

# Workshop 3

# Azure ML No-Code

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)



# Program overview

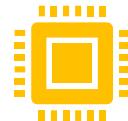
# Workshop Prerequisites



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

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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



# Open Q&A about the last workshop

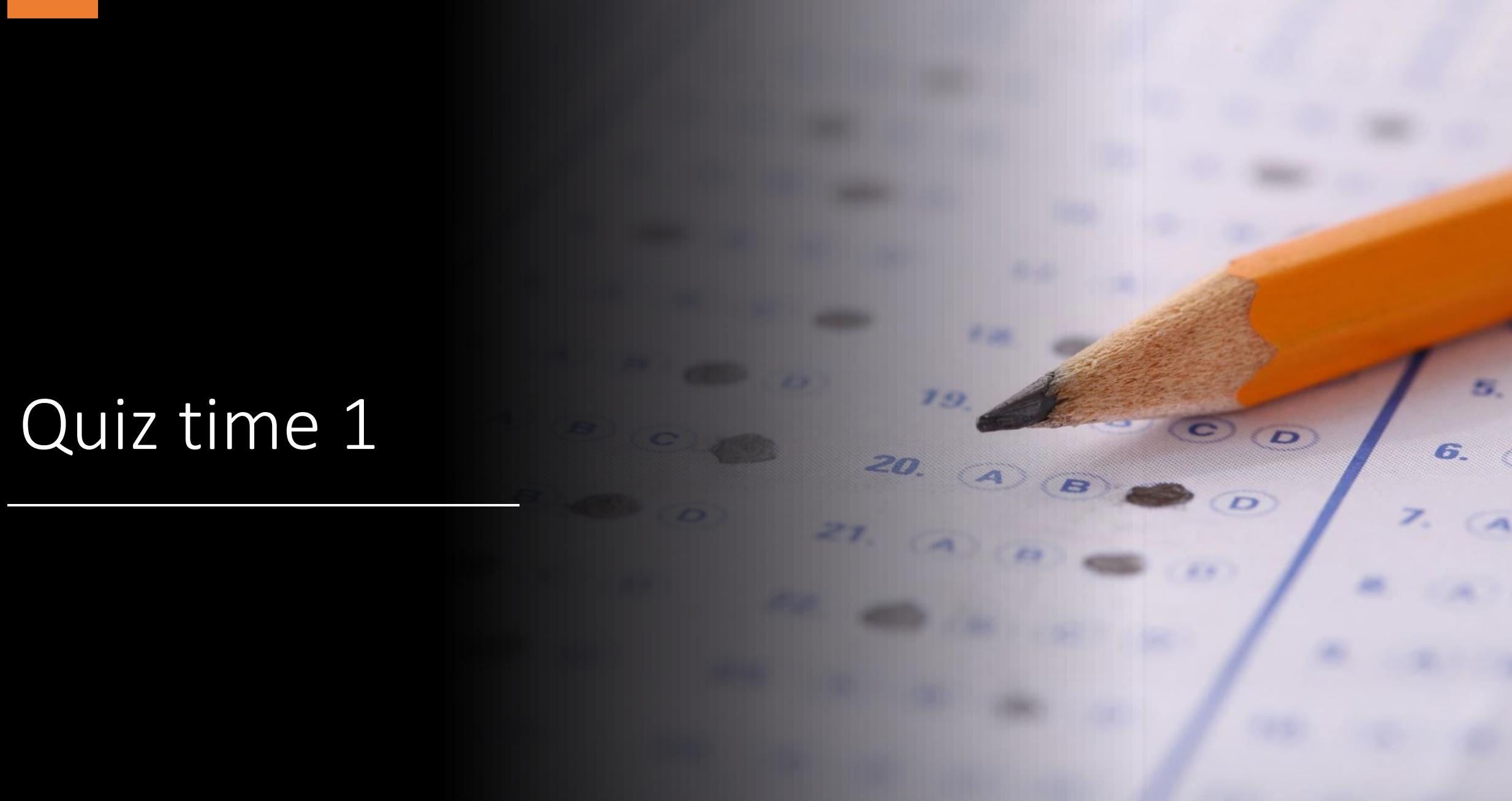
## Reminder

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



# Quiz time 1

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# 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  
**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

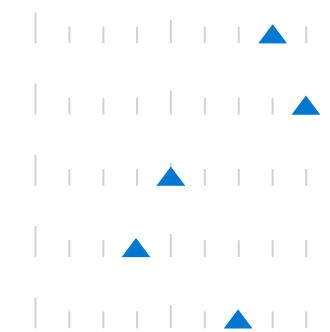
Which features?



Which algorithm?



Which parameters?



30%

15%

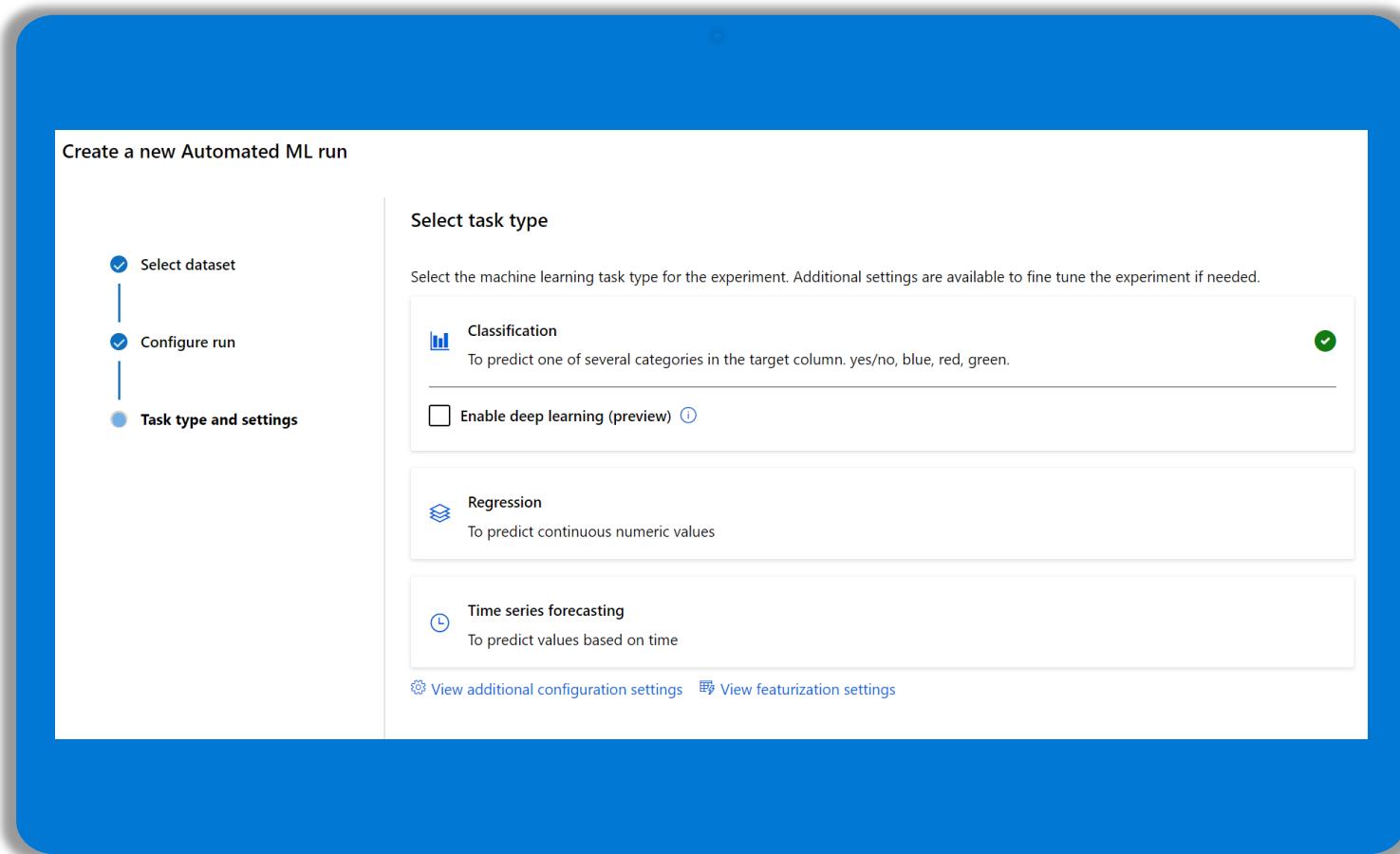
Iterate

*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**, Designer, Assets, Datasets, Experiments, Pipelines, Models, Endpoints, Manage, Compute, Datastores, and Data Labeling. The **Automated ML** option is highlighted with a red box.

The main area displays the "Azure Machine Learning studio" 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 these cards is a section titled "My recent resources".

Runs						
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				
Name	Type	Provisioning state	Created on	
automl	Machine Learning com...	<span style="color: green;">✓ Succeeded (4 nodes)</span>	Nov 23, 2020 1:54 PM	
instanceakeasmodel	Kubernetes service	<span style="color: green;">✓ Succeeded</span>	Nov 19, 2020 1:20 PM	
Designer	Machine Learning com...	<span style="color: green;">✓ Succeeded (0 nodes)</span>	Nov 19, 2020 11:34 AM	
clusterCPU	Machine Learning com...	<span style="color: green;">✓ Succeeded (0 nodes)</span>	Nov 19, 2020 11:29 AM	
notebookinstanceup	Compute instance	<span style="color: green;">✓ Succeeded</span>	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

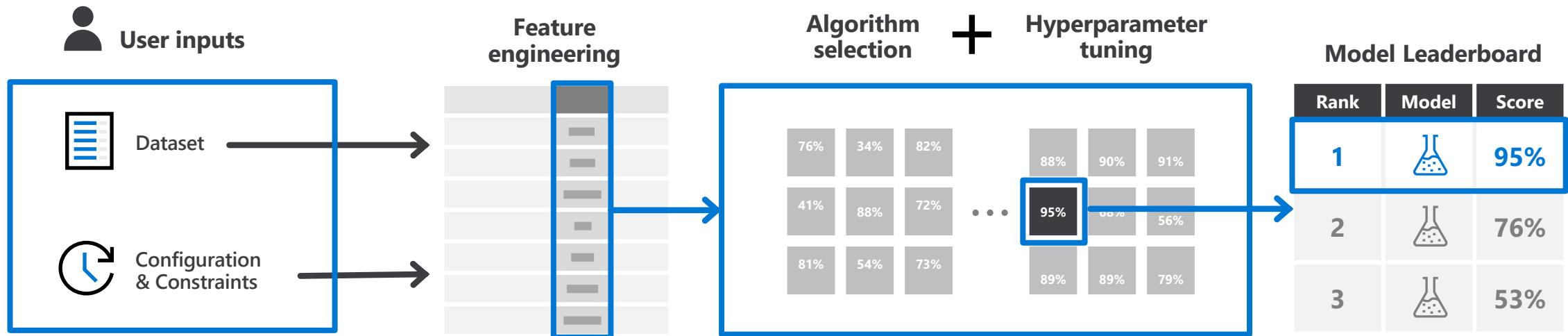
Run status  
Running

Experiment name  
new-experiment

# Automated ML – How it works?



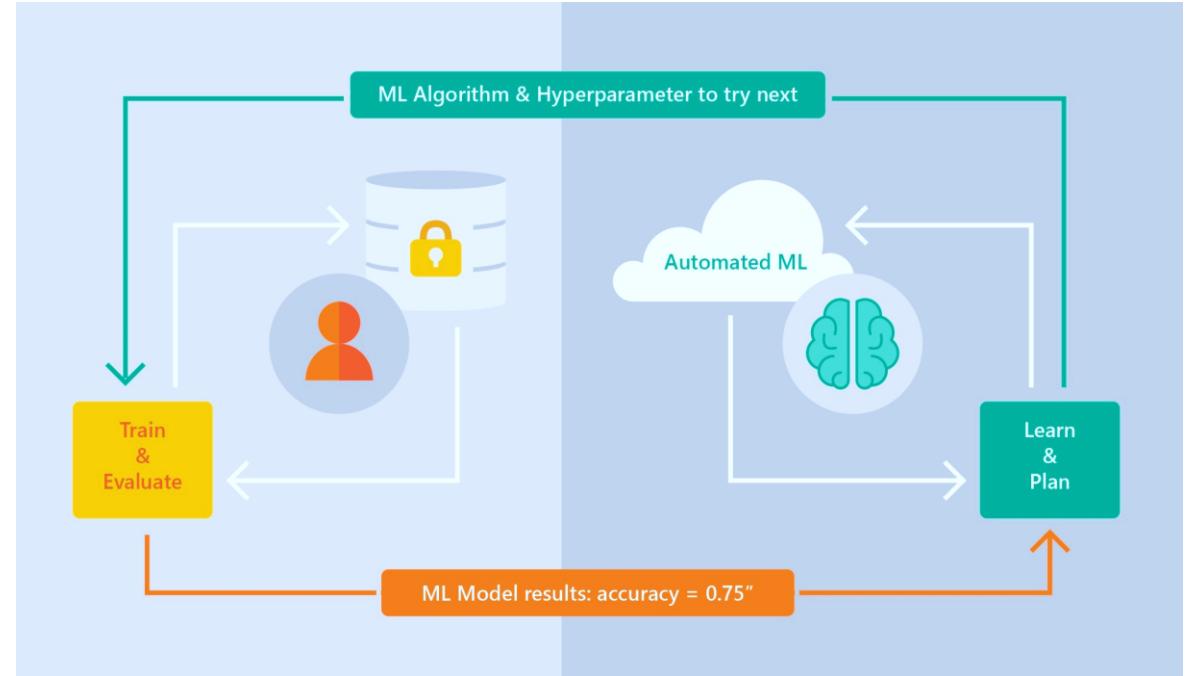
Automated machine learning (automated ML) automates **feature engineering**, **algorithm and hyperparameter** selection to find the 'best model' for your data.



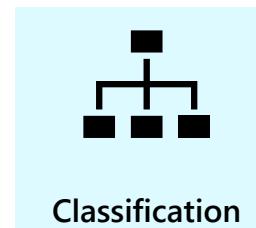
# Automated ML – How it works?



