Azure Machine Learning & ML.NET: Better Together

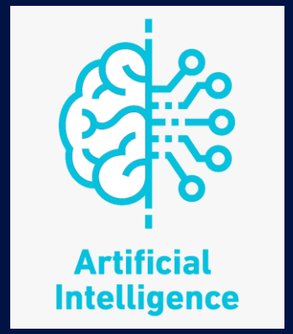
Who?

Jose Luis Latorre
@joslat - https://github.com/joslat
Microsoft MVP
DEV Community Lead & SW Architect

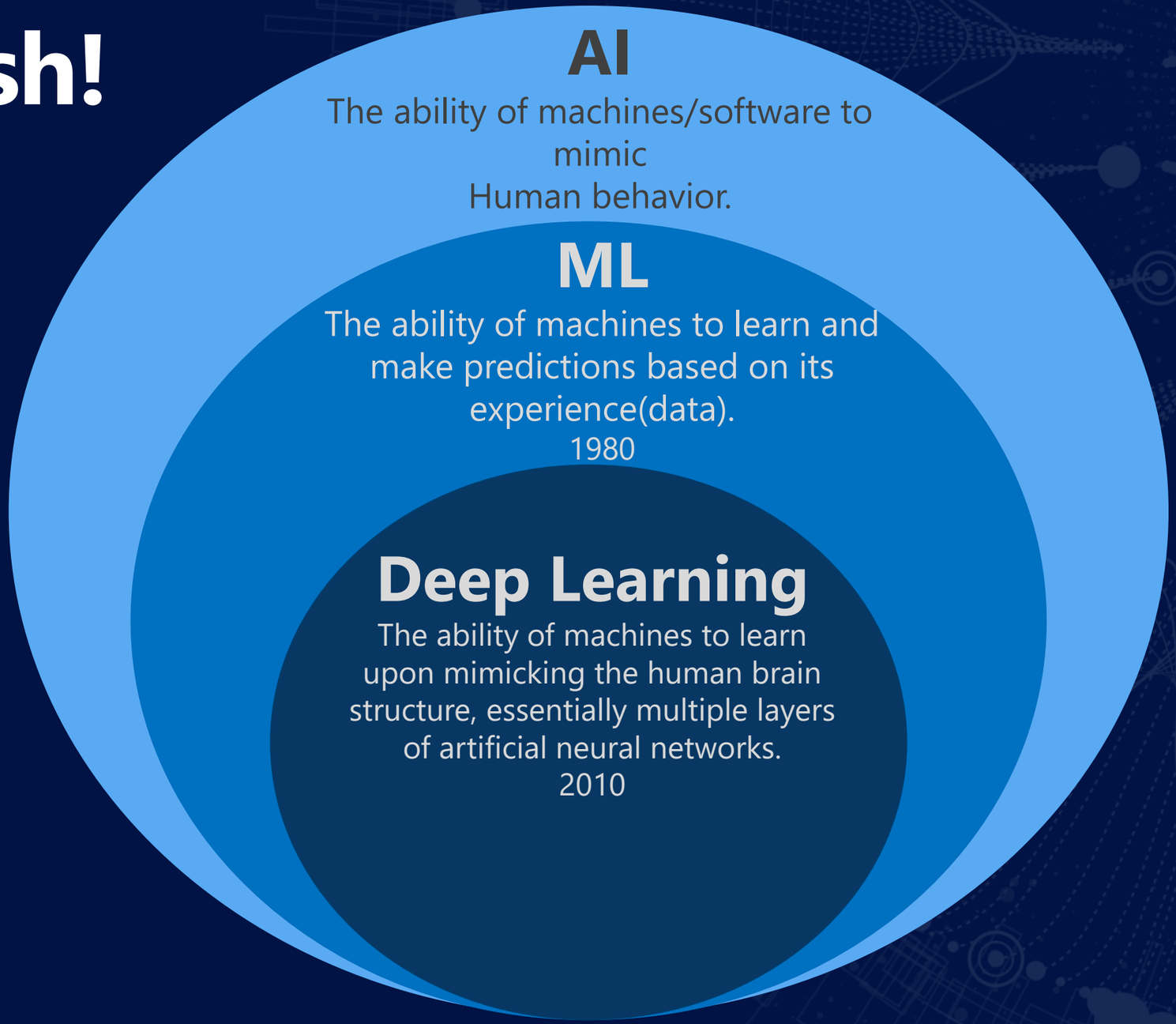
.NET User Group Zürich

Agenda

- Quick refresher on AI
- Azure Machine Learning
- ONNX
- Generating an ONNX Model
- ML.NET
- Consuming an ONNX Model



