

# Workshop Azure ML

## part2

04/03/2021

# Microsoft contacts

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Credits: Original version of deck by Serge Retkowsky [serge.retkowsky@microsoft.com](mailto: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, Jupiter 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/patterns/build-ai-solutions-with-azure-ml-service>

**ML with No Code / Low Code:**  
<https://docs.microsoft.com/en-us/learn/patterns/create-no-code-predictive-models-azure-machine-learning>

**ML at the Edge for IoT:**  
<https://docs.microsoft.com/en-us/learn/patterns/ai-edge-engineer>



# Workshop 1

## Azure ML fundamentals

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



# Workshop 2

## Azure ML fundamentals

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- 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

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- 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

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- 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

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

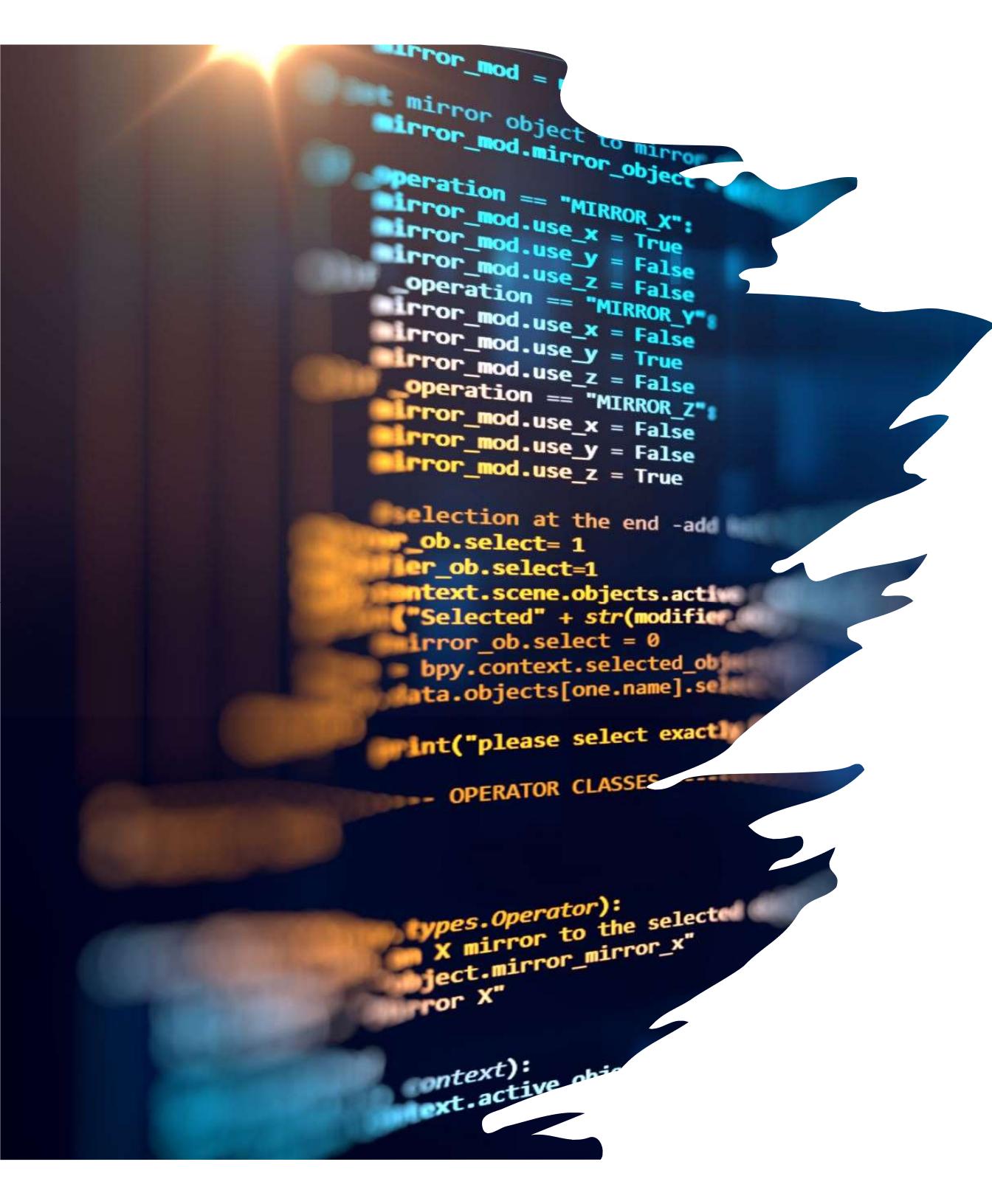


# Workshop 6

## Azure Databricks

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- 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  
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Prerequisites by Role

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Recommended Azure ML  
training on Microsoft  
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**ML with Code:**  
<https://docs.microsoft.com/en-us/learn/patterns/build-ai-solutions-with-azure-ml-service>

**ML with No Code / Low Code:**  
<https://docs.microsoft.com/en-us/learn/patterns/create-no-code-predictive-models-azure-machine-learning>

