



Customer

Azure ML No-Code workshop

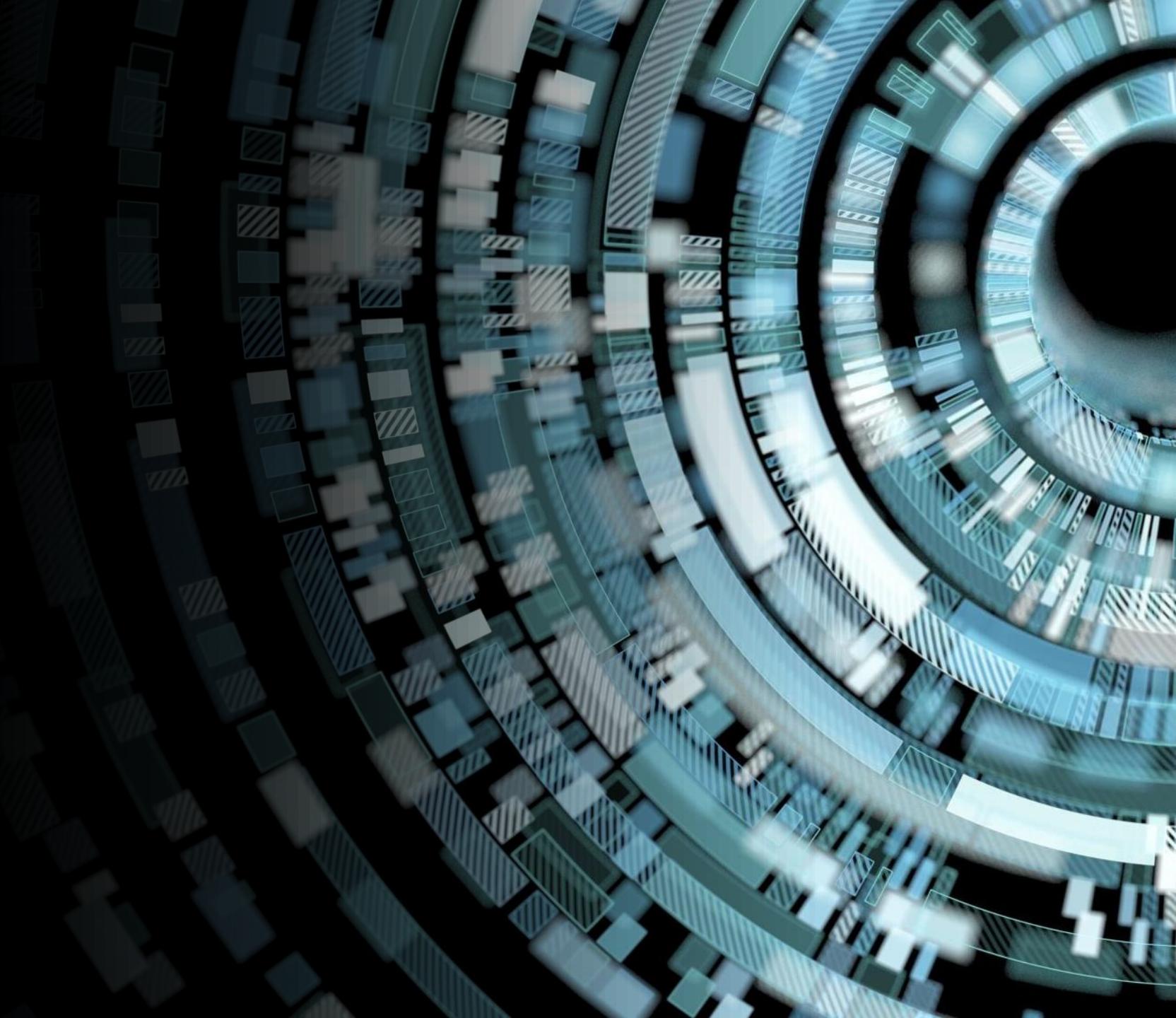
Date



Microsoft contacts

Serge Retkowsky

serge.retkowsky@microsoft.com





Program overview

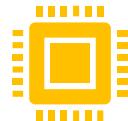
Workshop Prerequisites



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



Recommended Azure ML
training on Microsoft
Learn

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

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

- 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



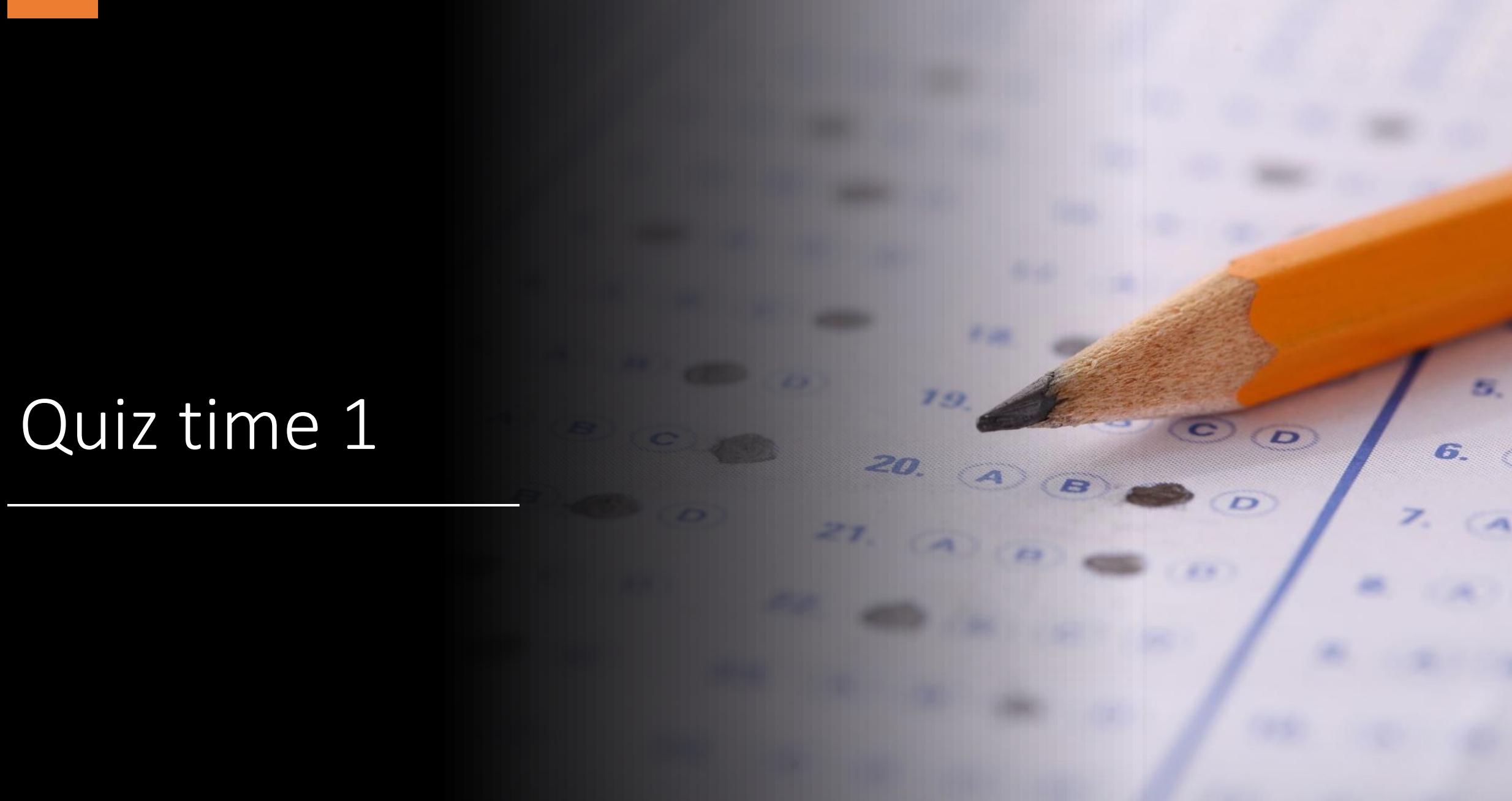
Open Q&A about the last workshop

Reminder

Workshop materials are available here:
<https://github.com/retkowsky/AMLlabs>



Quiz time 1





Azure ML

“No-Code” visual interfaces

Bring AI to Everyone



End Users



Analysts



Data/BI Professionals



Today's workshop



Professional Data Scientists

Natural Language exploration
Explore influencers

Capabilities:
Quick Insights
Q&A



Out of box AI in PQ
One-click AI transformations
PQ integration for Azure ML
Consume **pre-built models**

Capabilities:
Sentiment analysis
Key phrase extraction
OCR, Text Translations
Integration Azure ML



Generate **ML models in clicks**

Capabilities:
Predictions: Classification,
Regression, Forecasting



Create ML model via powerful visual **drag-and-drop/step-by-step** where no coding is necessary

Integration:
Power BI
MLOps



Automated ML (UI)

Azure ML Designer

Azure Machine Learning Service



Bots

Cognitive Services (PBI)

PowerBI

Office 365 and Power Platform (Power BI, PowerApps, Flow)

Notebook VMs / Python IDE

Azure Databricks



AutoML



Azure Machine Learning

**1) AutoML with Azure ML
using “no-code” interface**

Model Creation Is Typically Time-Consuming

	Which features?	Which algorithm?	Which parameters?	
Mileage	Gradient Boosted	Parameter 1		
Condition	Nearest Neighbors	Parameter 2		
Car brand	SVM	Parameter 3		
Year of make	Bayesian Regression	Parameter 4		
Regulations	LGBM	...		
...	...	Criterion		
		Loss		
		Min Samples Split		
		Min Samples Leaf		
		Others		

30%
Model

Model Creation Is Typically Time-Consuming

Which features?

Mileage
Condition
Car brand
Year of make
Regulations
...

Which algorithm?

Gradient Boosted
Nearest Neighbors
SVM
Bayesian Regression
LGBM
...

Which parameters?

Neighbors
Weights
Min Samples Split
Min Samples Leaf
Others

30%
Model



Model Creation Is Typically Time-Consuming

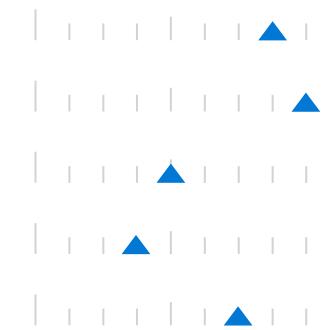
Which features?



Which algorithm?



Which parameters?



30%

15%

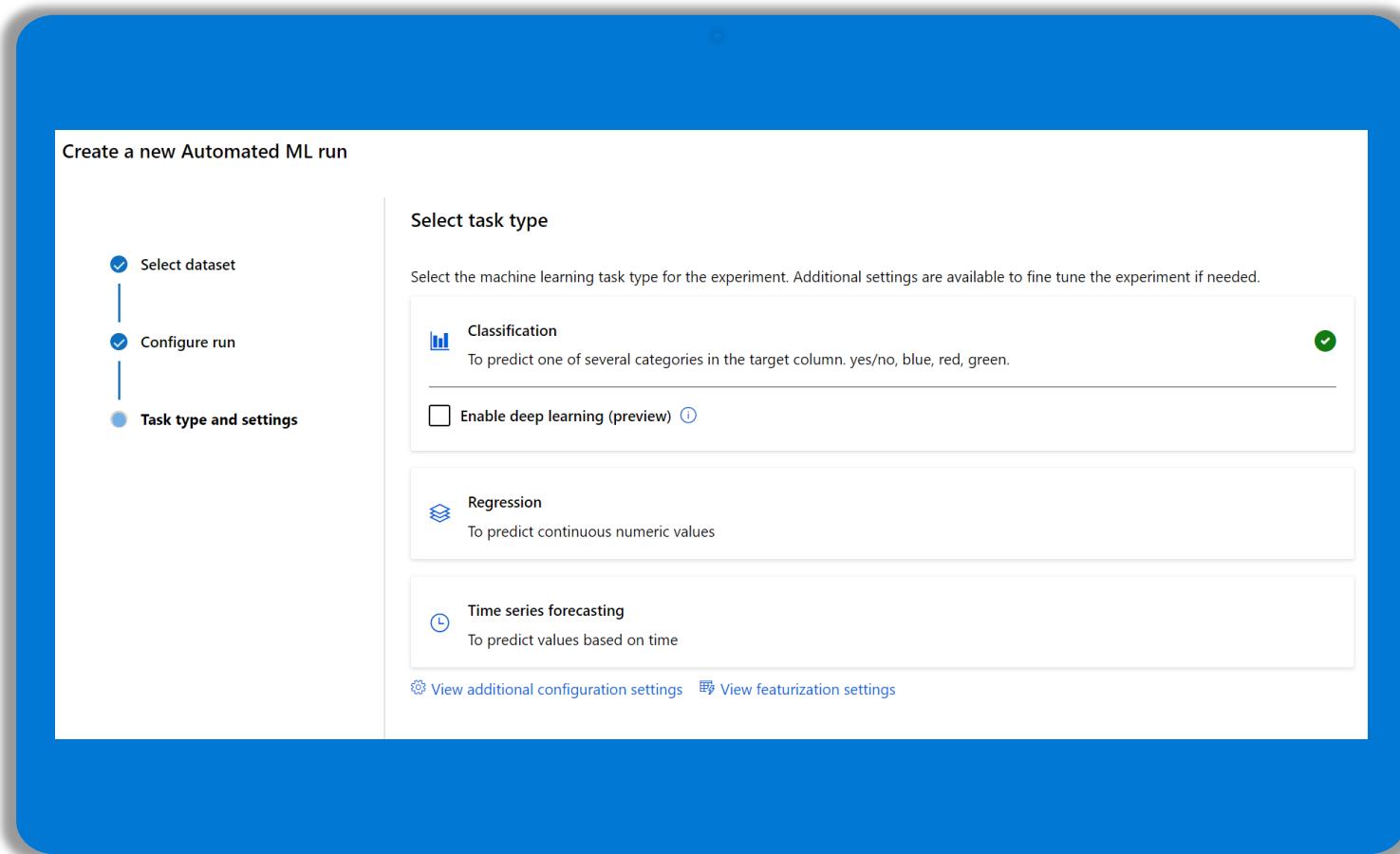
Iterate

*What if we can simplify
machine learning?*

Automated ML with Azure ML



- Automatically build and deploy predictive models using the no-code UI or through a code-first notebooks experience.
- Increase productivity with easy data exploration and profiling and with intelligent feature engineering.
- Easily create accurate models customized to your data and refined by a wide array of algorithms and hyperparameters.
- Build responsible AI solutions with model interpretability and fine-tune your models to improve accuracy.
- Available with No-Code UI and with the Azure ML SDK.



Azure No-Code AutoML

Automated ML with Azure



Let's access to the Automated ML user interface for AutoML with zero code:

Screenshot of the Microsoft Azure Machine Learning studio interface.

The left sidebar shows navigation options: New, Home, Author, Notebooks, **Automated ML** (highlighted with a red box), Designer, Assets, Datasets, Experiments, Pipelines, Models, Endpoints, Manage, Compute, Datastores, and Data Labeling.

The main area displays the "Azure Machine Learning studio" dashboard with three cards:

- Create new** (with a plus icon)
- Notebooks** (with a document icon): "Code with Python SDK and run sample experiments." Includes a "Start now" button.
- Automated ML** (with a lightning bolt icon): "Automatically train and tune a model using a target metric." Includes a "Start now" button. This card is also highlighted with a red box.
- Designer** (with a cluster icon): "Drag-and-drop interface from prepping data to deploying models." Includes a "Start now" button.

Below the dashboard, there are sections for "My recent resources" (Runs and Compute) and "Compute" (listing existing resources).

Runs table:

Run	Run ID	Experiment	Status	Submitted time	Submitted by	Run type
Run 186	AutoML_bee7d619-b1fd...	AutoMLC...	Completed	Nov 23, 2020 4:42 PM	Serge Retko...	Automated...
Run 1	dataset_120aa8bb-5dff...	dataset_p...	Completed	Nov 23, 2020 4:33 PM	Serge Retko...	Script
Run 122	AutoML_fa9ddbe1-ed2d...	AutoMLC...	Completed	Nov 23, 2020 3:45 PM	Serge Retko...	Automated...
Run 62	AutoML_080ee330-93d...	AutoMLC...	Completed	Nov 23, 2020 2:54 PM	Serge Retko...	Automated...
Run 5	AutoML_c02d7caa-0312...	AutoMLC...	Completed	Nov 23, 2020 2:17 PM	Serge Retko...	Automated...

Compute table:

Name	Type	Provisioning state	Created on
automl	Machine Learning com...	✓ Succeeded (4 nodes)	Nov 23, 2020 1:54 PM
instanceeaksmodel	Kubernetes service	✓ Succeeded	Nov 19, 2020 1:20 PM
Designer	Machine Learning com...	✓ Succeeded (0 nodes)	Nov 19, 2020 11:34 AM
clusterCPU	Machine Learning com...	✓ Succeeded (0 nodes)	Nov 19, 2020 11:29 AM
notebookinstanceup	Compute instance	✓ Succeeded	Nov 19, 2020 11:11 AM

Automated ML with no-code



automl_ws > Automated ML (preview) > new-experiment > Run 1

Run 1 Running

⟳ Refresh ✖ Cancel

Details Data guardrails Models Outputs + Logs Child runs Snapshot

Properties	
Status	Running
Created	Jul 7, 2020 4:37 PM
Compute target	automl-compute
Run ID	AutoML_badd2cb1-c415-44c2-b0a8-1e6ee55fd8b8
Run number	1
Script name	--
Created by	Nina Baccam
Input datasets	Input name: input_data, 5f9ae693-c4cc-4f14-97ae- ID: 442ec7297840
Output datasets	

Run summary

Task type
Classification View all run settings

Primary metric
AUC weighted

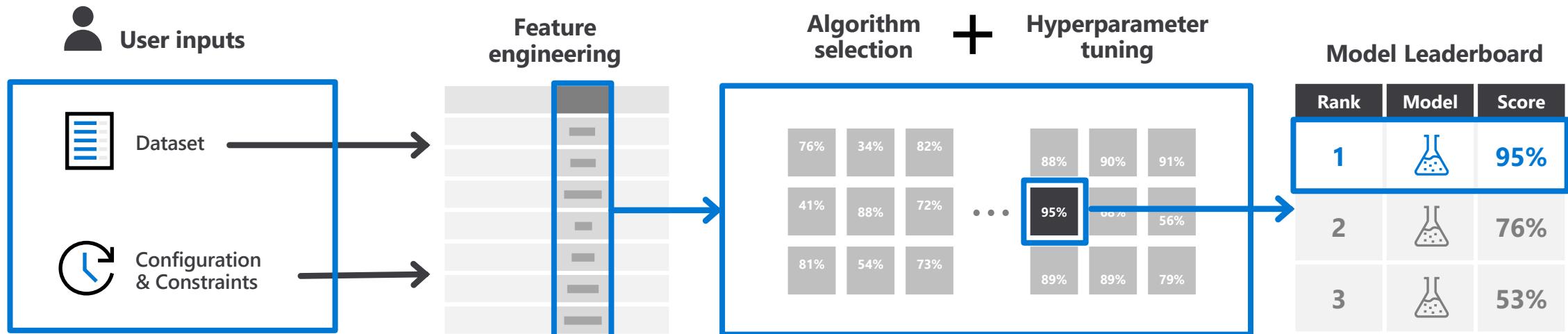
Run status
Running

Experiment name
new-experiment

Automated ML – How it works?



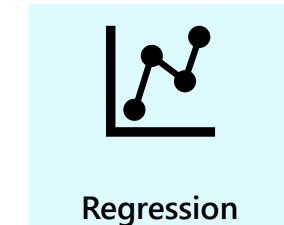
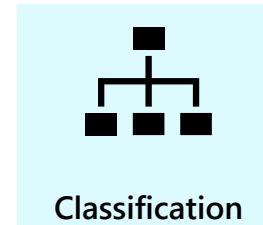
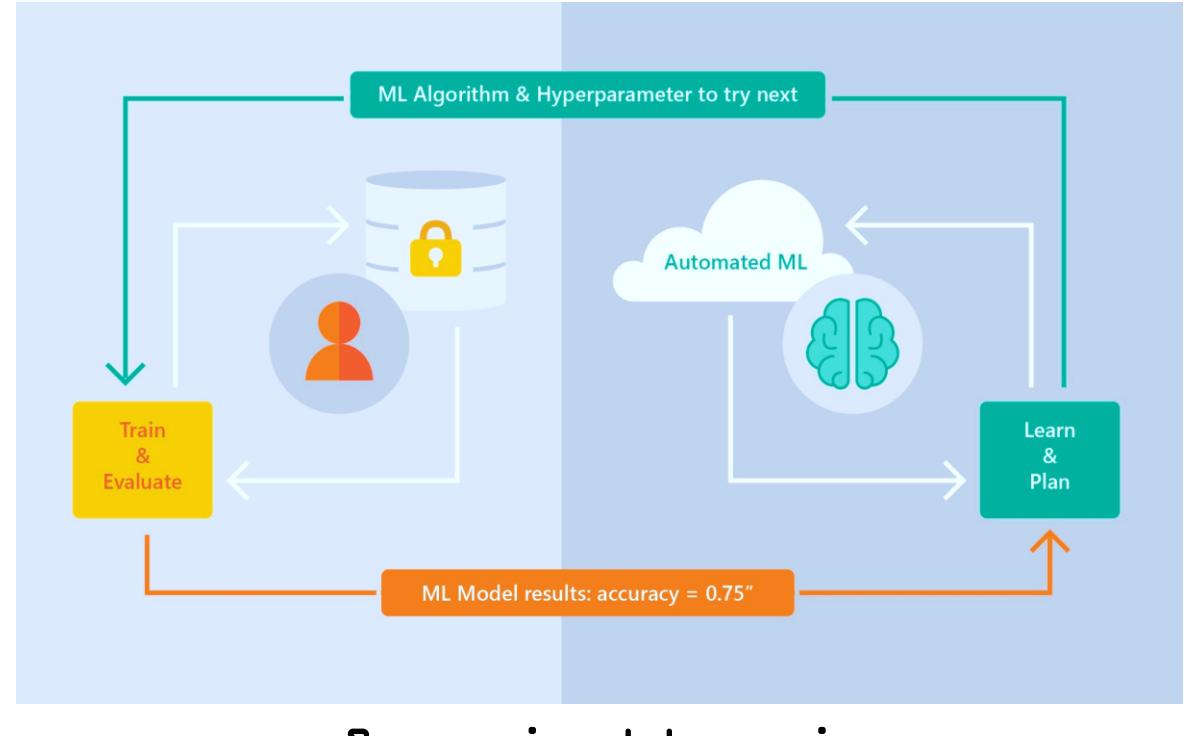
Automated machine learning (automated ML) automates **feature engineering**, **algorithm and hyperparameter** selection to find the 'best model' for your data.