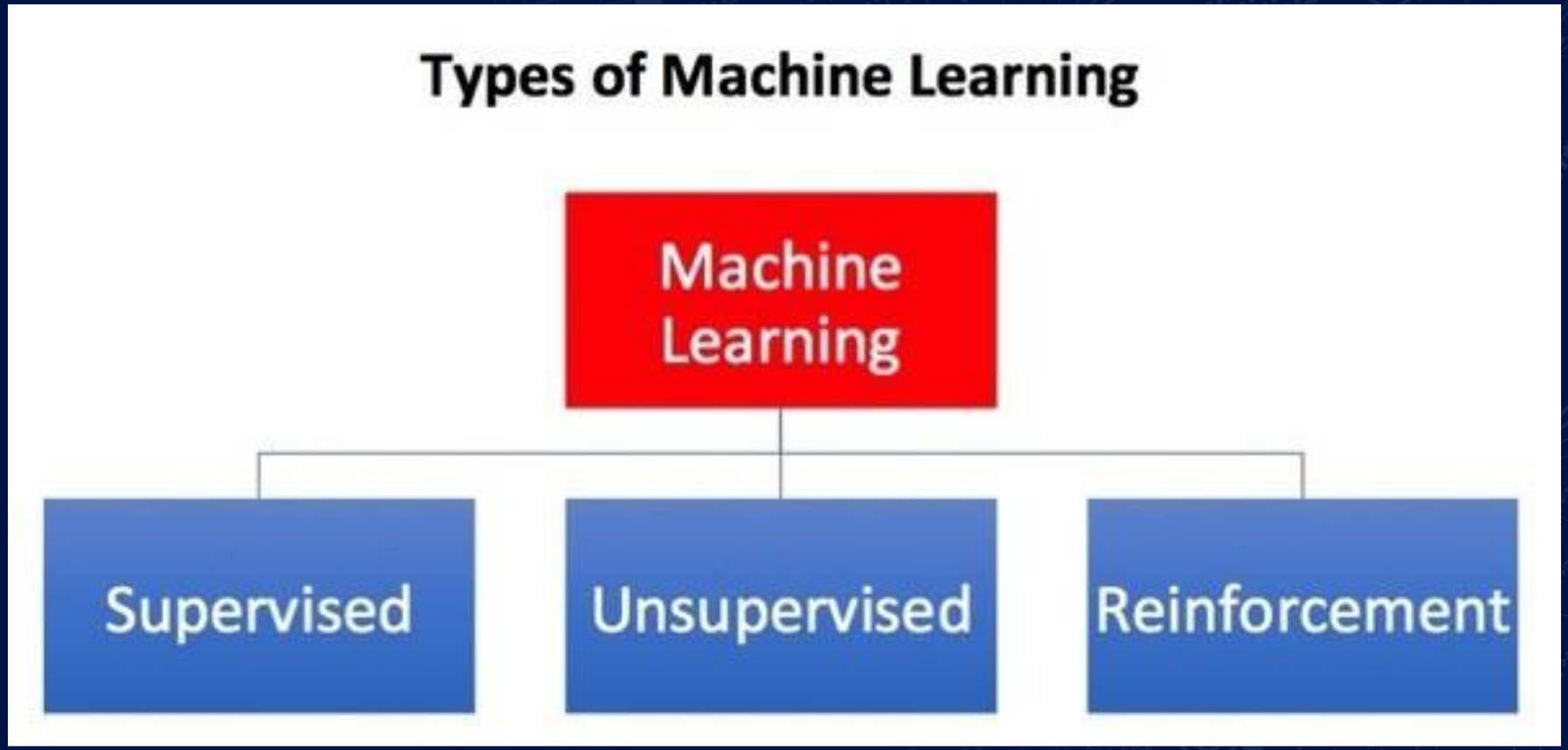
AI Refresh!


