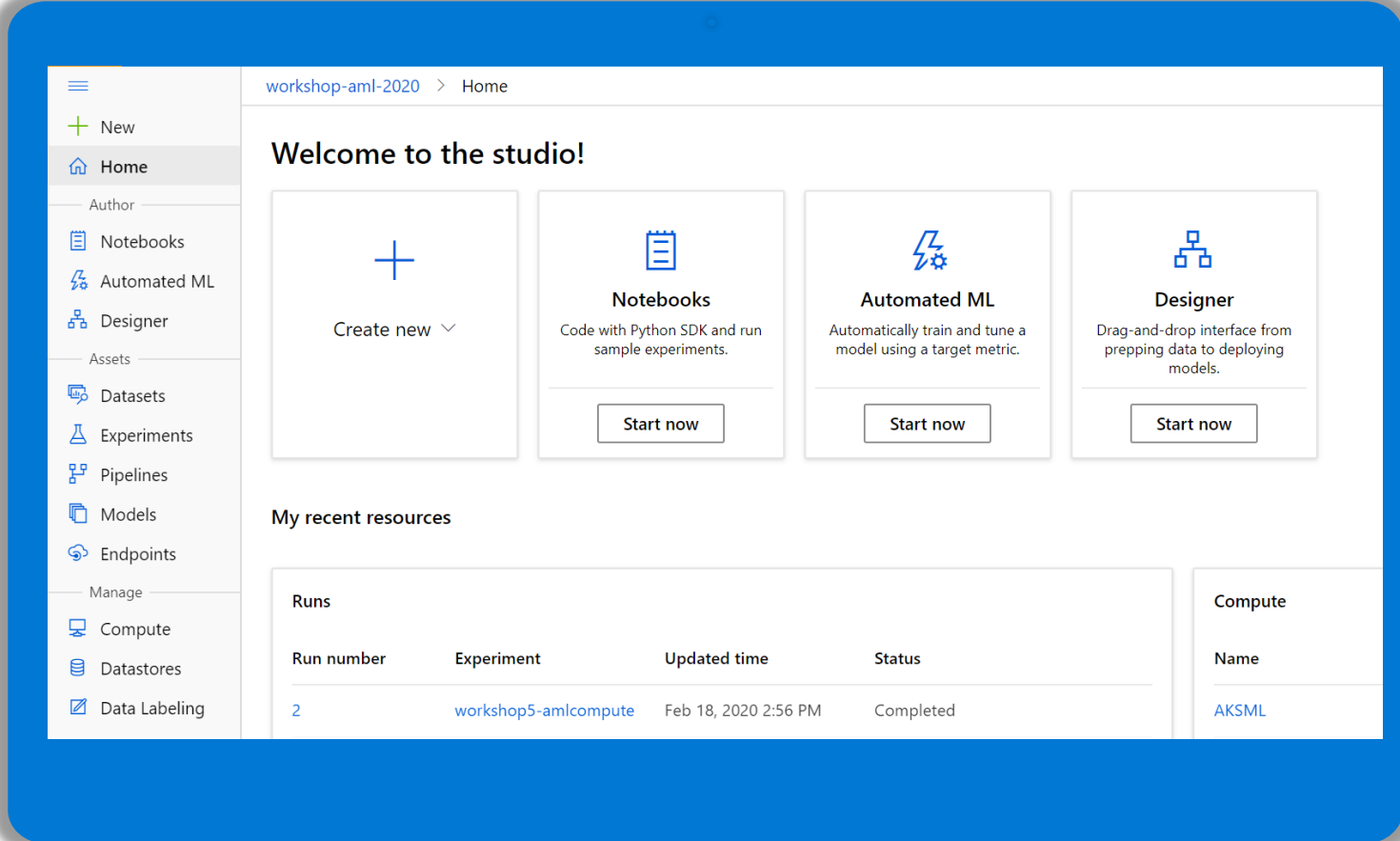
- ✓ Manage Models
- ✓ Track Experiments
- ✓ Deploy Models