Automated ML – How it works?



- Based on Microsoft Research
- Brain trained with several million experiments
- Collaborative filtering and Bayesian optimization
- Privacy preserving: No need to “see” the data



AutoML Power BI integration



Choose model

Select data

Customize inputs

Name + train

Choose a model type

Classification

Identify the category or class an entity belongs to.

Forecast

Estimate values and trends based on historical data.

Binary Prediction

Determine the likelihood of a specific outcome being achieved.

New to machine learning models?

Next

MODEL PERFORMANCE

How the model was evaluated

The model predicted diagnosis_boolean probabilities for a test set of 113 records and compared the predicted outcomes (based on the selected threshold) to the historical outcomes.

Model performance

The Area under the curve (AUC) observed on the test set is :

100%

Different features have varying influence on the predicted outcome. Click below for details.

See top predictors

	Predicted Malignant	Predicted Benign
Actual Malignant	43.00	0.00
Actual Benign	8.00	62.00

84%

Precision

100%

Recall

Probability Threshold

Increase Recall

0.00 0.03

Increase Precision

of records predicted as Malignant are likely to actually be Malignant

of records that are actually Malignant are likely to be predicted as Malignant

Pros & Cons of AutoML



Benefits:

1. Automatic prediction of the best pipeline.
2. Automates various iterative ML tasks (like model selection, featurization)
3. Doesn't require expertise in Data Science or technical background.
4. Low development cost, fast delivery.

Warnings:

1. Non-optimal performance (sometimes very good sometimes bad).
2. Not suitable for complex data structure and issues.
3. Performance issues if the Dataset is too small.

AutoML



- ✓ **Automated machine learning**, also referred to as automated ML or AutoML, is the **process of automating the time consuming, iterative tasks of machine learning model development**.
- ✓ It allows data scientists, analysts, and developers to build ML models with high scale, efficiency, and productivity all while sustaining model quality.
- ✓ Automated ML is based on a breakthrough from our **Microsoft Research division**.
- ✓ Traditional machine learning model development is resource-intensive, requiring significant domain knowledge and time to produce and compare dozens of models. With automated machine learning, **you'll accelerate the time it takes to get production-ready ML models with great ease and efficiency**.
- ✓ You can use AutoML for **Classification, Regression and Time Series Forecasting using both Python SDK or the Visual interfaces for no-code. There is an integration with PowerBI**.



Azure ML Designer



Azure Machine Learning

2) “No-code ML” with Azure ML Designer

Azure ML Designer



- Azure Machine Learning designer lets you visually connect datasets and modules on an interactive canvas to create machine learning models.
- The designer gives you a **visual canvas to build, test, and deploy machine learning models.**



Connect to any data source and prepare and preprocess data using a variety of built-in modules



Build and train models visually using the latest machine learning and deep learning algorithms

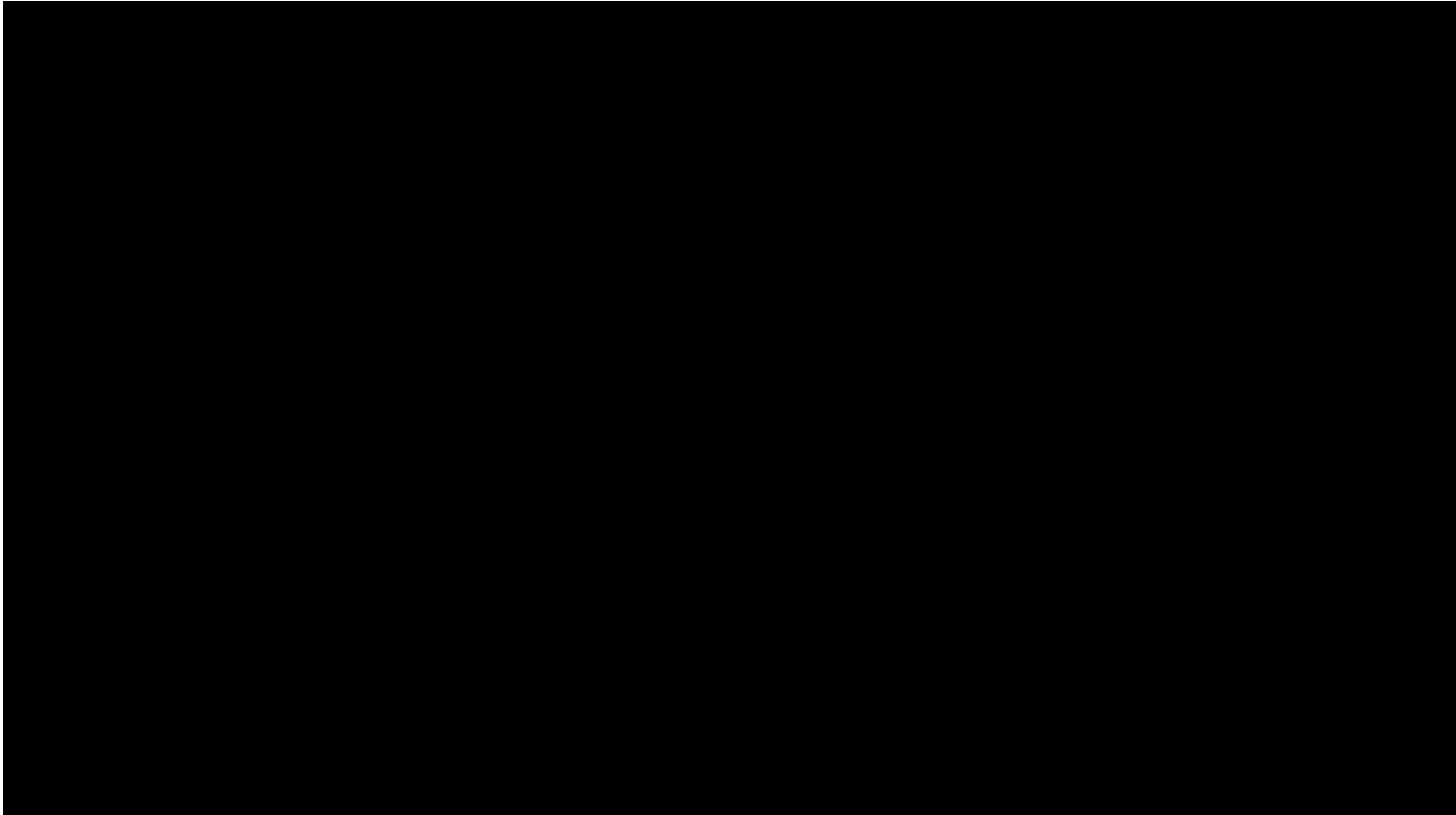


Use drag and drop modules to validate and evaluate models



Deploy and publish real-time or batch inference endpoints with a few clicks

Azure ML Designer



Azure Machine Learning Designer



Let's access to the Designer interface:

Microsoft Azure Machine Learning

retail > Home

Azure Machine Learning studio

- Create new
- Notebooks
- Automated ML
- Designer** (highlighted with a red box)
- Assets
- Datasets
- Experiments
- Pipelines
- Models
- Endpoints
- Manage
- Compute
- Datastores
- Data Labeling

The Designer card is highlighted with a red box. It contains the following text:
Drag-and-drop interface from prepping data to deploying models.
[Start now](#)

My recent resources

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clusterCPU	Machine Learning com...	✓ Succeeded (0 nodes)	Nov 19, 2020 11:29 AM
notebookinstanceup	Compute instance	✓ Succeeded	Nov 19, 2020 11:11 AM

Azure Machine Learning designer



Drag-and-drop workflow to build, test and deploy your ML models more easily and efficiently

Microsoft Azure Machine Learning

AML-Data-Labeling-WS > Designer

Designer

New pipeline

- Easy-to-use prebuilt modules
- Image Classification using DenseNet
- Binary Classification using Vowpal Wabbit Model - Adu...
- Wide & Deep based Recommendation - Restaur...
- Regression - Automobile Price Prediction (Basic)
- Regression - Automobile Price Prediction (Compare algorit...
- Binary Classification with Feature Selection - Income ...
- Binary Classification with custom Python script - Cred...

- Binary Classification - Customer Relationship Prediction
- Use custom R script - Flight Delay Prediction
- Text Classification - Wikipedia SP 500 Dataset
- Cross Validation for Binary Classification - Adult Incom...
- Permutation Feature Importance
- Recommendation - Movie Rating Tweets
- Tune Parameters for Binary Classification - Adult Incom...
- Multiclass Classification - Letter Recognition

Pipelines

Pipeline drafts Pipeline runs

Refresh Delete Search to filter items...

Name	Pipeline type	Updated on	Created by
Regression - Automobile Price Predictio...	Real-time inference	Nov 2, 2020 11:10 AM	Lu Zhang (AI)
Regression - Automobile Price Predictio...	Training	Nov 2, 2020 11:05 AM	Lu Zhang (AI)
Copy of Bookstore-Warehouse-Subway ...	Training	Nov 2, 2020 10:38 AM	Lu Zhang (AI)
Bookstore-Warehouse-Subway Image Cl...	Real-time inference	Nov 2, 2020 9:21 AM	Lu Zhang (AI)
Bookstore-Warehouse-Subway Image Cl...	Training	Nov 2, 2020 9:09 AM	Lu Zhang (AI)

Automobile price data (Raw) Dataset output Dataset Select Columns in Dataset Exclude normalized losses which have many Completed

Select Missing Data Remove missing value rows Completed

Linear Regression Completed

Split Data Split the dataset into training set (0.7) and test Completed

A screenshot of the Azure Machine Learning Designer interface. On the left is a navigation sidebar with options like New, Home, Designer (which is selected), Assets, Datasets, Experiments, Pipelines, Models, Endpoints, Compute, Datastores, and Data Labeling. The main area shows a grid of prebuilt machine learning modules. Below that is a table of existing pipelines. On the right is a large window showing a drag-and-drop pipeline canvas with several components connected by arrows.

Azure Machine Learning designer



Azure Machine Learning

Preview Microsoft Azure Machine Learning

mlworkspace > Designer > Authoring

1. Navigation Bar

Sample 1: Regression - Automobile Price Prediction (Basic)

3. Pipeline Settings

4. Pipeline Actions

Submit Publish ...

5. Menu Items

6. Last Run Status Not started

7. Canvas

Automobile price data (Raw)

Select Columns in Dataset

Clean Missing Data

Split Data

Linear Regression

Train Model

Navigator

2. Algorithms & Modules

8. Properties

Split Data

Splitting mode *

Split Rows

Fraction of rows in the first output dataset *

0.7

Randomized split

Random seed *

0

Stratified split *

False

Regenerate output

Compute target

Comment

Help documentation

```
graph TD; A[Automobile price data (Raw)] --> B[Select Columns in Dataset<br/>Exclude normalized losses which have many...]; B --> C[Clean Missing Data<br/>Remove missing value rows]; C --> D[Split Data<br/>Split the dataset into training set (0.7)...]; D --> E[Linear Regression]; D --> F[Train Model];
```

Azure ML Designer

Drag and Drop interface for zero or low-code



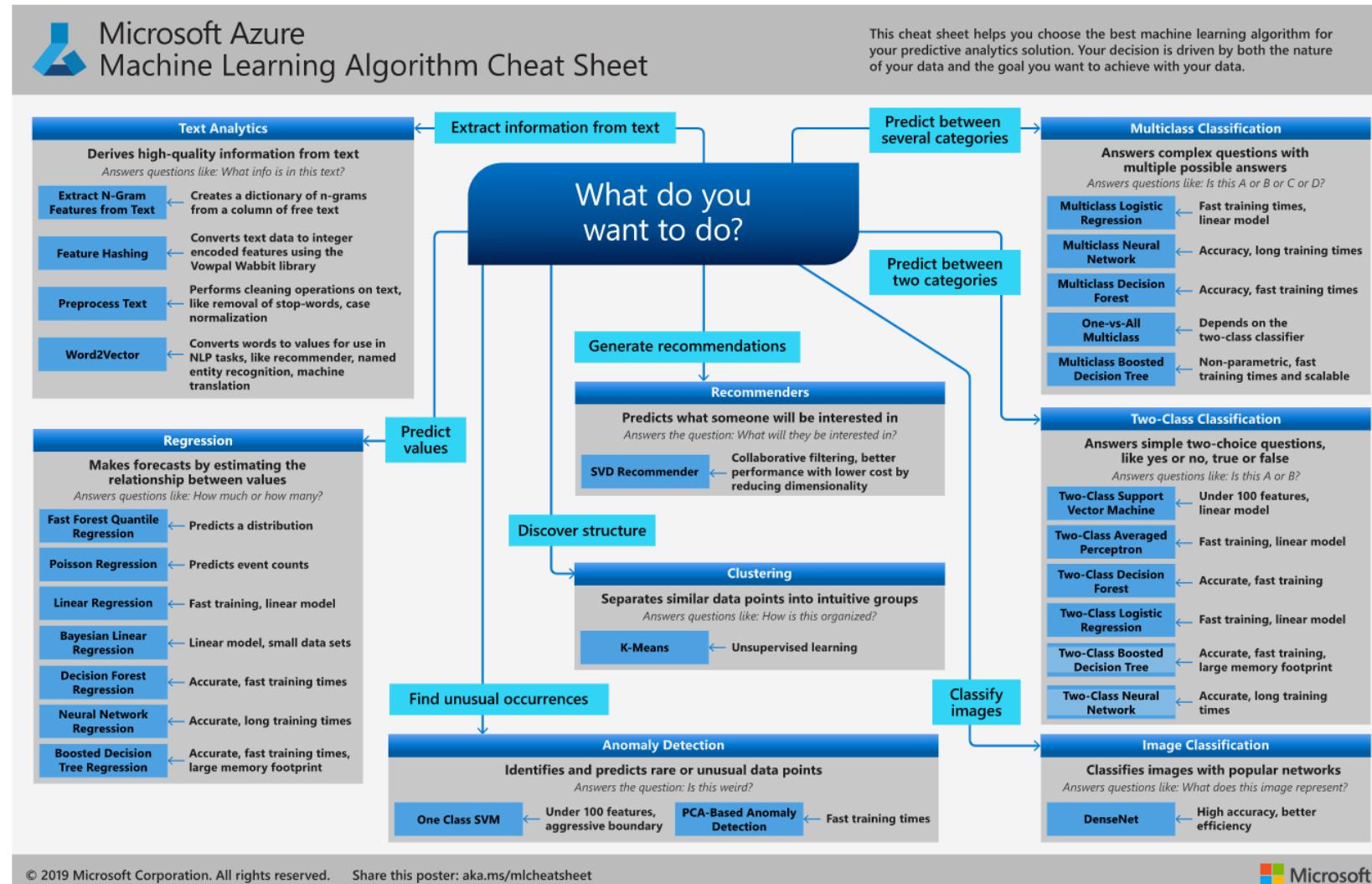
The screenshot shows the Azure ML Designer interface. On the left, a sidebar menu includes options like New, Home, Notebooks, Automated ML, Designer (which is selected), Assets, Datasets, Experiments, Pipelines, Models, and Endpoints. The main workspace is titled "Flight Delays" and shows a data transformation pipeline. A "Flight Delays Data" dataset is connected via a vertical line to a "Normalize Data" step. The pipeline toolbar at the top includes an "Autosave on" toggle, a search bar, and various icons for saving, loading, and managing datasets.

```
graph TD; FlightDelaysData[Flight Delays Data] --> NormalizeData[Normalize Data]
```

Azure ML Designer Cheat Sheet



Azure Machine Learning



<https://aka.ms/mlcheatsheet>

Azure ML Designer reference documentation

- This reference content provides the technical background on each of the machine learning algorithms and modules available in **Azure Machine Learning Designer**.
- **Each module represents a set of code** that can run independently and perform a machine learning task, given the required inputs.
- **A module might contain a particular algorithm** or perform a task that is important in machine learning, such as missing value replacement, or statistical analysis.



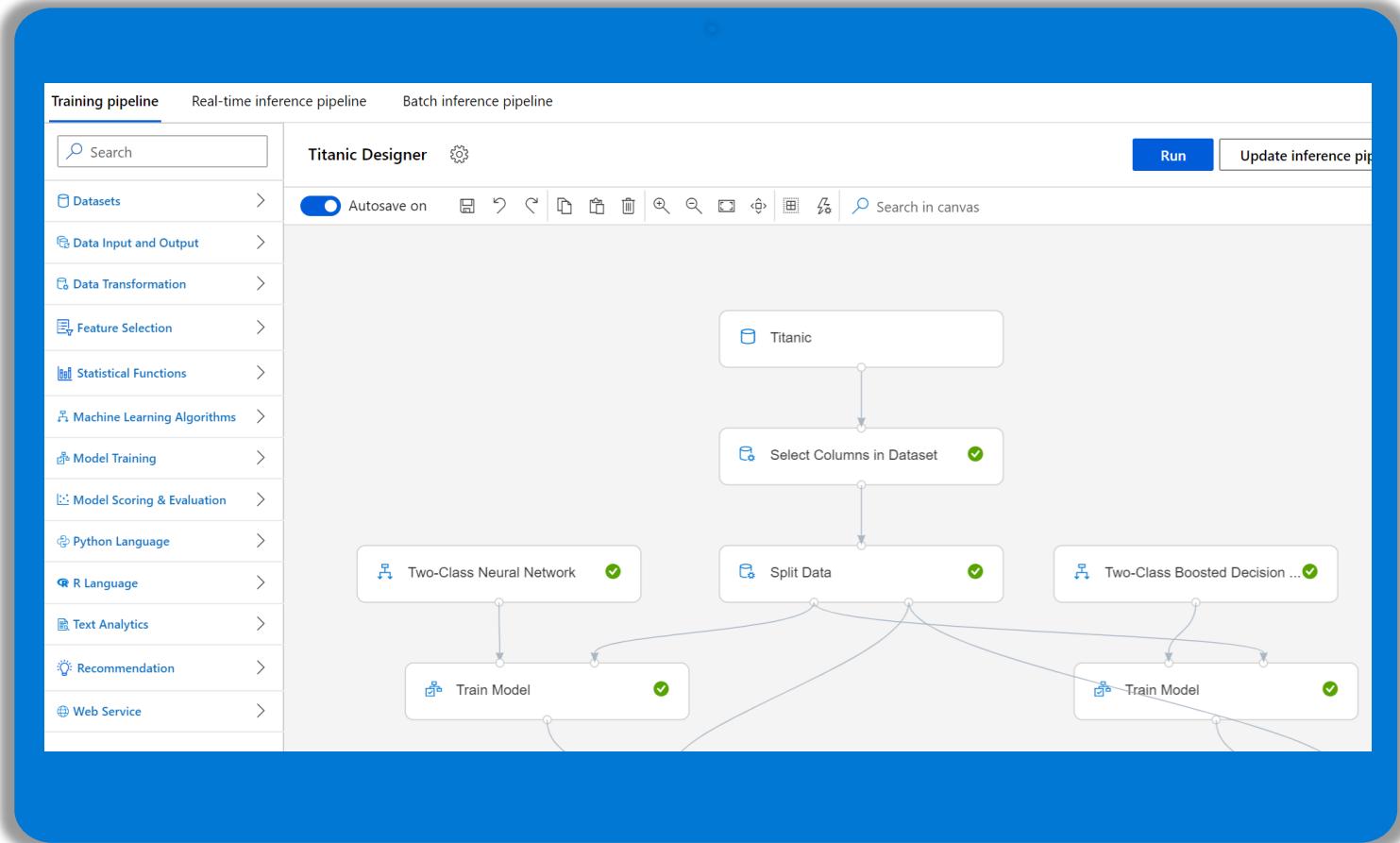
[Algorithm & module reference - Azure Machine Learning | Microsoft Docs](#)

Azure ML Designer

Key features



- ✓ Drag-n-drop workflow capability.
- ✓ Simplify the process of building, testing, and operating machine learning models.
- ✓ Drag-and-drop datasets and modules onto the canvas.
- ✓ Connect the modules together to create a pipeline draft.
- ✓ Submit a pipeline run using the compute resources in your Azure Machine Learning workspace.
- ✓ Convert your training pipelines to inference pipelines.
- ✓ Publish your pipelines to a REST pipeline endpoint to submit new pipeline runs with different parameters and datasets.
- ✓ Deploy a real-time inference pipeline to a real-time endpoint to make predictions on new data in real time.