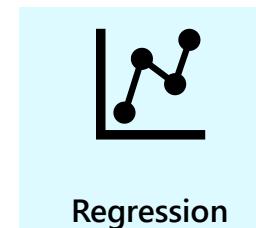
- Based on Microsoft Research
- Brain trained with several million experiments
- Collaborative filtering and Bayesian optimization
- Privacy preserving: No need to “see” the data



## Supervised Learning



Classification



Regression



Time Series Forecasting

# 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

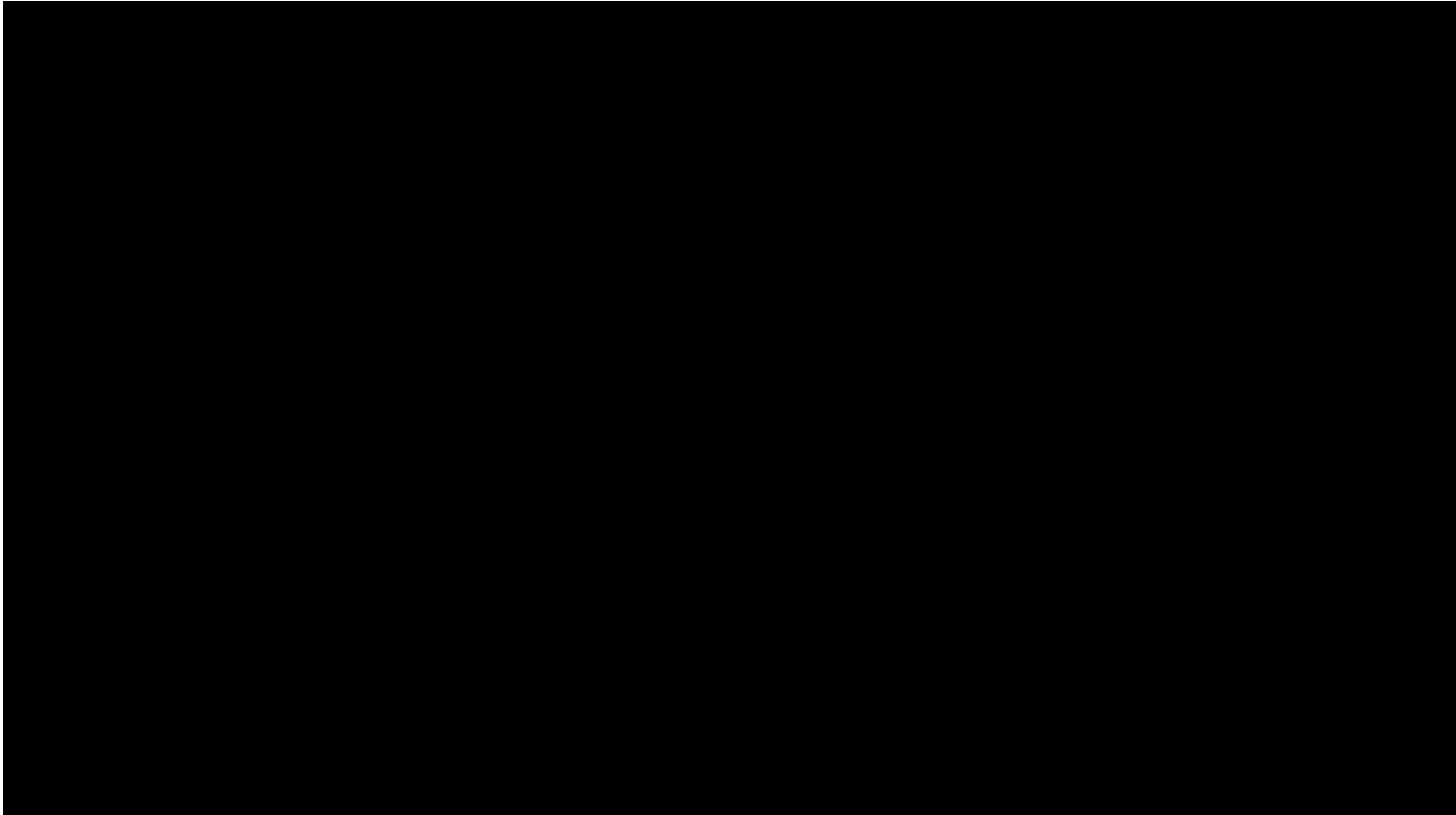


Use drag and drop modules to validate and evaluate models



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

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...
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#### Compute

Name	Type	Provisioning state	Created on
automl	Machine Learning com...	<span>✓ Succeeded (4 nodes)</span>	Nov 23, 2020 1:54 PM
instanceakeaksmodel	Kubernetes service	<span>✓ Succeeded</span>	Nov 19, 2020 1:20 PM
Designer	Machine Learning com...	<span>✓ Succeeded (0 nodes)</span>	Nov 19, 2020 11:34 AM
clusterCPU	Machine Learning com...	<span>✓ Succeeded (0 nodes)</span>	Nov 19, 2020 11:29 AM
notebookinstanceup	Compute instance	<span>✓ Succeeded</span>	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 pre-built machine learning modules. Below that is a table of pipeline drafts and runs. On the right is a large window showing a drag-and-drop pipeline canvas with several components connected by arrows, including 'Select Columns in Dataset', 'Linear Regression', and 'Split Data'. The status of each component is shown as 'Completed'.

# 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



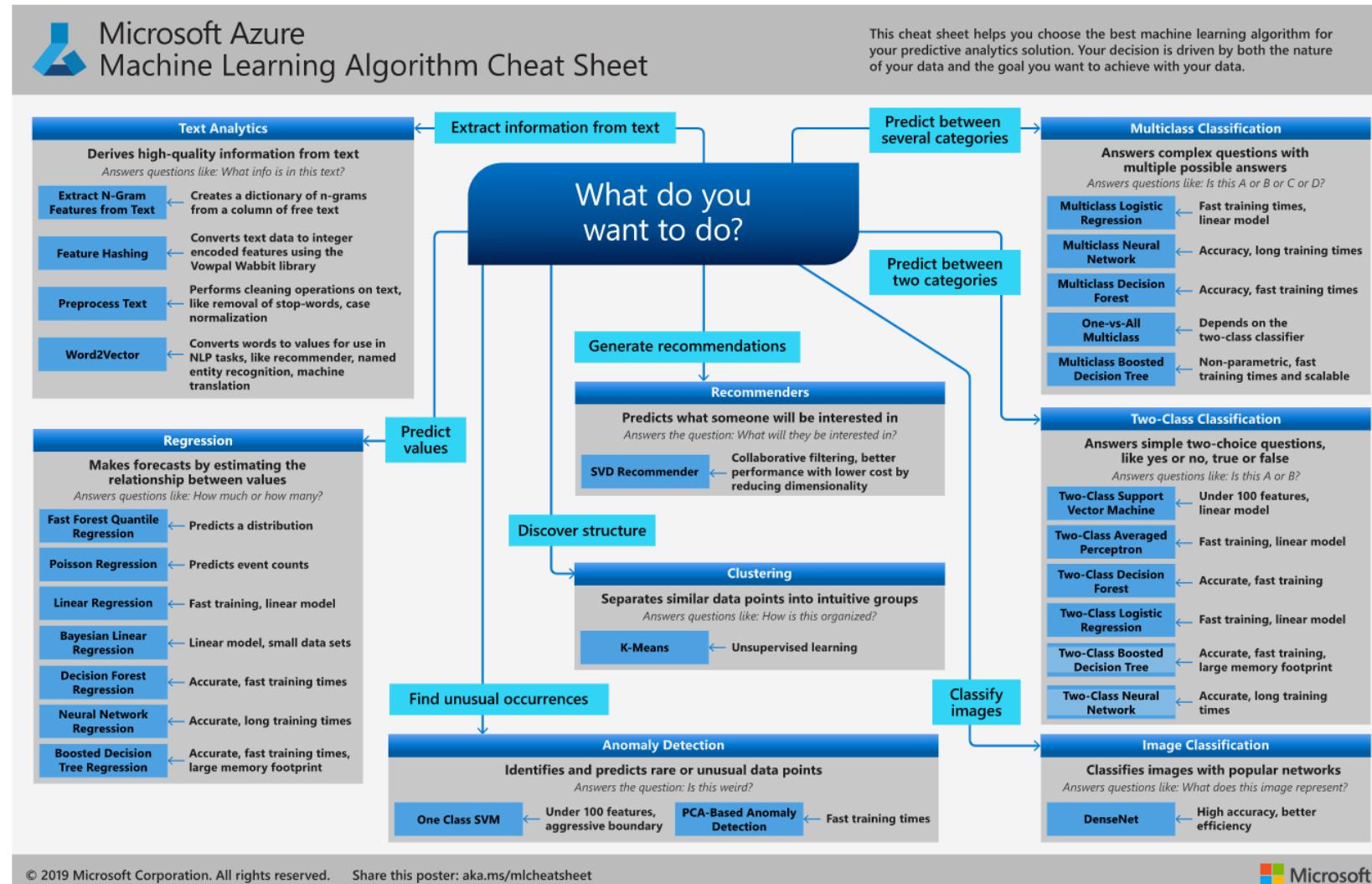
The screenshot shows the Azure ML Designer interface. On the left, a sidebar menu includes options like New, Home, Notebooks, Automated ML, Designer (which is selected), Assets, Datasets, Experiments, Pipelines, Models, and Endpoints. The main workspace is titled "Flight Delays" and contains a data transformation 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.



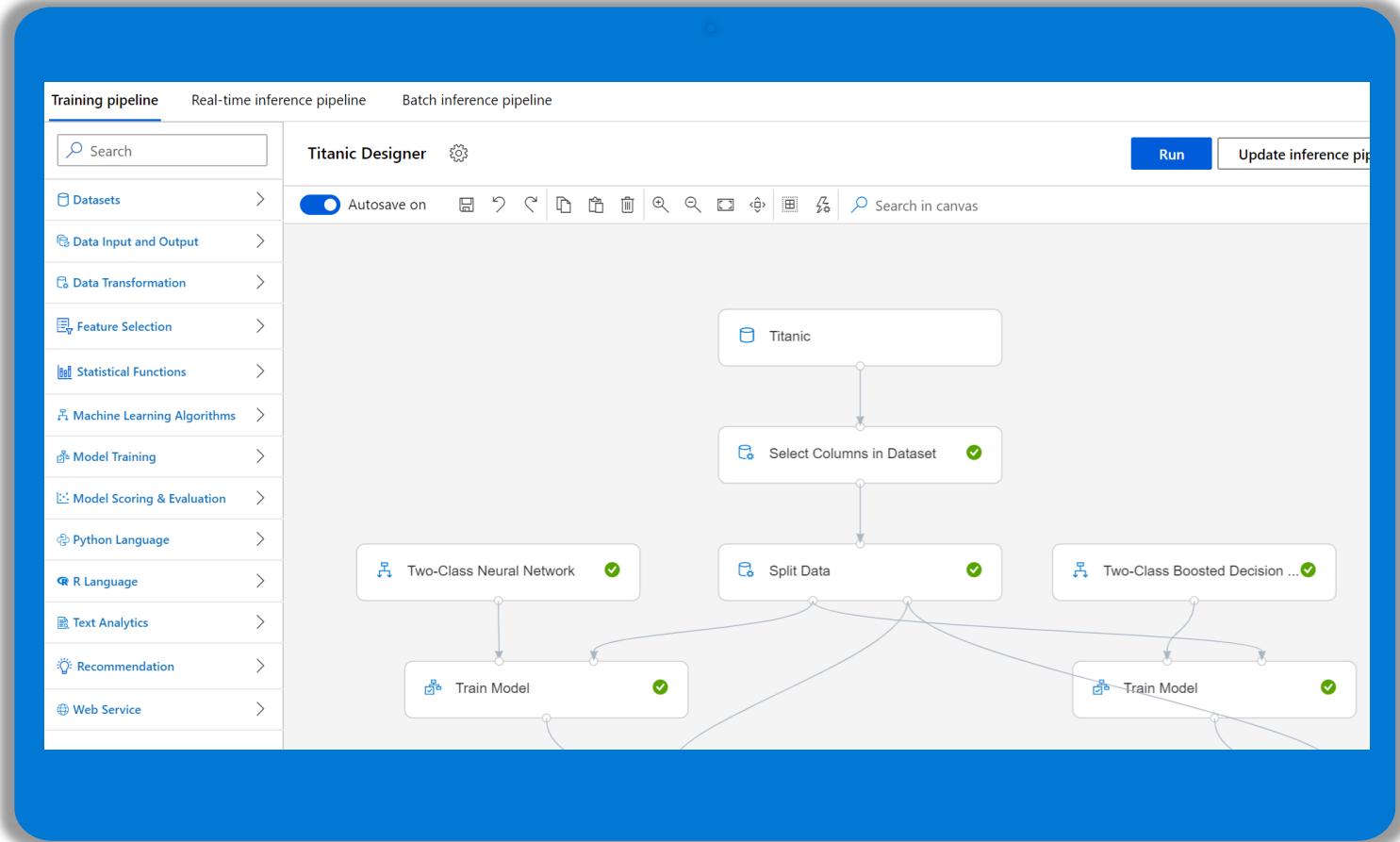
[Algorithm & module reference - Azure Machine Learning | Microsoft Docs](#)