Azure Machine Learning



Azure ML Studio


For all skill levels
studio web experience




The screenshot displays the Azure ML Studio web interface. On the left is a navigation sidebar with a menu icon at the top, followed by 'New', 'Home' (selected), 'Author' (Notebooks, Automated ML, Designer), 'Assets' (Datasets, Experiments, Pipelines, Models, Endpoints), 'Manage' (Compute, Datastores, Data Labeling), and a search icon. The main content area has a breadcrumb 'workshop-aml-2020 > Home'. Below this is a 'Welcome to the studio!' message. A row of four cards follows: 'Create new' with a plus icon and dropdown; 'Notebooks' with a notepad icon, description 'Code with Python SDK and run sample experiments.', and a 'Start now' button; 'Automated ML' with a lightning bolt icon, description 'Automatically train and tune a model using a target metric.', and a 'Start now' button; and 'Designer' with a flowchart icon, description 'Drag-and-drop interface from prepping data to deploying models.', and a 'Start now' button. Below these is a 'My recent resources' section. It contains a 'Runs' table and a 'Compute' section.

workshop-aml-2020 > Home

Welcome to the 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
Run number	Experiment	Updated time	Status	Name
2	workshop5-amlcompute	Feb 18, 2020 2:56 PM	Completed	AKSML

Azure ML Studio



New

Home

Author

Notebooks

Automated ML

Designer

Assets

Datasets

Experiments

Pipelines

Models

Endpoints

Manage

Compute

Datastores

Data Labeling

shwinneworkshop > Experiments > keras-mnist

keras-mnist

Switch to old experience ?

Edit table Refresh Reset to default view Add chart Include child runs

Customizations to this page will be preserved for you in this browser and they will not affect how other people experience the same page.

Add filter

Run status

0 Running

20 Completed

0 Failed

5 Other

Accuracy

Max(Accuracy)

1 0.5

1 5 7 9 11 13 15 17 19 21 23 25

Run number

Accuracy

1 0.5

0 5 10 15

Iteration

Min(Loss)

15 10 5 0

Apr 26 2020 May 3 May 10

Run created time

Loss

15 10 5 0

0 50 100

Time (seconds)

Show only selected rows (25 selected)

Page Size: 25

Run	Status	Duration	Compute target	Run type	Min(Loss)	Max(Accuracy)
Run 25	Completed	2m 40s	gpu-cluster	Script	0.00637676913137492	0.9986000011364619
Run 24	Completed	2m 50s	gpu-cluster	Script	0.0062801566226492545	0.9987500011424224
Run 23	Completed	2m 33s	gpu-cluster	Script	0.28901339417672905	0.9698499940832456

Microsoft Learn

Azure ML training



10800 XP

Build AI solutions with Azure Machine Learning

8 hr 26 min remaining • Learning Path • 4 of 13 modules completed

Intermediate Data Scientist Student Azure Machine Learning Azure Portal

Azure Machine Learning is a cloud platform for training, deploying, managing, and monitoring machine learning models. Learn how to use the Azure Machine Learning Python SDK to create enterprise-ready AI solutions.

Prerequisites

This learning path assumes that you have experience of training machine learning models with Python and open-source frameworks like Scikit-Learn, PyTorch, and Tensorflow. If not, you should complete the [Create machine learning models](#) learning path before starting this one.

Start >



Bookmark



Add to collection

<https://docs.microsoft.com/en-us/learn/paths/build-ai-solutions-with-azure-ml-service/>

Azure ML documentation

<https://docs.microsoft.com/en-us/azure/machine-learning/>



Microsoft | Docs Documentation Learn Q&A Code Samples

Search

Portal Free account

Azure / Machine Learning

Bookmark Edit Share

Filter by title

Azure Machine Learning Documentation

- Overview
 - What is Azure Machine Learning?
 - What is Azure Machine Learning studio?
 - Architecture & terms
- Tutorials
 - Python get started (Day 1)
 - 1. Set up local computer
 - 2. "Hello world"
 - 3. Train your model
 - 4. Bring your own data
 - Jupyter Notebooks
- Studio
 - Automated ML (UI)
 - Designer (drag-n-drop)
 - Label image data

Download PDF

Azure Machine Learning documentation

Learn how to train, deploy, & manage machine learning models, use AutoML, and run pipelines at scale with Azure Machine Learning. Tutorials, code examples, API references, and more show you how.