**ML at the Edge for IoT:**  
<https://docs.microsoft.com/en-us/learn/patterns/ai-edge-engineer>



# Reminder

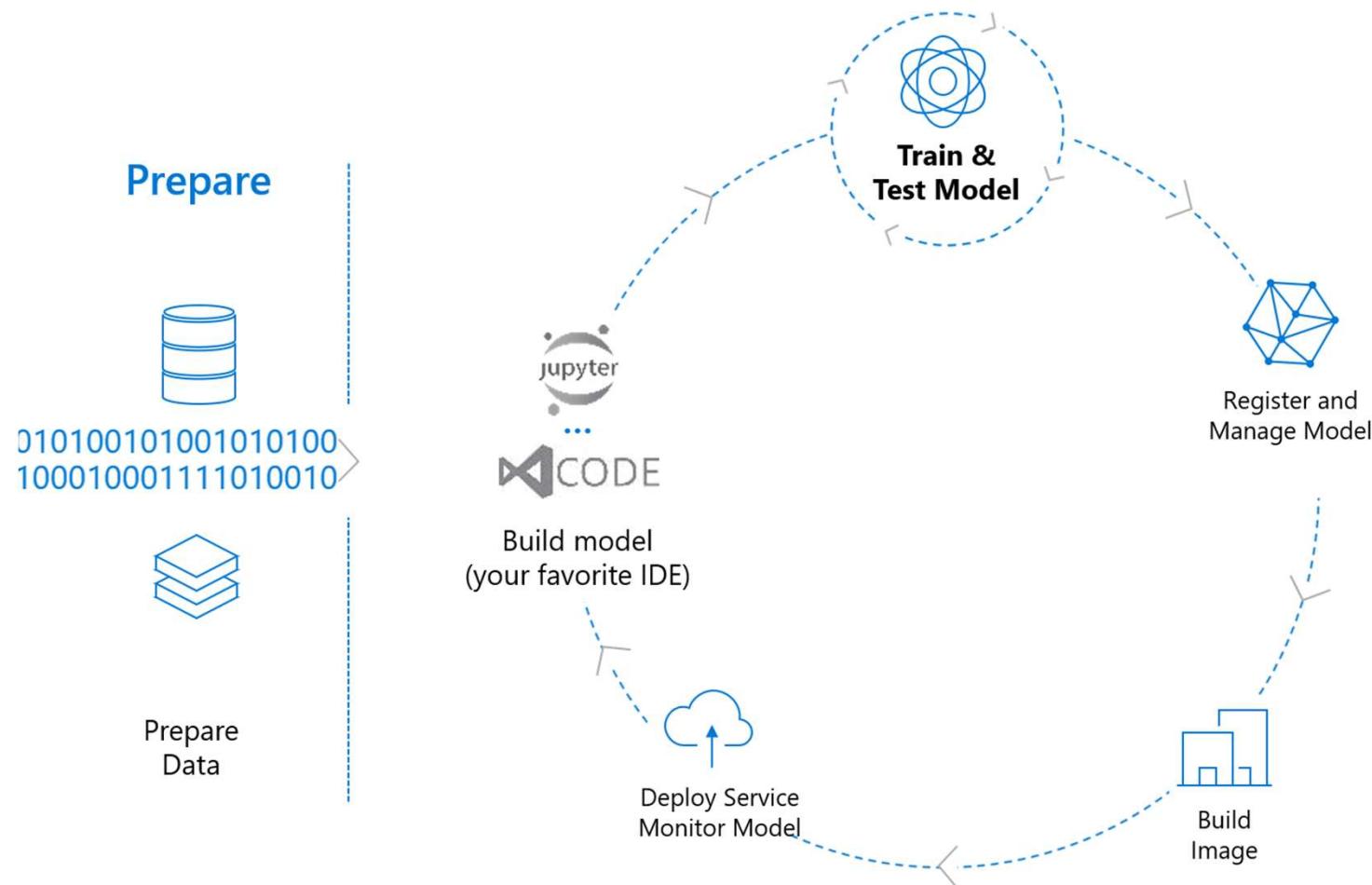
# Azure Machine Learning overview

# Machine Learning

Typical E2E Process



Azure Machine Learning



# Azure Machine Learning



Azure Machine Learning

**Set of Azure  
Cloud Services**



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

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That enables you to:

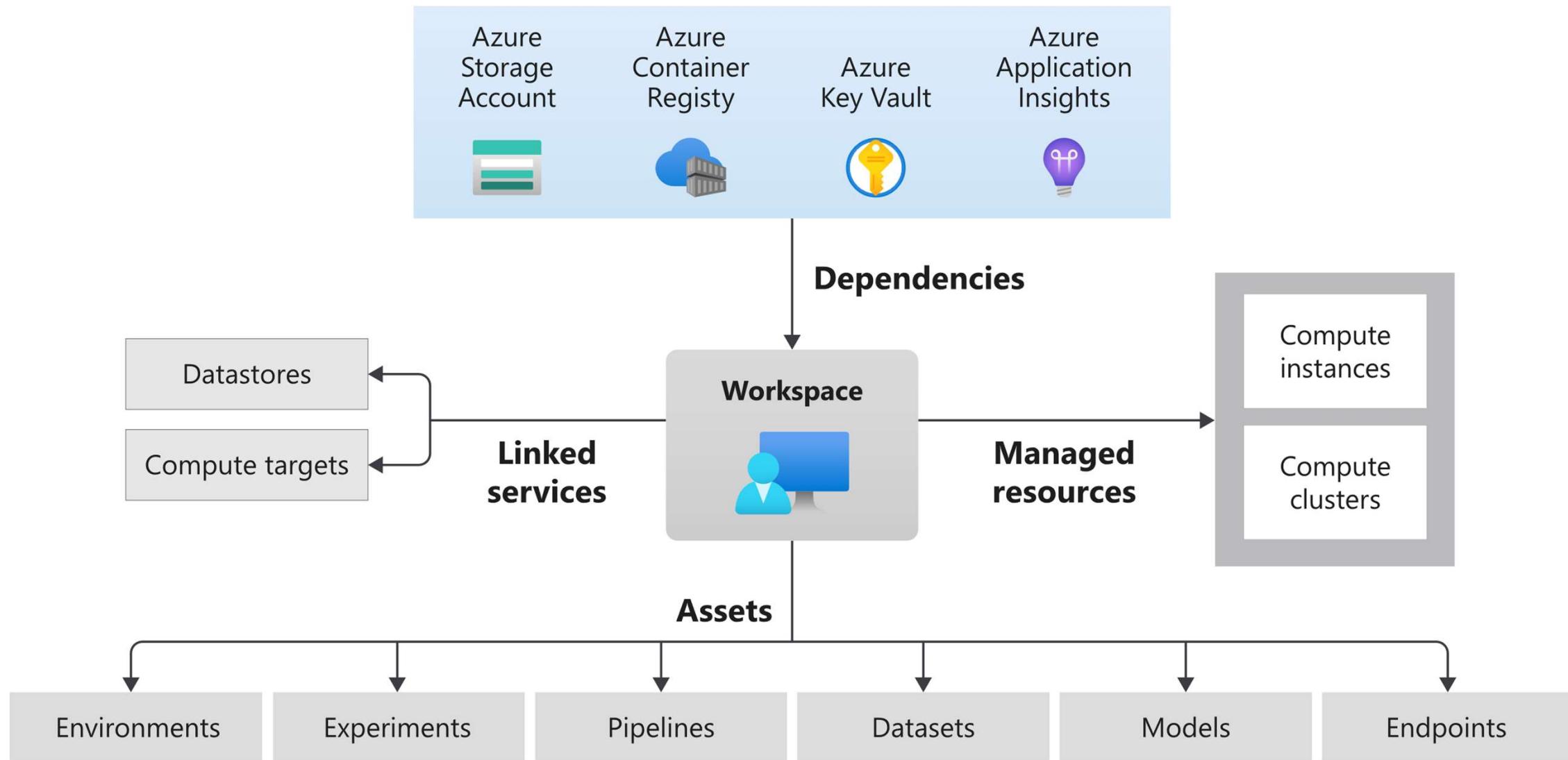
- ✓ Prepare Data
- ✓ Build Models
- ✓ Train Models