# 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

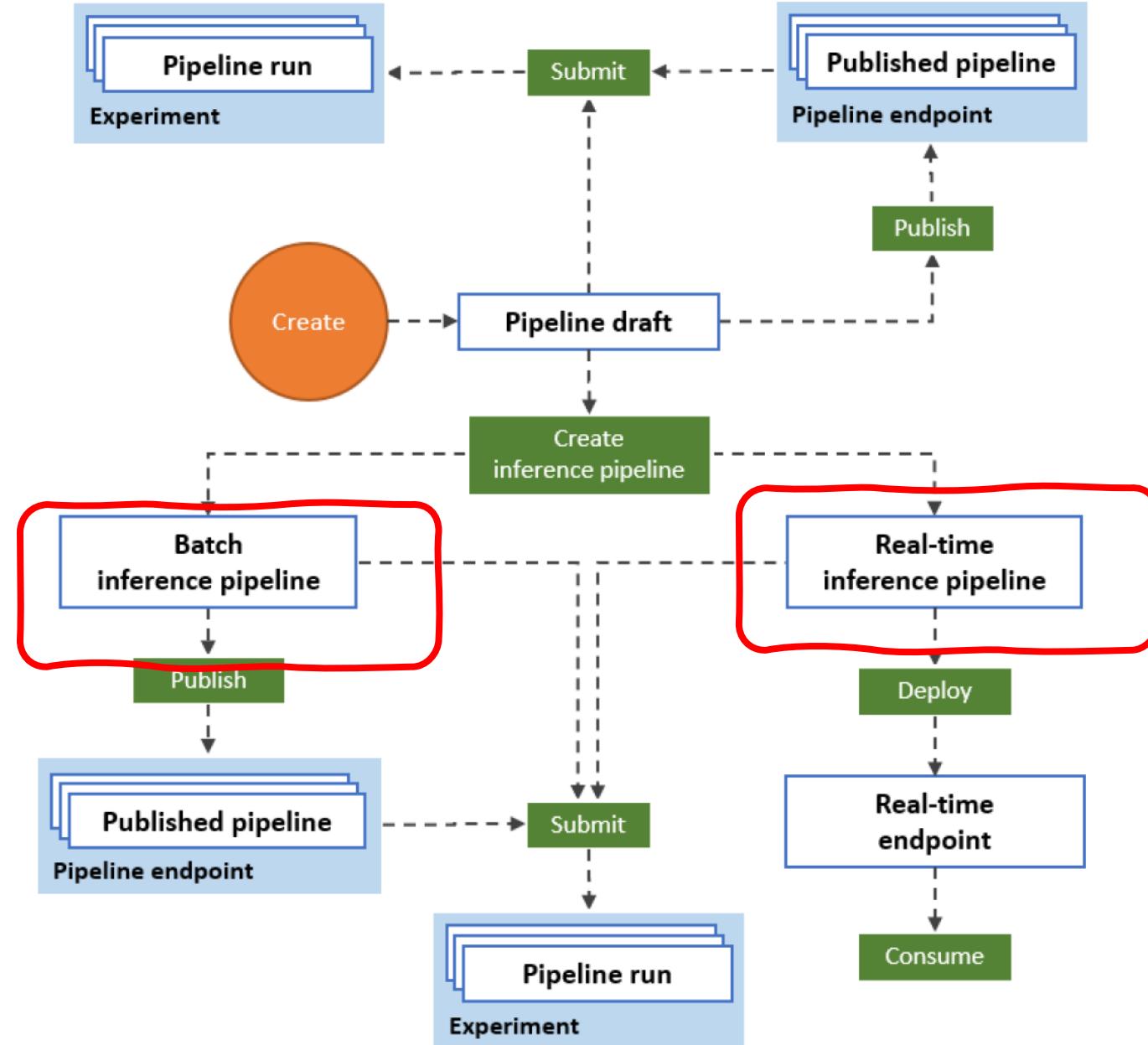


- The chain of datasets and analytical modules in a canvas is a **pipeline**.
- The resulting pipeline must be associated to an **experiment**.
- A **default compute target** must be declared in the pipeline settings. This compute setting applies to all steps of the pipeline.
- Once you run a pipeline,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



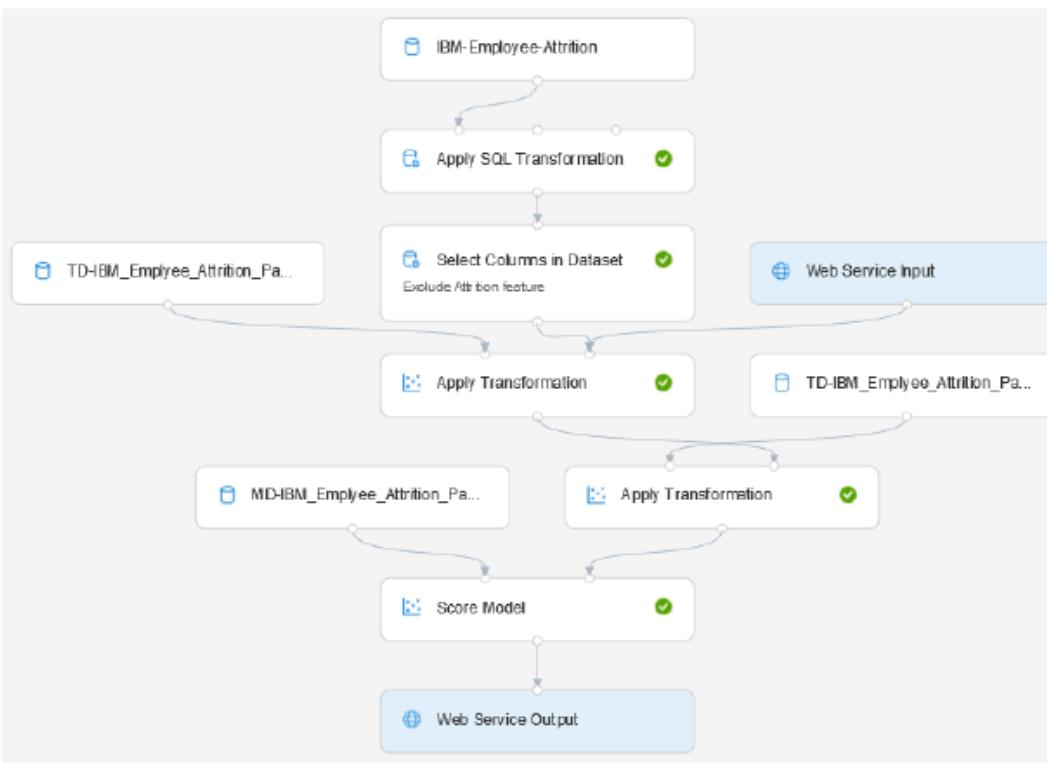
Azure Machine Learning

# 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

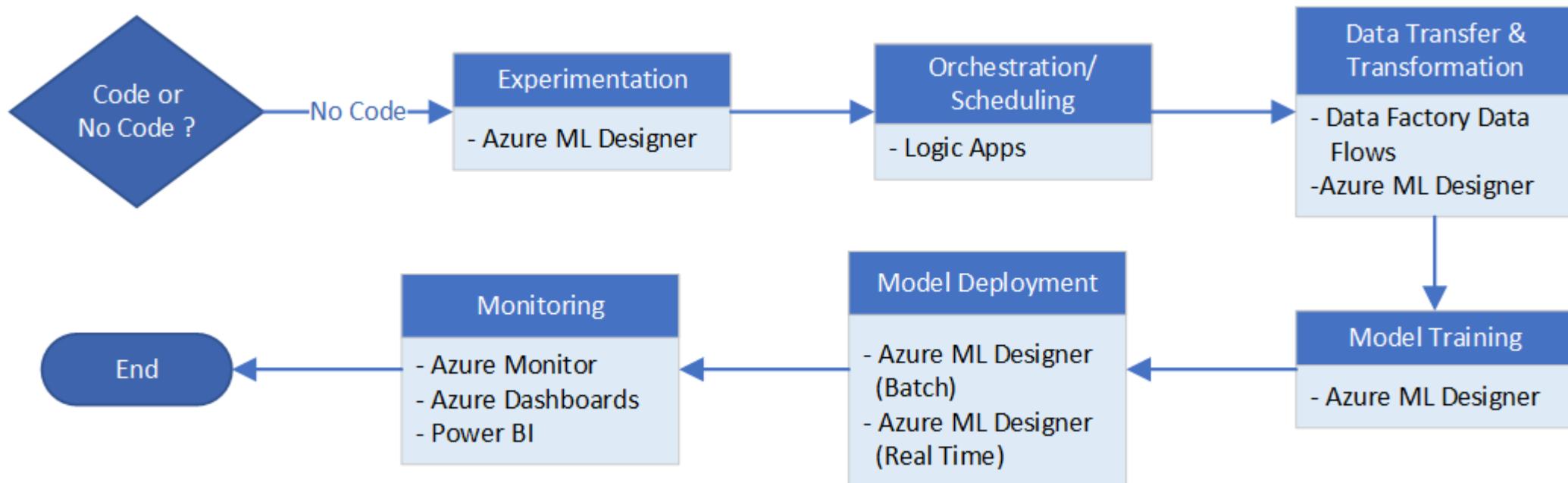
Cancel

# Which interface to use?

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



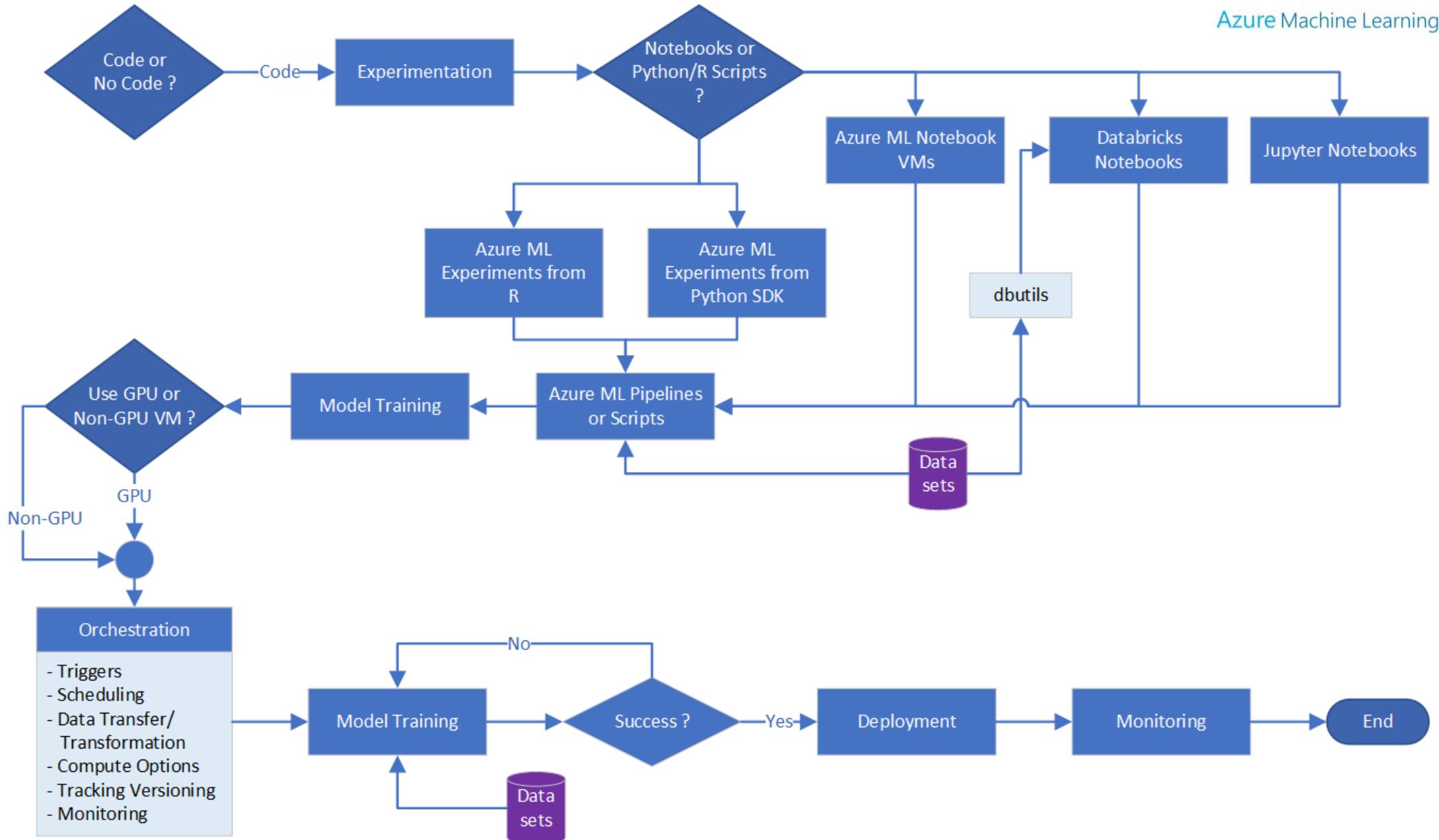
# Code or No Code?



# 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 surface in the center. A small white cable lies nearby. 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



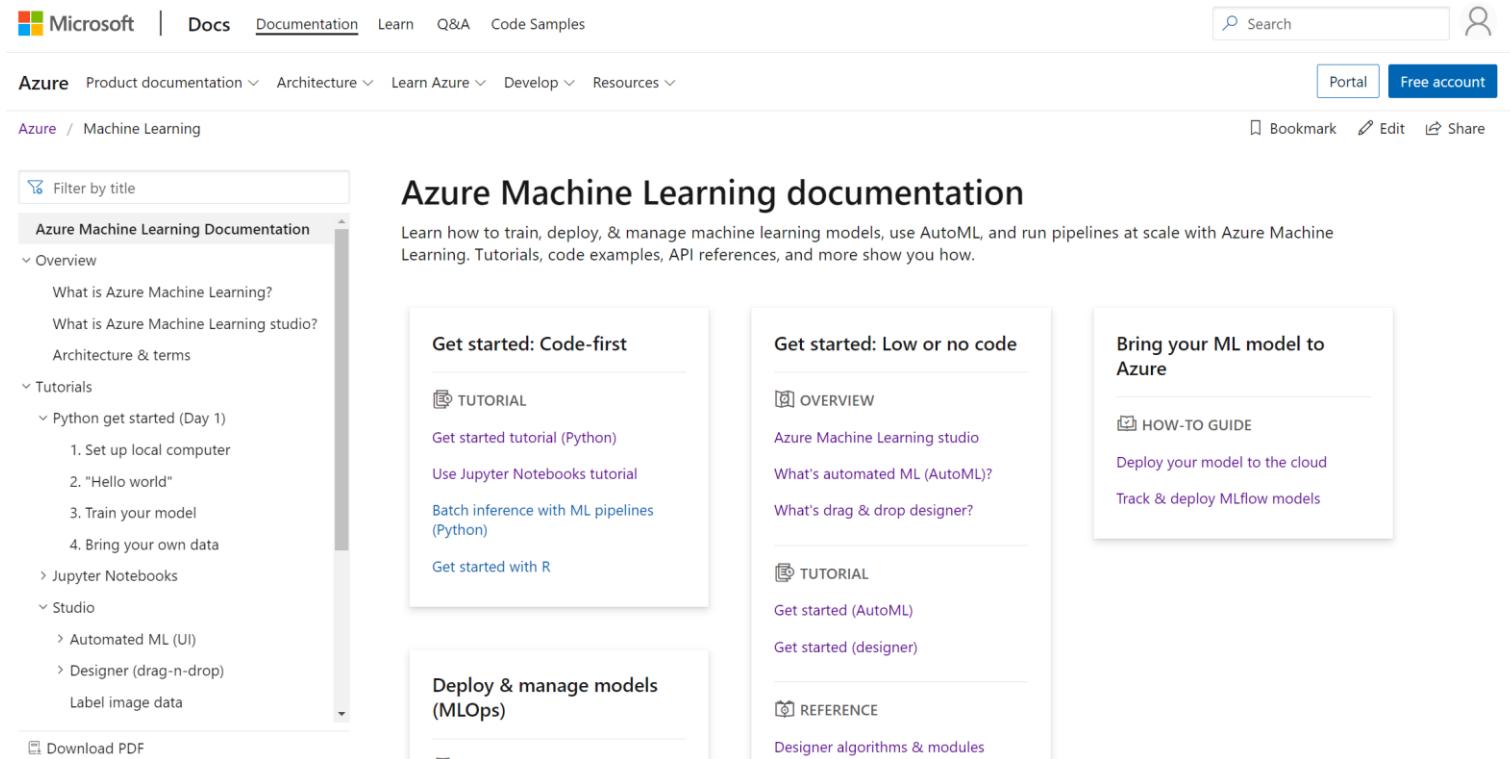
# Azure ML documentation



Azure Machine Learning

## Documentation

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



The screenshot shows the Microsoft Docs page 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).