Get started: Code-first

TUTORIAL

- Get started tutorial (Python)
- Use Jupyter Notebooks tutorial
- Batch inference with ML pipelines (Python)
- Get started with R

Get started: Low or no code

OVERVIEW

- Azure Machine Learning studio
- What's automated ML (AutoML)?
- What's drag & drop designer?

TUTORIAL

- Get started (AutoML)
- Get started (designer)

REFERENCE

- Designer algorithms & modules

Bring your ML model to Azure

HOW-TO GUIDE

- Deploy your model to the cloud
- Track & deploy MLflow models

Deploy & manage models (MLOps)

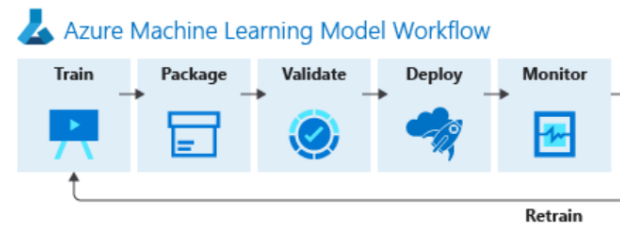
Azure ML Git

<https://github.com/Azure/MachineLearningNotebooks/>



Azure Machine Learning service example notebooks

This repository contains example notebooks demonstrating the [Azure Machine Learning](#) Python SDK which allows you to build, train, deploy and manage machine learning solutions using Azure. The AML SDK allows you the choice of using local or cloud compute resources, while managing and maintaining the complete data science workflow from the cloud.



Quick installation

```
pip install azureml-sdk
```

Read more detailed instructions on [how to set up your environment](#) using Azure Notebook service, your own Jupyter notebook server, or Docker.

How to navigate and use the example notebooks?

If you are using an Azure Machine Learning Notebook VM, you are all set. Otherwise, you should always run the [Configuration](#) notebook first when setting up a notebook library on a new machine or in a new environment. It configures your notebook library to connect to an Azure Machine Learning workspace, and sets up your workspace and compute to be used by many of the other examples.

Additional resources



Azure Machine Learning

<https://azure.microsoft.com/en-us/services/machine-learning-service/>

Pricing

<https://azure.microsoft.com/en-us/pricing/details/machine-learning-service/>

Concepts

<https://docs.microsoft.com/en-us/azure/machine-learning/service/concept-azure-machine-learning-architecture>

Forum

<https://social.msdn.microsoft.com/Forums/en-US/home?forum=AzureMachineLearningService>

Addin Visual Studio

<https://marketplace.visualstudio.com/items?itemName=ms-toolsai.vscode-ai#overview>

Power BI integration

<https://docs.microsoft.com/en-us/power-bi/service-machine-learning-automated>



Quiz time 1



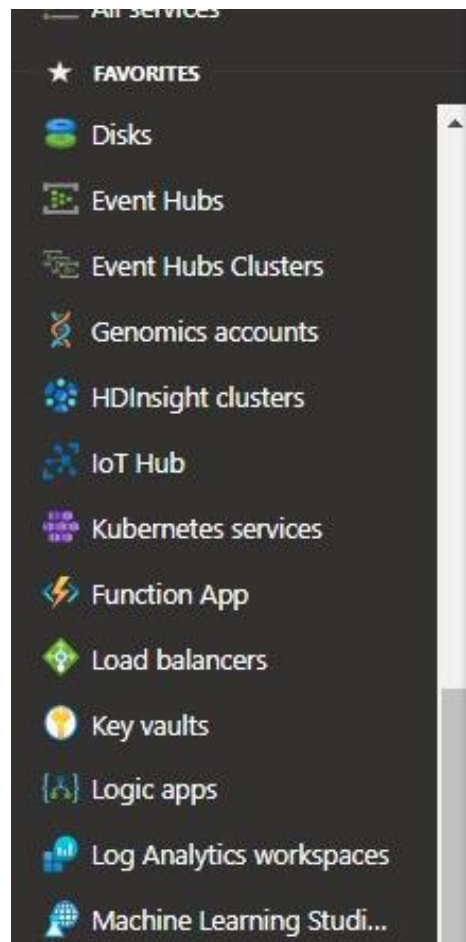


Hands-on lab

Workshop 2

Azure ML fundamentals

- Hands-on labs:
 1. Azure ML experimentations
 2. AutoML with Azure ML Python SDK
 3. Estimators with Azure ML Python SDK
 4. Interpretation & Fairness of ML models
 5. Hyperparameter tuning with Azure ML
 6. Model deployment



Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ

Microsoft Azure Internal Consumption

Resource group * ⓘ

(New) AMLworkshop-rg

[Create new](#)

Workspace details

Specify the name and region for the workspace.