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

# Azure Machine Learning



Azure Machine Learning





Azure Machine Learning

# Azure ML Studio

## For all skill levels studio web experience

The screenshot shows the Azure ML Studio home page. On the left is a vertical navigation menu:

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

The main content area has a blue header bar with the text "workshop-aml-2020 > Home". Below it is a "Welcome to the studio!" message. There are four main cards:

- Create new** (with a plus icon) - Description: "Code with Python SDK and run sample experiments." - Button: "Start now"
- Notebooks** (with a notebook icon) - Description: "Code with Python SDK and run sample experiments." - Button: "Start now"
- Automated ML** (with a lightning bolt icon) - Description: "Automatically train and tune a model using a target metric." - Button: "Start now"
- Designer** (with a three-dot grid icon) - Description: "Drag-and-drop interface from prepping data to deploying models." - Button: "Start now"

Below these cards is a section titled "My recent resources" with a "Runs" table:

Run number	Experiment	Updated time	Status
2	workshop5-amlcompute	Feb 18, 2020 2:56 PM	Completed

On the right side, there is a "Compute" section with a table:

Name
AKSML



# Azure ML Studio

shwinneworkshop > Experiments > keras-mnist

## keras-mnist

Switch to old experience ?

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

(i) 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

Status	Count
Running	0
Completed	20
Failed	0
Other	5

Accuracy

Min(Loss)

Loss

Accuracy

Min(Loss)

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	0.998600011364619
Run 24	Completed	2m 50s	gpu-cluster	Script	0.0062801566226492545	0.998750011424224
Run 23	Completed	2m 33s	gpu-cluster	Script	0.28901339417672905	0.9698499940832456



Azure Machine Learning

# Microsoft Learn Azure ML training



## Build AI solutions with Azure Machine Learning

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

10800 XP

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

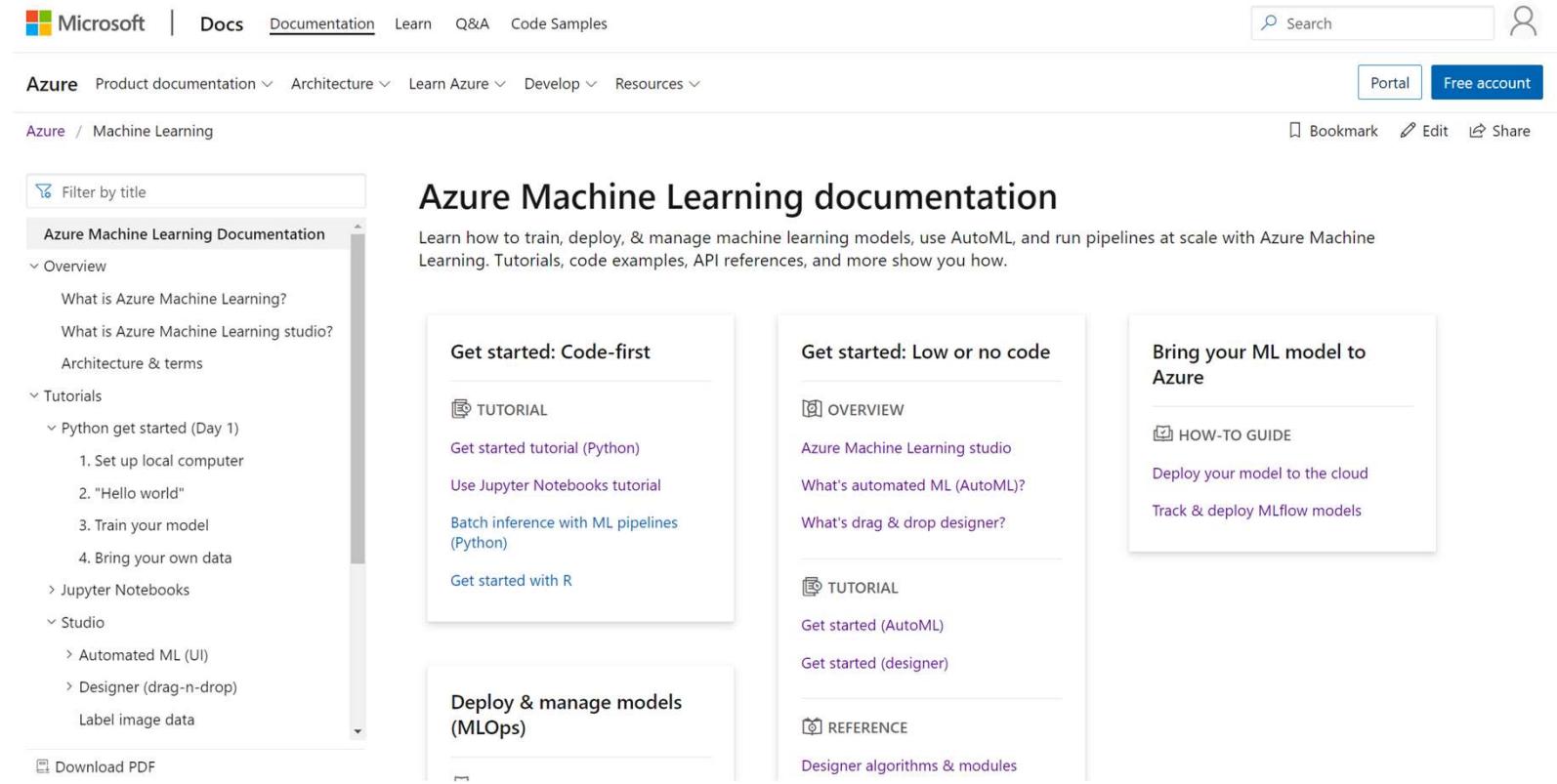
<https://docs.microsoft.com/en-us/learn/patterns/build-ai-solutions-with-azure-ml-service/>