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Portal Free account

Bookmark Edit Share

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

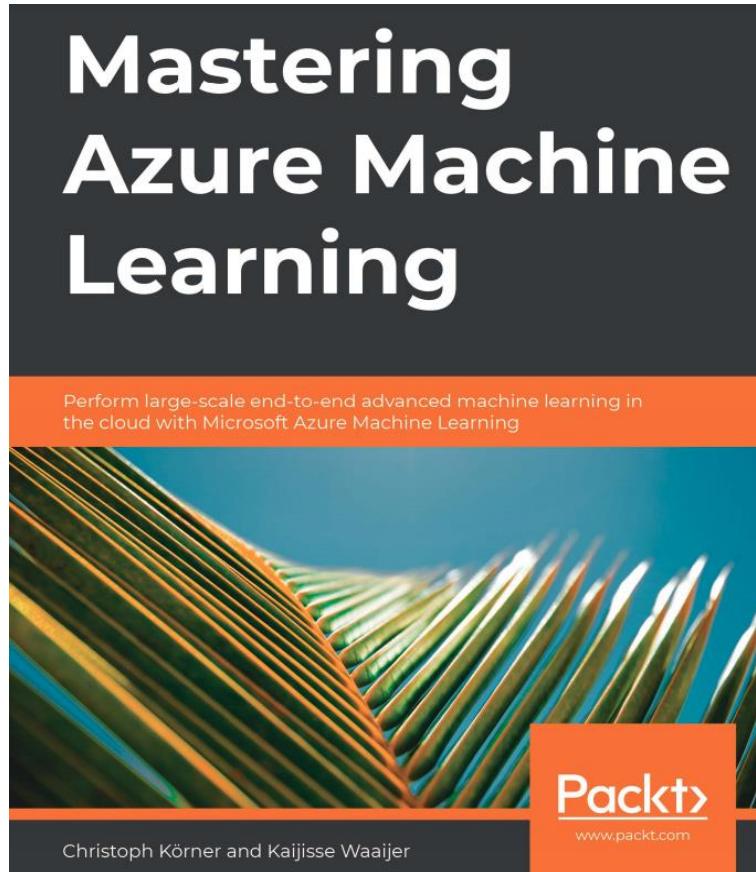
Designer algorithms & modules



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:

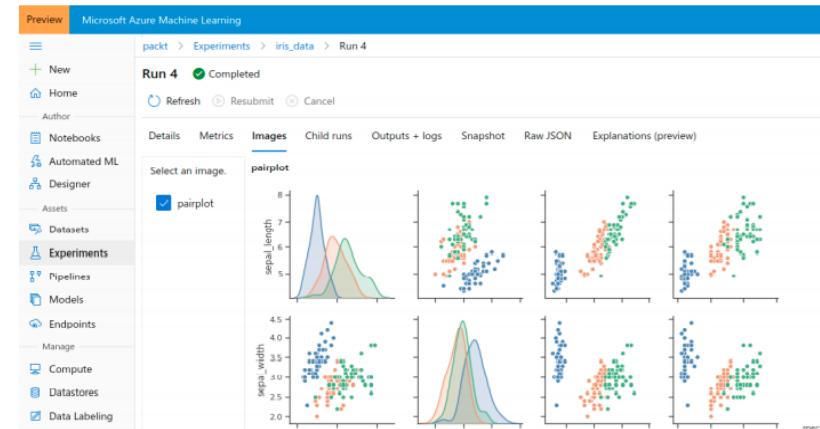


Figure 3.11: The Images tab, showing a pairplot in the Azure Machine Learning workspace

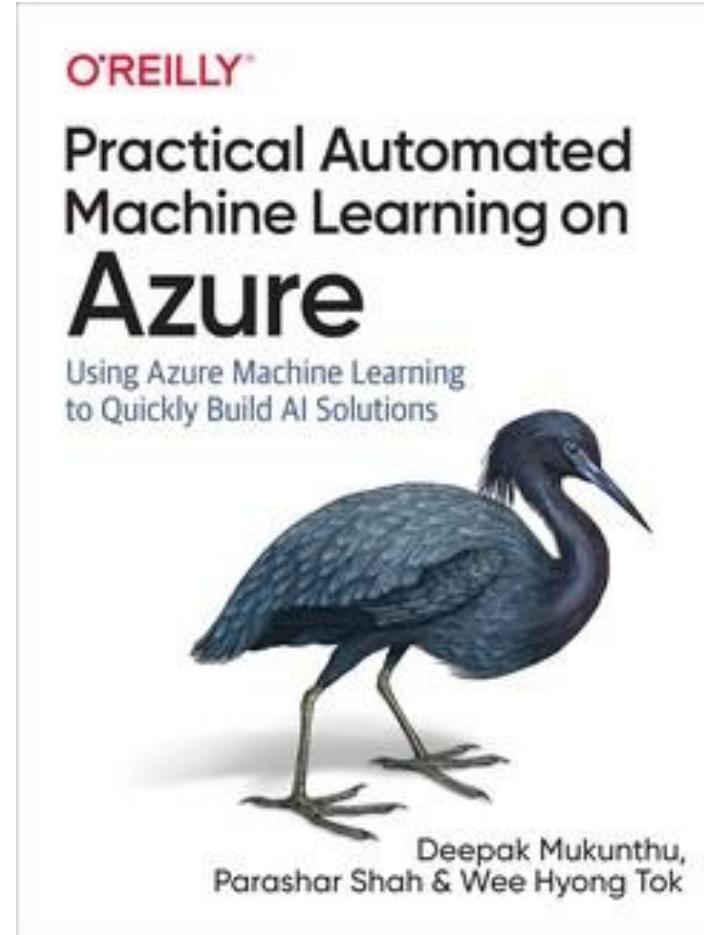
Code: <https://github.com/PacktPublishing/Mastering-Azure-Machine-Learning>



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/orcelik/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/orcelik/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/orcelik/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

nocodeazureml > Datasets

Datasets

Registered datasets    Dataset monitors (preview)

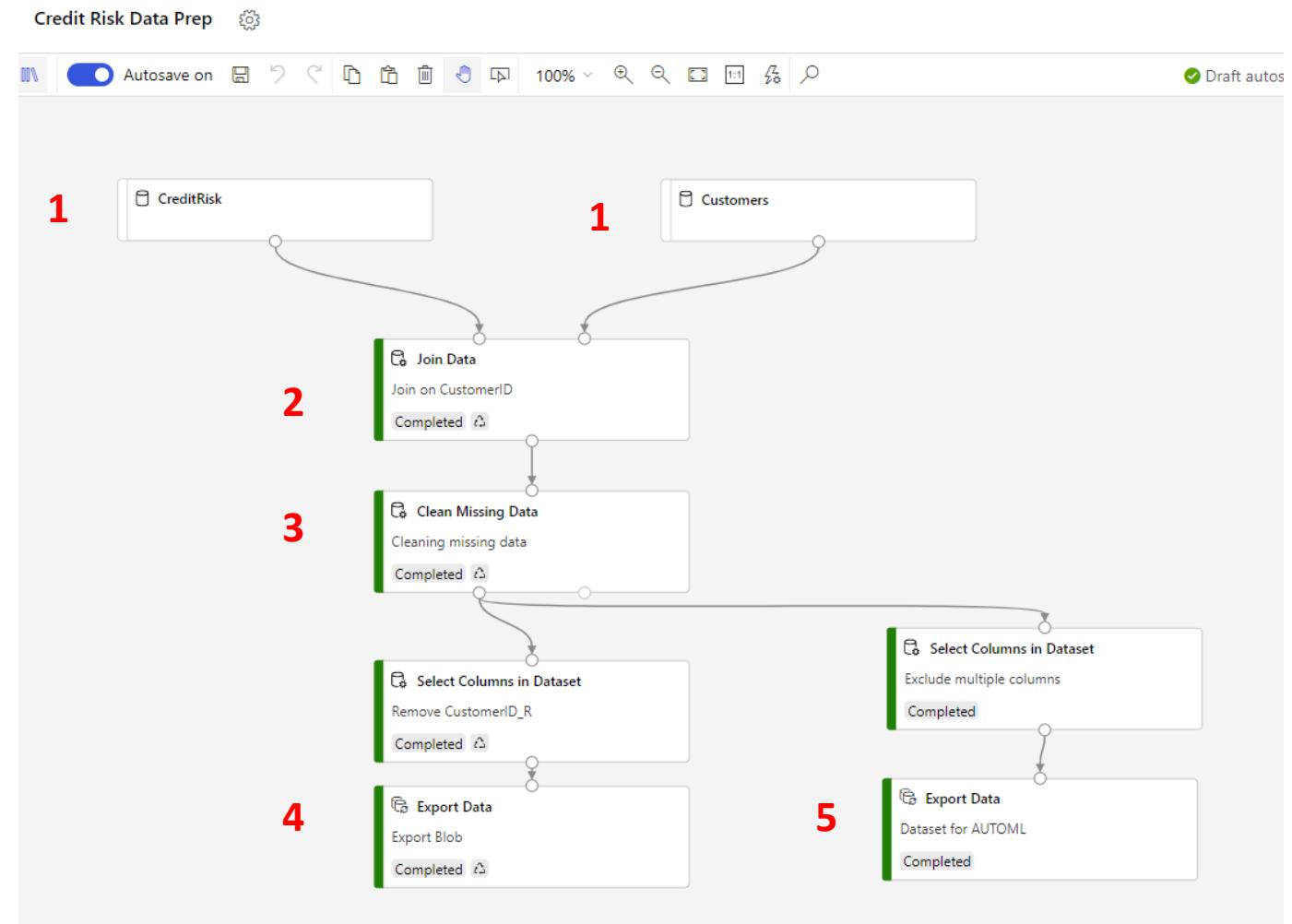
+ Create dataset    Refresh    Unregister

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

The screenshot shows the Microsoft Azure Machine Learning Studio interface. The left sidebar has a 'Datasets' section highlighted with a red box around the 'CreditRisk' and 'Customers' entries. The main area displays a table of registered datasets with columns for Name, Version, Data source, Created on, Modified on, Properties, and Created by. The 'CreditRisk' and 'Customers' datasets are specifically circled in red.

# 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. On the left, there's a sidebar with 'Datasets' and a table of registered datasets. The main dialog has a 'Basic info' tab selected under 'Datastore selection'. It asks to 'Select or create a datastore \*' with options for 'Currently selected datastore: workspaceblobstore (Azure Blob Storage) (Default)' and 'Previously created datastore'. A 'Path selection' modal is open, showing a list of files and folders in the 'ExportAutoML' directory. The 'ExportAutoML' folder is highlighted with a red rectangle. At the bottom right of the dialog are 'Save' and 'Cancel' buttons.

Create dataset from datastore

Basic info

Datastore selection

Select or create a datastore \*

Currently selected datastore: workspaceblobstore (Azure Blob Storage) (Default)

Previously created datastore

Path selection

Selected path: ExportAutoML

Include files in subfolders

Filter (case-sensitive and prefix-only)...

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

Save Cancel

# 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' and created on Nov 30, 2023. The first dataset is 'Datamart' (Version 1) and the second is 'ExportAutoML' (Version 1). Both rows are highlighted with a red box. Other datasets listed include 'MD-CreditRiskModelling-Train\_Model-Trained\_model-8bf09abd' (Version 2), 'CreditRisk' (Version 2), and 'Customers' (Version 1).