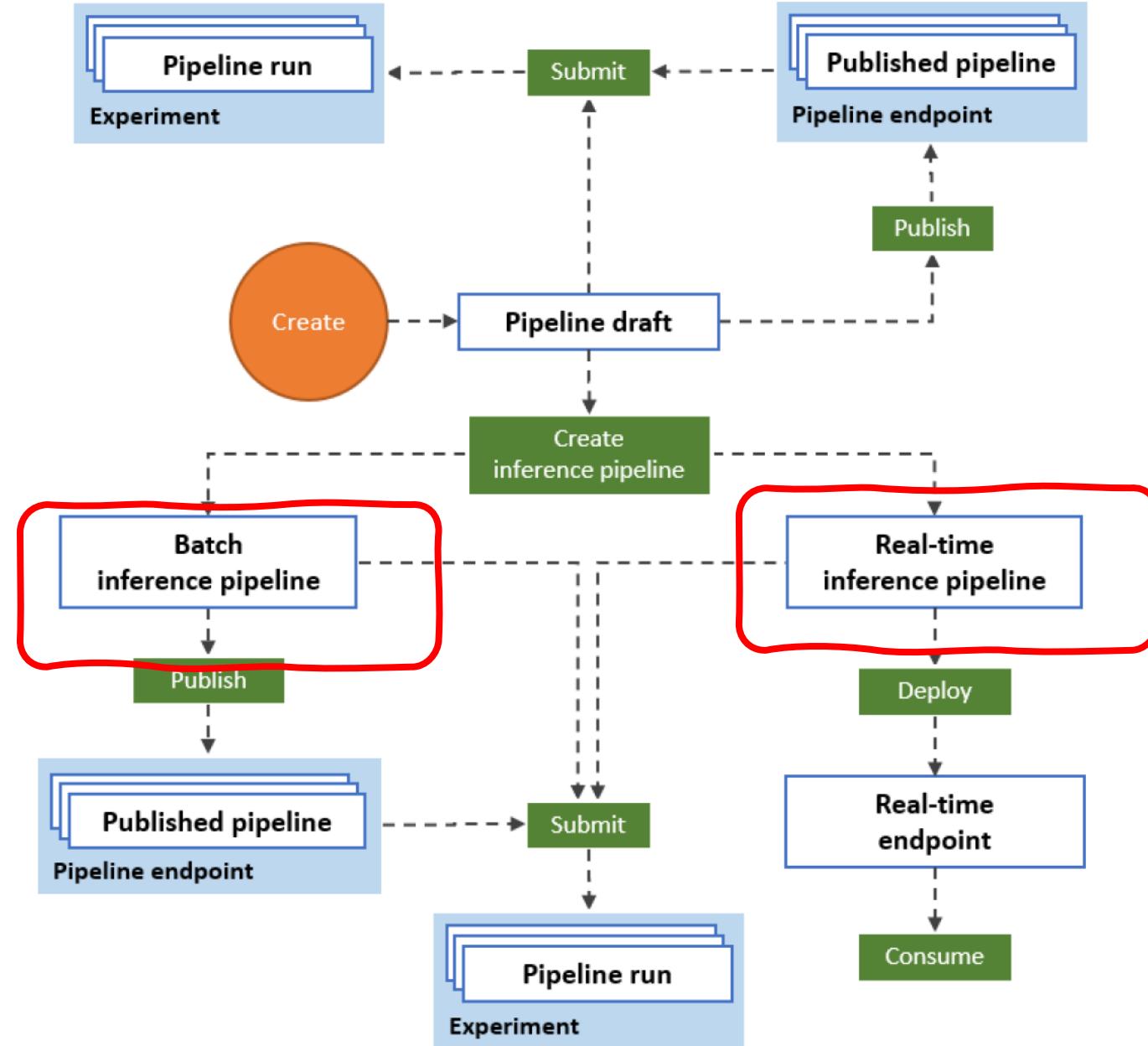
Pipelines

- The chain of datasets and analytical modules in a canvas is a **pipeline**.
- The resulting pipeline must be associated to an **experiment**.
- A **default compute target** must be declared in the pipeline settings. This compute setting applies to all steps of the pipeline.
- Once you run a pipeline, its **configuration and results are stored in your workspace**.

Pipelines



Azure Machine Learning



Pipelines for Batch Inference



Run Create inference pipeline Publish ...

Real-time inference pipeline
Batch inference pipeline

Run finished View run overview

Run Deploy ...

Run finished View run overview

TD-IBM_Employee_Attrition_Pa... IBM-Employee-Attrition

TD-IBM_Employee_Attrition_Pa... Apply Transformation

MD-IBM_Employee_Attrition_Pa... Apply Transformation

Score Model

Evaluate Model

```
graph TD; TD1[TD-IBM_Employee_Attrition_Pa...]; TD2[TD-IBM_Employee_Attrition_Pa...]; MD1[MD-IBM_Employee_Attrition_Pa...]; TD1 --> AT1[Apply Transformation]; TD2 --> AT1; MD1 --> AT2[Apply Transformation]; AT1 --> SM[Score Model]; AT2 --> SM; SM --> EM[Evaluate Model]
```

Set up endpoint

PipelineEndpoint *

+ New PipelineEndpoint

New PipelineEndpoint name *

IBM Employee Attrition Parma-batch inference

PipelineEndpoint description (optional)

Example of batch interface endpoint

Published pipeline

IBM Employee Attrition Parma-batch inference 11-21-2019-0 ...

Set as default pipeline for this endpoint.

Continue on failure step

Pipeline parameters and default values

No pipeline parameters are specified. Set a data node as a pipeline parameter to use different data input when invoking this endpoint.

Deploy Cancel

Endpoints

Real-time endpoints Pipeline endpoints

Refresh Disable Enable View disable

Name ↓	Description
IBM Employee Attrition Parma-batch inference	Example of batch interfa...



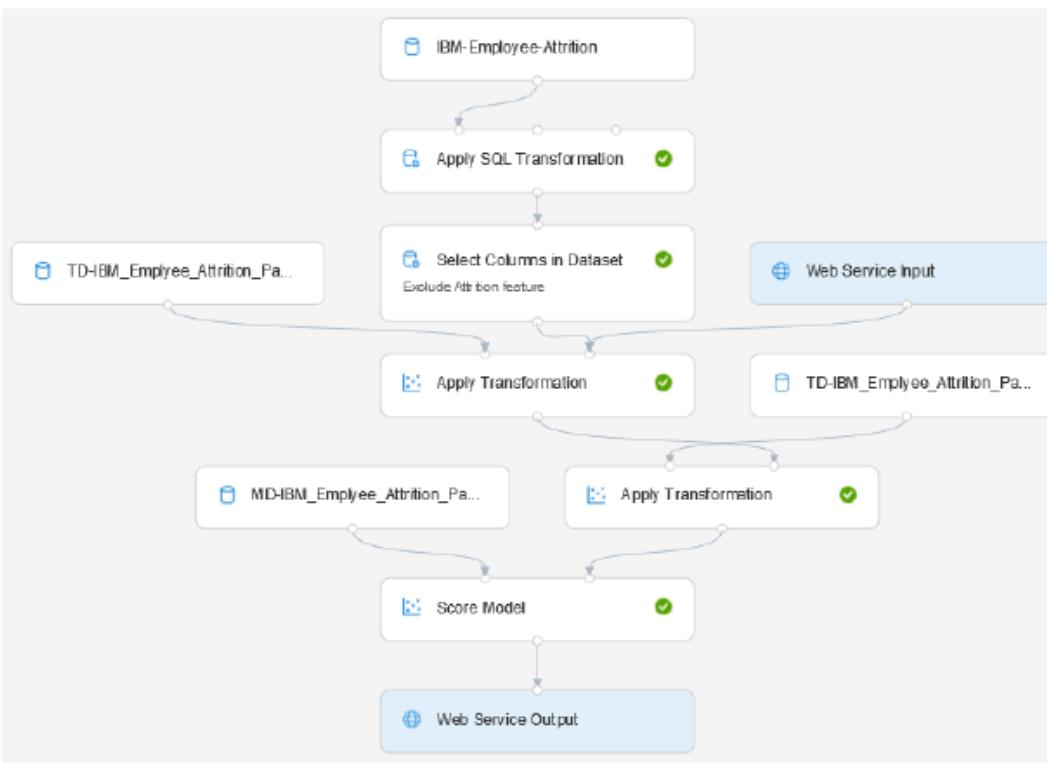
Azure Machine Learning

Pipelines for Real time inference

Run Create inference pipeline Publish ...

Real-time inference pipeline
finished View run overview

Batch inference pipeline



Set up real-time endpoint

Deploy new real-time endpoint Replace an existing real-time endpoint

Real-time endpoint name *

ibm-employee-attrition-parma-real

Endpoint description (optional)

Example of inference real-time endpoint

Compute target

Existing compute target(s)

Refresh

Compute target name	Node count	Region	Status ↓
infer-cluster	1	westeurope	Succeeded

< Prev Next >

Deploy

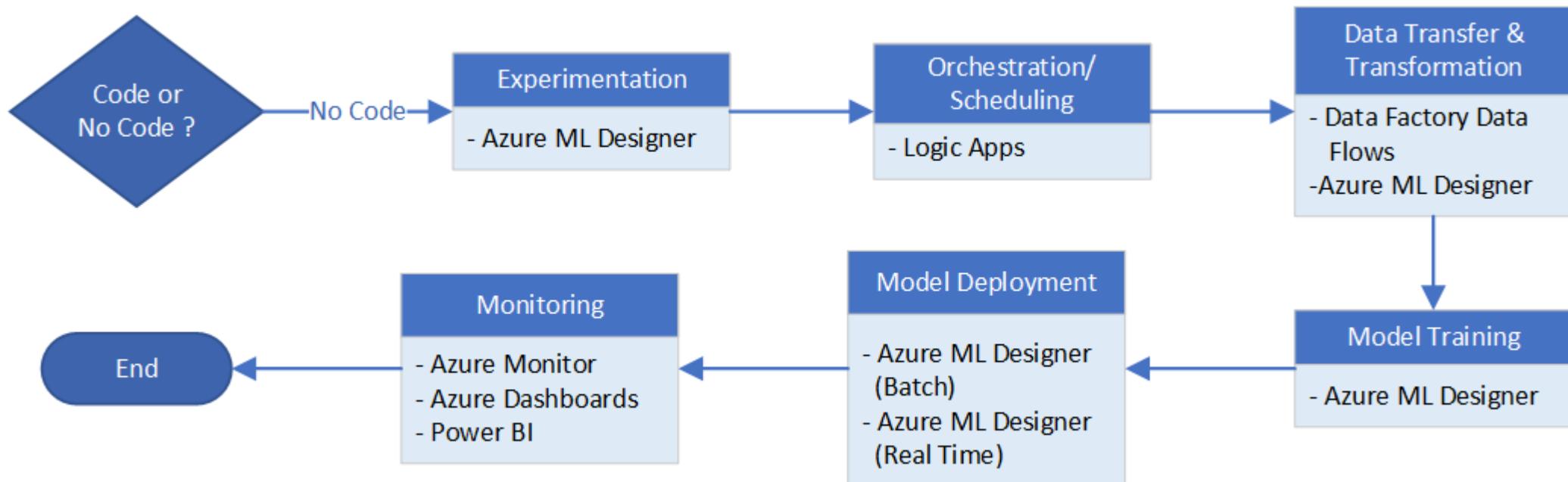
Cancel

Which interface to use?

**No-code Azure ML interfaces?
Azure ML SDK?**



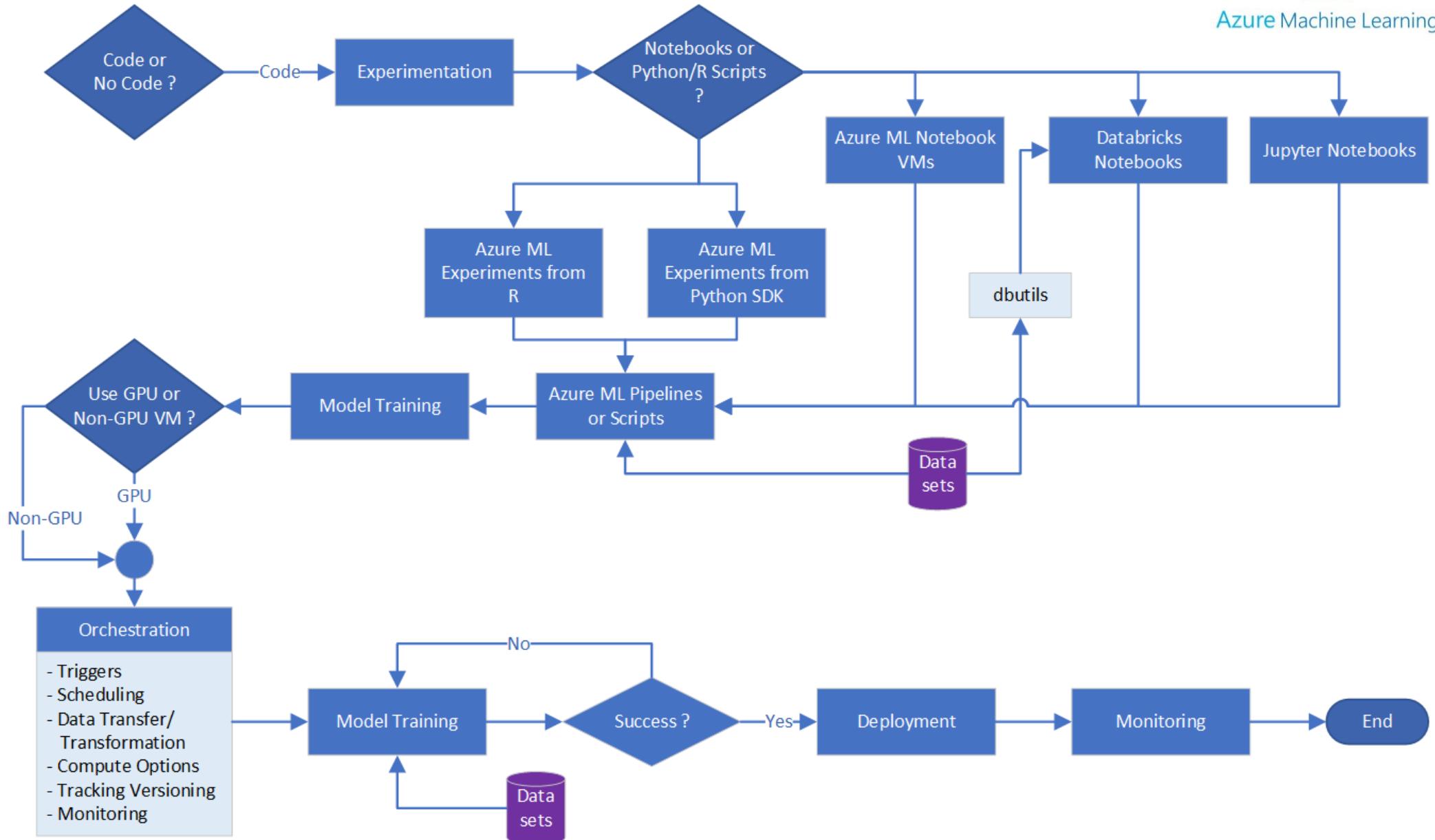
Code or No Code?



SDK



Azure Machine Learning



The background of the image is a soft-focus photograph of a workspace. It features a laptop with its screen visible, a dark mug on the left, and a pair of glasses resting on a book or document in the center. A small white cable lies on the desk to the left of the glasses. The overall atmosphere is professional and focused.

Training

Free training on Microsoft Learn



4300 XP

Create no-code predictive models with Azure Machine Learning

2 hr 47 min remaining • Learning Path • 0 of 4 modules completed

Beginner AI Engineer Data Scientist Azure Machine Learning

Machine learning is at the core of artificial intelligence, and many modern applications and services depend on predictive machine learning models. Learn how to use Azure Machine Learning to create and publish models without writing code.

Prerequisites

Ability to navigate the Azure portal

[Create no-code predictive models with Azure Machine Learning - Learn | Microsoft Docs](#)

Documentation



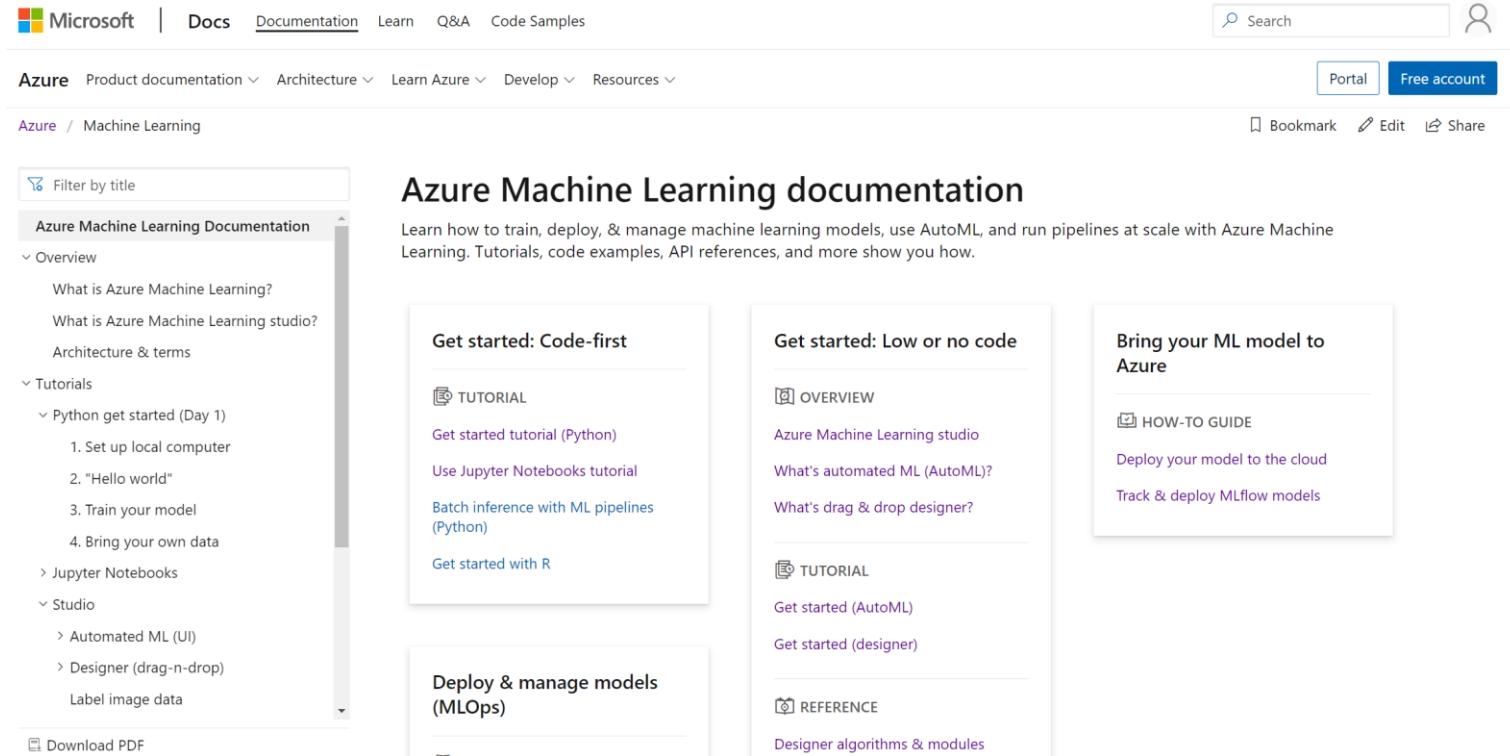
Azure ML documentation



Azure Machine Learning

Documentation

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



The screenshot shows the Microsoft Docs website for Azure Machine Learning. The top navigation bar includes links for Microsoft, Docs, Documentation (which is underlined), Learn, Q&A, and Code Samples. A search bar and account options (Portal, Free account) are also present. The main content area has a breadcrumb trail: Azure / Machine Learning. On the left, there's a sidebar with a 'Filter by title' dropdown and a list of topics under 'Azure Machine Learning Documentation'. The main content area features several cards: 'Get started: Code-first' (with TUTORIAL, Get started tutorial (Python), Use Jupyter Notebooks tutorial, Batch inference with ML pipelines (Python), and Get started with R), 'Get started: Low or no code' (with OVERVIEW, Azure Machine Learning studio, What's automated ML (AutoML), and What's drag & drop designer?), 'Deploy & manage models (MLOps)' (with TUTORIAL, Get started (AutoML), Get started (designer), and REFERENCE, Designer algorithms & modules), and a 'Bring your ML model to Azure' section (with HOW-TO GUIDE, Deploy your model to the cloud, and Track & deploy MLflow models).

Microsoft | Docs Documentation Learn Q&A Code Samples

Search

Azure Product documentation ▾ Architecture ▾ Learn Azure ▾ Develop ▾ Resources ▾

Portal Free account

Azure / Machine Learning

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?