AI
The ability of machines/software to mimic
Human behavior.
ML
The ability of machines to learn and make predictions based on its experience(data).
1980
Deep Learning
The ability of machines to learn upon mimicking the human brain structure, essentially multiple layers of artificial neural networks.
2010

How does Machine Learning work?

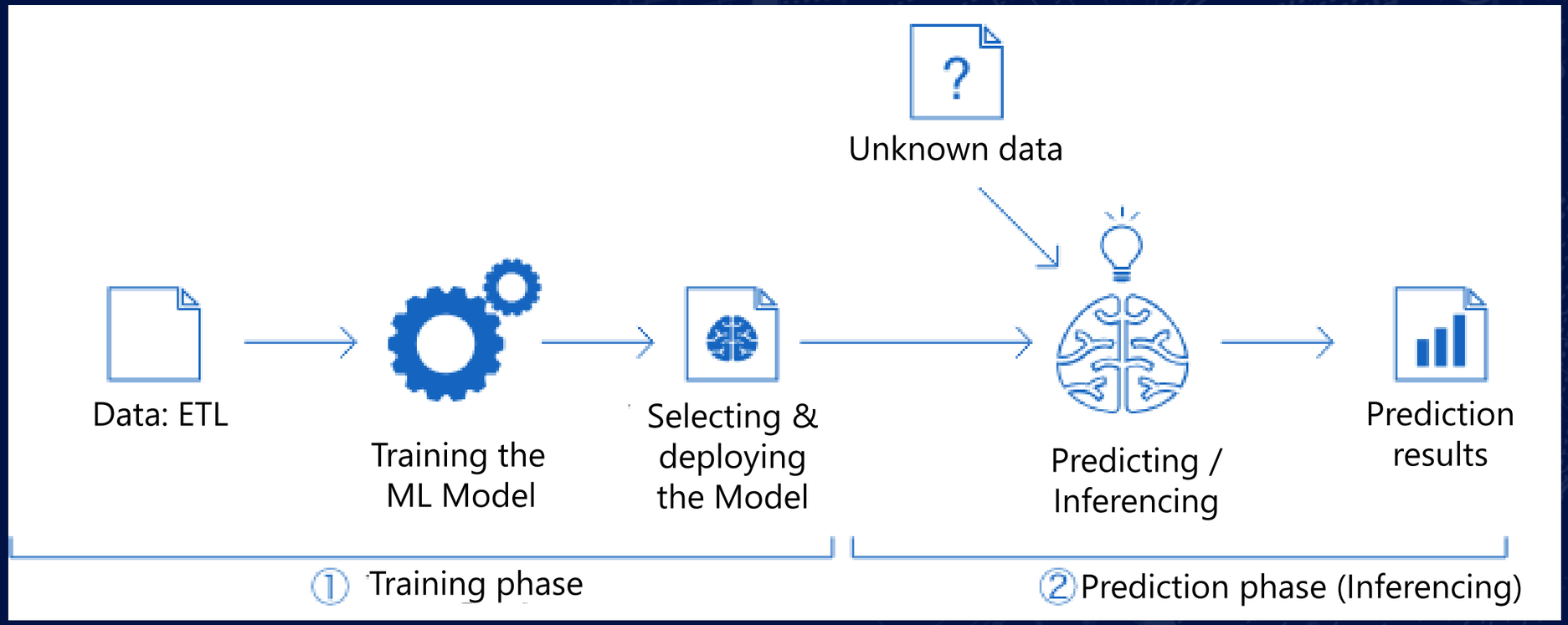
ML Algorithms

- Generally, we have three main Categories/Techniques: Supervised, Unsupervised & Reinforcement learning.



The Machine Learning Workflow

- The process of training a ML model which involves several steps which we can summarize on the following picture.