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

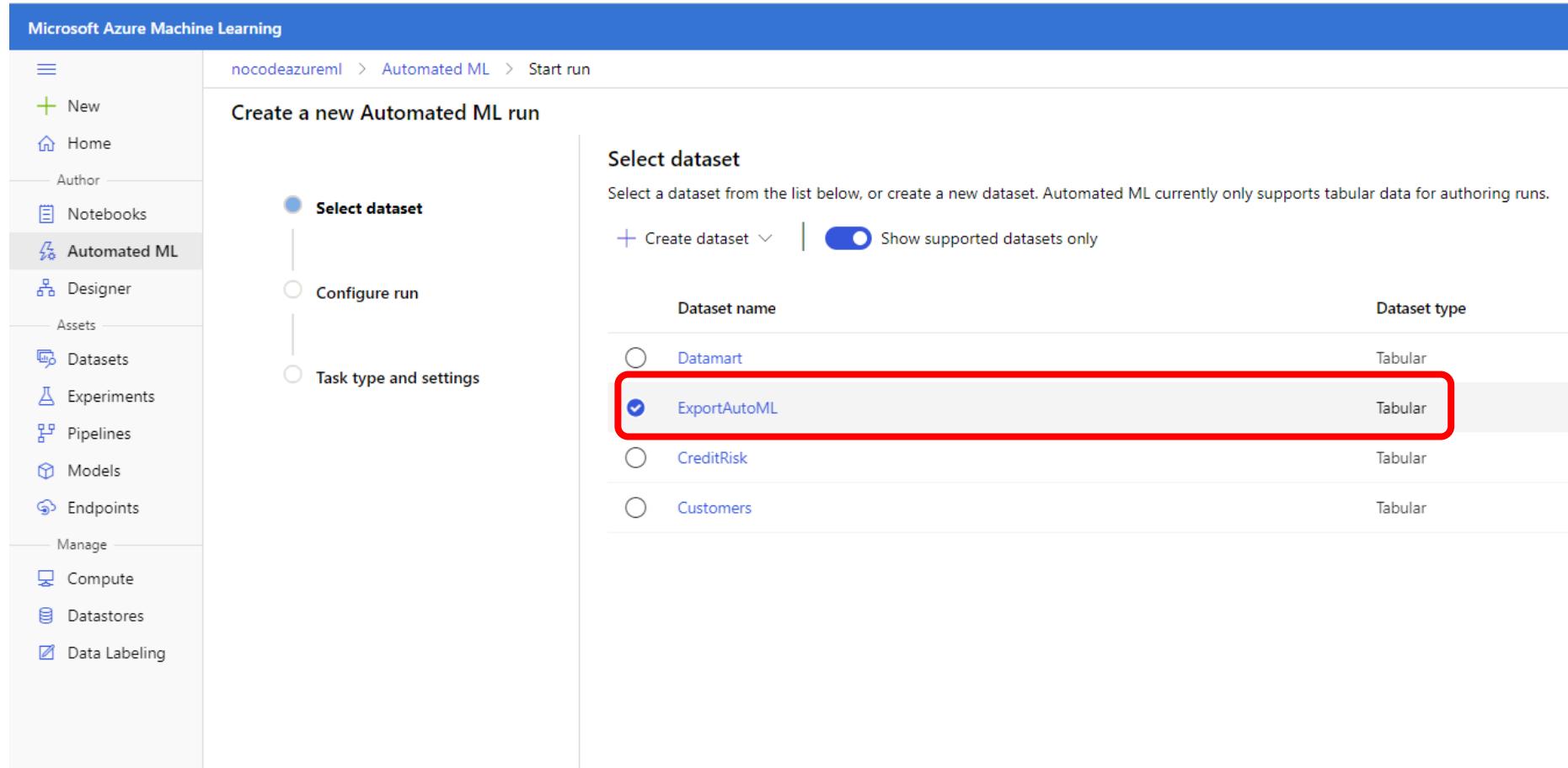
Endpoints

Manage

Compute

Datastores

Data Labeling



# 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](#))

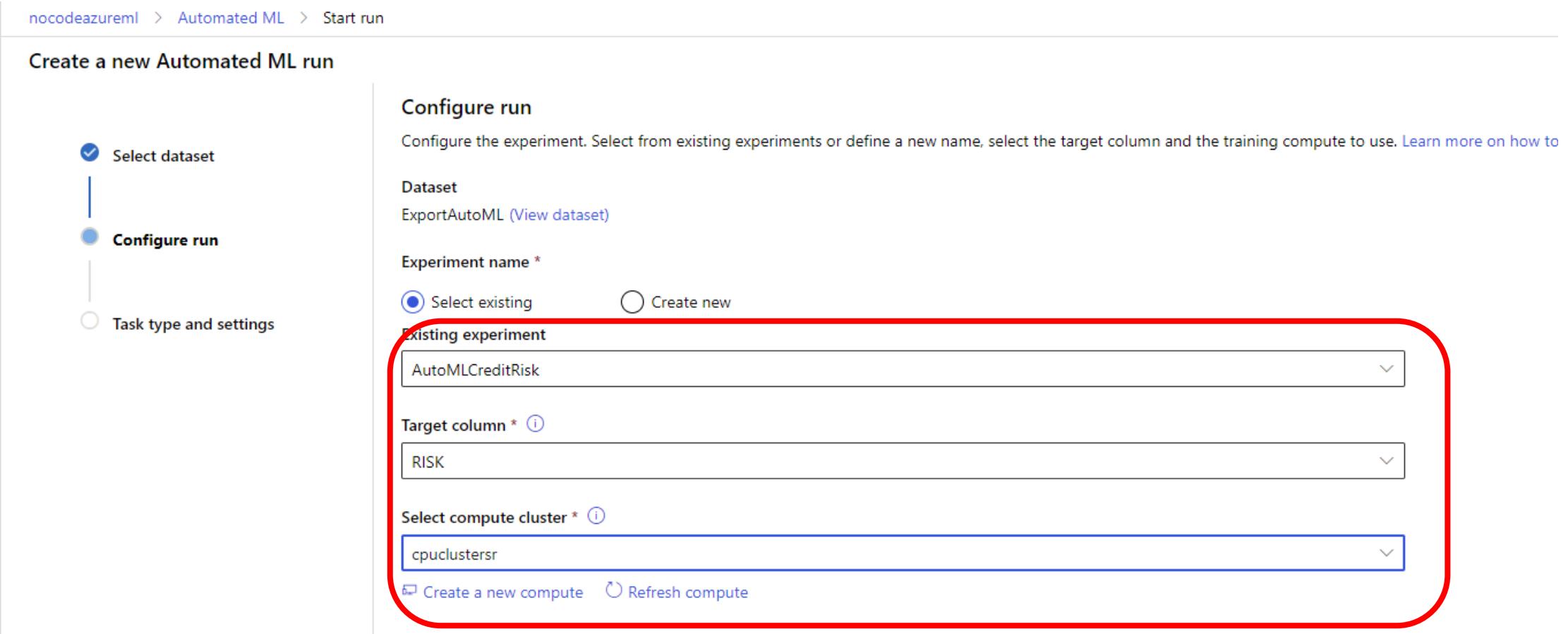
Experiment name \*  
 Select existing  Create new

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

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  
cpuclustersrs

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](#)

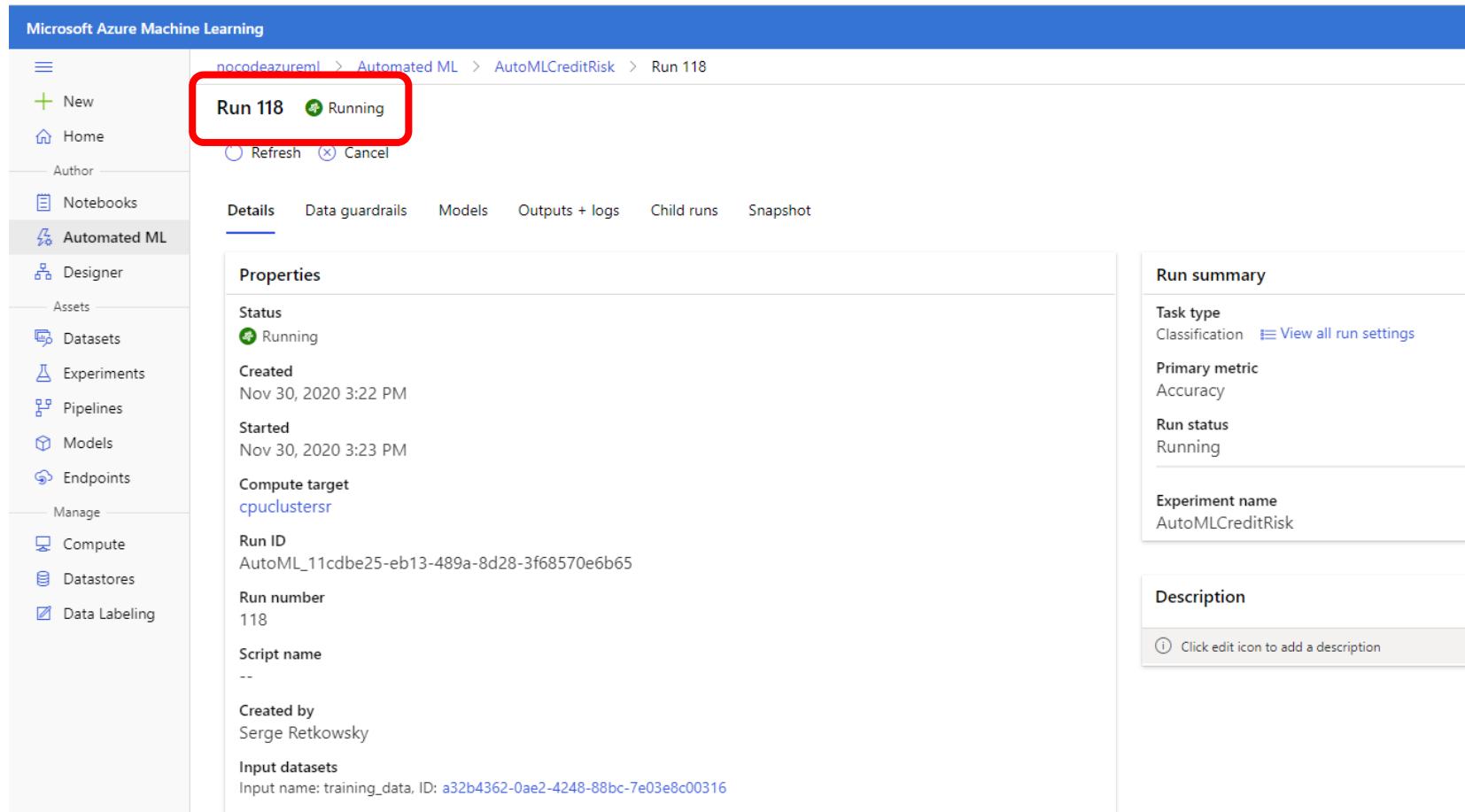
Primary metric  
Accuracy

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. <a href="#">Learn more about validation data.</a>	<span style="color: green;">✓</span>
<span style="border: 1px solid #ccc; padding: 2px;">+ View additional details</span>			
Class balancing detection	Passed	Your inputs were analyzed, and all classes are balanced in your training data. <a href="#">Learn more about imbalanced data.</a>	<span style="color: green;">✓</span>
Missing feature values imputation	Passed	No feature missing values were detected in the training data. <a href="#">Learn more about missing value imputation.</a>	<span style="color: green;">✓</span>
High cardinality feature detection	Passed	Your inputs were analyzed, and no high cardinality features were detected. <a href="#">Learn more about high cardinality feature detection.</a>	<span style="color: green;">✓</span>

# 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	<a href="#">View explanation</a>	0.77900	100.00 %	<a href="#">Run 166</a>	Nov 30, 2020 3:42 PM	1m 8s	Completed
StackEnsemble		0.76501	100.00 %	<a href="#">Run 165</a>	Nov 30, 2020 3:42 PM	1m 11s	Completed
MaxAbsScaler, SGD		0.76403	100.00 %	<a href="#">Run 141</a>	Nov 30, 2020 3:35 PM	43s	Completed
MaxAbsScaler, SGD		0.76300	100.00 %	<a href="#">Run 132</a>	Nov 30, 2020 3:31 PM	50s	Completed
MaxAbsScaler, SGD		0.75898	100.00 %	<a href="#">Run 133</a>	Nov 30, 2020 3:32 PM	31s	Completed
MaxAbsScaler, LightGBM		0.75800	100.00 %	<a href="#">Run 122</a>	Nov 30, 2020 3:26 PM	43s	Completed
MaxAbsScaler, SGD		0.75501	100.00 %	<a href="#">Run 163</a>	Nov 30, 2020 3:41 PM	39s	Completed
MaxAbsScaler, XGBoostClassifier		0.74900	100.00 %	<a href="#">Run 124</a>	Nov 30, 2020 3:26 PM	1m 47s	Completed
SparseNormalizer, RandomForest		0.74899	100.00 %	<a href="#">Run 158</a>	Nov 30, 2020 3:39 PM	44s	Completed
MaxAbsScaler, SGD		0.74898	100.00 %	<a href="#">Run 145</a>	Nov 30, 2020 3:36 PM	43s	Completed
MaxAbsScaler, SGD		0.74206	100.00 %	<a href="#">Run 127</a>	Nov 30, 2020 3:29 PM	28s	Completed
MaxAbsScaler, ExtremeRandomTrees		0.73999	100.00 %	<a href="#">Run 129</a>	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

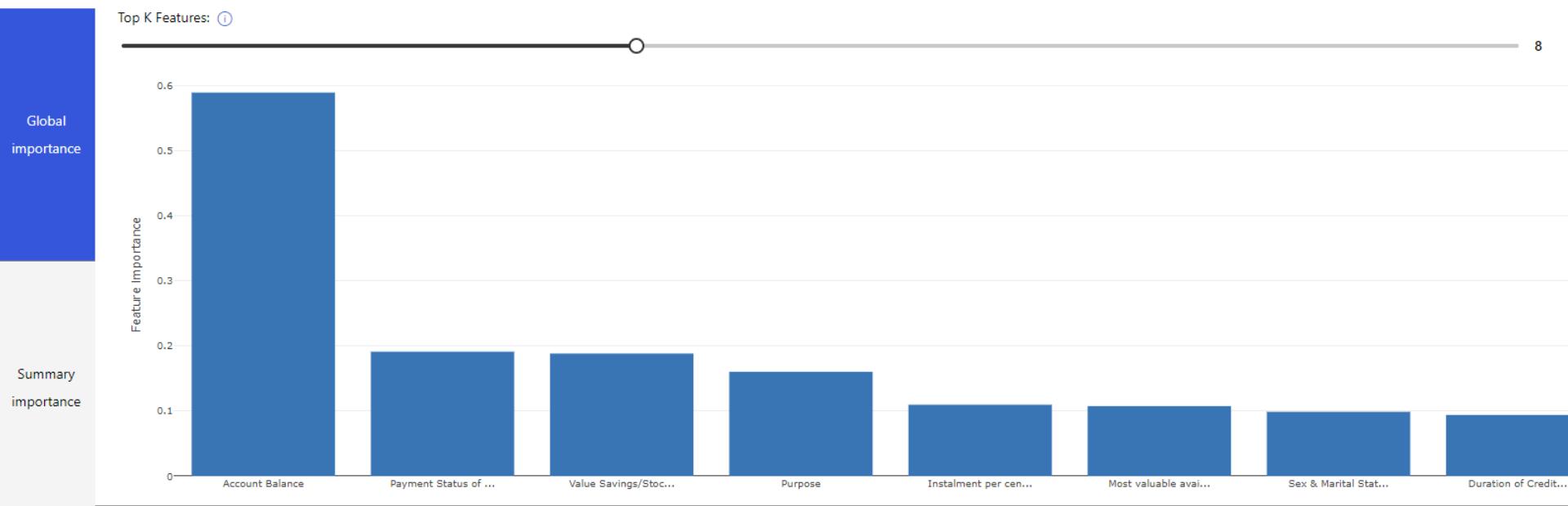
Model explanations are used to understand what features are directly impacting the model and why. [Learn more about model explainability.](#)