Deploy & manage models (MLOps)

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

Bring your ML model to Azure

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

Search

Portal Free account

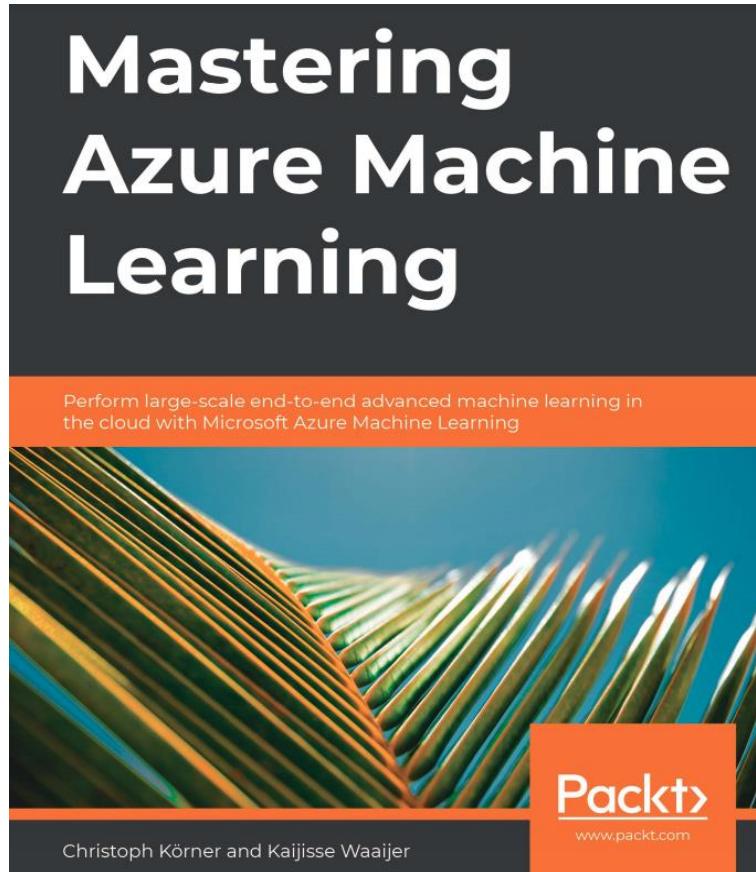
Bookmark Edit Share



Azure Machine Learning

Mastering Azure Machine Learning

<https://www.packtpub.com/product/mastering-azure-machine-learning/9781789807554>



What is more interesting is how we can automatically embed code like the preceding in our data experimentation and preparation script, and later, in the training and optimization pipelines. With a few lines of code, we can track all Matplotlib figures and attach them to our experimentation run. To do so, we only have to pass the Matplotlib reference to the `run.log_image()` method and give it an appropriate name. The following snippet shows how this would look in an experiment:

```
with exp.start_logging() as run:  
    fig = sns.pairplot(df, hue="species")  
    run.log_image("pairplot", plot=fig)
```

Now, this is the amazing part. By calling the function with the Matplotlib reference, Azure Machine Learning will render the figure, save it, and attach it to the experiment run. Figure 3.11 shows the Azure Machine Learning UI with the **Images** tab clicked. You can see the **pairplot** image that we just created and registered attached to the run:

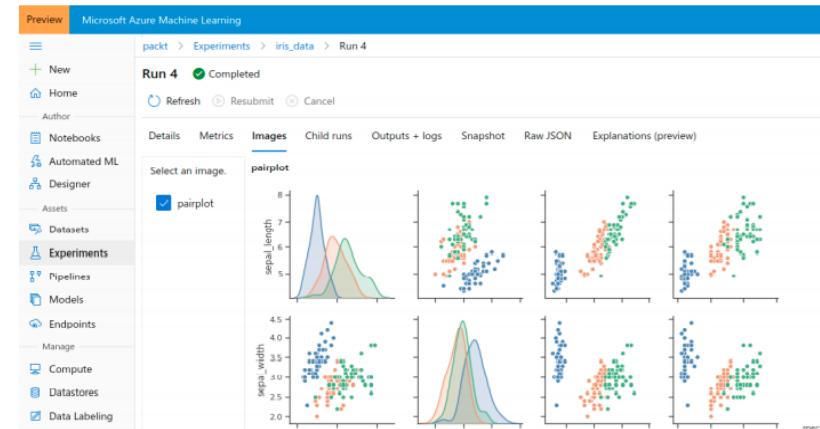


Figure 3.11: The Images tab, showing a pairplot in the Azure Machine Learning workspace

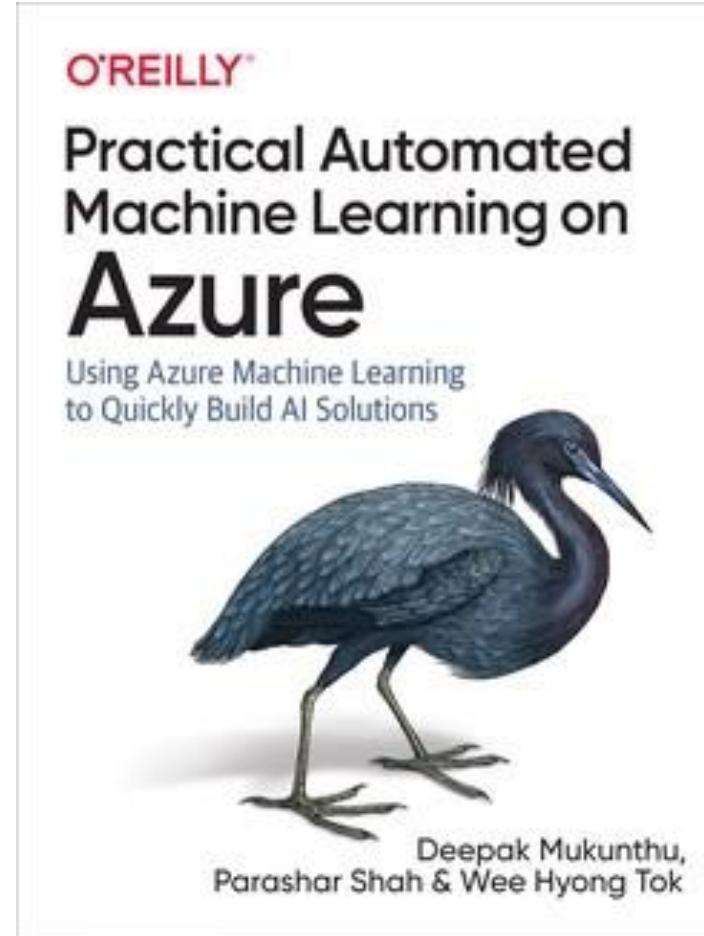
Code: <https://github.com/PacktPublishing/Mastering-Azure-Machine-Learning>



Azure Machine Learning

AutoML with Azure Book

<https://www.oreilly.com/library/view/practical-automated-machine/9781492055587/>



Code: <https://github.com/PracticalAutomatedMachineLearning/Azure>

Hands-on labs



Workshops materials

All the datasets are available here:

<https://github.com/retkowsky/AMLlabs/tree/main/Nocode>



Lab 1

Data Preparation with Azure ML
Designer



Lab1 – Data Preparation with Azure ML Designer



1. We will use Azure ML Designer for some data preparation



2. We will save the generated dataset as an Azure ML Dataset for reuse with AutoML

Lab1 - Steps

1. Create a new Dataset called **Customers**

Use this link to define the Customers dataset:

<https://raw.githubusercontent.com/retkowsky/AMLlabs/main/Nocode/Customers.csv>

2. Create a new Dataset called **CreditRisk**

Use this link to define the Credit Risk dataset:

<https://raw.githubusercontent.com/retkowsky/AMLlabs/main/Nocode/CreditRisk.csv>

Lab1 - Steps

Use the wizard to define a dataset

The screenshot shows the Microsoft Azure Machine Learning Studio interface. The left sidebar contains a navigation menu with the following items:

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

The main content area is titled "Datasets" and shows a list of registered datasets:

Name	Count
datamart	1
CreditRisk	2
Customers	1

A dropdown menu is open under the "Create dataset" button, listing four options:

- From local files (highlighted with a red box)
- From datastore
- From web files
- From Open Datasets

Lab1 – Steps

Check that you do have now these 2 datasets

Microsoft Azure Machine Learning

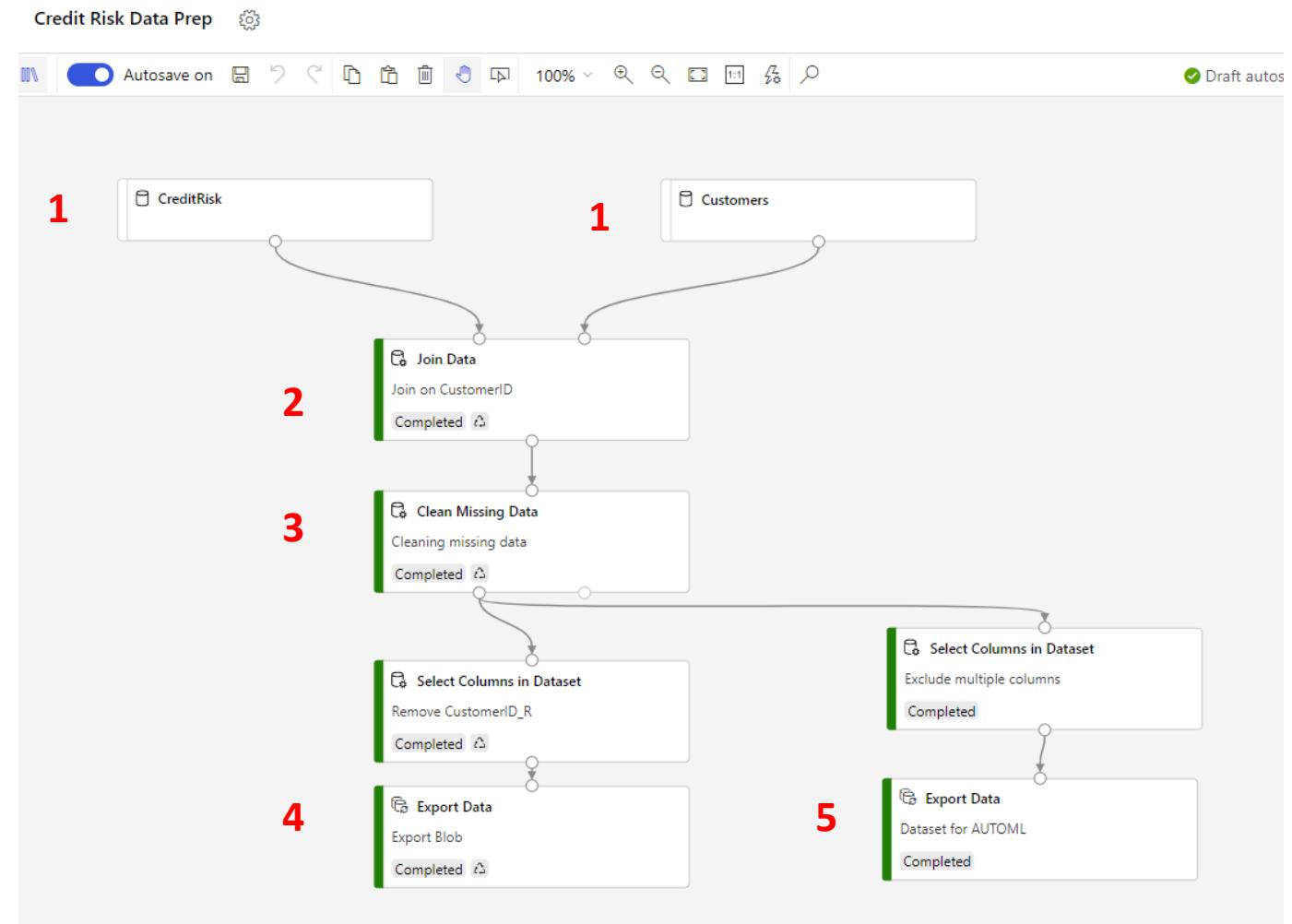
The screenshot shows the Microsoft Azure Machine Learning interface. On the left, there's a navigation sidebar with various options like New, Home, Notebooks, Automated ML, Designer, Datasets (which is selected and highlighted in grey), Experiments, Pipelines, Models, Endpoints, Compute, Datastores, and Data Labeling. The main content area is titled 'Datasets' and shows 'Registered datasets'. It includes a 'Create dataset' button, a 'Refresh' button, and an 'Unregister' button. Below these are two datasets listed in a table:

Name	Version	Data source	Created on	Modified on	Properties	Created by
MD-CreditRiskModelling-Train_Model-Trained_model-8bf09abd	2	workspaceblobstore	Nov 19, 2020 5:42 PM	Nov 19, 2020 5:43 PM	File	Serge Retkowsky
datamart	1	workspaceblobstore	Nov 19, 2020 4:59 PM	Nov 19, 2020 4:59 PM	Tabular	Serge Retkowsky
CreditRisk	2	workspaceblobstore	Nov 19, 2020 4:32 PM	Nov 19, 2020 4:50 PM	Tabular	Serge Retkowsky
Customers	1	workspaceblobstore	Nov 19, 2020 4:33 PM	Nov 19, 2020 4:33 PM	Tabular	Serge Retkowsky

A red box highlights the 'CreditRisk' and 'Customers' rows in the table.

Lab1 – Azure ML Designer Steps

1. Create a compute cluster for Designer
2. Add the 2 data sources into Designer
3. Create a **join** between these 2 data sources using Azure ML Designer
4. Use the **Clean Missing** data module
5. Export the whole output into a blob storage as a parquet file called **Datamart** (exclude the **CustomerID_R** column)
6. Export the output as into a blob storage as **ExportAutoML** without the following columns *CustomerID*, *CustomerID_R*, *Address*, *ZipCode*, *City*, *Title*, *Name*, *Lastname*



Lab1 – Data Preparation with Azure ML Designer

1. Run the Azure ML Designer pipeline
2. Then register the 2 output data sources from the blob storage

The screenshot shows the 'Create dataset from datastore' dialog box over a background of the Azure ML Designer interface. The dialog has two tabs: 'Basic info' (selected) and 'Path selection'. In the 'Datastore selection' section, the 'Currently selected datastore: workspaceblobstore (Azure Blob Storage) (Default)' radio button is selected. The 'Path selection' tab displays a list of files and folders under the path 'Selected path: ExportAutoML'. A red box highlights the row for 'ExportAutoML'. The table has columns for Name, Created on, and Modified on.

Name	Created on	Modified on
UI/	--	--
azureml/	--	--
ExportAutoML	Nov 30, 2020 3:15 PM	Nov 30, 2020 3:15 PM
datamart	Nov 30, 2020 3:16 PM	Nov 30, 2020 3:16 PM

Lab1 – Data Preparation with Azure ML Designer

You have registered the 2 outputs datasets from Azure ML Designer

The screenshot shows the Microsoft Azure Machine Learning interface, specifically the 'Datasets' section. On the left is a navigation sidebar with options like 'New', 'Home', 'Author', 'Notebooks', 'Automated ML', 'Designer', 'Assets', 'Datasets' (which is selected and highlighted in grey), 'Experiments', 'Pipelines', 'Models', 'Endpoints', 'Manage', 'Compute', 'Datastores', and 'Data Labeling'. The main area is titled 'Datasets' and shows a list of 'Registered datasets'. There are two datasets listed, both named 'workspaceblobstore': 'Datamart' and 'ExportAutoML'. A red box highlights these two entries. Below them is another dataset entry: 'MD-CreditRiskModelling-Train_Model-Trained_model-8bf09abd' with version 2 and data source 'workspaceblobstore'. At the bottom of the list are 'CreditRisk' (version 2) and 'Customers' (version 1), both with data source 'workspaceblobstore'. The top right of the main area shows 'nocodeazureml > Datasets', and there are buttons for 'Create dataset', 'Refresh', and 'Unregister'.

Name	Version	Data source	Created
Datamart	1	workspaceblobstore	Nov 30, 2023
ExportAutoML	1	workspaceblobstore	Nov 30, 2023
MD-CreditRiskModelling-Train_Model-Trained_model-8bf09abd	2	workspaceblobstore	Nov 19, 2023
CreditRisk	2	workspaceblobstore	Nov 19, 2023
Customers	1	workspaceblobstore	Nov 19, 2023



Lab 2

AutoML



Lab2 – AutoML User Interface



1. Let's use the ExportAutoML saved dataset from Lab 1



2. We are going to use now the no-code interface for autoML

Lab2 – AutoML User Interface

- Please create a **Compute Instance for AutoML** (or use the previous one)
- Let's create a new AutoML using the Azure ML Studio interface
 1. Use the AutoML dataset created in lab 1
 2. Choose a **Classification** problem in order to predict the column **RISK**
 3. Choose 0.25 hour (= 15 minutes) for the experiment timeout

Lab2 – AutoML User Interface

Select the ExportAutoML dataset

Microsoft Azure Machine Learning

nocodeazureml > Automated ML > Start run

Create a new Automated ML run

Select dataset

Select a dataset from the list below, or create a new dataset. Automated ML currently only supports tabular data for authoring runs.

+ Create dataset | Show supported datasets only

Dataset name	Dataset type
Datamart	Tabular
<input checked="" type="radio"/> ExportAutoML	Tabular
CreditRisk	Tabular
Customers	Tabular

New

Home

Author

Notebooks

Automated ML

Designer

Assets

Datasets

Experiments

Pipelines

Models

Endpoints

Manage

Compute

Datastores

Data Labeling

The screenshot shows the Microsoft Azure Machine Learning interface for creating a new Automated ML run. The left sidebar has a 'New' button highlighted. The main area shows the 'Create a new Automated ML run' process with three steps: 'Select dataset' (selected), 'Configure run', and 'Task type and settings'. In the 'Select dataset' step, a list of datasets is shown, with 'ExportAutoML' selected and highlighted by a red box. Other datasets listed are Datamart, CreditRisk, and Customers, all categorized as Tabular.

Lab2 – AutoML User Interface Configuration

nocodeazureml > Automated ML > Start run

Create a new Automated ML run

Configure run

Configure the experiment. Select from existing experiments or define a new name, select the target column and the training compute to use. [Learn more on how to](#)

Dataset
ExportAutoML ([View dataset](#))

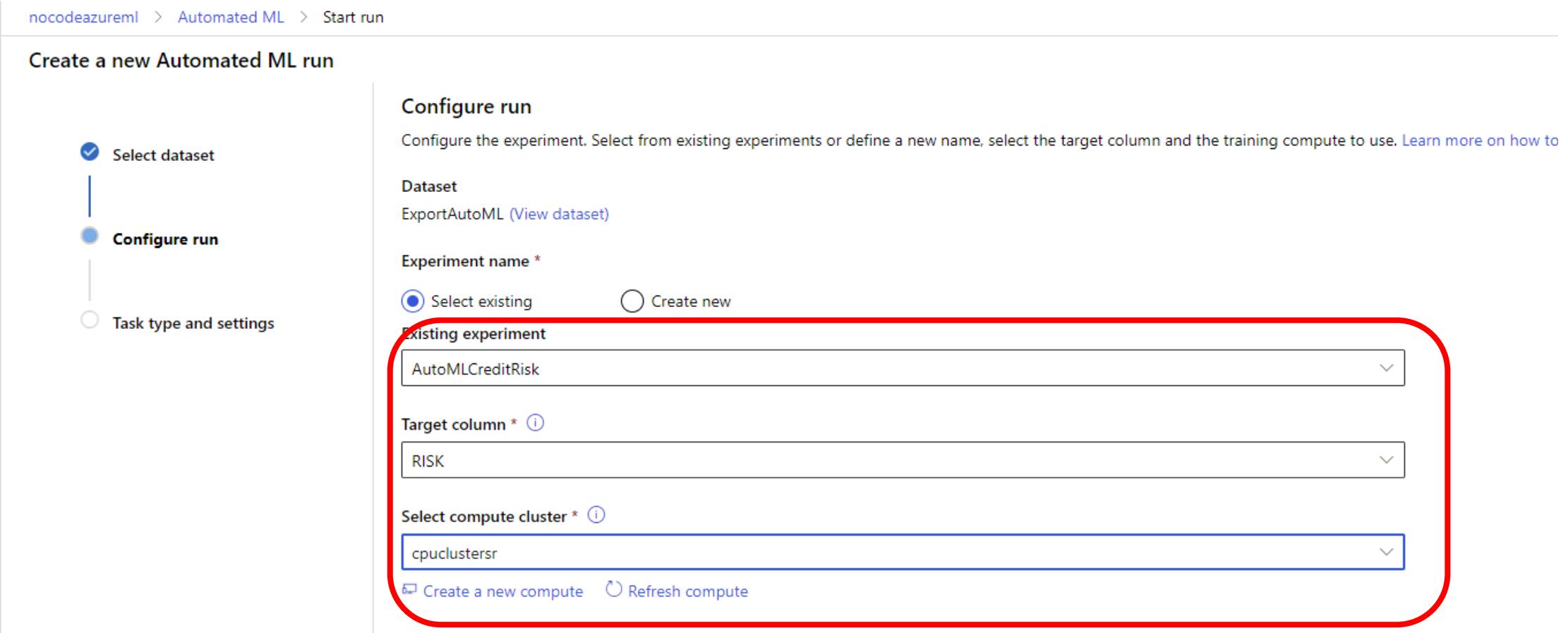
Experiment name *
 Select existing Create new

Existing experiment

Target column * [\(i\)](#)

Select compute cluster * [\(i\)](#)

[Create a new compute](#) [Refresh compute](#)



Lab2 – AutoML User Interface Configuration

nocodeazureml > Automated ML > Start run

Create a new Automated ML run

Select task type

Select the machine learning task type for the experiment. Additional settings are available to fine tune the experiment if needed.

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

Enable deep learning

Regression
To predict continuous numeric values

Time series forecasting
To predict values based on time

[View additional configuration settings](#) [View featurization settings](#)

Additional configurations

Primary metric [\(i\)](#)
Accuracy

Explain best model [\(i\)](#)

Blocked algorithms [\(i\)](#)
A list of algorithms that Automated ML will not use during training.

Exit criterion

Training job time (hours) [\(i\)](#) 0.25

Metric score threshold [\(i\)](#) Metric score threshold

Validation

Concurrency

The screenshot shows the 'Create a new Automated ML run' wizard. On the left, a sidebar lists steps: 'Select dataset' (checked), 'Configure run' (checked), and 'Task type and settings' (unchecked). The main area is titled 'Select task type' and contains three options: 'Classification' (selected and highlighted with a red box), 'Regression', and 'Time series forecasting'. Below these are links to 'View additional configuration settings' and 'View featurization settings'. To the right, a panel titled 'Additional configurations' is open, containing sections for 'Primary metric' (set to 'Accuracy'), 'Explain best model' (checked), 'Blocked algorithms' (empty), 'Exit criterion' (set to 'Training job time (hours) 0.25'), 'Metric score threshold' (empty), and sections for 'Validation' and 'Concurrency'.