Azure Machine Learning

# Azure ML documentation

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



The screenshot shows the Microsoft Docs interface for the Azure Machine Learning documentation. At the top, there's a navigation bar with links for Microsoft, Docs, Documentation (which is underlined), Learn, Q&A, and Code Samples. To the right are search, portal, free account, bookmark, edit, and share buttons. The main content area has a title "Azure Machine Learning documentation" with a subtext about training, deploying, and managing models. It features three main sections: "Get started: Code-first", "Get started: Low or no code", and "Bring your ML model to Azure". Each section contains links to various tutorials and guides.

Microsoft | Docs Documentation Learn Q&A Code Samples

Search

Portal Free account

Bookmark Edit Share

## 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)

### Deploy & manage models (MLOps)

- REFERENCE Designer algorithms & modules

### Bring your ML model to Azure

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



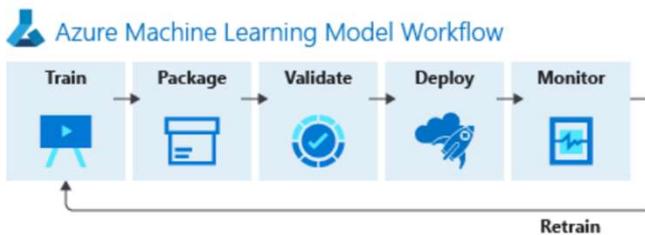
Azure Machine Learning

# Azure ML Git

[https://github.com/Azure/Machine LearningNotebooks/](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>

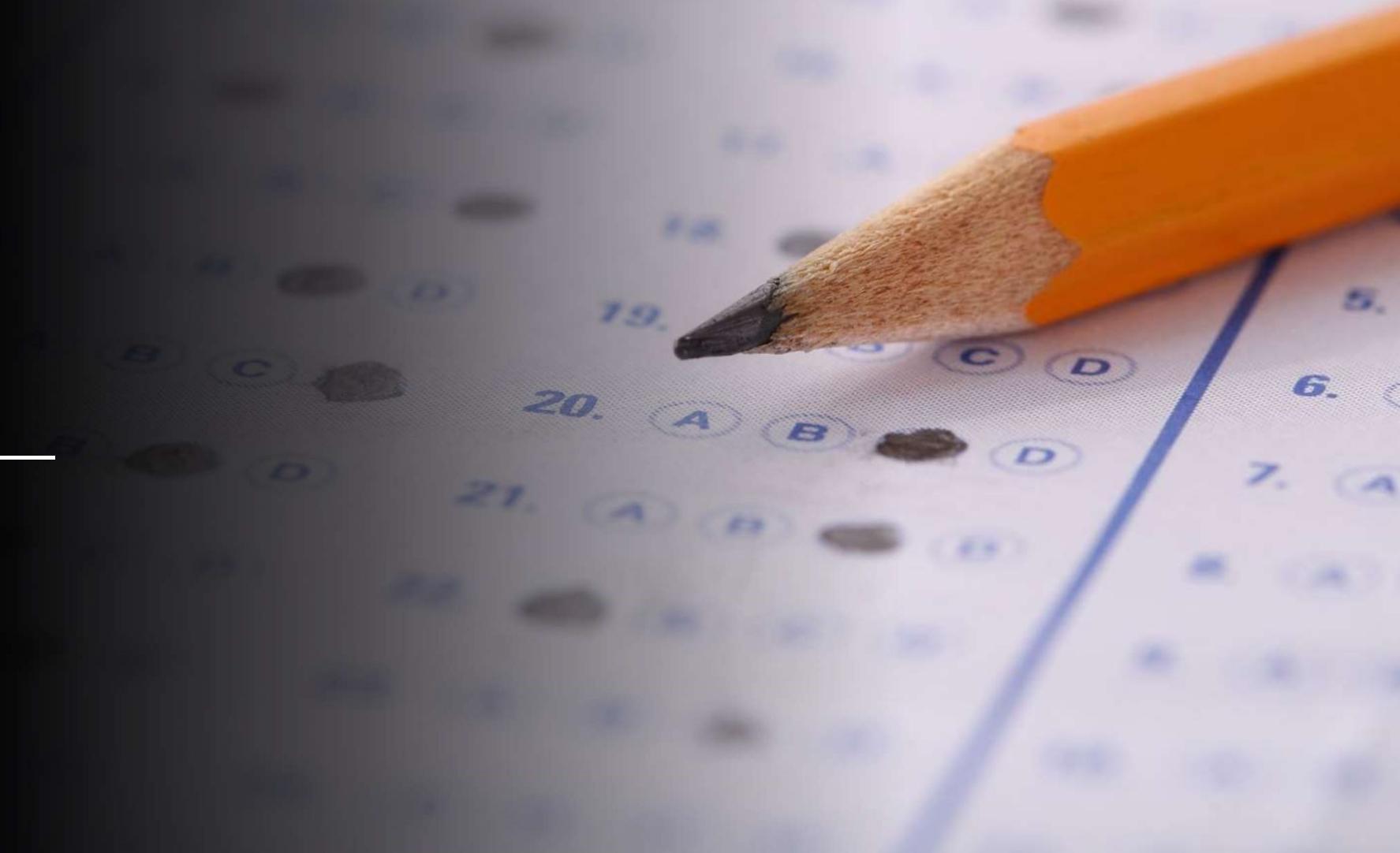
Power BI integration

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



# Quiz time 1

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# Hands-on lab



# Workshop 2

## Azure ML fundamentals

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- 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

ALL SERVICES

★ FAVORITES

- Disks
- Event Hubs
- Event Hubs Clusters
- Genomics accounts
- HDInsight clusters
- IoT Hub
- Kubernetes services
- Function App
- Load balancers
- Key vaults
- Logic apps
- Log Analytics workspaces
- Machine Learning Studio...