Workspace name * ⓘ

AMLworkshop

Region * ⓘ

West Europe



For your convenience, these resources are added automatically to the workspace, if regionally available: [Azure Storage](#), [Azure Application Insights](#), [Azure Key Vault](#)

Prerequisites

1. An Azure ML workspace



Microsoft.MachineLearningServices | Overview



Deployment



Delete



Cancel



Redeploy



Refresh



Overview



Inputs



Outputs



Template



We'd love your feedback! →

Deployment is in progress



Deployment name: Microsoft.MachineLearningServices

Subscription: [Microsoft Azure Internal Consumption](#)

Resource group: [AMLworkshop-rg](#)

Start time: 16/11/2020 à 11:35:00

Correlation ID: a5d97661-2075-492f-a8b2-c729a6dce6e3



Deployment details [\(Download\)](#)

Resource	Type	Status	Operation details
amlworkshop7235867183	Microsoft.Insights/components	OK	Operation details
amlworkshop5296527961	Microsoft.KeyVault/vaults	OK	Operation details
amlworkshop1458610383	Microsoft.Storage/storageAccounts	Accepted	Operation details

Creation of the workspace

AMLworkshop

Machine Learning

Search (Ctrl+/)

Download config.json

Delete

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Events

Settings

Private endpoint connections

Properties

Locks

Monitoring

Alerts

Metrics

Diagnostic settings

Logs

Automation

Essentials

Workspace edition : Basic

Resource group : AMLworkshop-rg

Location : West Europe

Subscription : Microsoft Azure Internal Consumption

Subscription ID : 70b8f39e-8863-49f7-b6ba-34a80799550c

Studio web URL : <https://ml.azure.com/?tid=72f988bf-86f1-41af-91ab-2d7cd011db47&wsid=/subscriptions/70b8f39e-8863-49f7-b6ba-34a80799550c>

Storage : amlworkshop1458610383

Registry : ...

Key Vault : amlworkshop5296527961

Application Insights : amlworkshop7235867183

Manage your machine learning lifecycle

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

Launch studio

Getting started quickly

Join the community

Done.
We can access to the Azure ML Studio.

Automated ML

Designer

Assets

Datasets

Experiments

Pipelines

Models

Endpoints

Manage

Compute

Datastores

Data Labeling

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


Tutorials




What is Azure Machine Learning?




Train your first ML model with Notebook




Create, explore and deploy Automated ML experiments.



What is Azure Machine Learning designer?



What are compute targets in Azure Machine Learning?



Deploy models with Azure Machine Learning

[View all tutorials →](#)

Azure ML Studio

- + New
- Home
- Author
 - Notebooks
 - Automated ML
 - Designer
- Assets
 - Datasets
 - Experiments
 - Pipelines
 - Models
 - Endpoints
- Manage
 - Compute**
 - Datastores
 - Data Labeling

Compute

- Compute instances
- Compute clusters
- Inference clusters
- Attached compute



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](#)

Create

Prerequisites

2. Creation of a Compute Instance

Region ⓘ

westeurope

Virtual machine type ⓘ

☒ CPU ☐ GPU

Virtual machine size ⓘ

+ Add filter

Search by VM name...

Showing 63 VM sizes | Current selection: Standard_D12_v2

Total available quota: 155 cores ⓘ

	Name ↑	Category	Cores ⓘ	Available quota ⓘ	RAM	Storage	Cost ⓘ
<input type="radio"/>	Standard_D11_v2	Memory optimized	2	119 cores	14 GB	100 GB	\$0.19/hr
<input checked="" type="radio"/>	Standard_D12_v2	Memory optimized	4	119 cores	28 GB	200 GB	\$0.38/hr
<input type="radio"/>	Standard_D13_v2	Memory optimized	8	119 cores	56 GB	400 GB	\$0.76/hr
<input type="radio"/>	Standard_D14_v2	Memory optimized	16	119 cores	112 GB	800 GB	\$1.52/hr

Let's create a Compute instance for handling our Python notebooks.