Lab2 – AutoML User Interface

AutoML is running

Microsoft Azure Machine Learning

nocodeazurerm1 > Automated ML > AutoMLCreditRisk > Run 118

Run 118 Running Refresh Cancel

[Details](#) [Data guardrails](#) [Models](#) [Outputs + logs](#) [Child runs](#) [Snapshot](#)

Properties

Status: Running
Created: Nov 30, 2020 3:22 PM
Started: Nov 30, 2020 3:23 PM
Compute target: cpuclustersr
Run ID: AutoML_11cdbe25-eb13-489a-8d28-3f68570e6b65
Run number: 118
Script name: --
Created by: Serge Retkowsky
Input datasets: Input name: training_data, ID: [a32b4362-0ae2-4248-88bc-7e03e8c00316](#)

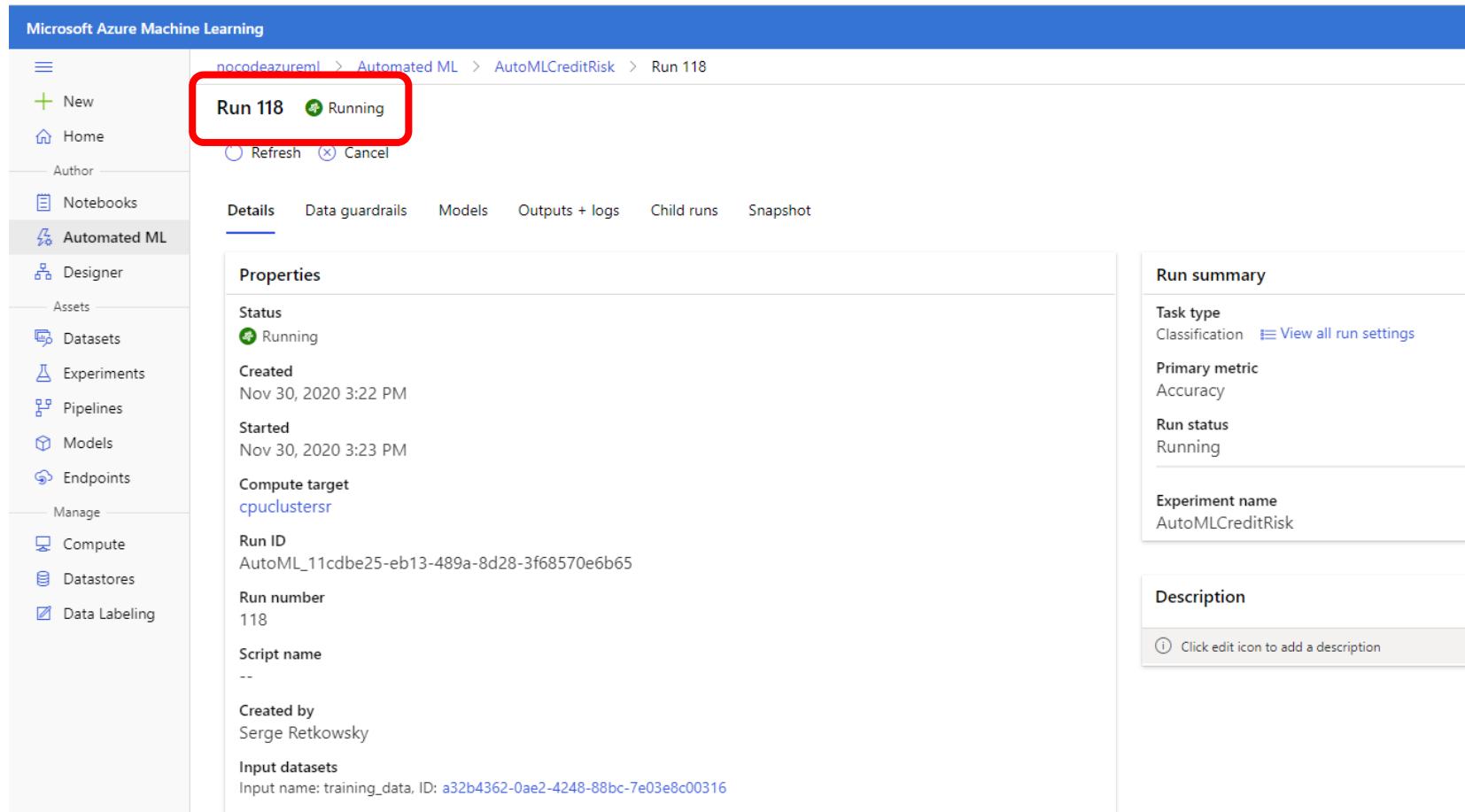
Run summary

Task type: Classification [View all run settings](#)
Primary metric: Accuracy
Run status: Running

Experiment name: AutoMLCreditRisk

Description

[Click edit icon to add a description](#)



Lab2 – AutoML User Interface Results

nocodeazureml > Automated ML > AutoMLCreditRisk > Run 118

Run 118 ✓ 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	
Validation split handling	Done	The input data has been split for validation to improve model performance. Learn more about validation data.	✓
+ View additional details			
Class balancing detection	Passed	Your inputs were analyzed, and all classes are balanced in your training data. Learn more about imbalanced data.	✓
Missing feature values imputation	Passed	No feature missing values were detected in the training data. Learn more about missing value imputation.	✓
High cardinality feature detection	Passed	Your inputs were analyzed, and no high cardinality features were detected. Learn more about high cardinality feature detection.	✓

Lab2 – AutoML User Interface Results

nocodeazureml > Automated ML > AutoMLCreditRisk > Run 118

Run 118 Completed

↻ Refresh ✖ Cancel

Details Data guardrails **Models** Outputs + logs Child runs Snapshot

▷ Deploy ⬇️ Download 🔍 Explain model 🔍 Search to filter items...

Algorithm name	Explained	Accuracy ↓	Sampling ⓘ	Run	Created	Duration	Status
VotingEnsemble	View explanation	0.77900	100.00 %	Run 166	Nov 30, 2020 3:42 PM	1m 8s	Completed
StackEnsemble		0.76501	100.00 %	Run 165	Nov 30, 2020 3:42 PM	1m 11s	Completed
MaxAbsScaler, SGD		0.76403	100.00 %	Run 141	Nov 30, 2020 3:35 PM	43s	Completed
MaxAbsScaler, SGD		0.76300	100.00 %	Run 132	Nov 30, 2020 3:31 PM	50s	Completed
MaxAbsScaler, SGD		0.75898	100.00 %	Run 133	Nov 30, 2020 3:32 PM	31s	Completed
MaxAbsScaler, LightGBM		0.75800	100.00 %	Run 122	Nov 30, 2020 3:26 PM	43s	Completed
MaxAbsScaler, SGD		0.75501	100.00 %	Run 163	Nov 30, 2020 3:41 PM	39s	Completed
MaxAbsScaler, XGBoostClassifier		0.74900	100.00 %	Run 124	Nov 30, 2020 3:26 PM	1m 47s	Completed
SparseNormalizer, RandomForest		0.74899	100.00 %	Run 158	Nov 30, 2020 3:39 PM	44s	Completed
MaxAbsScaler, SGD		0.74898	100.00 %	Run 145	Nov 30, 2020 3:36 PM	43s	Completed
MaxAbsScaler, SGD		0.74206	100.00 %	Run 127	Nov 30, 2020 3:29 PM	28s	Completed
MaxAbsScaler, ExtremeRandomTrees		0.73999	100.00 %	Run 129	Nov 30, 2020 3:30 PM	2m 47s	Completed

Lab2 – AutoML User Interface Results

nocodeazureml > Automated ML > AutoMLCreditRisk > Run 118 > Run 166

Run 166 ✓ Completed

Refresh Deploy Download Explain model Cancel

Details Model Explanations (preview) Metrics Outputs + logs Images Child runs Snapshot

Model explanations are used to understand what features are directly impacting the model and why. [Learn more about model explainability.](#)

Select Explanation

tabular | mimic.lightgbm | raw | classification | f40618ba-91b7-44a3-9b17-add59dd8c499 | 11/30/2020, 3:46:22 PM

Explainer: mimic.lightgbm

Top K Features: [\(i\)](#)

The chart displays the global and summary importance of various features for a LightGBM model. The y-axis represents Feature Importance from 0 to 0.6. The x-axis lists several features: Account Balance, Payment Status of ..., Value Savings/Stoc..., Purpose, Instalment per cen..., Most valuable avail..., Sex & Marital Stat..., and Duration of Credit... . The 'Account Balance' feature has the highest global importance at approximately 0.58. Other features like 'Payment Status of ...' and 'Value Savings/Stoc...' also show significant global importance. The 'Summary importance' bar for 'Account Balance' is slightly higher than its 'Global importance' bar.

Feature	Global importance	Summary importance
Account Balance	~0.58	~0.60
Payment Status of ...	~0.19	~0.20
Value Savings/Stoc...	~0.19	~0.20
Purpose	~0.16	~0.16
Instalment per cen...	~0.11	~0.11
Most valuable avail...	~0.11	~0.11
Sex & Marital Stat...	~0.11	~0.11
Duration of Credit...	~0.11	~0.11

Lab2 – AutoML User Interface Results

nocodeazureml > Automated ML > AutoMLCreditRisk > Run 118 > Run 166

Run 166 Completed

Refresh Deploy Download Explain model Cancel

Metrics Outputs + logs Images Child runs Snapshot

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

View as: Chart Table

precision_score_macro	f1_score_micro	weighted_accuracy
0.7417196654928343	0.7789975604346862	0.8360298599108992

Precision-Recall

The Precision-Recall chart displays the relationship between precision and recall for various metrics. The Y-axis represents Precision (0 to 1) and the X-axis represents Recall (0% to 100%). The chart includes several data series: Weighted Average (blue circles), Macro Average (dark blue circles), Micro Average (teal circles), Ideal (black dashed horizontal line at 1.0), and two diagonal lines representing True Positive Rate (0 and 1). The Micro Average curve shows the highest overall performance, starting near (0%, 1.0) and ending near (100%, 0.5).

ROC

The ROC chart displays the True Positive Rate (Y-axis, 0 to 1) against the False Positive Rate (X-axis, 0% to 100%). It includes curves for Weighted Average (blue), Macro Average (dark blue), Micro Average (teal), Ideal (black dashed horizontal line at 1.0), Random (purple dashed diagonal line), and two diagonal lines representing True Positive Rate (0 and 1). The Micro Average curve is the most efficient, staying closest to the top-left corner of the plot.

Lab2 – AutoML User Interface

We can deploy our AutoML model

nocodeazureml > Automated ML > AutoMLCreditRisk > Run 118 > Run 166

Run 166 Completed

Details Model Explanations (preview) Metrics Outputs + logs Images Child runs Snapshot

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

accuracy_table
 confusion_matrix
 precision_score_macro
 f1_score_micro
 weighted_accuracy
 AUC_macro
 recall_score_micro
 average_precision_score_weighted
 recall_score_weighted
 balanced_accuracy
 norm_macro_recall
 accuracy
 f1_score_weighted

View as: Chart Table

precision_score_macro	f1_score_micro	weighted_accuracy
0.7417196654928343	0.7789975604346862	0.8360298599108992

Precision-Recall

Legend: Weighted Average (blue), Macro Average (dark blue), Micro Average (teal), Ideal (dashed horizontal line at 1.0), 0 (dotted line at 0.0), 1 (dotted line at 1.0).

Deploy a model

Name *

Description

Compute type *

Models: AUTOMLCREDITRISK43

Enable authentication

Keys can be found on the endpoint details page.

This model supports no-code deployment. You may optionally override the default environment and driver file.

Use custom deployment assets

Lab2 – AutoML User Interface

The model is deployed using Azure Container Instance (ACI)

Microsoft Azure Machine Learning

The screenshot shows the Microsoft Azure Machine Learning studio interface. The left sidebar has a navigation menu with items like 'New', 'Home', 'Author', 'Notebooks', 'Automated ML', 'Designer', 'Assets', 'Datasets', 'Experiments', 'Pipelines', 'Models', 'Endpoints' (which is highlighted with a red box), 'Manage', 'Compute', 'Datastores', and 'Data Labeling'. The main content area shows the 'Endpoints' page under the 'nocodeazureml' workspace. It has tabs for 'Real-time endpoints' and 'Pipeline endpoints', with 'Real-time endpoints' selected. There are buttons for 'Refresh' and 'Delete'. A table lists three endpoints: 'myautomlmodel', 'riskrealtimemodel', and 'riskmodel'. The 'myautomlmodel' row is also highlighted with a red box. The table columns are: Name, Description, Created on, Created by, Updated on, Compute type, and Compute target. The data for 'myautomlmodel' is: Name - myautomlmodel, Description - --, Created on - November 30, 2020 3:50 PM, Created by - Serge Retkowsky, Updated on - November 30, 2020 3:50 PM, Compute type - ACI, Compute target - --. The other two rows have similar structures.

Name	Description	Created on	Created by	Updated on	Compute type	Compute target
myautomlmodel	--	November 30, 2020 3:50 PM	Serge Retkowsky	November 30, 2020 3:50 PM	ACI	--
riskrealtimemodel	Real time Risk ML ...	November 20, 2020 9:35 AM	Serge Retkowsky	November 20, 2020 9:35 AM	AKS	aksnocode
riskmodel	ML model for risk	November 19, 2020 5:50 PM	Serge Retkowsky	November 19, 2020 5:50 PM	ACI	--

Lab2 – AutoML User Interface

How to consume the deployed model

The screenshot shows the Microsoft Azure Machine Learning studio interface. The left sidebar has a tree view with nodes like 'New', 'Home', 'Author', 'Notebooks', 'Automated ML', 'Designer', 'Assets', 'Datasets', 'Experiments', 'Pipelines', 'Models', 'Endpoints' (which is selected and highlighted in grey), 'Manage', 'Compute', 'Datastores', and 'Data Labeling'. The main content area shows a breadcrumb path: 'nocodeazureml > Endpoints > myautomlmodel'. Below this, the 'myautomlmodel' endpoint details are displayed. A red box highlights the 'Basic consumption info' section, which includes:

- REST endpoint:** <http://175ced5f-687d-4d87-aec1-ad7be5c2ae80.westeurope.azurecontainer...> (with a copy icon)
- Authentication types:** A radio button is selected for "Using key".
- Primary key:** RpdvUkhcyhPnMn1dxKjTZhtre34eCEHR (with a Regenerate icon)
- Secondary key:** gsugbWLwY8aB0G3wetcZh4rDi1D2CN0r (with a Regenerate icon)

Lab2 – AutoML User Interface

The model is available in the *Models* section

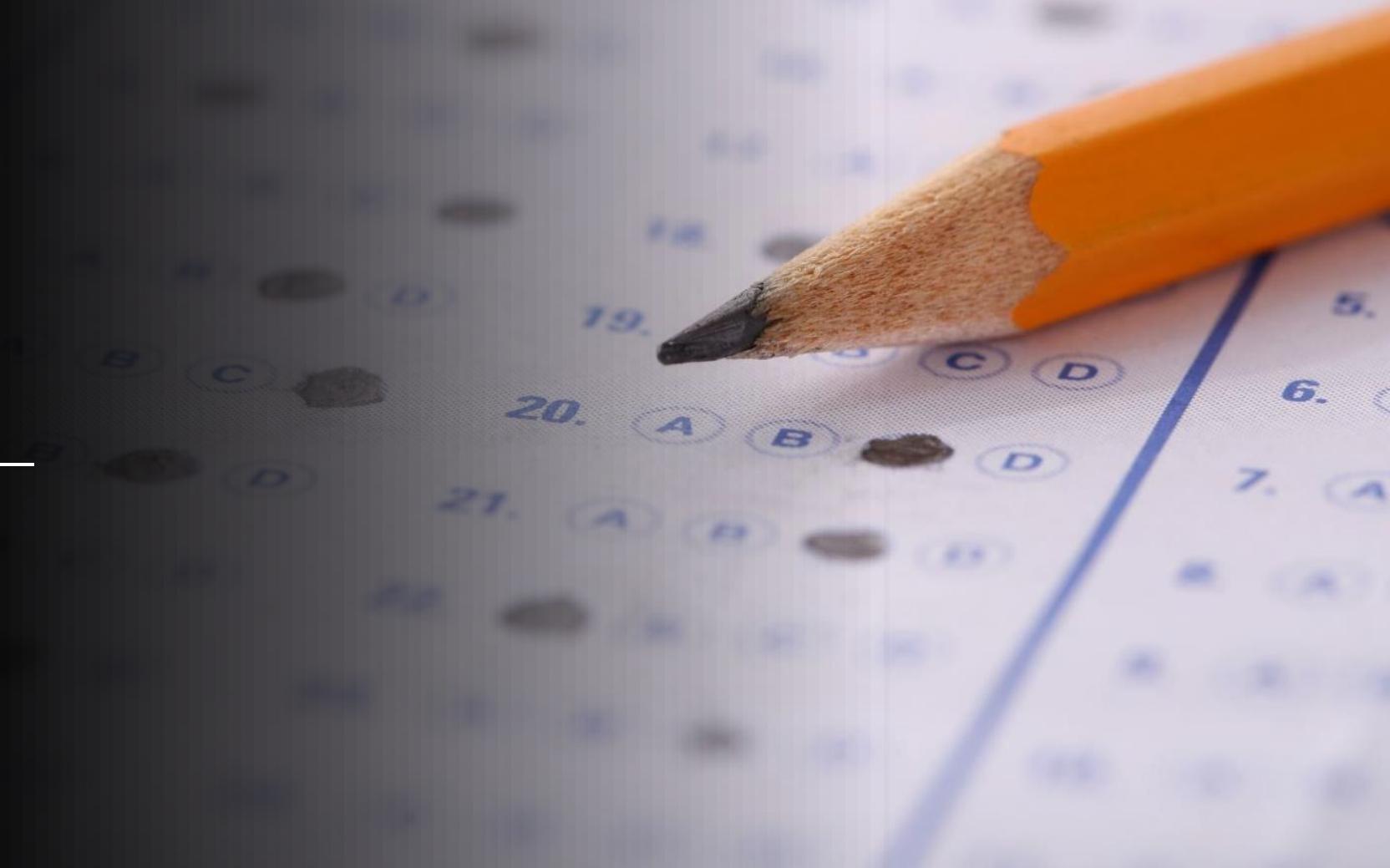
The screenshot shows the Microsoft Azure Machine Learning interface. On the left, there is a navigation sidebar with the following sections:

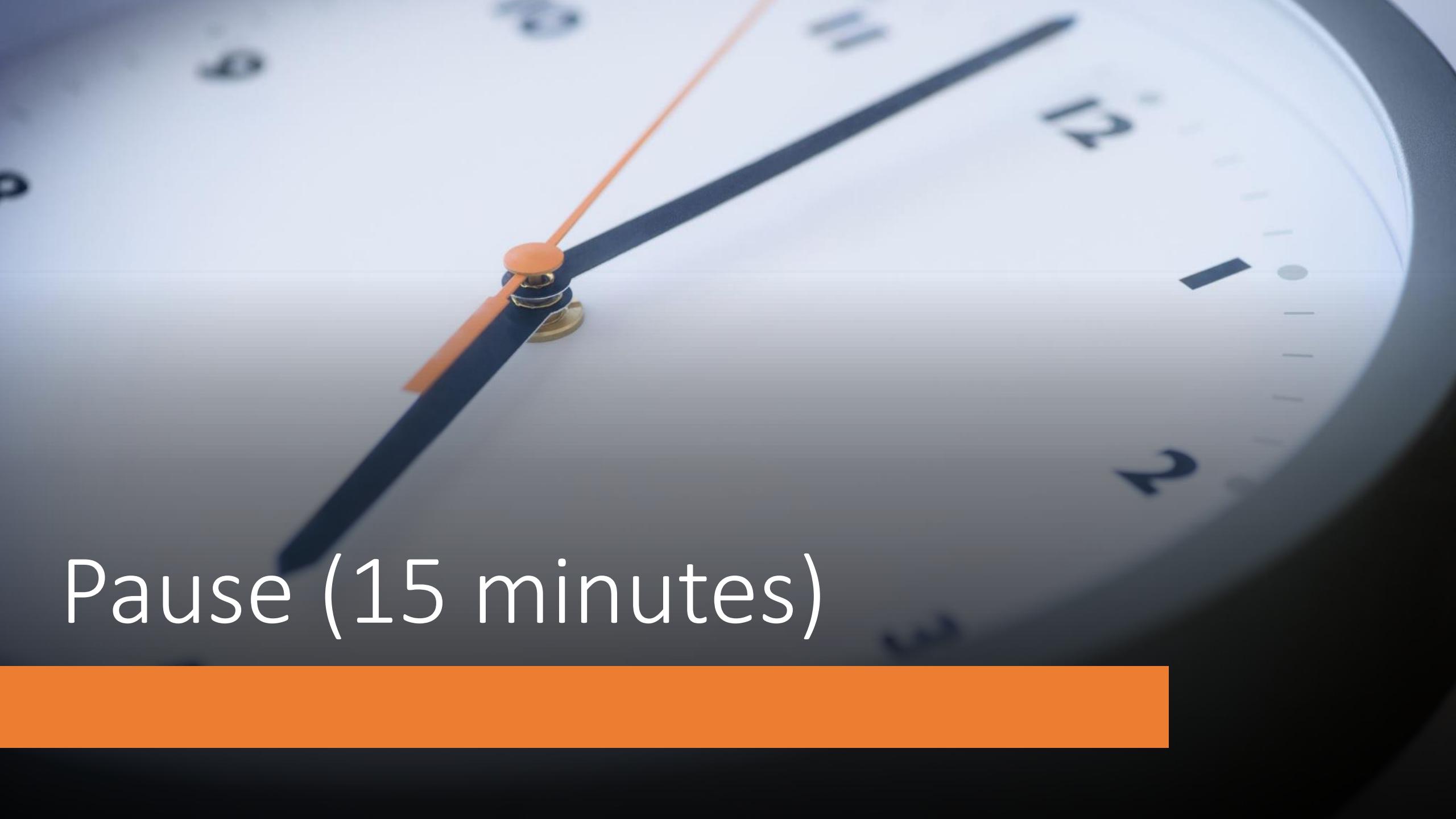
- New
- Home
- Author
 - Notebooks
 - Automated ML
 - Designer
- Assets
 - Datasets
 - Experiments
 - Pipelines
- Models** (highlighted with a red box)
- Endpoints
- Manage
 - Compute
 - Datastores
 - Data Labeling

The main content area is titled "Model List". It includes a toolbar with "Register model", "Delete", "Deploy", "Refresh", and "Add filter" buttons. Below the toolbar is a table with the following columns: Name, Version, Experiment, Run ID, Created on, and Tags. The table contains three rows of data:

Name	Version	Experiment	Run ID	Created on	Tags
AutoML11cdbe25e43	1	AutoMLCreditRisk	AutoML_11cdbe25-eb13-489a...	Nov 30, 2020 3:50 PM	
amlstudio-riskrealmtemodel	1	CreditRisk	4d7523ea-6d90-4b76-88e1-c55...	Nov 20, 2020 9:35 AM	<button>Create</button>
amlstudio-riskmodel	1	CreditRisk	4d7523ea-6d90-4b76-88e1-c55...	Nov 19, 2020 5:50 PM	<button>Create</button>

Quiz time 2





Pause (15 minutes)



Lab 3

Azure ML Designer for ML



Lab3 – Azure ML Designer



1. Let's use the saved dataset from Lab 1



2. Let's do some ML modelling using azure ML Designer (classification models).



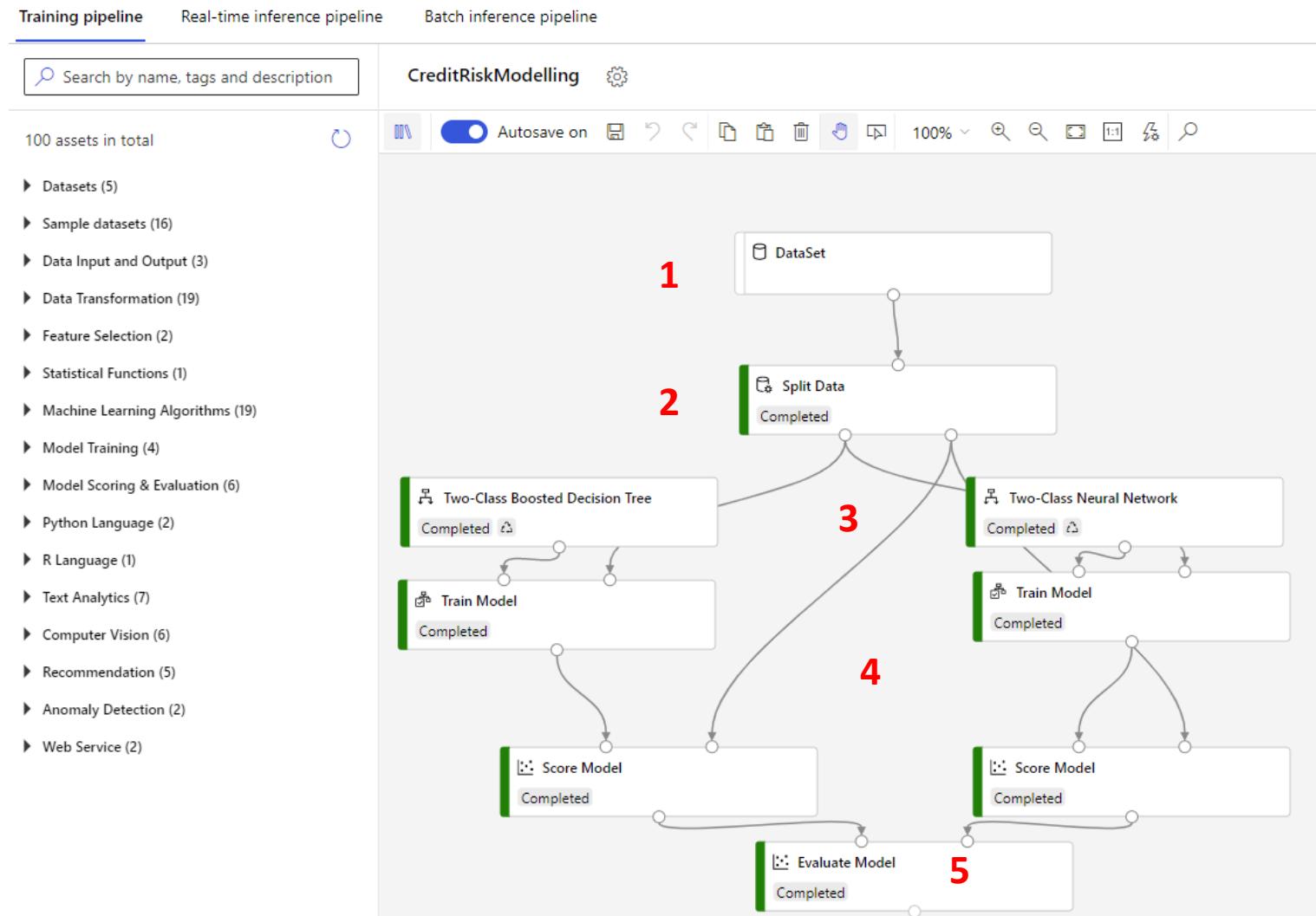
3. Then we will save our visual pipeline for Batch and Real time



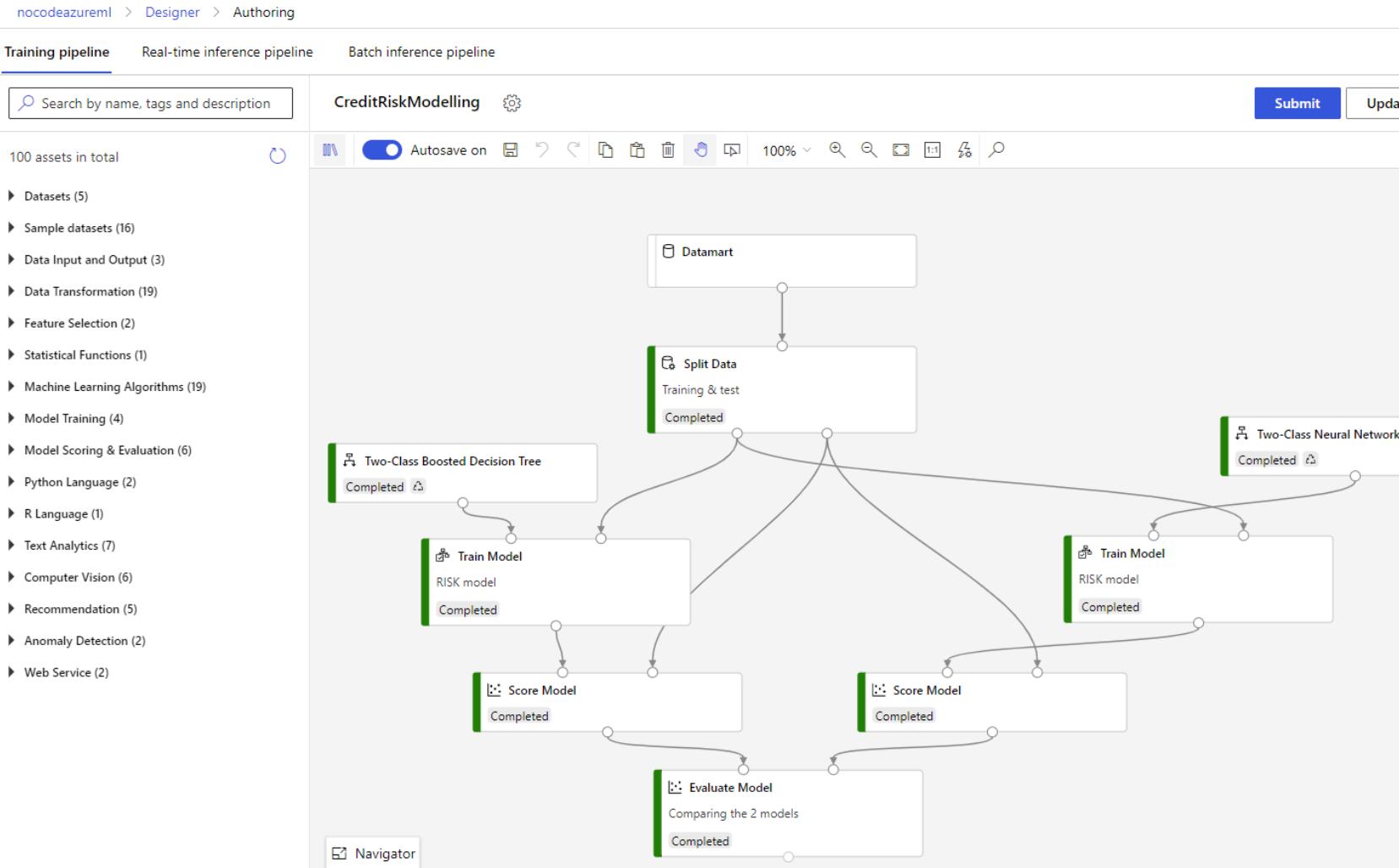
4. You can use a Python notebook for calling our deployed model

Lab3 – Azure ML Designer

1. Use the Datamart dataset
2. Split Data (70%)
3. Use a decision tree & a neural network in order to predict the **RISK** variable
4. Train & score these 2 ML models
5. Evaluate the 2 models
6. Submit the visual pipeline using a compute instance

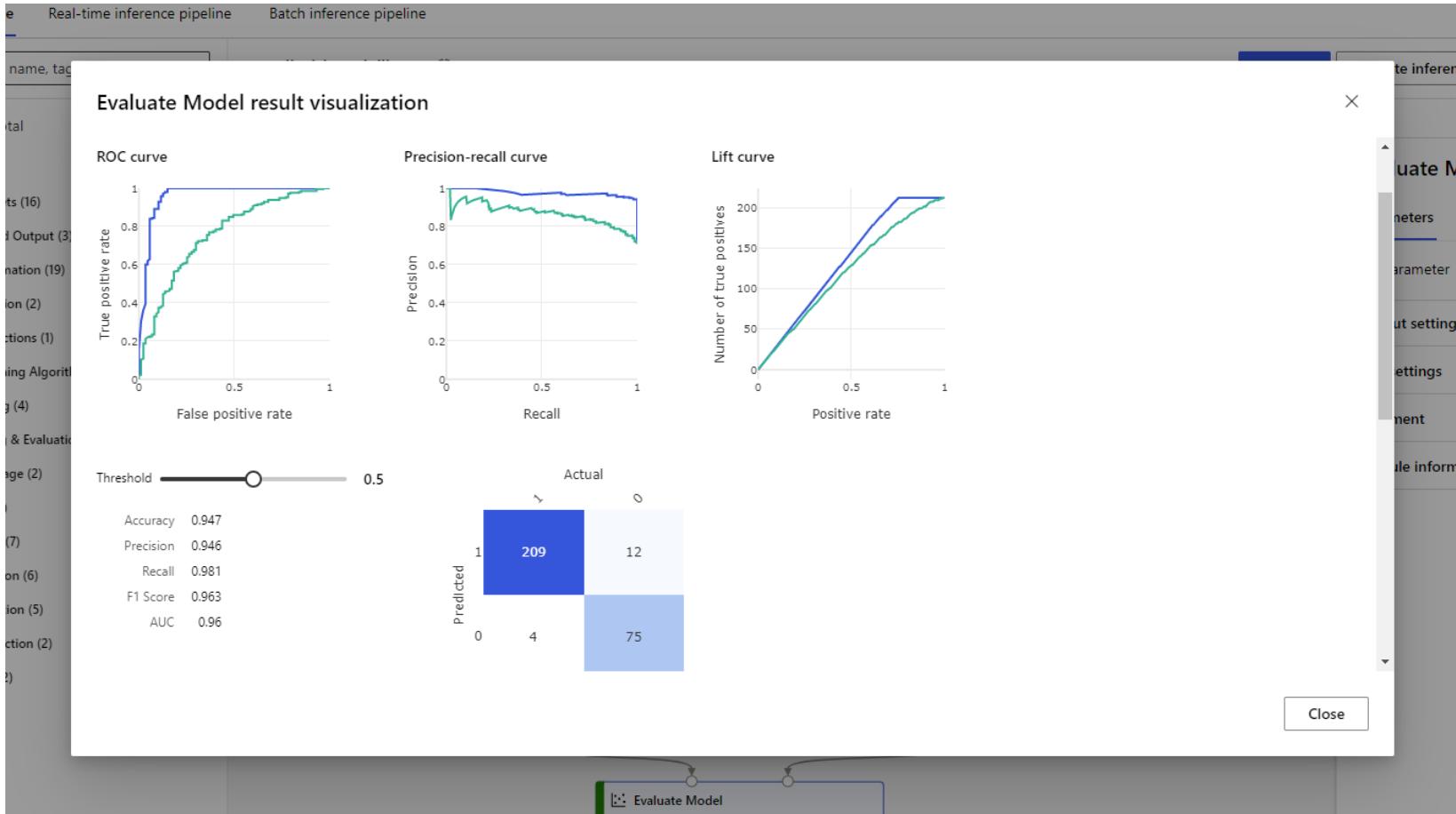


Lab3 – Azure ML Designer Run is complete



Lab3 – Azure ML Designer

We can view the results



Lab3 – Azure ML Designer

We can generate a batch pipeline

nocodeazureml > Designer > Authoring

Training pipeline Batch inference pipeline

CreditRiskModelling-batch inference

Search by name, tags and description

Submit Publish ...

100 assets in total Not started

Datasets (5)

Sample datasets (16)

Data Input and Output (3)

Data Transformation (19)

Feature Selection (2)

Statistical Functions (1)

Machine Learning Algorithms (19)

Model Training (4)

Model Scoring & Evaluation (6)

Python Language (2)

R Language (1)

Text Analytics (7)

Computer Vision (6)

Recommendation (5)

Anomaly Detection (2)

Web Service (2)

```
graph TD; A[MD-CreditRiskModelling-Train_Mo...] --> B[Score Model]; C[Datamart] --> B; B --> D[Evaluate Model];
```

The diagram illustrates a batch inference pipeline. It starts with two input sources: 'MD-CreditRiskModelling-Train_Mo...' and 'Datamart'. Both feed into a 'Score Model' component. The output of the 'Score Model' then feeds into an 'Evaluate Model' component, which has a descriptive note: 'Comparing the 2 models'.

Lab3 – Azure ML Designer

We can generate a batch pipeline endpoint

The screenshot shows the Azure ML Designer interface with the 'Batch inference pipeline' tab selected. On the left, there's a sidebar with various asset categories like Datasets, Sample datasets, Data Input and Output, etc. The main area displays a pipeline named 'CreditRiskModelling-batch inference'. A modal dialog box titled 'Set up published pipeline' is open in the center. This dialog has several sections: 'PipelineEndpoint' where 'Create new' is selected and a name 'CreditRiskModelling-batch' is entered; 'Published pipeline' which lists 'CreditRiskModelling-batch inference 11-30-2020-04-01'; and 'Pipeline parameters and default values' which notes 'No pipeline parameters are specified'. At the bottom of the dialog are 'Publish' and 'Cancel' buttons. The 'Create new' radio button and the pipeline name input field are highlighted with a red rectangle.

Lab3 – Azure ML Designer Batch Pipeline endpoint

Microsoft Azure Machine Learning

nocodeazureml > Pipelines > CreditRiskModelling-batch

CreditRiskModelling-batch

Details Published pipelines

Refresh Submit Clone

Hide overview

Pipeline endpoint overview

Status: Active

REST endpoint: <https://westeurope.api.azureml.ms/pipelines/v1.0/subscriptions/70b8f39e-8863-49f7-b6ba-34a80799550c/resourceGroups/nocode/providers/Microsoft.MachineLearningServices/workspaces/nocodeazureml/PipelineRuns/PipelineEndpointSubmit/Id/7bd4a366-26da-424f-8619-5d370b8ae0c1>

REST endpoint documentation: <https://westeurope.api.azureml.ms/pipelines/swagger/pipelineendpointsubmit/swagger.json>

Published by: Serge Retkowsky

Date published: November 30, 2020 4:01 PM

PipelineEndpoint ID: 7bd4a366-26da-424f-8619-5d370b8ae0c1

Default version: 0

Default published pipeline: ed693ab6-9298-4483-b0c6-bfe938d3bcac

Last run submit time: -

Navigator

Lab3 – Azure ML Designer Real time Pipeline

nocodeazureml > Designer > Authoring

Training pipeline Real-time inference pipeline Batch inference pipeline

Search by name, tags and description CreditRiskModelling-real time inference Submit Deploy ...

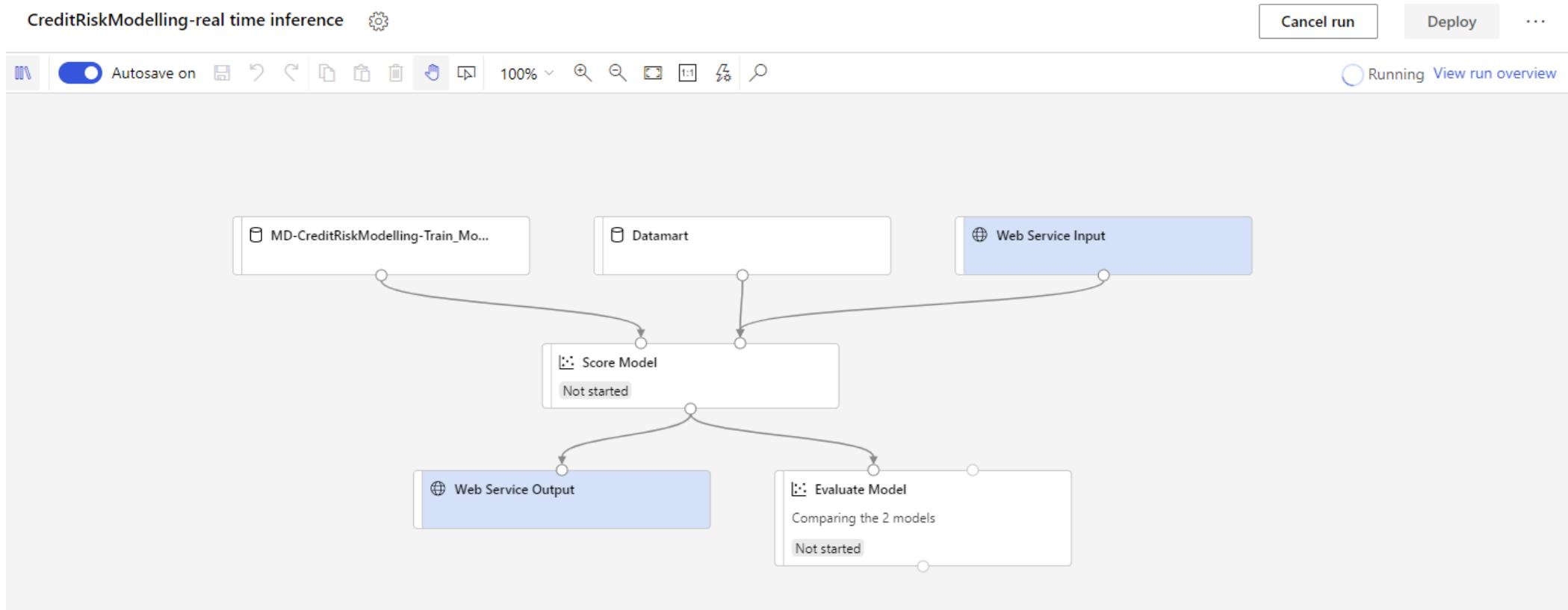
100 assets in total Autosave on Not started

Datasets (5) Sample datasets (16) Data Input and Output (3) Data Transformation (19) Feature Selection (2) Statistical Functions (1) Machine Learning Algorithms (19) Model Training (4) Model Scoring & Evaluation (6) Python Language (2) R Language (1) Text Analytics (7) Computer Vision (6) Recommendation (5) Anomaly Detection (2) Web Service (2)

```
graph LR; A[MD-CreditRiskModelling-Train_Mo...] --> C[Score Model]; B[Datamart] --> C; D[Web Service Input] --> C; C --> E[Web Service Output]; C --> F[Evaluate Model]; F --- G[Comparing the 2 models]
```

Lab3 – Azure ML Designer Real time Pipeline

Submit the pipeline and then you can deploy it for real time



Lab3 – Azure ML Designer

Let's create an inference cluster for model deployment

You can use an existing AKS instance or create a new one

The screenshot shows the Azure ML Designer interface under the 'Compute' section. On the left, there is a sidebar with 'Compute instances' and 'Compute clusters' sections, featuring buttons for 'New', 'Refresh', 'Delete', and a search bar. A table lists an existing compute instance named 'myaksinstance'. The main area is titled 'Create inference cluster' and contains a 'Select virtual machine' section. It offers two options: 'Virtual Machine' (selected) and 'Settings'. Below this, there is a 'Kubernetes Service' section with radio buttons for 'Create new' (selected) and 'Use existing'. A 'Region *' dropdown menu is also present.

Lab3 – Azure ML Designer

The inference cluster is available

Microsoft Azure Machine Learning

The screenshot shows the Azure Machine Learning Compute interface. On the left is a navigation sidebar with options like New, Home, Author, Notebooks, Automated ML, Designer, Assets, Datasets, Experiments, Pipelines, Models, Endpoints, Manage, Compute (which is selected), Datastores, and Data Labeling. The main area is titled 'Compute' and shows tabs for Compute instances, Compute clusters, Inference clusters (which is selected and highlighted in blue), and Attached compute. Below the tabs are buttons for New, Refresh, Delete, and Detach. A table lists an inference cluster: myaksinstance (Name), Kubernetes service (Type), Attached (Created/Attached), Succeeded (Provisioning state), and Nov 30, 2020 4:29 PM (Created on). The row for 'myaksinstance' is highlighted with a red box.