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

**i** For your convenience, these resources are added automatically to the workspace, if regionally available: Azure Storage, Azure Application Insights, Azure Key Vault

This screenshot shows the 'Create a workspace' step in the Azure Machine Learning service. On the left is a sidebar with various service icons. The main area has two sections: 'Project details' and 'Workspace details'. In 'Project details', users can select a subscription (set to 'Microsoft Azure Internal Consumption') and a resource group ('(New) AMLworkshop-rg'). Below that is a note about automatically adding resources like storage and application insights. In 'Workspace details', users specify the workspace name ('AMLworkshop') and region ('West Europe').

# Prerequisites

## 1. An Azure ML workspace

Dashboard >

## Microsoft.MachineLearningServices | Overview

Deployment

Search (Ctrl+ /)



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	<a href="#">Operation details</a>
amlworkshop5296527961	Microsoft.KeyVault/vaults	OK	<a href="#">Operation details</a>
amlworkshop1458610383	Microsoft.Storage/storageAccounts	Accepted	<a href="#">Operation details</a>

# Creation of the workspace

**AMLworkshop** 

Machine Learning

Search (Ctrl+ /)  

 Overview

 Activity log

 Access control (IAM)

 Tags

 Diagnose and solve problems

 Events

 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=/subscr>  
Storage : amlworkshop1458610383  
Registry : ...  
Key Vault : amlworkshop5296527961  
Application Insights : amlworkshop7235867183

Settings

 Private endpoint connections

 Properties

 Locks

Monitoring

 Alerts

 Metrics

 Diagnostic settings

 Logs

Automation

**Manage your machine learning lifecycle**

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



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

Virtual machines

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

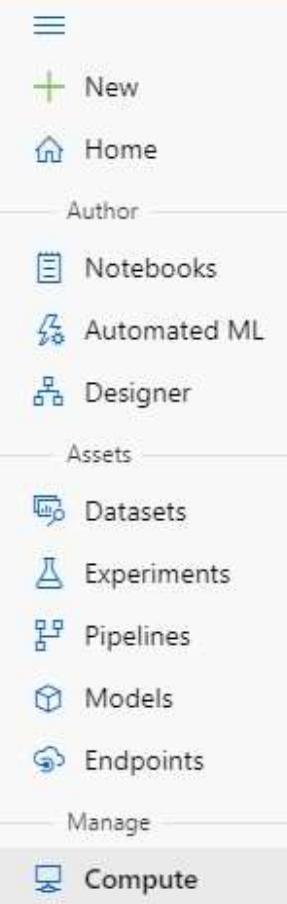
Compute name \* (i)



Enable SSH access (i)

> Show advanced settings

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



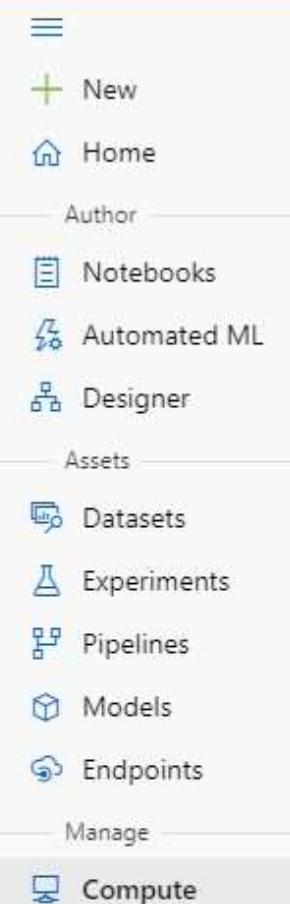
## Compute

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



## 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.



Quit

Files

Running

Clusters

AzureML Samples

Select items to perform actions on them.

Upload

New ▾



0



/

Name ▾

Last Modified

File size

Users

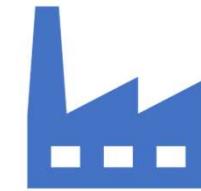
a minute ago

Let's access to Jupyter notebooks

# Importing the workshop materials

All the materials are available here:

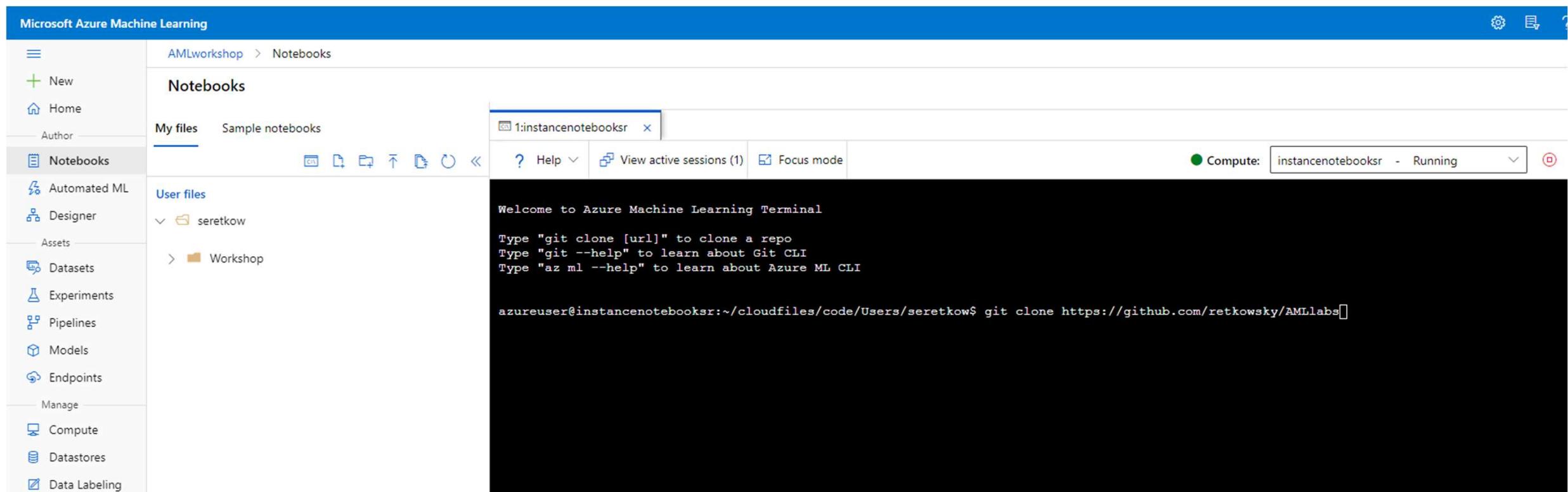
<https://github.com/orcelik/AMLlabs>



# Importing the workshop materials into your workspace

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

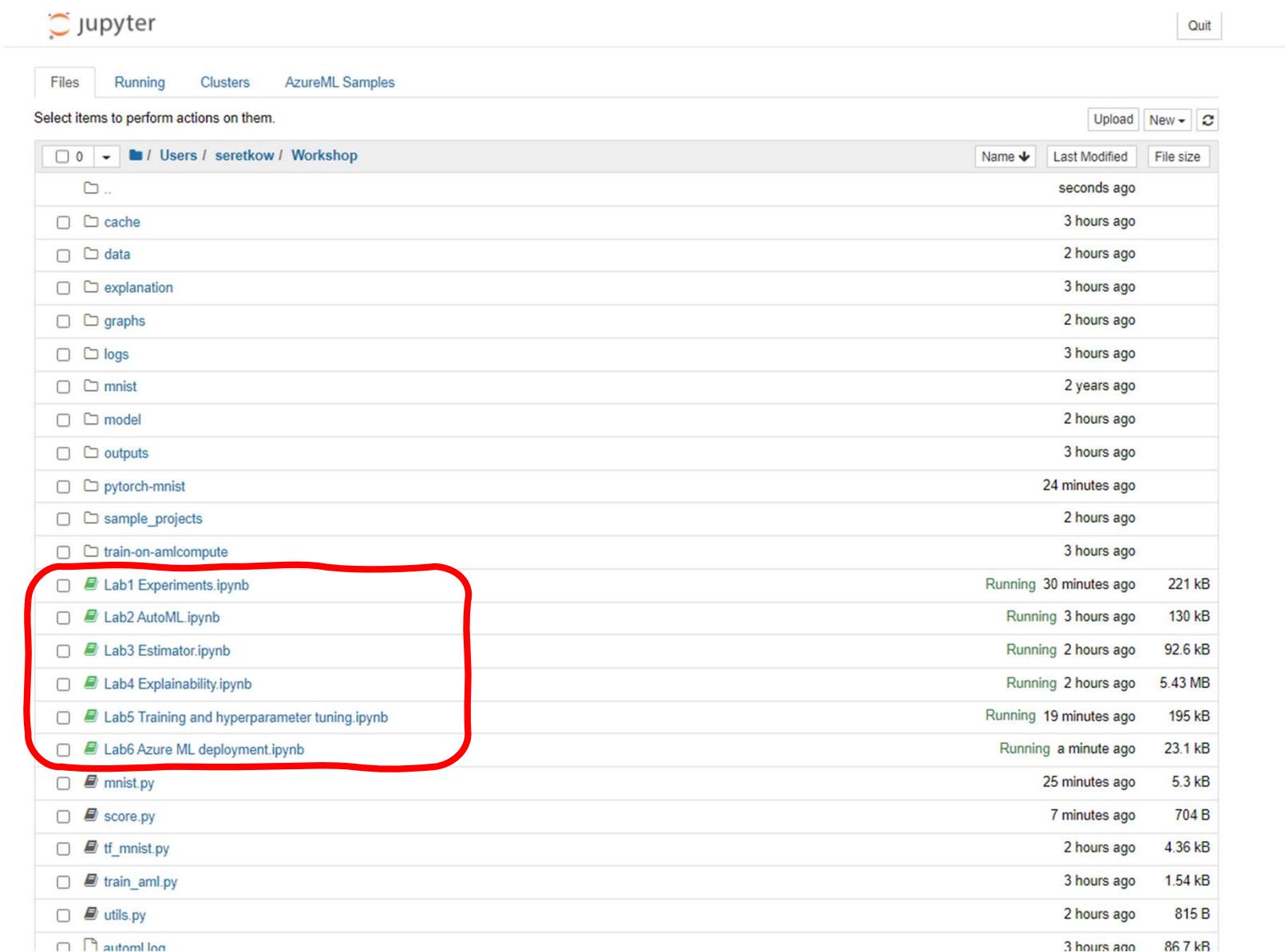
**git clone https://github.com/orcelik/AMLlabs**