- Virtual Machine
- Settings

Configure Settings

Configure compute instance settings for your selected virtual machine size.

Name	Category	Cores	Available quota	RAM	Storage	Cost/Hour
Standard_D12_v2	Memory optimized	4	119 cores	28 GB	200 GB	\$0.38/hr

Compute name * ⓘ 👁

instancenotebooksr

☐ Enable SSH access ⓘ

> Show advanced settings

Let's create a Compute instance for handling our Python notebooks. Please choose an unique name.



+ New

Home

Author

Notebooks

Automated ML

Designer

Assets

Datasets

Experiments

Pipelines

Models

Endpoints

Manage

Compute

AMLworkshop > Compute

Compute

Compute instances

Compute clusters

Inference clusters

Attached compute

+ New

Refresh

Start

Stop

Restart

Delete

View quota

Show all



Name	Status	Application URI	Virtual machine size	Created on ↓
instancenotebooksr	Creating		STANDARD_D12_V2	16 nov. 2020 11:38

Creation... Usually took between 3 to 4 minutes



New



Home

Author



Notebooks



Automated ML



Designer

Assets



Datasets



Experiments



Pipelines



Models



Endpoints

Manage



Compute

AMLworkshop > Compute

Compute

Compute instances

Compute clusters

Inference clusters

Attached compute



New

Refresh



Start



Stop



Restart



Delete



View quota

Show all

▼

Name	Status	Application URI	Virtual machine size	Created on ↓
instancenotebooksr	Running	JupyterLab Jupyter RStudio SSH	STANDARD_D12_V2	Nov 16, 2020 11:38 AM

The Compute instance is now running.

Files

Running

Clusters

AzureML Samples

Select items to perform actions on them.

Upload

New ▾


☐ 0 ▾  /

Name ▾

Last Modified

File size

☐  Users

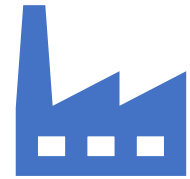
a minute ago

Let's access to Jupyter notebooks

Importing the workshop materials

All the materials are available here:

<https://github.com/retkowsky/AMLLabs>



Importing the workshop materials into your workspace

1. Go to the Notebooks section
2. Open a terminal windows
3. Run this command

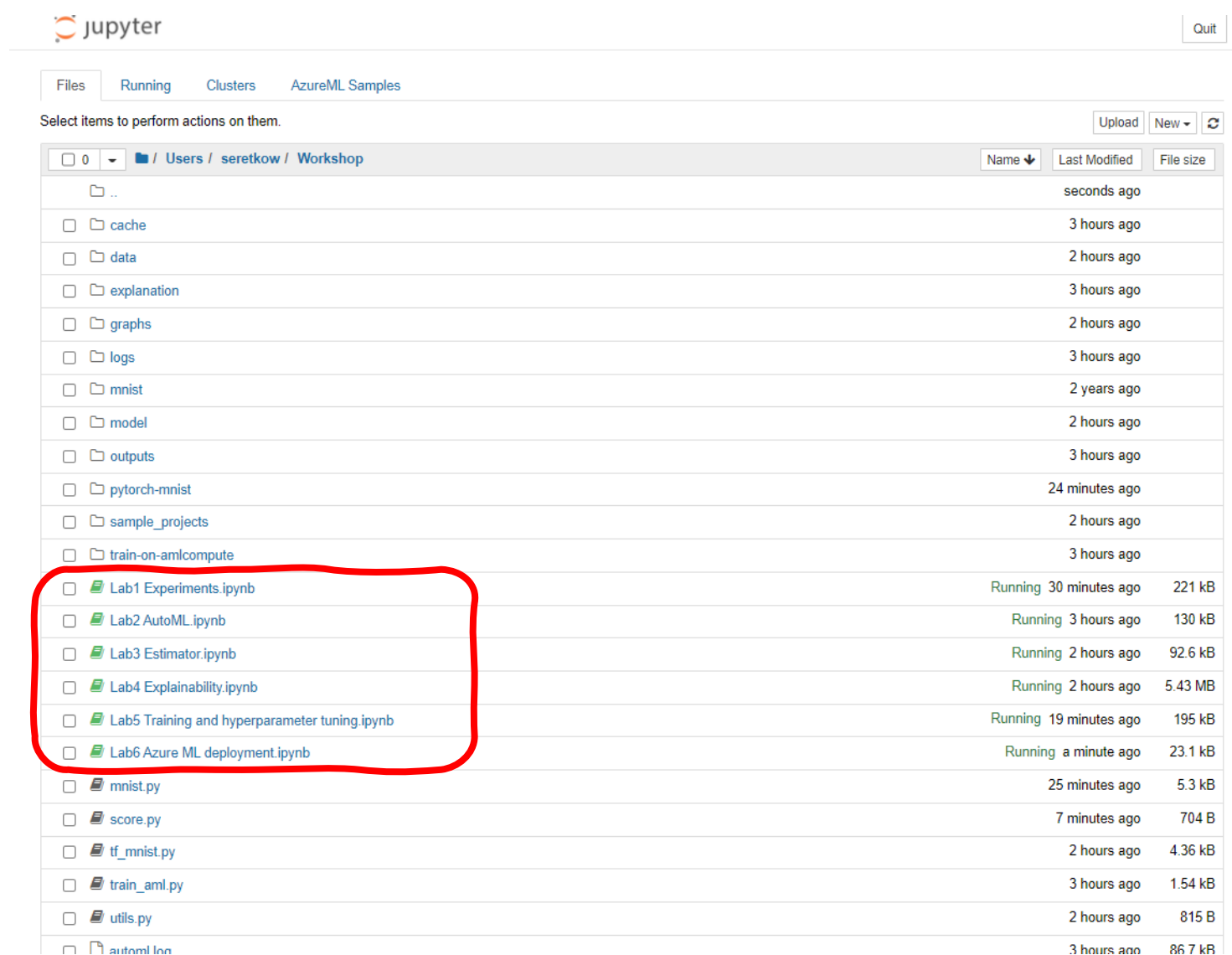
git clone https://github.com/retkowsky/AMLlabs

The screenshot displays the Microsoft Azure Machine Learning web interface. The top navigation bar is blue with the text "Microsoft Azure Machine Learning". The left sidebar contains a menu with options: "New", "Home", "Author", "Notebooks" (selected), "Automated ML", "Designer", "Assets", "Datasets", "Experiments", "Pipelines", "Models", "Endpoints", "Manage", "Compute", "Datastores", and "Data Labeling". The main content area shows the "Notebooks" section with a breadcrumb "AMLworkshop > Notebooks". Below this, there are tabs for "My files" and "Sample notebooks". The "My files" tab is active, showing a file tree with "User files" and "seretkow" (expanded) containing a "Workshop" folder. A terminal window is open in the foreground, titled "1:instancenotebooksr". The terminal displays the following text: "Welcome to Azure Machine Learning Terminal", "Type 'git clone [url]'' to clone a repo", "Type 'git --help' to learn about Git CLI", "Type 'az ml --help' to learn about Azure ML CLI", and the command "azureuser@instancenotebooksr:~/cloudfiles/code/Users/seretkow\$ git clone https://github.com/retkowsky/AMLlabs" followed by a cursor. The terminal's status bar shows "Compute: instancenotebooksr - Running".

Notebooks

All the notebooks and other files are imported into your compute instance.

You should have the files and we are going to use the Lab1, Lab2... Lab6 Jupyter notebooks.



The screenshot shows the JupyterLab interface with the 'Files' tab selected. The breadcrumb path is '/ Users / seretkow / Workshop'. A table lists the contents of the directory, including folders and notebooks. A red rectangle highlights a group of six Jupyter notebooks: 'Lab1 Experiments.ipynb', 'Lab2 AutoML.ipynb', 'Lab3 Estimator.ipynb', 'Lab4 Explainability.ipynb', 'Lab5 Training and hyperparameter tuning.ipynb', and 'Lab6 Azure ML deployment.ipynb'. All these notebooks are in a 'Running' state.