Name	Type	Created/Attached	Provisioning state	Created on
myaksinstance	Kubernetes service	Attached	Succeeded	Nov 30, 2020 4:29 PM

Lab3 – Azure ML Designer

Let's deploy the real-time pipeline

nocodeazureml > Designer > Authoring

Training pipeline Real-time inference pipeline Batch inference pipeline

Search by name, tags and description

CreditRiskModelling-real time inference

100 assets in total

Datasets (5) Sample datasets (16) Data Input and Output (3) Data Transformation (19) Feature Selection (2) Statistical Functions (1) Machine Learning Algorithms (19) Model Training (4) Model Scoring & Evaluation (6) Python Language (2) R Language (1) Text Analytics (7) Computer Vision (6) Recommendation (5) Anomaly Detection (2) Web Service (2)

Autosave

Set up real-time endpoint

Deploy new real-time endpoint Replace an existing real-time endpoint

Name * creditriskmodelrealtime

Description Credit Risk Model for real time

Compute type * Azure Kubernetes Service

Compute name * myaksinstance

Advanced

Deploy Cancel

The screenshot shows the Azure ML Designer interface with the 'Real-time inference pipeline' selected. A modal dialog titled 'Set up real-time endpoint' is open, prompting the user to either 'Deploy new real-time endpoint' or 'Replace an existing real-time endpoint'. The 'Deploy new real-time endpoint' option is selected. The 'Name' field is populated with 'creditriskmodelrealtime'. The 'Description' field contains 'Credit Risk Model for real time'. The 'Compute type' dropdown is set to 'Azure Kubernetes Service'. The 'Compute name' dropdown is set to 'myaksinstance'. At the bottom of the dialog are 'Advanced' and 'Deploy' buttons, with 'Deploy' being highlighted in blue.

Lab3 – Azure ML Designer

The pipeline is deployed into AKS for real time usage

Microsoft Azure Machine Learning

nocodeazureml > Endpoints

Endpoints

Real-time endpoints Pipeline endpoints

Refresh Delete

Name	Description	Created on	Created by	Updated on	Compute type	Compute target
creditriskmodelrealtime	Credit Risk Model for real time	November 30, 2020 4:34 PM	Serge Retkowsky	November 30, 2020 4:34 PM	AKS	myaksinstance
myautomlmodel	--	November 30, 2020 3:50 PM	Serge Retkowsky	November 30, 2020 3:50 PM	ACI	--

Endpoints

- Manage
- Compute
- Datastores
- Data Labeling

Lab3 – Azure ML Designer

Real time deployed pipeline information

Microsoft Azure Machine Learning

nocodeazureml > Endpoints > creditriskmodelrealtime

creditriskmodelrealtime

Details Test Consume Deployment logs

Attributes

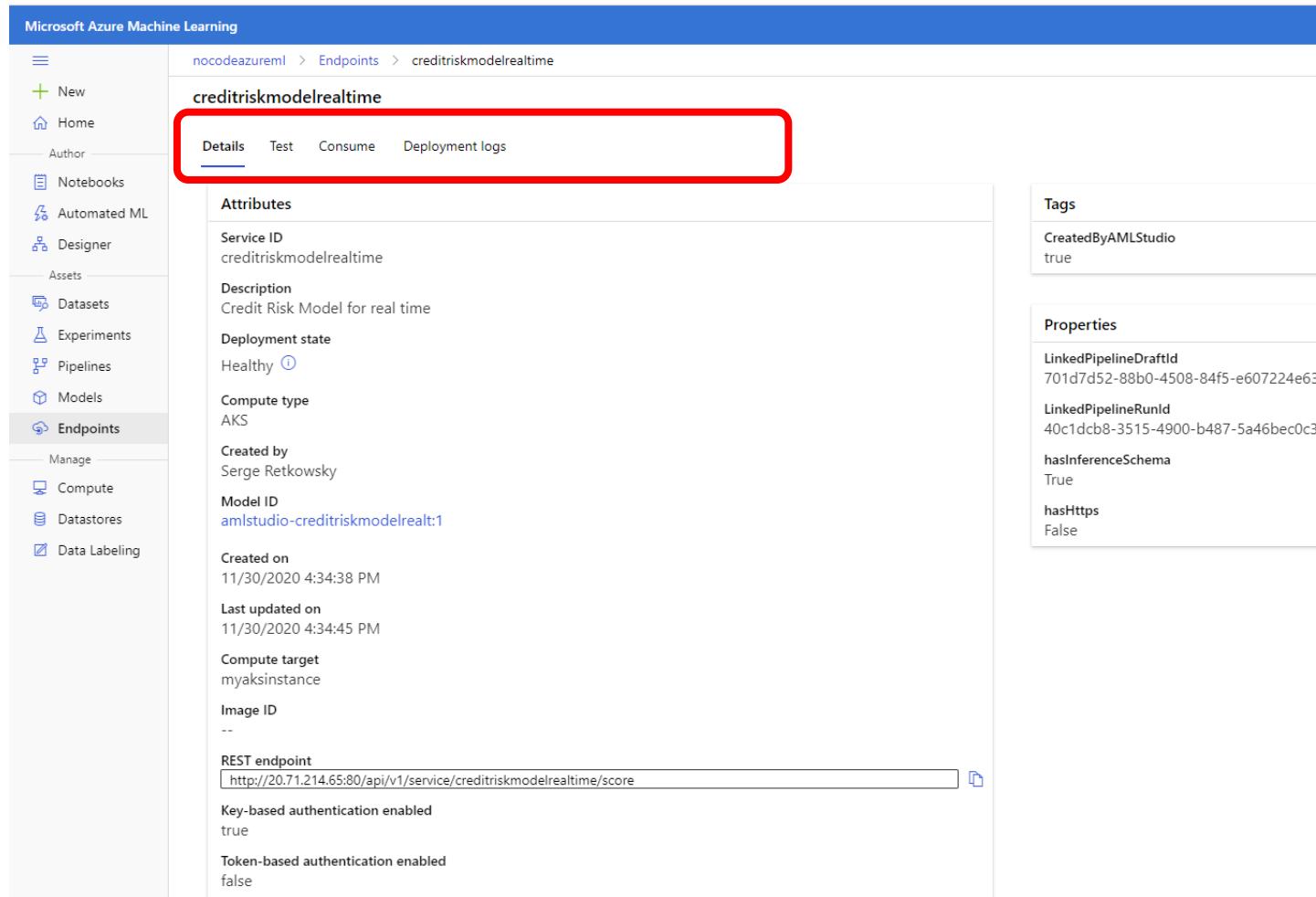
- Service ID: creditriskmodelrealtime
- Description: Credit Risk Model for real time
- Deployment state: Healthy ⓘ
- Compute type: AKS
- Created by: Serge Retkowsky
- Model ID: amlstudio-creditriskmodelrealtime:1
- Created on: 11/30/2020 4:34:38 PM
- Last updated on: 11/30/2020 4:34:45 PM
- Compute target: myaksinstance
- Image ID: --
- REST endpoint: <http://20.71.214.65:80/api/v1/service/creditriskmodelrealtime/score>
- Key-based authentication enabled: true
- Token-based authentication enabled: false

Tags

- CreatedByAMLStudio: true

Properties

- LinkedPipelineDraftId: 701d7d52-88b0-4508-84f5-e607224e63b:
- LinkedPipelineRundId: 40c1dc8-3515-4900-b487-5a46bec0c3b:
- hasInferenceSchema: True
- hasHttps: False



Lab3 – Azure ML Designer

We can test the deployed pipeline

Microsoft Azure Machine Learning

nocodeazureml > Endpoints > creditriskmodelrealtime

creditriskmodelrealtime

Details Test Consume Deployment logs

Input data to test real-time endpoint

WebServiceInput0

CustomerID
10000001

RISK
1

Account Balance
1

Duration of Credit (month)
18

Payment Status of Previous Credit
4

Purpose
2

Credit Amount
1049

Test

Test result

WebServiceOutput0

key	value
CustomerID	10000001
RISK	1
Account Balance	1
Duration of Credit (month)	18
Payment Status of Previous Cr...	4
Purpose	2
Credit Amount	1049
Value Savings/Stocks	1
Length of current employment	2
Instalment per cent	4
Sex & Marital Status	2
Guarantors	1
Duration in Current address	4
Most valuable available asset	2
Age (years)	21

The screenshot shows the Microsoft Azure Machine Learning Studio interface. On the left, a sidebar lists various options like New, Home, Notebooks, Automated ML, Designer, Assets, Datasets, Experiments, Pipelines, Models, and Endpoints. The 'Endpoints' option is currently selected. The main area displays a deployed endpoint named 'creditriskmodelrealtime'. The 'Test' tab is active. On the left, there's a form titled 'Input data to test real-time endpoint' with a section for 'WebServiceInput0'. It contains fields for CustomerID (10000001), RISK (1), Account Balance (1), Duration of Credit (month) (18), Payment Status of Previous Credit (4), Purpose (2), and Credit Amount (1049). A red box highlights the 'Test' button. On the right, the 'Test result' section shows the output in a table format, listing various key-value pairs corresponding to the input fields. The table has columns for 'key' and 'value'. Some keys include CustomerID, RISK, Account Balance, Duration of Credit (month), Payment Status of Previous Cr..., Purpose, Credit Amount, Value Savings/Stocks, Length of current employment, Instalment per cent, Sex & Marital Status, Guarantors, Duration in Current address, Most valuable available asset, and Age (years).

Lab3 – Azure ML Designer

We can test the deployed pipeline using Python, C# or R

The screenshot shows the Microsoft Azure Machine Learning studio interface. On the left, there's a sidebar with various navigation options like New, Home, Author, Notebooks, Automated ML, Designer, Assets, Datasets, Experiments, Pipelines, Models, and Endpoints. Under Endpoints, there's a 'Manage' section with Compute, Datastores, and Data Labeling.

The main area displays a deployed endpoint named 'creditriskmodelrealtime'. The 'Consume' tab is selected. Under 'Basic consumption info', it shows a REST endpoint at <http://20.71.214.65:80/api/v1/service/creditriskmodelrealtime/score>. It also lists authentication types: 'Using key' (selected) and 'Using token'. Below that are primary and secondary keys.

In the 'Consumption option' section, there's a 'Consumption types' panel with three tabs: C#, Python, and R. The 'Python' tab is highlighted with a red rectangle. Below it, there's a code editor window showing Python code for making a request to the endpoint. The code includes importing urllib.request, json, os, and ssl, defining a function to bypass certificate verification, and creating a JSON input data structure.

```
1 import urllib.request
2 import json
3 import os
4 import ssl
5
6 def allowSelfSignedHttps(allowed):
7     # bypass the server certificate verification on client side
8     if allowed and not os.environ.get('PYTHONHTTPSVERIFY', '') and getattr(ssl, '_create_unverified_context', None):
9         ssl._create_default_https_context = ssl._create_unverified_context
10
11 allowSelfSignedHttps(True) # this line is needed if you use self-signed certificate in your scoring service.
12
13 data = {
14     "Inputs": {
15         "WebServiceInput0": [
16             [
17                 {
18                     "Feature1": 1,
19                     "Feature2": 2
20                 }
21             ]
22         ]
23     }
24 }
```

Lab3 – Azure ML Designer

You can see all your Designer pipelines

Microsoft Azure Machine Learning

nocodeazureml > Designer

Designer

New pipeline

Easy-to-use prebuilt modules

Image Classification using DenseNet

Binary Classification using Vowpal Wabbit Model - Adu...

Wide & Deep based Recommendation - Restaur...

Regression - Autor...

Pipelines

Pipeline drafts Pipeline runs

Refresh Delete

Search to filter items...

Name	Pipeline type	Updated on ↓	Created by
CreditRiskModelling-real time inference	Real-time inference	Nov 30, 2020 4:34 PM	Serge Retkowsky
CreditRiskModelling-batch inference	Batch inference	Nov 30, 2020 4:04 PM	Serge Retkowsky
CreditRiskModelling	Training	Nov 30, 2020 4:04 PM	Serge Retkowsky
Credit Risk Data Prep	Training	Nov 30, 2020 3:02 PM	Serge Retkowsky

Lab4 – AutoML PowerBI integration



How to use AutoML from PowerBI?

Lab4 – AutoML PowerBI integration

Let's create a dataflow

The screenshot shows the Microsoft Power BI web interface. At the top, there is a navigation bar with the Microsoft logo, 'Power BI', and 'Power BI AI Preview Support'. On the left, a sidebar menu includes 'Home', 'Favorites', 'Recent', 'Create', 'Apps', 'Shared with me', 'Deployment pipelines', and 'Learn'. Below this is a 'Workspaces' section with a 'Power BI AI Preview...' item. The main content area features a title 'Start creating your dataflow' above three cards. The first card, 'Define new entities', is highlighted with a red box around its title and a yellow button at the bottom labeled 'Add new entities'. The second card, 'Link entities from other dataflows', has a yellow button at the bottom labeled 'Add linked entities'. The third card, 'Import Model', has a yellow button at the bottom labeled 'Import model'. To the right of the cards is a small diagram of three interconnected dataflow components.

Start creating your dataflow

Define new entities

Choose a data source to define the entities for your dataflow. You can map your data to [standard Common Data Model entities](#), or define custom entities instead.

[Learn more](#)

Add new entities

Link entities from other dataflows

Linking to entities from other dataflows reduces duplication and helps maintain consistency across your organization.

[Learn more](#)

Add linked entities

Import Model

Choose a dataflow model to import into your workspace.

[Learn more](#)

Import model

Lab4 – AutoML PowerBI integration

Let's create a dataflow using a CSV file format

The screenshot shows the 'Connection settings' section of the PowerBI Data Flow setup. A red box highlights the 'File path or URL' input field, which contains the value <https://raw.githubusercontent.com/retkowsky/AM>. To the left, there is a 'Text/CSV File' icon. Below the URL field, there are sections for 'Connection credentials', 'On-premises data gateway' (set to '(none)'), and 'Authentication kind' (set to 'Anonymous').

<https://raw.githubusercontent.com/retkowsky/AMlabs/main/Nocode/PowerBI.csv>

Lab4 – AutoML PowerBI integration

Let's create a dataflow

<https://raw.githubusercontent.com/retkowsky/AMLlabs/main/Nocode/PowerBI.csv>

File origin: 1252: Western European (Windows) | Delimiter: Comma | Data type detection: Based on first 200 rows | Refresh

12 RISK	12 Account Balance	12 Duration of Credit (month)	12 Payment Status of Previous Credit	12 Purpose	12 Credit Amount	12 Value Savings/Stocks	12 Length of current employment	12 Instalment per cent	12 Sex & Marital Status	12 Guarantors	12 Duration in Current add
1	1	18	4	2	1049	1	2	4	2	1	
1	1	9	4	0	2799	1	3	2	3	1	
1	2	12	2	9	841	2	4	2	2	1	
1	1	12	4	0	2122	1	3	3	3	1	
1	1	12	4	0	2171	1	3	4	3	1	
1	1	10	4	0	2241	1	2	1	3	1	
1	1	8	4	0	3398	1	4	1	3	1	
1	1	6	4	0	1361	1	2	2	3	1	
1	4	18	4	3	1098	1	1	4	2	1	
1	2	24	2	3	3758	3	1	1	2	1	
1	1	11	4	0	3905	1	3	2	3	1	
1	1	30	4	1	6187	2	4	1	4	1	
1	1	6	4	3	1957	1	4	1	2	1	
1	2	48	3	10	7582	2	1	2	3	1	
1	1	18	2	3	1936	5	4	2	4	1	
1	1	6	2	3	2647	3	3	2	3	1	
1	1	11	4	0	3939	1	3	1	3	1	
1	2	18	2	3	3213	3	2	1	4	1	
1	2	36	4	3	2337	1	5	4	3	1	
1	4	11	4	0	7228	1	3	1	3	1	
1	1	6	4	0	3676	1	3	1	3	1	
1	2	12	4	0	3124	1	2	1	3	1	
0	2	36	2	5	2384	1	2	4	3	1	
1	2	12	4	4	1424	1	4	4	3	1	
1	1	6	4	0	4716	5	2	1	3	1	
1	2	11	3	3	4771	1	4	2	3	1	
1	1	12	2	2	652	1	5	4	2	1	
1	2	9	4	3	1154	1	5	2	3	1	
1	4	15	2	0	3556	5	3	3	3	1	
1	3	42	4	1	4796	1	5	4	3	1	
1	3	30	4	3	3017	1	5	4	3	1	
1	4	36	4	0	3535	1	4	4	3	1	
1	4	36	4	0	6514	1	5	4	2	1	

Back Cancel Transform data

Lab4 – AutoML PowerBI integration

Let's create a dataflow

Power Query - Edit queries

Home Transform Add column View

Get data Options Manage parameters Refresh Properties Advanced editor

Choose columns Remove columns Keep rows Remove rows Sort

Split column Group by Reduce rows Data type: Whole number ABC Use first row as headers Append queries Combine files Map to entity CDM AI insights

Queries < PowerBIdataset

Table.TransformColumnTypes(#"Promoted headers", {"RISK", Int64.Type}, {"Account Balance", Int64.Type}, {"Duration of Credit (month)", Int64.Type}, {"Payment Status of Previous Credit", Int64.Type}, {"Purpose", Int64.Type}, {"Credit Amount", Int64.Type}, {"Value Savings/Stocks", Int64.Type}, {"Length of current employment", Int64.Type}, {"Instalment per cent", Int64.Type})

Query settings

Name: PowerBIdataset

Entity type: Custom

Applied steps

- Source
- Promoted headers
- Changed colu... 123

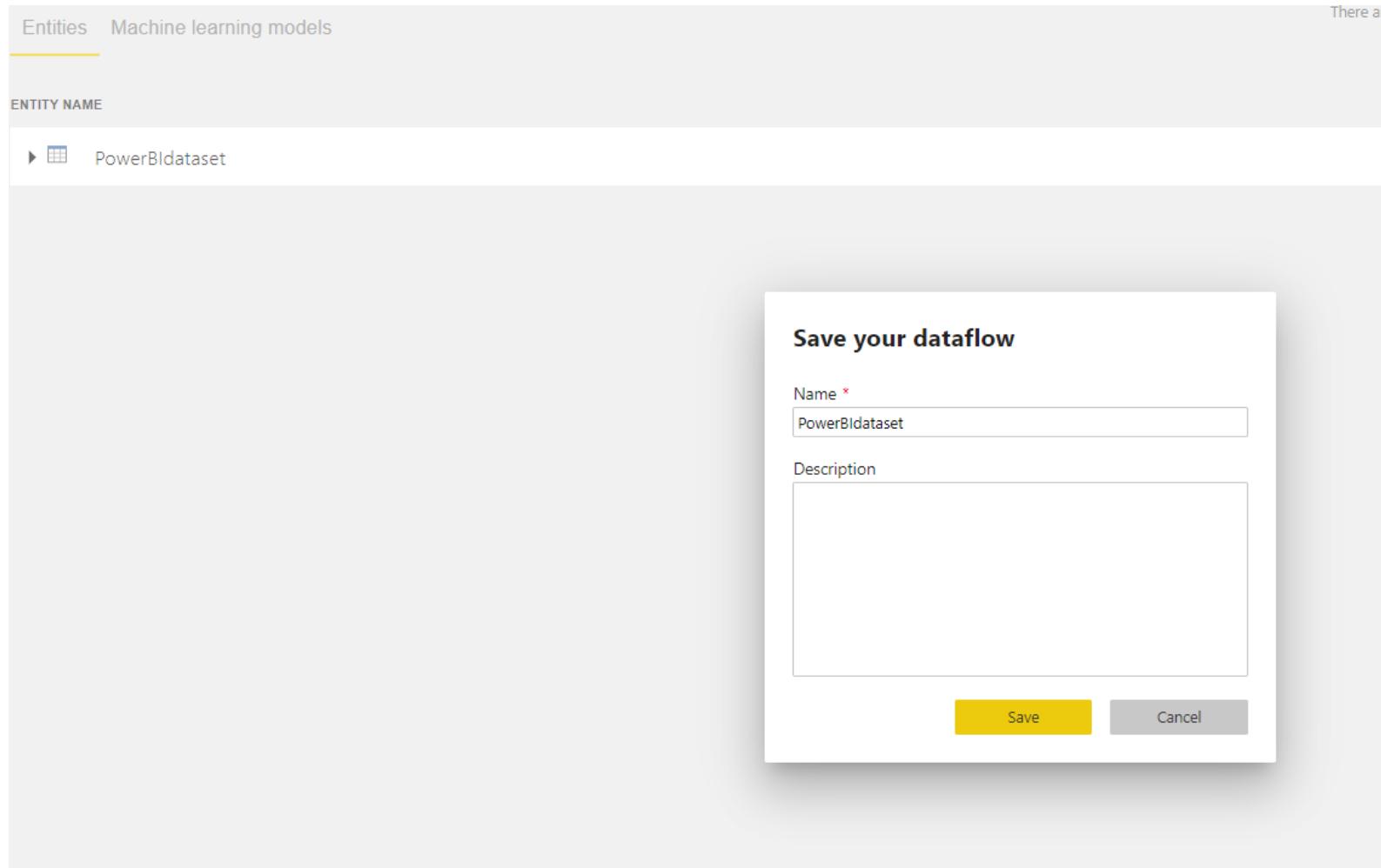
Columns: 21 Rows: 99+

Completed (2.00 s) Step Cancel Save & close

The screenshot shows the Power Query - Edit queries interface. The main area displays a data table with 31 rows and 21 columns. The columns are labeled: RISK, Account Balance, Duration of Credit (month), Payment Status of Previous Credit, Purpose, Credit Amount, Value Savings/Stocks, Length of current employment, and Instalment per cent. The 'Promoted headers' step has been applied to the first row. The 'Changed colu...' step is also listed under applied steps. The 'Query settings' pane on the right shows the dataset is named 'PowerBIdataset' and is of type 'Custom'. The status bar at the bottom indicates the operation completed in 2.00 seconds.

Lab4 – AutoML PowerBI integration

Let's create a dataflow



Lab4 – AutoML PowerBI integration

Let's create an autoML job

Entities Machine learning models

New to machine learning models? Here's what you'll be doing:

```
graph LR; A[1. Create and train your model] --- B[2. Improve it]; A --- C[3. Apply it]
```

1. Create and train your model

2. Improve it

3. Apply it

1. Create and train your model

- Select training data**
Select your base data to train your model.
- Choose a model type**
We'll help you pick the best model to achieve your business goals.
- Train your model**
The model will train on your data and report on its performance.

2. Improve it

- Iterate and retrain**
Evaluate, customize and retrain your model until it's optimized

3. Apply it

- Apply the model**
Apply your model to future data for predictive insights.