# 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.





# 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
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# Lab 0

## Azure ML settings



Azure Machine Learning

### 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



Azure Machine Learning

## 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



Azure Machine Learning

### 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



Azure Machine Learning

### 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.

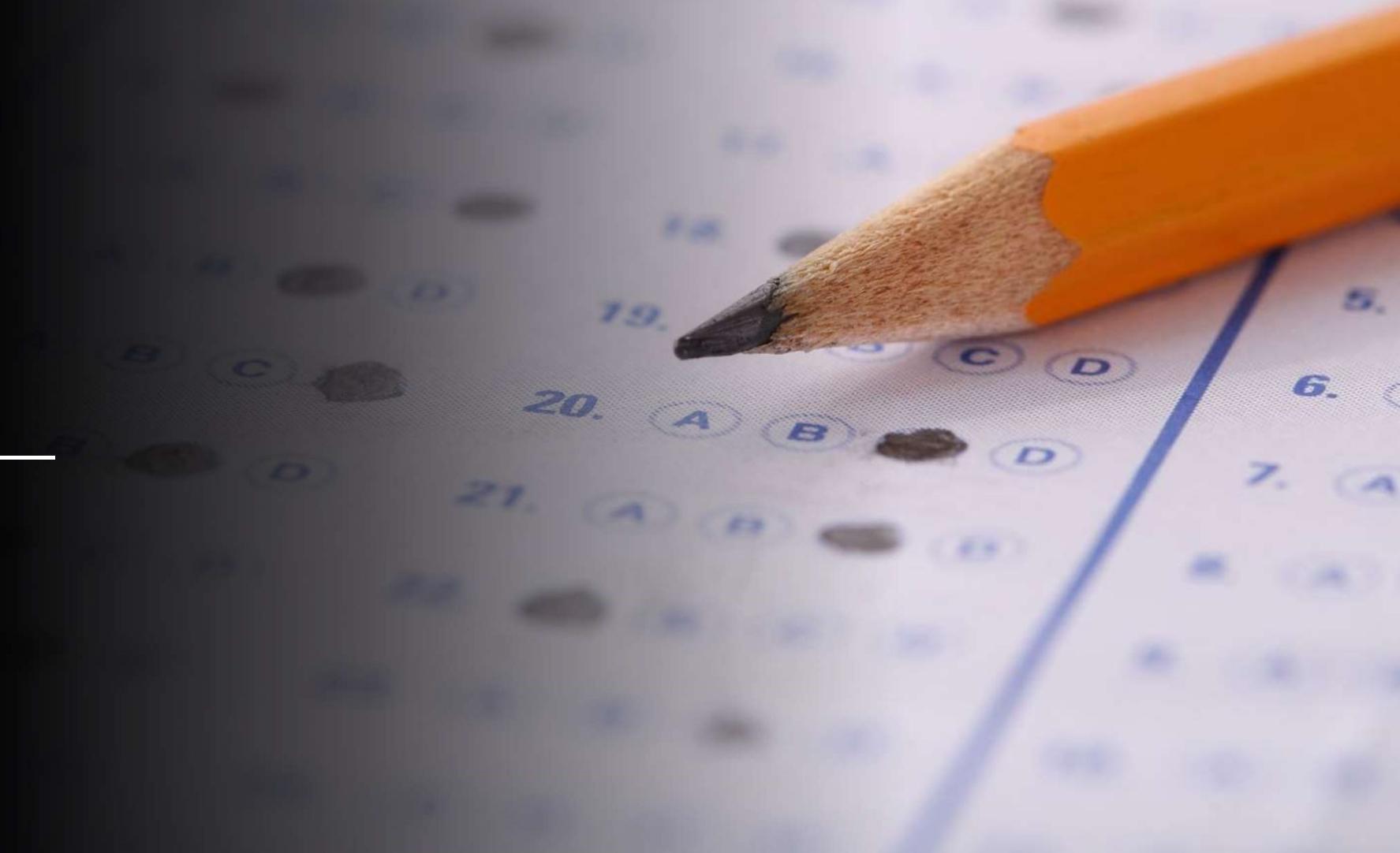
### Azure resources used:

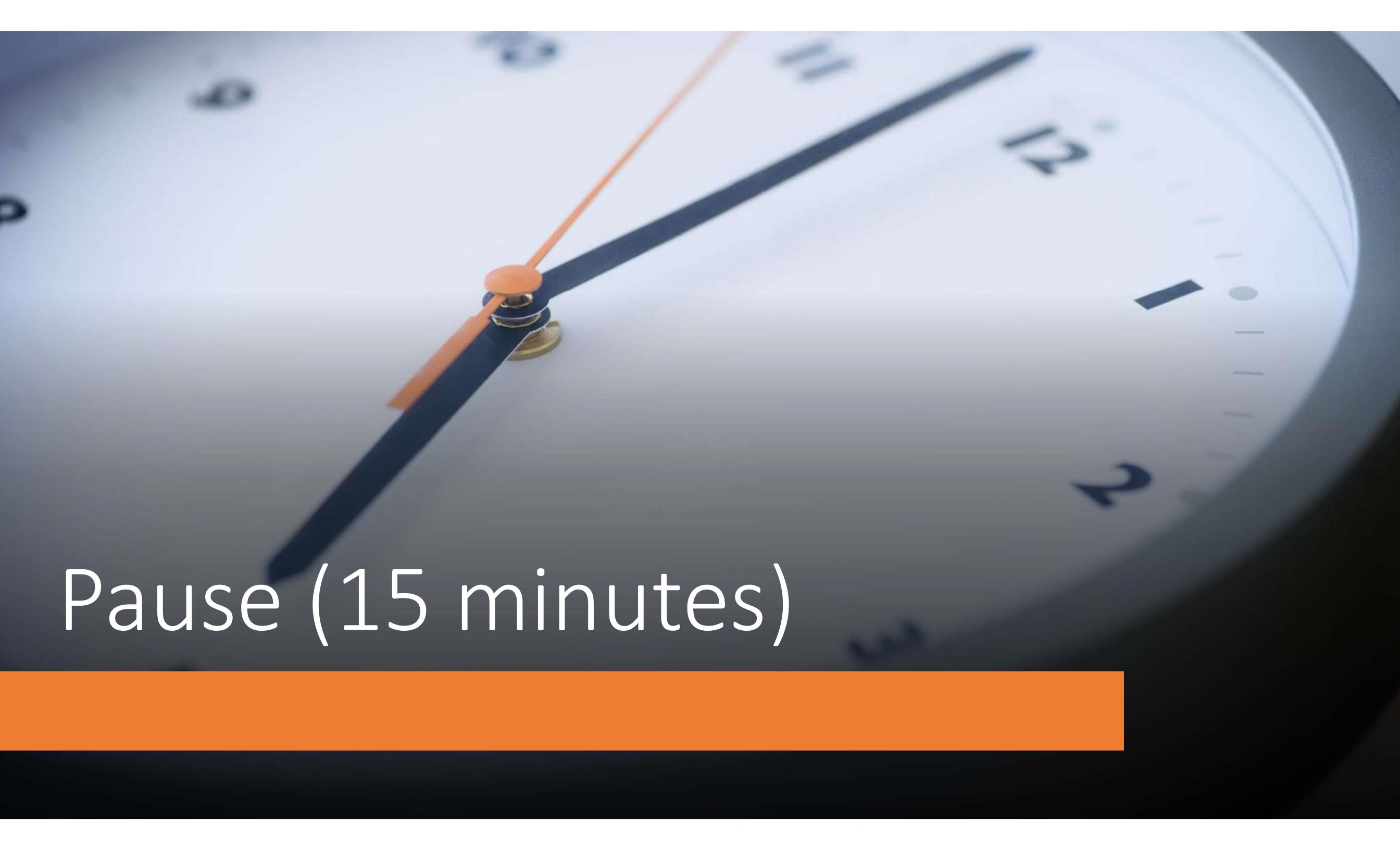
- An Azure ML workspace.
- An Azure ML Compute instance for handling your Jupyter notebook.
- Definition of a CPU compute cluster.