Azure Machine Learning

Bring AI to everyone with an end-to-end, scalable, trusted platform

Boost your data science productivity

Increase your rate of experimentation

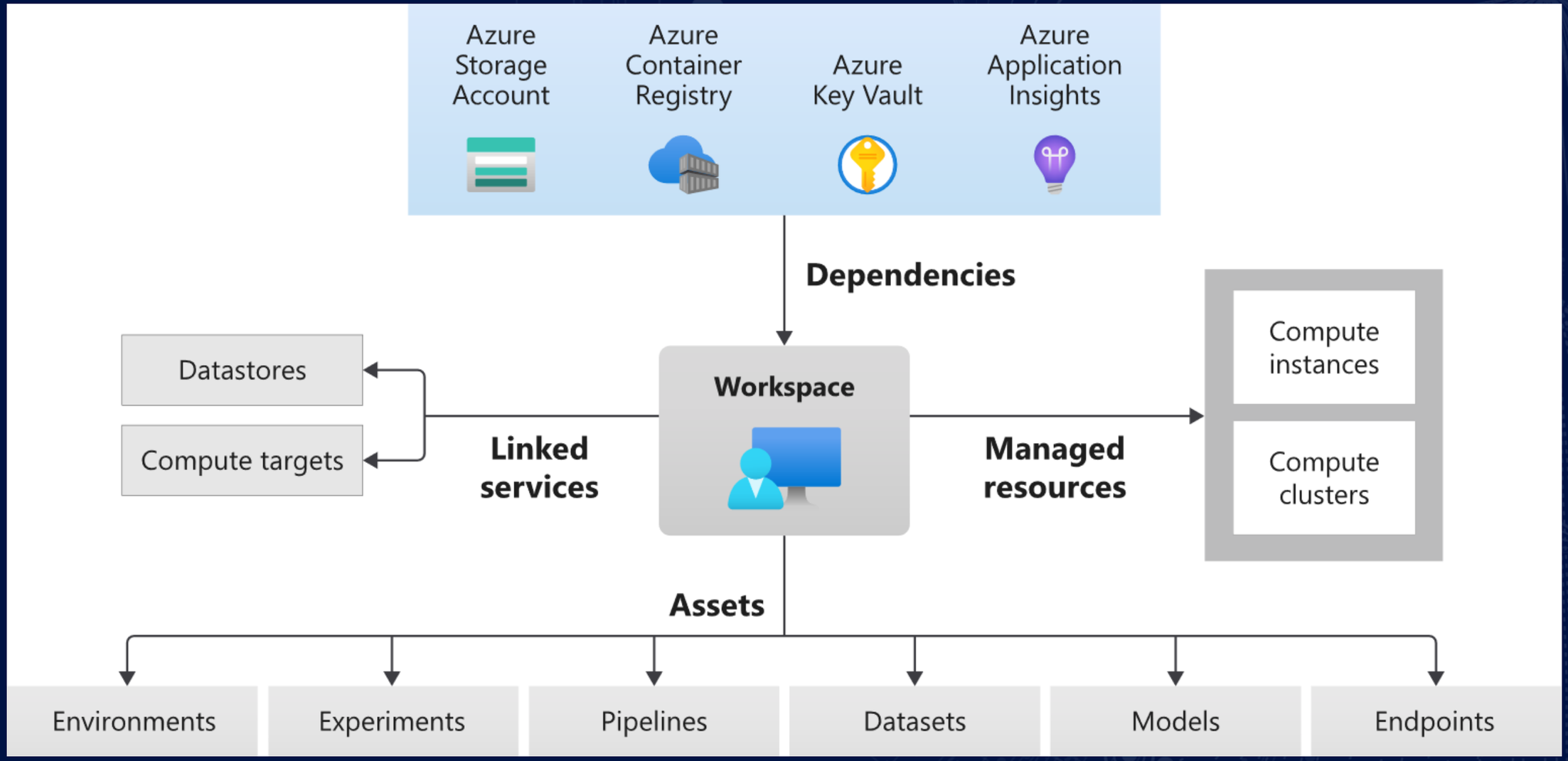
Deploy and manage your models everywhere

Built with your needs in mind

- Automated machine learning
- Managed compute
- Simple deployment
- DevOps for machine learning
- Support for open source frameworks
- Tool agnostic Python SDK