Get started

Lab4 – AutoML PowerBI integration

Let's create an autoML job

A screenshot of the Microsoft AutoML interface, showing the first step of creating a job: "Select a field to predict".

The interface features a horizontal progress bar with three steps:

- Step 1: Select a field to predict (highlighted with a yellow checkmark)
- Step 2: Choose a model
- Step 3: Select data to study

Below the progress bar, the text "What do you want to predict?" is displayed, followed by a descriptive message: "Select the entity and the outcome field you'd like to make predictions about so we can recommend the best model."

The "Entity" dropdown is set to "PowerBIdataset". The "Outcome field" dropdown is set to "RISK". Both dropdowns are highlighted with a red rectangular border.

Lab4 – AutoML PowerBI integration

Let's create an autoML job

Select a field to predict Choose a model Select data to study

Choose a model

Based on the field you selected, we recommend a Prediction model. This model learns from your data to predict whether or not an outcome will be achieved. Not what you're looking for? [Select a different model](#)

Binary Prediction
Predict whether or not an outcome will be achieved.

Choose a target outcome
Enter or select the RISK outcome that you're most interested in.

How should we label predictions in the model training report?

Match label
Enter the text you want to display when our prediction matches your target value.

Mismatch label
Enter the text you want to display when our prediction doesn't match your target value.

Lab4 – AutoML PowerBI integration

Let's create an autoML job

Select a field to predict Choose a model Select data to study Name and train

Select the data your model should study

Based on a sample of your data, we've selected fields that may produce more accurate outcomes. If we don't recommend a field, we've explained why next to it. Change your selections to include only the fields you want the model to study.

Search Reset Clear 16 fields selected

PowerBIdataset

- RISK (Outcome field)
- Account Balance
- Duration of Credit (month)
- Payment Status of Previous Credit
- Purpose
- Credit Amount
- Value Savings/Stocks
- Length of current employment
- Instalment per cent
- Sex & Marital Status (*low correlation with RISK*)
- Guarantors
- Duration in Current address (*low correlation with RISK*)
- Most valuable available asset
- Age (years) (*low correlation with RISK*)
- Concurrent Credits
- Type of apartment (*low correlation with RISK*)
- No of Credits at this Bank
- Occupation (*low correlation with RISK*)

Next Back Cancel

Lab4 – AutoML PowerBI integration

Let's create an autoML job

The screenshot shows a step-by-step wizard for creating an AutoML job. The first two steps are completed, indicated by yellow checkmarks above the progress bar. The third step, "Select data to study," is the current active step.

Name and train your model

Model name: CreditRiskAutoML

Description: (Optional)

Training time

The longer you train your model, the more accurate the results. Train for a short time if you just want to make sure you've selected the right data. Keep in mind, this won't result in the best model.

5 minutes • 360 minutes | 5 minutes

What happens next?

We'll take a statistically significant sample of your data and train the model using 80% of it. We'll then test the model on the remaining 20% and go over the Prediction accuracy in a report. You can find the training and test data we used in your workspace.

Lab4 – AutoML PowerBI integration

Results

germancreditrisk model training report

This report summarizes the model performance and training details and enables you to find an optimal threshold for defining your business outcome.

Apply model Edit model

MODEL PERFORMANCE

How the model was evaluated

The model predicted Risk probabilities for a test set of 200 records and compared the predicted outcomes (based on the selected threshold) to the historical outcomes.

Model performance

The Area under the curve (AUC) observed on the test set is :

72%

Different features have varying influence on the predicted outcome. Click below for details.

See top predictors

	Predicted bad	Predicted Not bad
Actual bad	41.00	22.00
Actual Not bad	46.00	91.00

47% of records predicted as bad are likely to actually be bad

Precision

68% of records that are actually bad are likely to be predicted as bad

Recall

Probability Threshold

0.00 0.50

Increase Recall Increase Precision

Cost-Benefit Analysis

Model Performance Accuracy Report Training Details

Lab4 – AutoML PowerBI integration

Results

germancreditrisk model training report

This report summarizes the model performance and training details and enables you find an optimal threshold for defining your business outcome.

Apply model Edit model

MODEL PERFORMANCE

How the model was evaluated
The model predicted Risk probabilities for a test set of 200 records and compared the predicted outcomes (based on the selected threshold) to the historical outcomes.

Model performance
The Area under the curve (AUC) observed on the test set is : **72%**

Different features have varying influence on the predicted outcome. Click below for details.

See top predictors

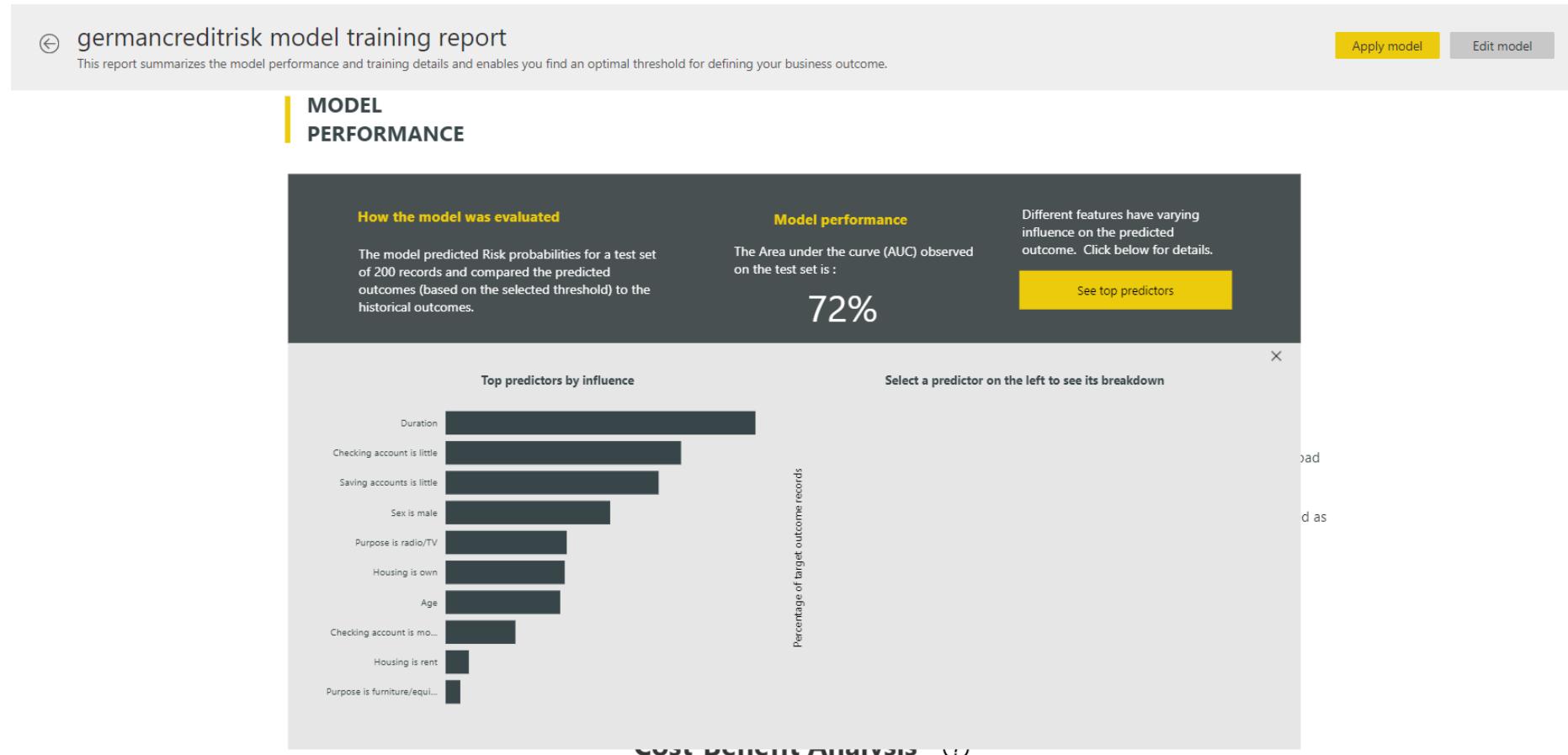
Top predictors by influence

Select a predictor on the left to see its breakdown

Duration
Checking account is little
Saving accounts is little
Sex is male
Purpose is radio/TV
Housing is own
Age
Checking account is mo...
Housing is rent
Purpose is furniture/equi...

Percentage of target outcome records

COST-BENEFIT ANALYSIS



Lab4 – AutoML PowerBI integration

Results

germancreditrisk model training report

This report summarizes the model performance and training details and enables you find an optimal threshold for defining your business outcome.

Apply model Edit model

ACCURACY REPORT

Accuracy of the model predictions
The likely accuracy of predictions generated by your machine learning model can be interpreted using a Cumulative Gains chart and the Receiver Operating Characteristics (ROC) curve.

Area under the ROC curve
72%

Cumulative Gains Chart
A Cumulative Gains chart shows what percentage of rows with the target outcome can be detected by targeting a percentage of the total rows.

This chart compares the performance of 3 approaches:
- "Model" -- your model is used to sort the rows in descending order of the predicted score indicating the target outcome
- "Ideal" -- a theoretically "perfect" model, which would always rank any rows in the target category above rows that do not belong to the target category
- "Random guess" -- no model being used. The rows are assumed to be evenly distributed so, for example, 10% of the total rows are expected to contain 10% of the target category rows.

Each point on the horizontal axis represents a percentage of the population. By inspecting the vertical coordinates, you can learn how many (%) correct targets would be identified by your model, an ideal model or a random guess.

The performance of your model gets better as it gets close to the ideal model line.

ROC Curve
An ROC (Received Operating Characteristics) curve tells you how capable your model is to distinguish between the target outcome (positive) and the other rows in your data (negative).

A model will produce probability, between 0 and 1, for each row it scores. Typically, you will select a threshold (e.g. 0.5) and decide that everything above that threshold will be treated as a positive prediction and everything below will be treated as a negative prediction.

Each point on the ROC curve represents a possible value of the probability threshold. The vertical coordinate represents the rate of correct positive predictions, while the horizontal coordinate represents the rate of negatives incorrectly labeled by your model as positives.

A random guess strategy is equally likely to make correct and incorrect predictions, therefore the ROC curve for a random guess is a diagonal line. An ideal model would identify all true positives at a cost of 0 incorrect predictions, therefore producing a perfect rectangle.

The area under the ROC curve associated with your model is the fraction of the performance of an ideal model that is achieved by your model. The higher the curve, the better your model is at predicting positives as positives and negatives as negatives.

Model Performance Accuracy Report Training Details

Lab4 – AutoML PowerBI integration Results

germancreditrisk model training report

This report summarizes the model performance and training details and enables you find an optimal threshold for defining your business outcome.

DETAILS

How the model was trained

Power BI used the automated ML capability in Azure Machine Learning to train your model. Automated ML was used to find the best way to prepare your data, determine the algorithms used and select the algorithm parameters likely to yield the best accuracy. These steps were used in the machine learning pipeline which generated your machine learning model.

Sampled rows	674	Final model used	Pre-fitted Soft Voting Classifier
Training rows	474	Iterations run	32

Model quality over iterations

Maximum Model Quality: 0.69

Model Quality

Iteration

Lab4 – AutoML PowerBI integration

Let's apply the ML model on the dataflow

germancreditrisk model training report

This report summarizes the model performance and training details and enables you find an optimal threshold for defining your business outcome.

Apply model Edit model

DETAILS

How the model was trained

Power BI used the automated ML capability to train your model. Automated ML was able to analyze your data, determine the algorithms and parameters likely to yield the best accuracy, and build a machine learning pipeline which generates predictions.

Model quality over iterations

Maximum Model Quality: 0.69

Model Quality

0.70
0.65
0.60
0.55
0.50

Apply germancreditrisk

Apply your model to get predictions

Input entity

The model can be applied to these entities, as they have the same attributes as the ones the model was trained on.

German enriched germancreditrisk (1)

New output column name

This column will contain predictions

germancreditrisk

Threshold

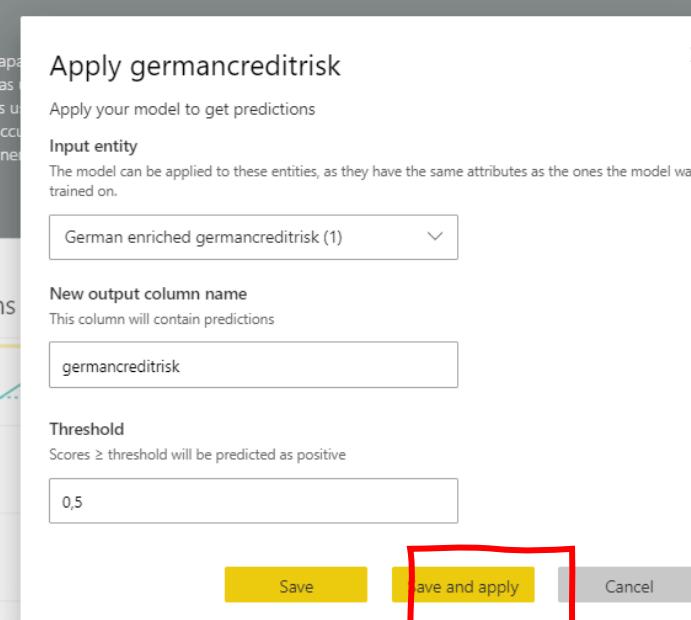
Scores ≥ threshold will be predicted as positive

0,5

Save Save and apply Cancel

Pre-fitted Soft Voting Classifier

32



Lab4 –PowerBI integration

Let's call a deployed ML model

Create a PowerBI dataflow using this csv file:

<https://raw.githubusercontent.com/retkowsky/AMLlabs/main/Nocode/ScoringPowerBI.csv>

Lab4 –PowerBI integration

Click on AI Insights

The screenshot shows the Microsoft Power BI AI Preview Support interface. On the left, there's a navigation sidebar with options like Home, Favorites, Recent, Create, Apps, Shared with me, Deployment pipelines, Learn, Workspaces, and Power BI AI Preview. The main area is titled "Power Query - Edit queries" and displays a table with 26 rows and 12 columns. The columns are labeled: CustomerID, RISK, Account Balance, Duration of Credit (month), Payment Status of Previous Credit, Purpose, Credit Amount, Value Savings/Stocks, Length of current employment, Instalmen, and another partially visible column. The "Transform" tab is selected in the ribbon. On the far right, there's a "Query settings" pane with fields for Name (Query) and Entity type (Custom). Below it is an "Applied steps" pane showing a list of steps: Source, Promoted he..., and ABC Changed colu... (with a delete icon). A red box highlights the "AI insights" button in the top right corner of the ribbon.

Lab4 –PowerBI integration

You can see the Azure ML deployed models et do the mapping

AI insights

The screenshot shows the 'AI insights' section of a dashboard. On the left, there is a search bar labeled 'Search'. Below it is a list of Azure Machine Learning models, each with a small icon and a name. One model, 'AzureML.myautomlmodel', is highlighted with a red rectangular box. To the right of the search bar, there is a folder icon labeled 'Cognitive Services' with a count of '[4]'. The main area displays the details for the selected model.

The screenshot shows the details for the 'AzureML.myautomlmodel' model. At the top, it says 'Region : westeurope', 'Created On : 11/30/2020 2:50 PM', and 'Last modified On : 11/30/2020 2:50 PM'. Below this, there is a list of input fields, each with a dropdown icon and a label. The fields are: 'Account Balance', 'Duration of Credit (month)', 'Payment Status of Previous Credit', 'Purpose', 'Credit Amount', 'Value Savings/Stocks', 'Length of current employment', 'Instalment per cent', 'Sex & Marital Status', 'Guarantors', 'Duration in Current address', and 'Most valuable available asset'. At the bottom right are 'Apply' and 'Cancel' buttons.

Lab4 –PowerBI integration

You get now the prediction values

Power Query - Edit queries

Home Transform Add column View

Get data Enter data Options Manage parameters Refresh Properties Advanced editor Choose columns Remove columns Sort

Manage rows Keep rows Remove rows Reduce rows Split column Group by Data type: Whole number Use first row as headers

Merge queries Append queries Combine files Map to entity CDM AI insights

Queries < AIFunctions.PostProcess(#"Invoked AzureML.myautomlmodel", "AzureML.myautomlmodel", Record.FieldOrDefault(Value.Metadata(AzureML.myautomlmodel), "PostProcessFunctionName", "/

AI insights [1] Query

Available asset 12 Age (years) 12 Concurrent Credits 12 Type of apartment 12 No of Credits at this Bank 12 Occupation 12 No of dependents 12 Telephone 12 Foreign Worker 12 AzureML.myautomlmodel

	Age (years)	Concurrent Credits	Type of apartment	No of Credits at this Bank	Occupation	No of dependents	Telephone	AzureML.myautomlmodel
1	21	3	1	1	3	1	1	0
2	36	3	1	2	3	2	1	1
3	23	3	1	1	2	1	1	1
4	39	3	1	2	2	2	1	1
5	38	1	2	2	2	1	1	1
6	48	3	1	2	2	2	1	1
7	39	3	2	2	2	1	1	1
8	40	3	2	1	2	2	1	1
9	65	3	2	2	1	1	1	1
10	23	3	1	1	1	1	1	1
11	36	3	1	2	3	2	1	1
12	24	3	1	2	3	1	1	1
13	31	3	2	1	3	1	1	1
14	31	3	2	1	4	1	2	1
15	23	3	1	2	2	1	1	1
16	44	3	1	1	3	2	1	1
17	40	3	2	2	2	2	1	1
18	25	3	1	1	3	1	1	1
19	36	3	2	1	3	1	1	1
20	39	3	2	2	2	1	1	1
21	37	3	1	3	3	2	1	1
22	49	1	2	2	2	2	1	1
23	33	3	1	1	2	1	1	0
24	26	3	2	1	3	1	1	1
25	44	3	2	2	2	2	1	1

Query settings >

Name: Query

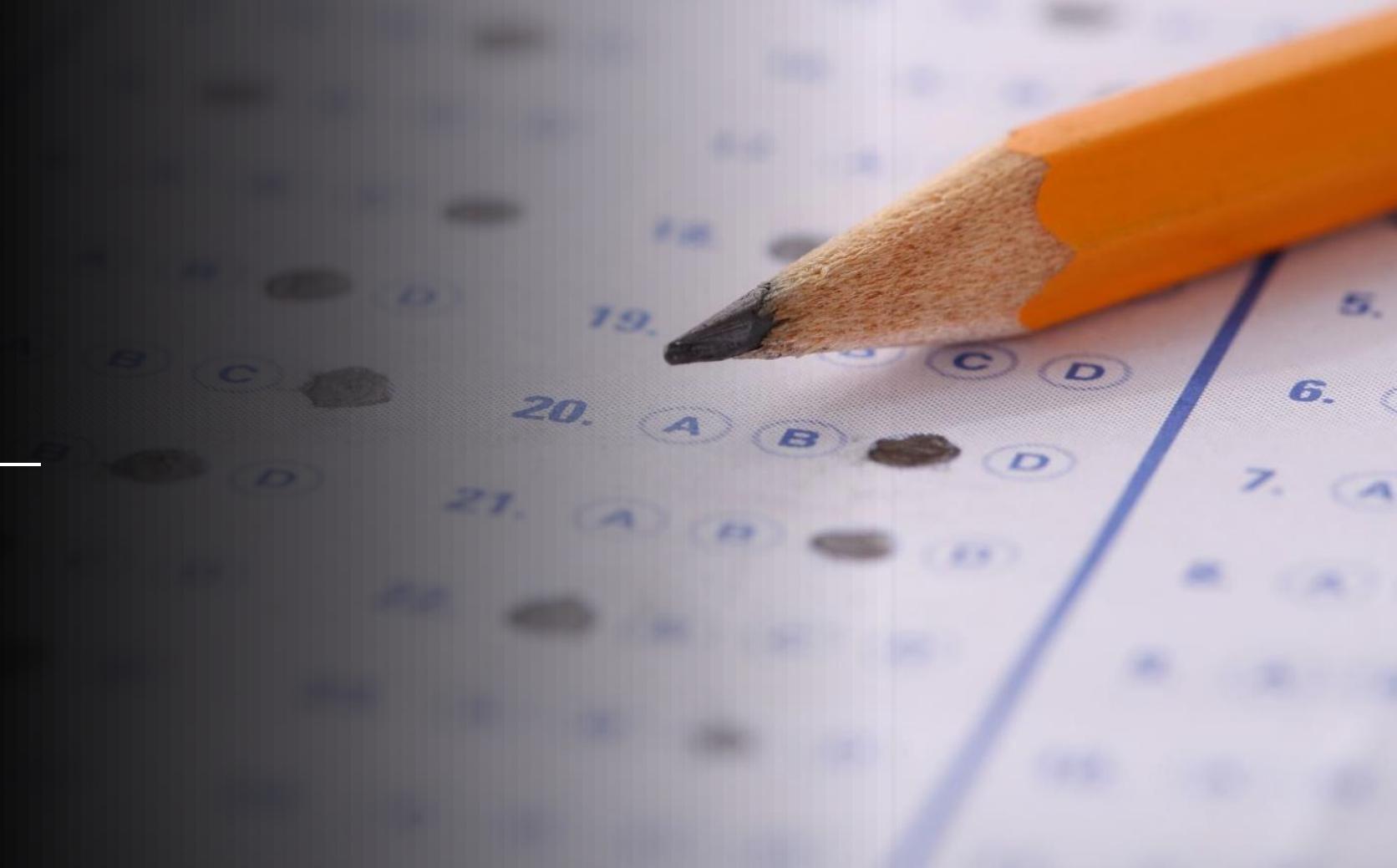
Entity type: Custom

Applied steps:

- CSV Source
- Promoted header
- Changed column names
- Invoked AzureML

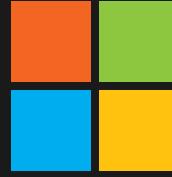
fx Post process A...

Quiz time 3





Q&A



Microsoft Azure

Be future
ready

Build on
your terms

Operate hybrid
seamlessly

Trust
your cloud