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: ⓘ



Feature	Global importance
Account Balance	~0.58
Payment Status of ...	~0.19
Value Savings/Stoc...	~0.19
Purpose	~0.16
Instalment per cen...	~0.12
Most valuable avail...	~0.12
Sex & Marital Stat...	~0.11
Duration of Credit...	~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:

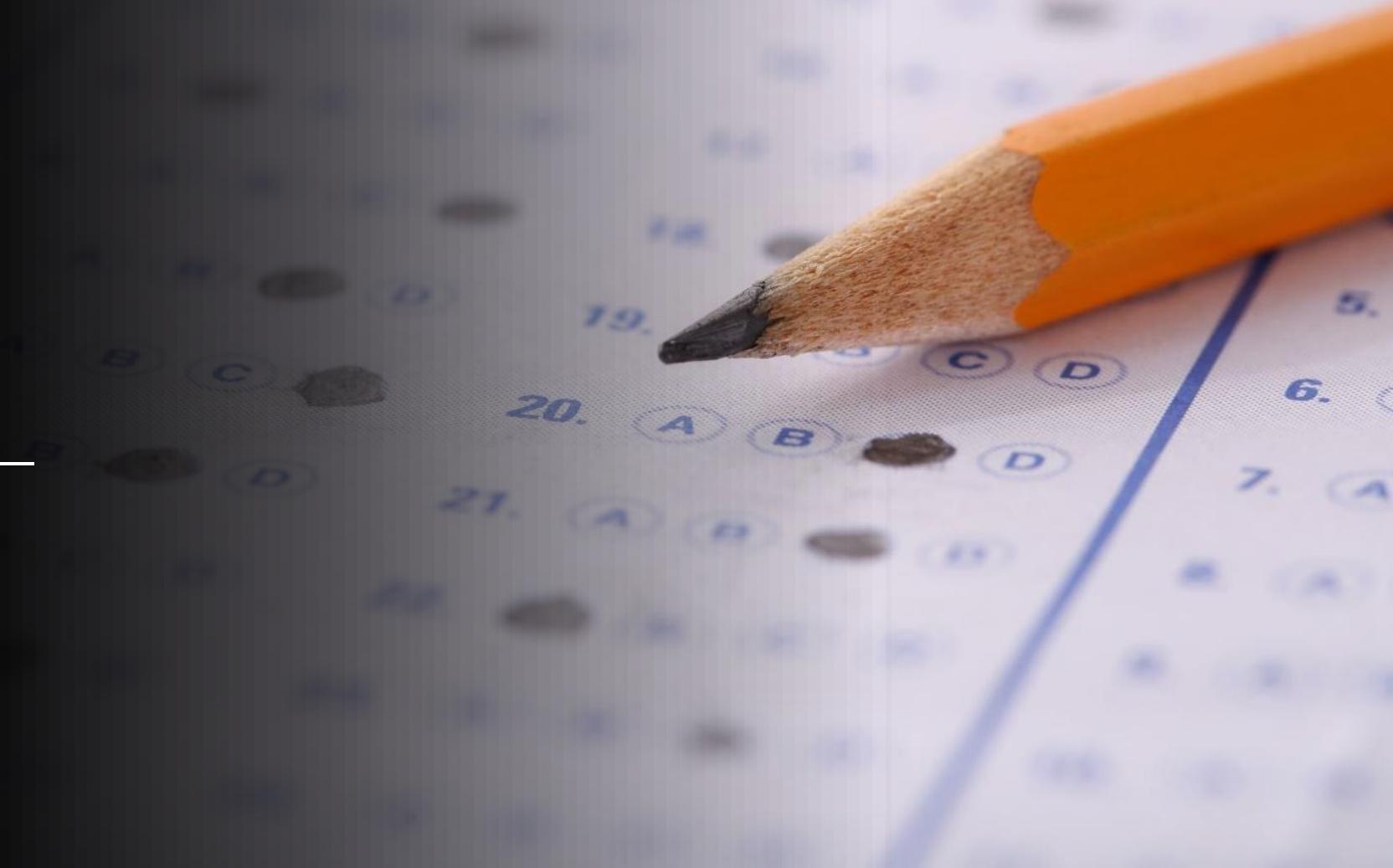
- New
- Home
- Author
  - Notebooks
  - Automated ML
  - Designer
- Assets
  - Datasets
  - Experiments
  - Pipelines
- Models** (highlighted with a red box)
- Endpoints
- Manage
  - Compute
  - Datastores
  - Data Labeling

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).



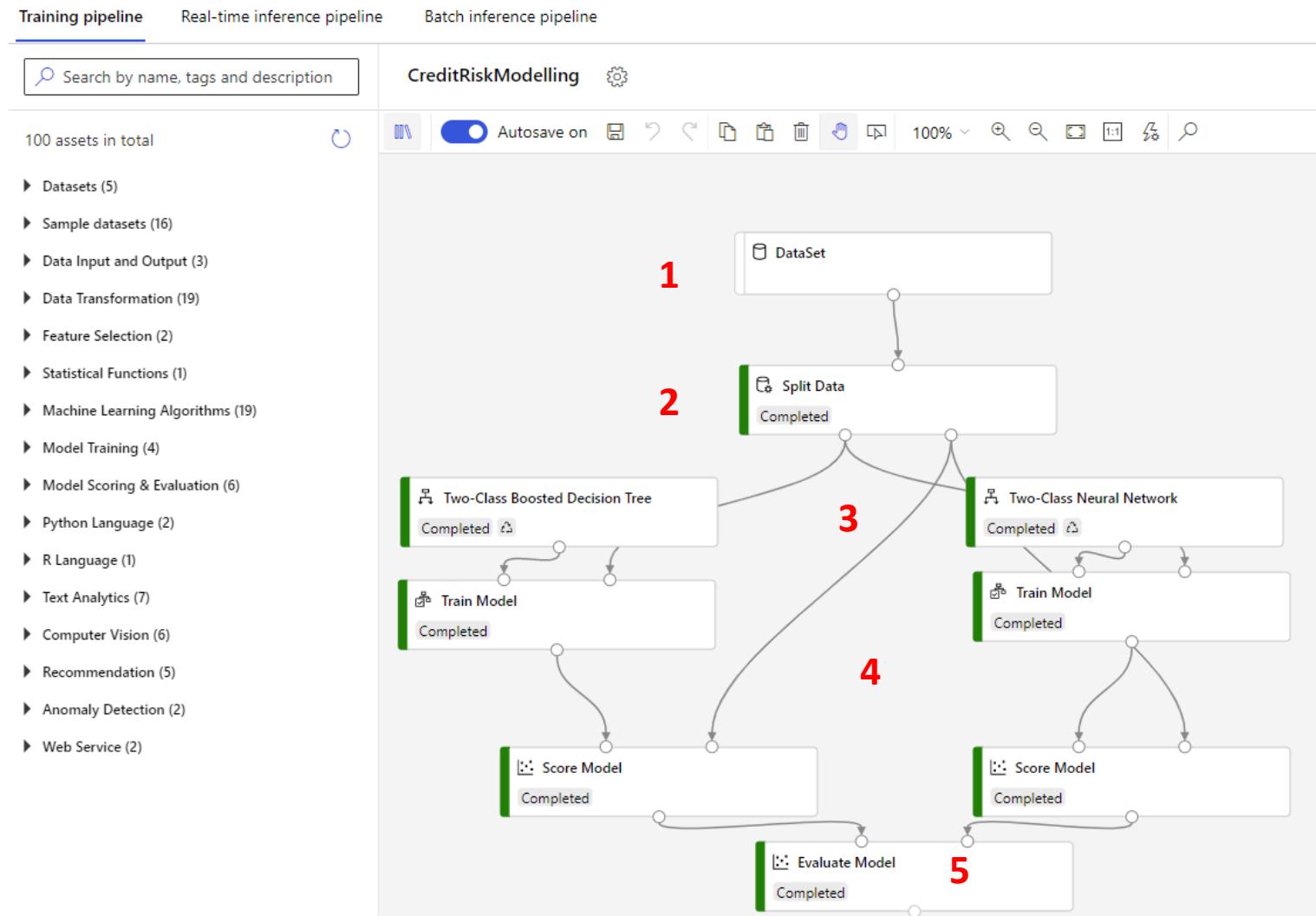
3. Then we will save our visual pipeline for Batch and Real time



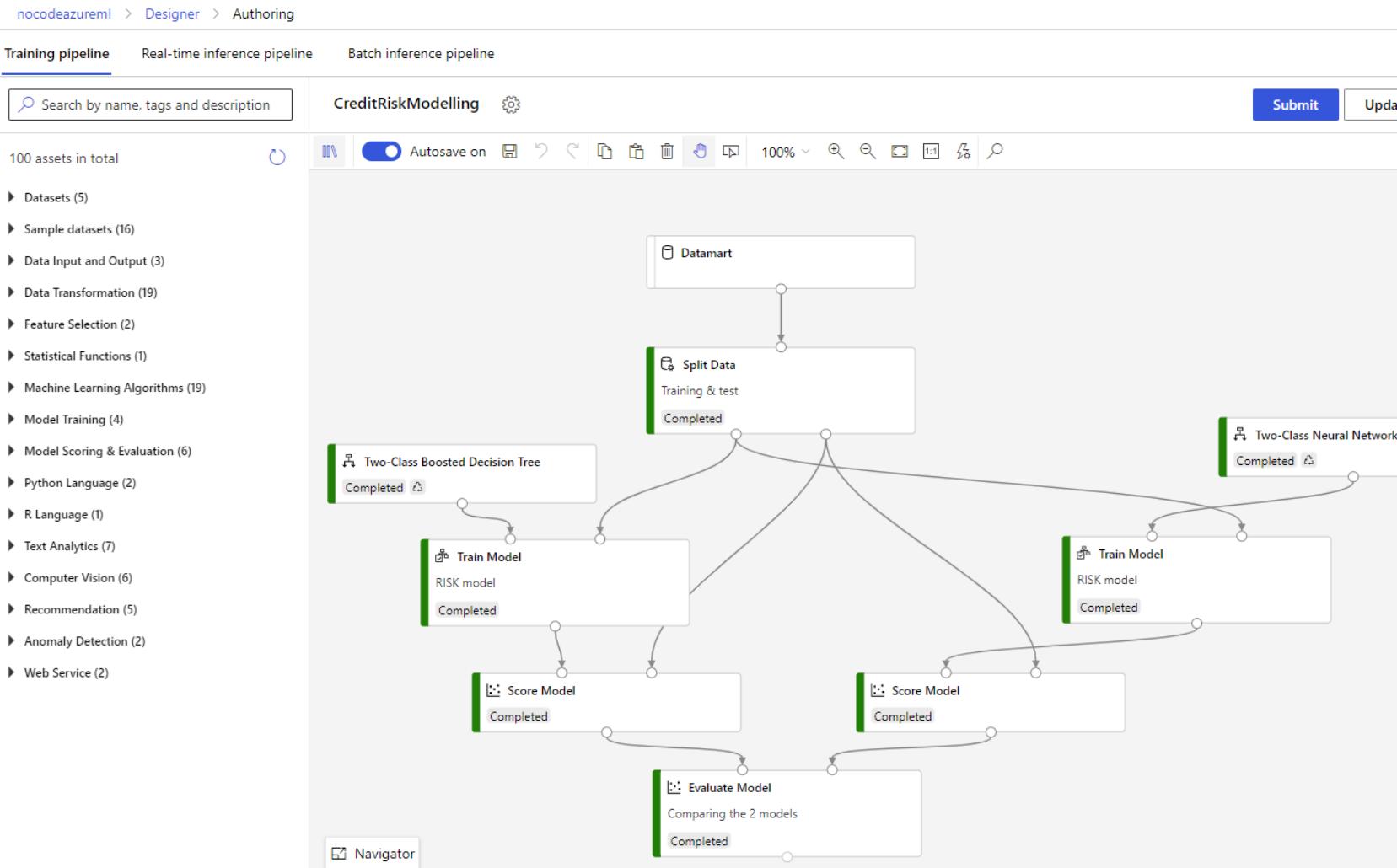
4. You can use a Python notebook for calling our deployed model

# 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

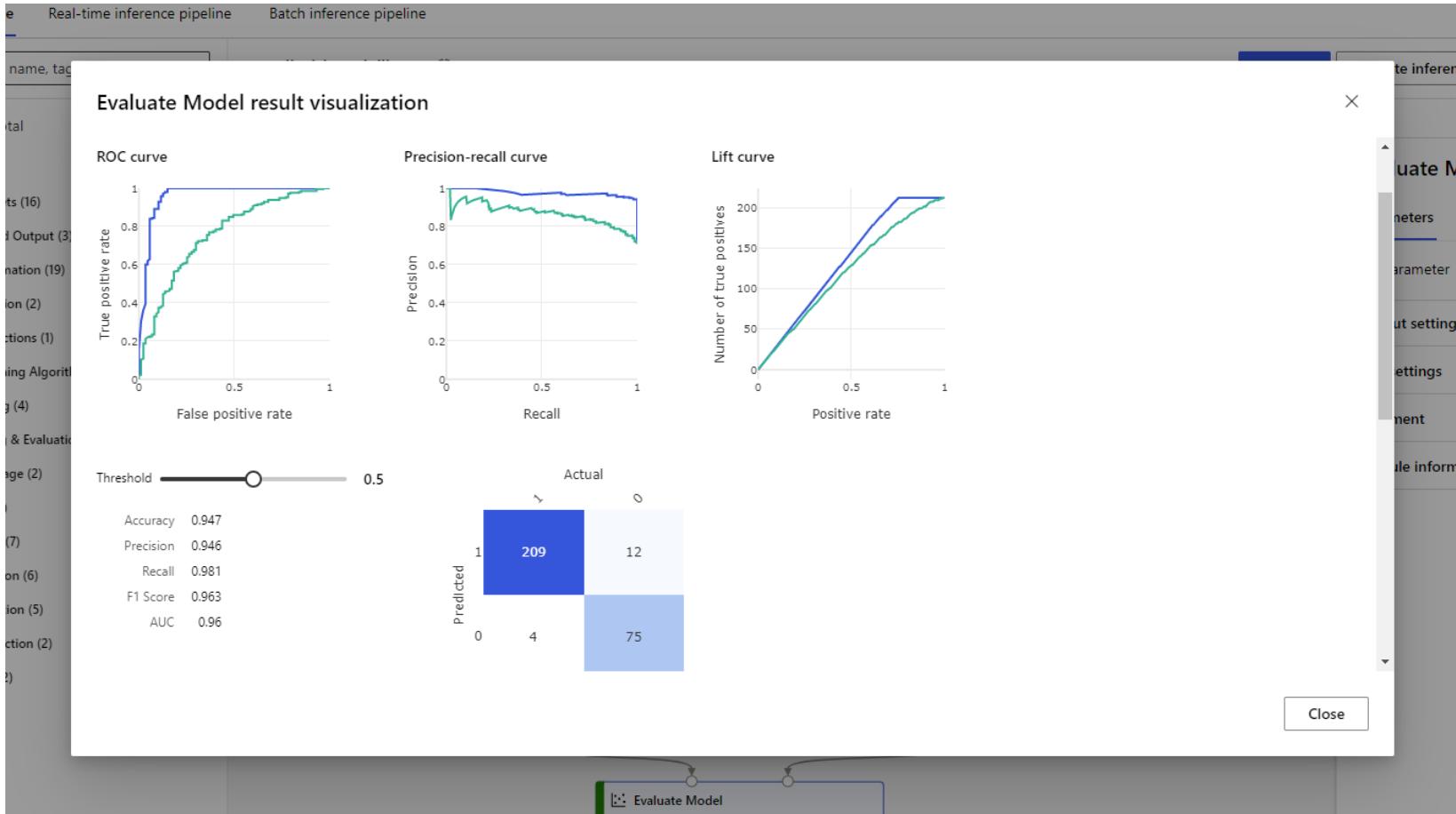


# Lab3 – Azure ML Designer Run is complete



# 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 nodes: 'MD-CreditRiskModelling-Train\_Mo...' and 'Datamart'. Both nodes have arrows pointing to a central 'Score Model' node. From the 'Score Model' node, an arrow points down to an 'Evaluate Model' node. The 'Evaluate Model' node has a descriptive text below it: '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

100% Hide overview

MD-CreditRiskModelling-Train\_Mo...