## Quiz time 2

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A close-up photograph of a clock face, likely from a smartphone. The clock has a white face with black Arabic numerals at 12, 3, 6, and 9. The hour hand is dark blue/black and the minute hand is orange. The second hand is also orange. The background is dark, and the lighting highlights the metallic case of the phone and the clock's face.

Pause (15 minutes)

# Lab 4

# Interpretation & Fairness of ML models



Azure Machine Learning

## 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



Azure Machine Learning

### 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



Azure Machine Learning

### 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.

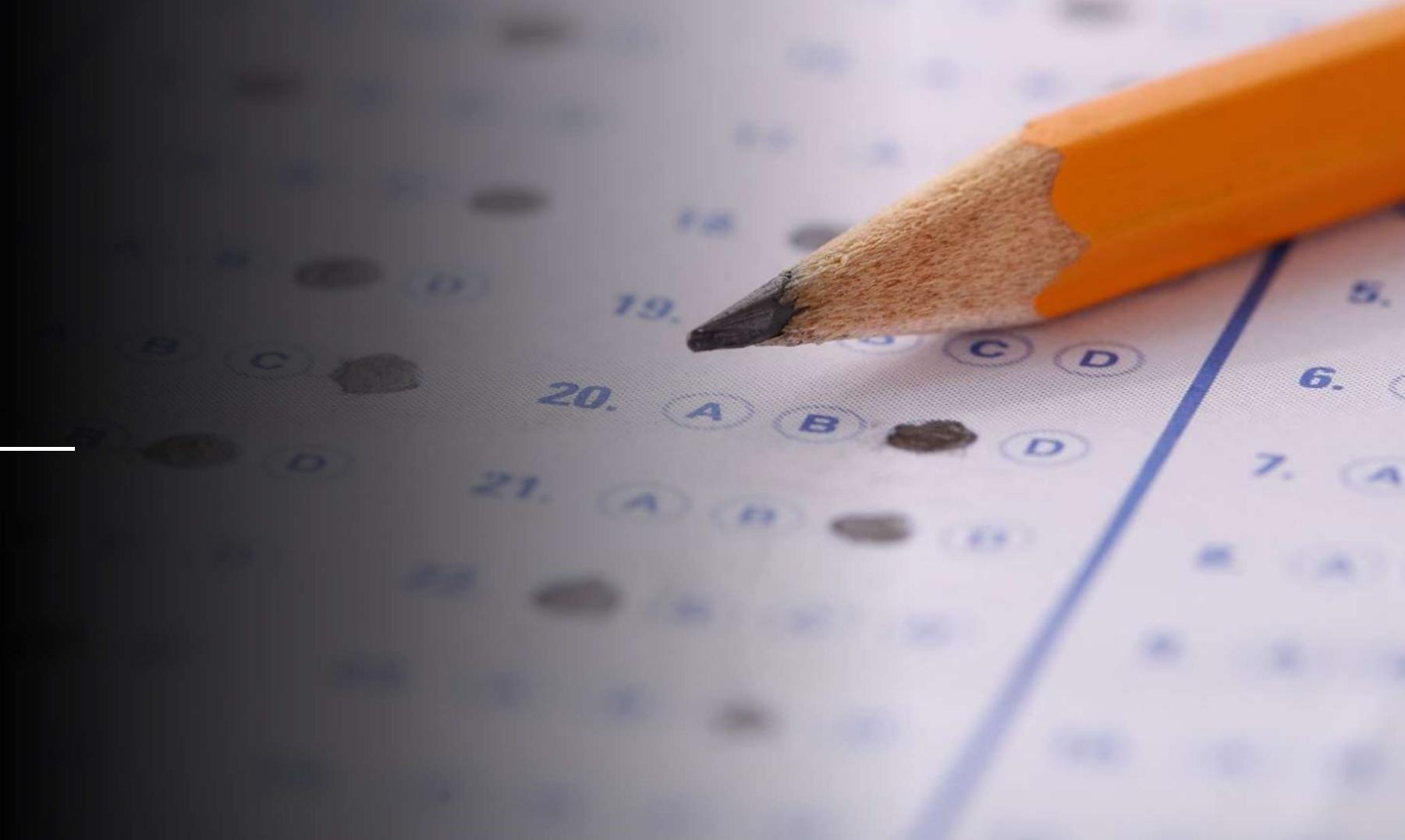
### Azure resources used:

- 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

---

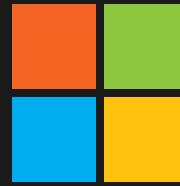




## Q&A

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# Microsoft Azure

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Be future  
ready

Build on  
your terms

Operate hybrid  
seamlessly

Trust  
your cloud