Name	Last Modified	File size
..	seconds ago	
cache	3 hours ago	
data	2 hours ago	
explanation	3 hours ago	
graphs	2 hours ago	
logs	3 hours ago	
mnist	2 years ago	
model	2 hours ago	
outputs	3 hours ago	
pytorch-mnist	24 minutes ago	
sample_projects	2 hours ago	
train-on-amlcompute	3 hours ago	
Lab1 Experiments.ipynb	Running 30 minutes ago	221 kB
Lab2 AutoML.ipynb	Running 3 hours ago	130 kB
Lab3 Estimator.ipynb	Running 2 hours ago	92.6 kB
Lab4 Explainability.ipynb	Running 2 hours ago	5.43 MB
Lab5 Training and hyperparameter tuning.ipynb	Running 19 minutes ago	195 kB
Lab6 Azure ML deployment.ipynb	Running a minute ago	23.1 kB
mnist.py	25 minutes ago	5.3 kB
score.py	7 minutes ago	704 B
tf_mnist.py	2 hours ago	4.36 kB
train_aml.py	3 hours ago	1.54 kB
utils.py	2 hours ago	815 B
automl.log	3 hours ago	86.7 kB

Workshop 2

Azure ML fundamentals

- Hands-on labs:
 1. Azure ML experimentations
 2. AutoML with Azure ML Python SDK
 3. Estimators with Azure ML Python SDK
 4. Interpretation & Fairness of ML models
 5. Hyperparameter tuning with Azure ML
 6. Model deployment

Lab 0

Azure ML settings

What we are going to see?

- We will create a notebook and create the connection with an Azure ML workspace.

What is the value?

- A workspace allows you to manage and share results, compute instances, compute clusters and much more...

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- Azure ML to connect to the workspace.

Lab 1

Azure ML experimentation

What we are going to see?

- We will see how to run a ML model into an Azure ML experiment.
- We will log some metrics during the run.

What is the value?

- Azure ML experiments allows you to save your Azure ML runs (outputs, logs, results...).

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- Use of the run.log command.

Lab 2

AutoML with Azure ML

What we are going to see?

- We will use the Azure ML AutoML using the Python SDK for classification problems.
- AutoML can be used as well for Regression and time series problems.
- An AutoML graphical user interface is available

What is the value?

- AutoML allows you to automatically identify the best pipeline using standard and open-source algorithm.

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- Use of the autoML method.

Lab 3

Estimators with Azure ML Python SDK using Compute Clusters



What we are going to see?

- We are going to use the scikit-learn estimator using Azure ML Python SDK.

What is the value?

- You can leverage all the scikit learn models using Azure ML.
- We can run the training process using Azure CPU or GPU resources.

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- Definition of a CPU compute cluster.



Quiz time 2





Pause (15 minutes)



Lab 4

Interpretation & Fairness of ML models

What we are going to see?

- We are going to evaluate what are the key variables of a ML model.

What is the value?

- We are able to identify the variables explanations of a ML model.
- Any model even an advanced model is not a black-box anymore.

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- The explainability features of Azure ML.

Lab 5

Hyperparameter tuning with Azure ML

What we are going to see?

- We will see how it is possible to do hyperparameter tuning from a deep learning model.

What is the value?

- It is easy to identify the best set of hyper parameter from a ML or a DL model.
- You will distribute the run using the Azure ML Hyperdrive class to minimize the training time.

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- Azure ML GPU compute instance.
- The Hyperdrive class.

Lab 6

Deploying a model with Azure ML

What we are going to see?

- We are going to see how to deploy a model into an Azure Container Instance for testing our model.
- For production purpose we can deploy our model into an Azure Kubernetes Service instance.

What is the value?

- Easy deployment of a ML model into Azure.
- We can expose our model into a wide range of technologies.

Azure resources used:

- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- An Azure Container instance for handling the deployed model.



Quiz time 3





Q&A





Microsoft Azure

Be future
ready

Build on
your terms

Operate hybrid
seamlessly

Trust
your cloud