Score Model

Evaluate Model

Scored dataset

Scored data...

Scored data...

Dataset

Dataset output

Trained model...

Comparing the 2 models

Evaluation results

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   ...

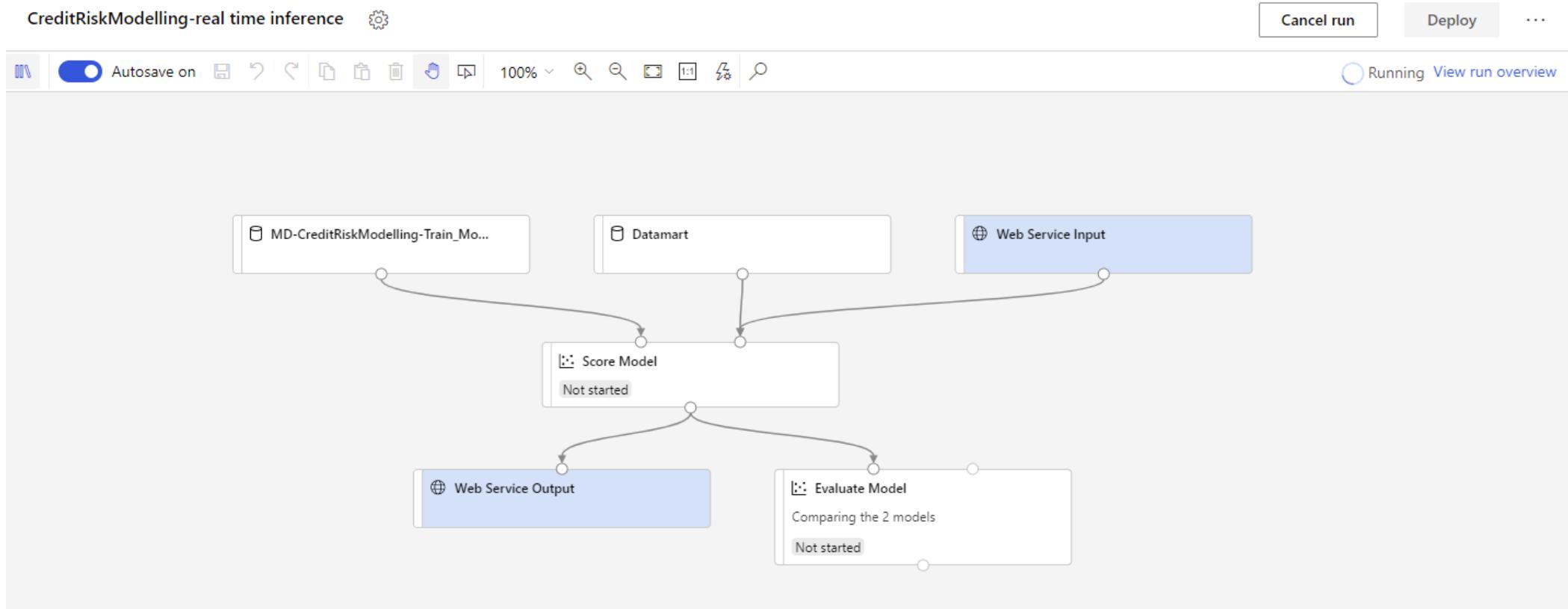
100 assets in total   Autosave on   Not started

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 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. On the left, there's a sidebar with various asset categories. In the center, a dialog box 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 filled with 'creditriskmodelrealtime', and the 'Description' field contains 'Credit Risk Model for real time'. Under 'Compute type', 'Azure Kubernetes Service' is chosen, and under 'Compute name', 'myaksinstance' is specified. At the bottom of the dialog are 'Advanced' settings and 'Deploy' and 'Cancel' buttons. The entire dialog box is circled with a thick red line.

# 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**

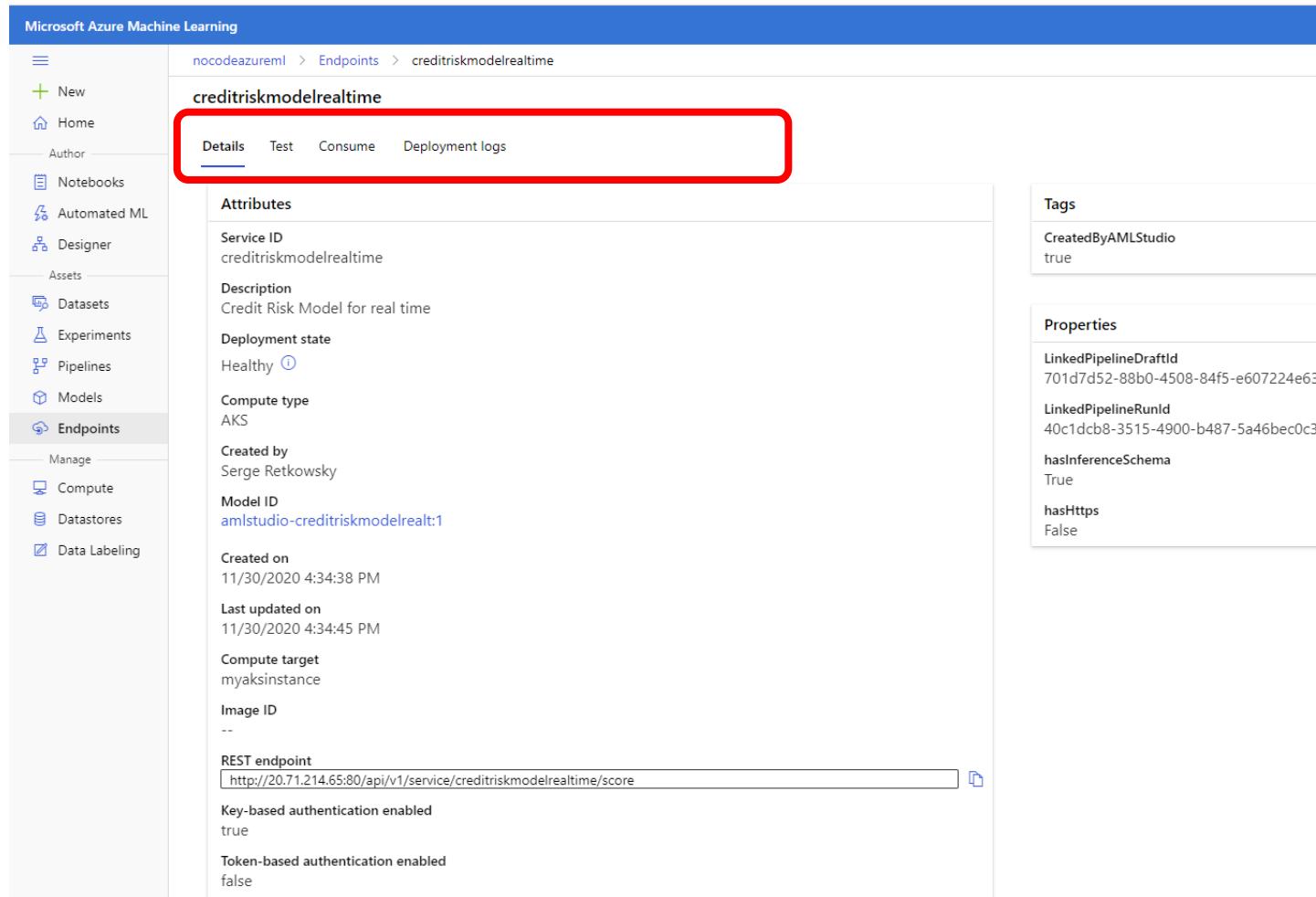
- Service ID: creditriskmodelrealtime
- Description: Credit Risk Model for real time
- Deployment state: Healthy ⓘ
- Compute type: AKS
- Created by: Serge Retkowsky
- Model ID: amlstudio-creditriskmodelrealtime:1
- Created on: 11/30/2020 4:34:38 PM
- Last updated on: 11/30/2020 4:34:45 PM
- Compute target: 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

# 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**

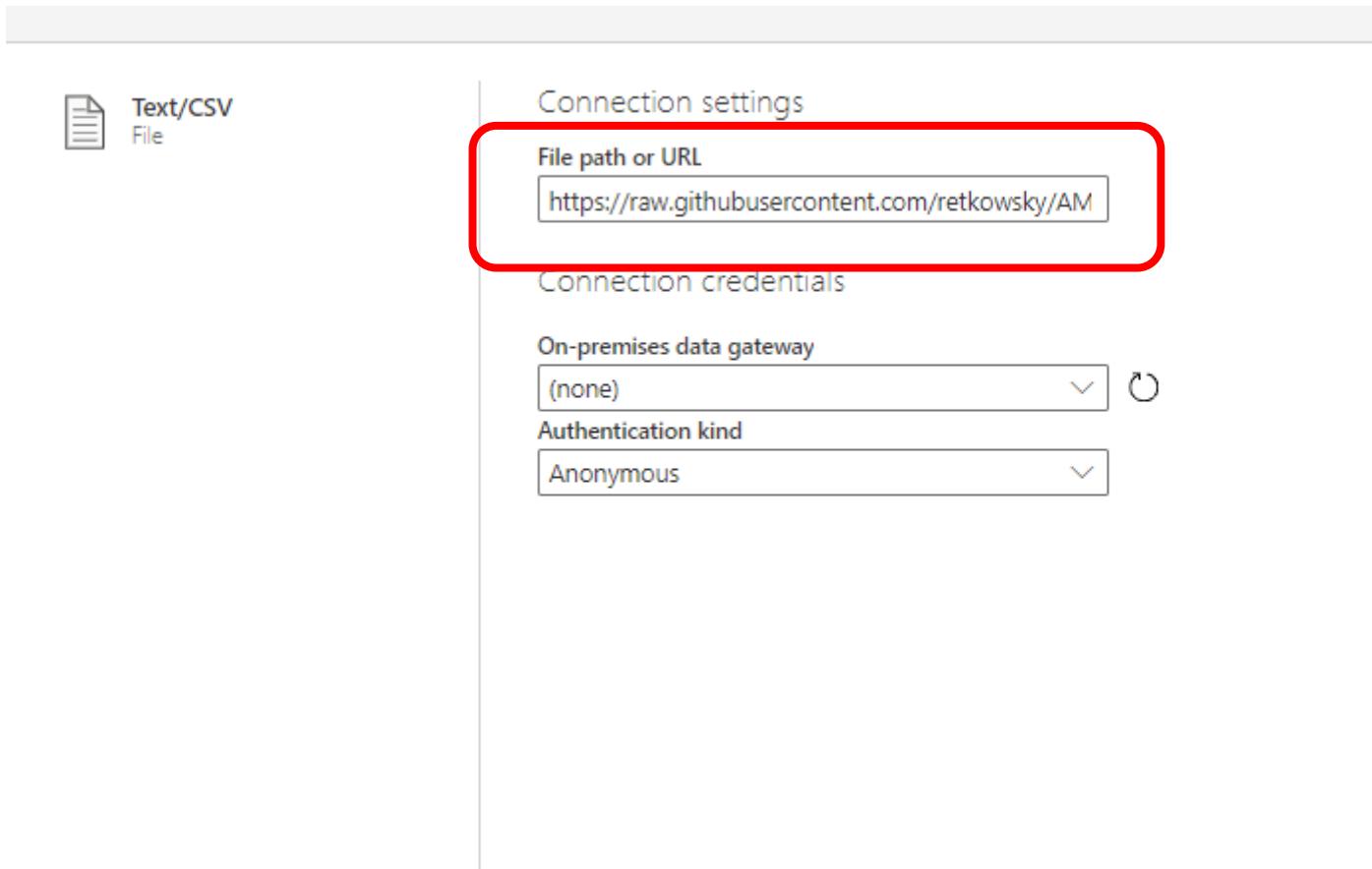
Choose a dataflow model to import into your workspace.

[Learn more](#)

**Import model**

# Lab4 – AutoML PowerBI integration

## Let's create a dataflow using a CSV file format



<https://raw.githubusercontent.com/orcelik/AMLlabs/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

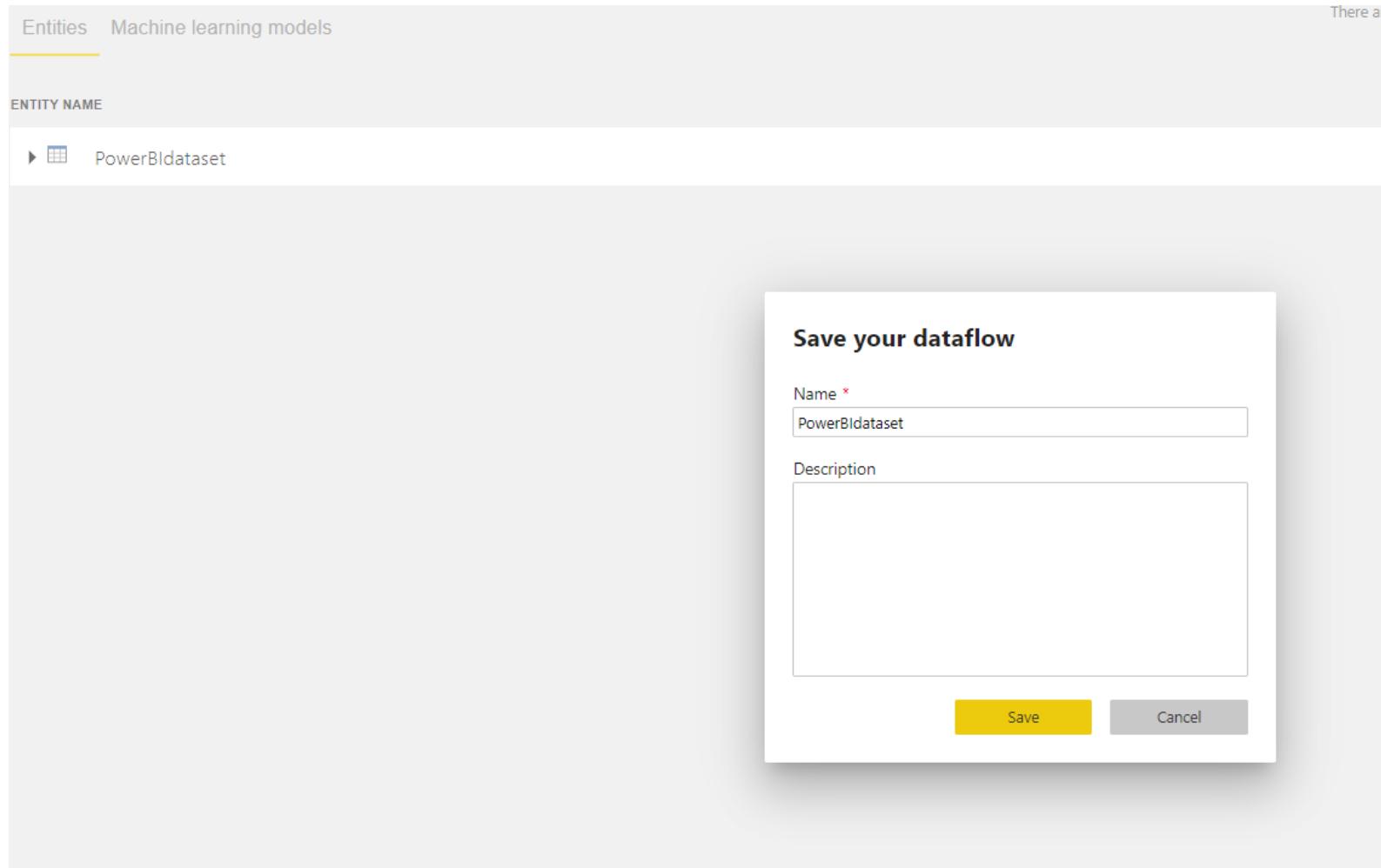
Columns: 21 Rows: 99+

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**

- 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 three-step wizard for creating an AutoML job. The first step, 'Select a field to predict', has a yellow checkmark above it. The second step, 'Choose a model', also has a yellow checkmark. The third step, 'Select data to study', has a yellow checkmark. Below these steps is a section titled 'Name and train your model'. It contains a 'Model name' input field with the value 'CreditRiskAutoML', which is highlighted by a red rectangular box. Below it is a 'Description' input field labeled '(Optional)'. Further down is a 'Training time' section, which is also highlighted by a red rectangular box. This section includes a note: '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.' It features a slider with values '5 minutes', '360 minutes', and '5 minutes' again. At the bottom, there's a section titled 'What happens next?' with the following text: '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.'

Select a field to predict

Choose a model

Select data to study

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

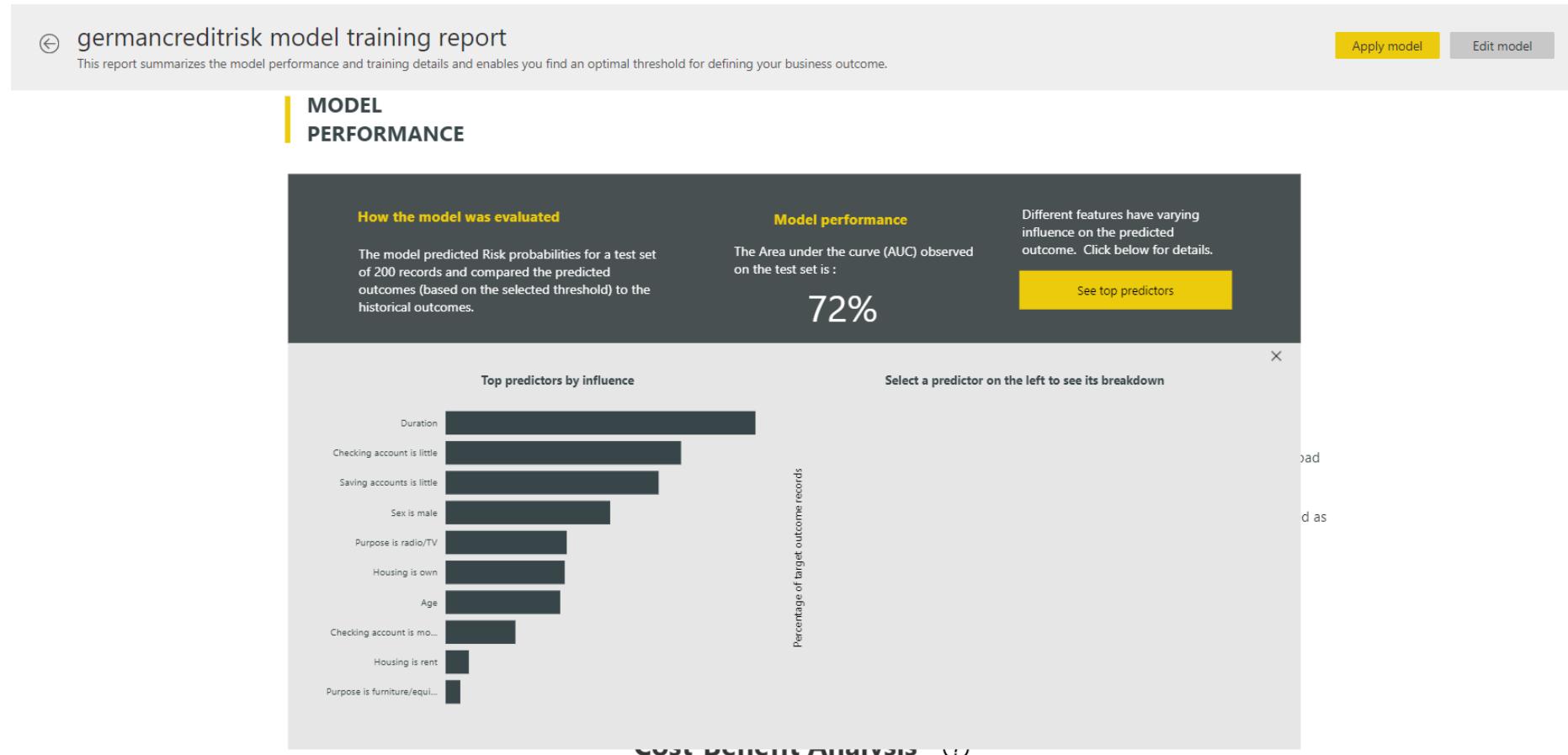
Top predictors by influence

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.

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

**Model quality over iterations**

Maximum Model Quality: 0.69

Iteration	Model Quality
0	0.65
2	0.67
4	0.65
6	0.66
8	0.67
10	0.65
12	0.66
14	0.65
16	0.66
18	0.64
20	0.67
22	0.66
24	0.67
25	0.65
26	0.50
27	0.68
28	0.66
30	0.68
31	0.60
32	0.69

Apply model Edit model

# 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

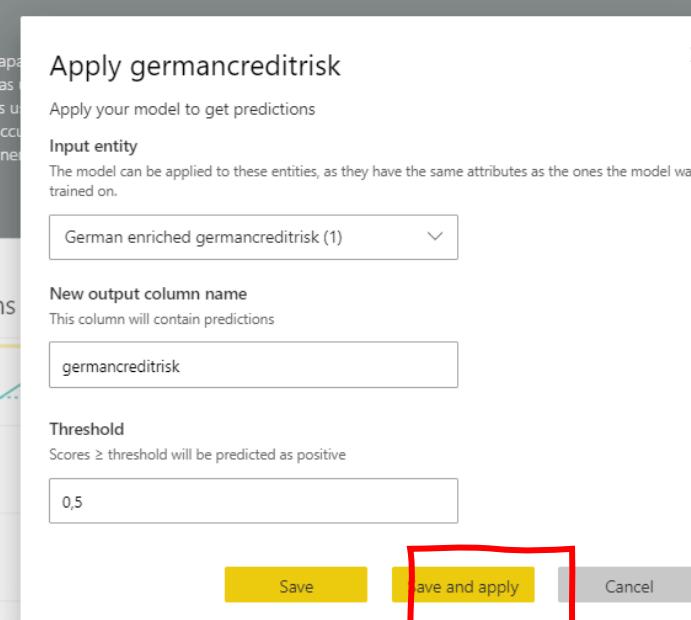
Scores ≥ threshold will be predicted as positive

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/orcelik/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 the Source step and a "Promoted headers" step. A red box highlights the "AI insights" button in the top ribbon, which is located next to the CDM button.

# 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 of the interface is a detailed view of the selected model.

This is a configuration dialog for the 'AzureML.myautomlmodel' model. At the top, it displays the region as 'westeurope', the creation date as '11/30/2020 2:50 PM', and the last modification date as '11/30/2020 2:50 PM'. Below this, there is a 'Show' button with a dropdown arrow. The main part of the dialog lists various input features with their corresponding dropdown menus:

- 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
- Most valuable available asset

At the bottom of the dialog are two buttons: 'Apply' and 'Cancel'.

# **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

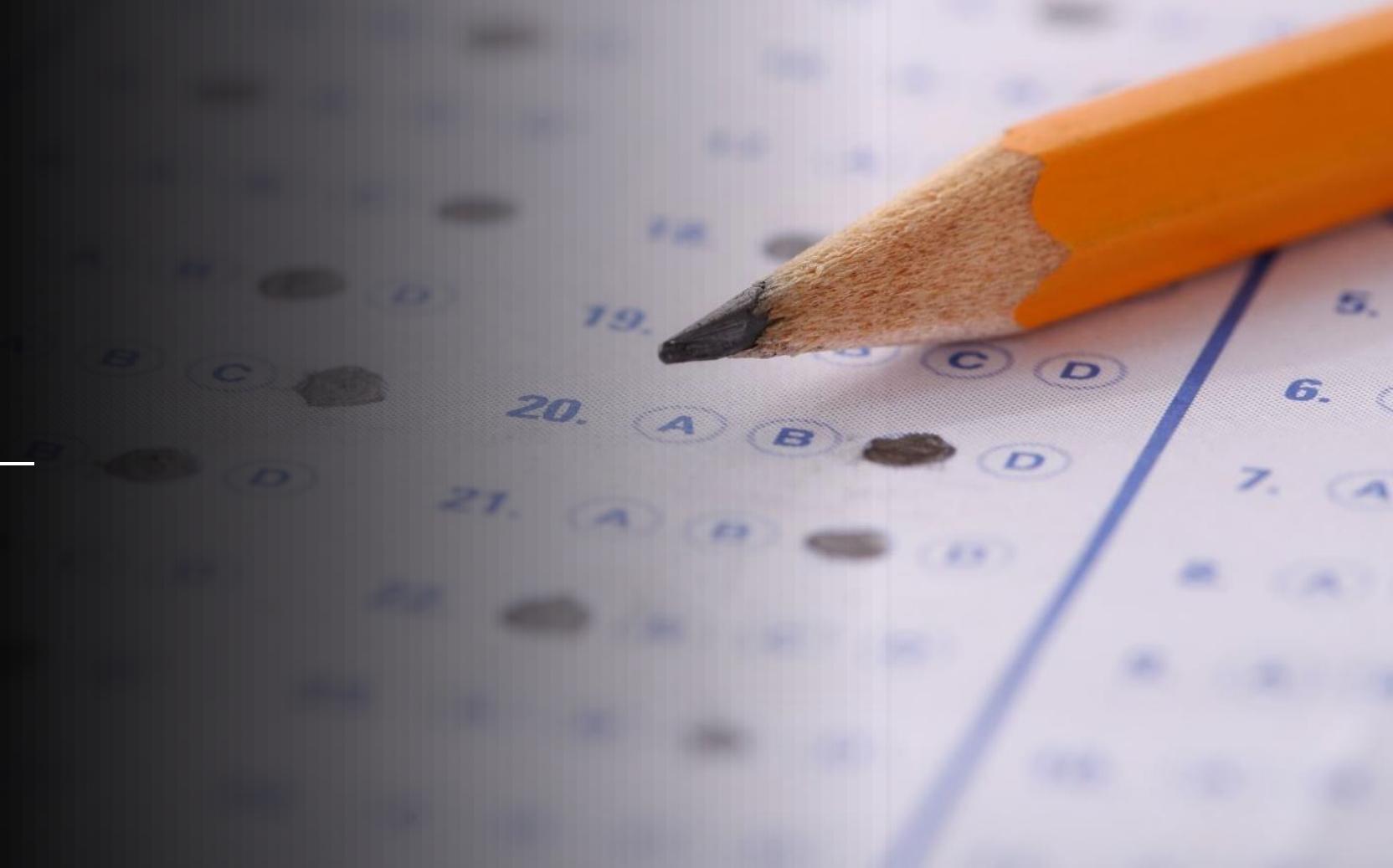
Applied steps:

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

fx Post process A...

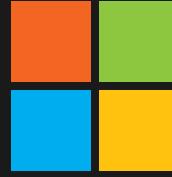
# Quiz time 3

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Q&A



# Microsoft Azure

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Be future  
ready

Build on  
your terms

Operate hybrid  
seamlessly

Trust  
your cloud