Seamlessly integrated with the Azure Portfolio

Azure Machine Learning WORKSPACE



Azure Machine Learning Studio

Set of Azure Cloud Services

Python SDK

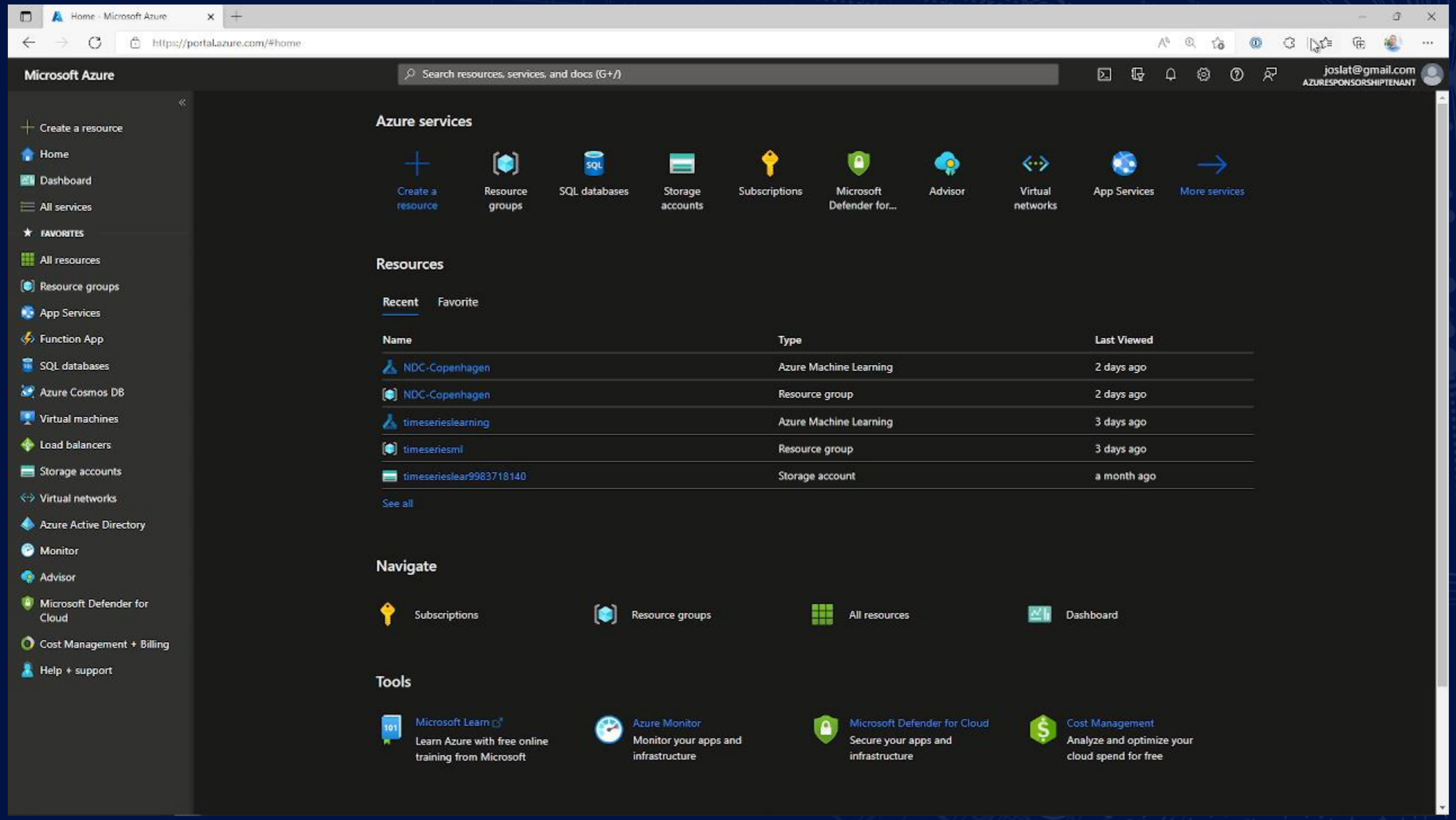
That enables you to:

- Prepare Data
- Build Models
- Train Models

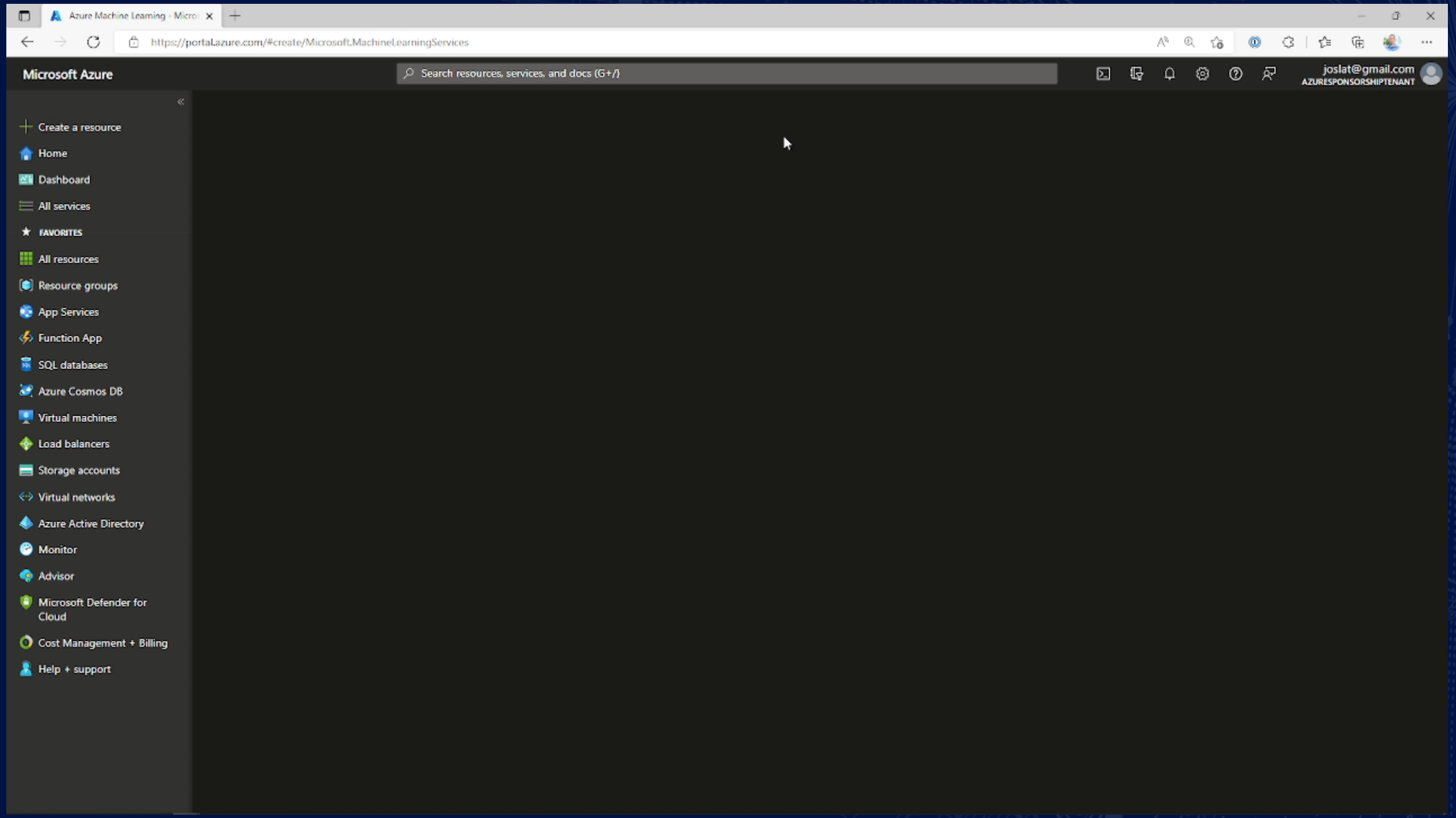
- Manage Models
- Track Experiments
- Deploy Models

An overview of the Azure ML Studio

How to create



Overview


Azure Machine Learning - Micro
https://portal.azure.com/#create/Microsoft.MachineLearningServices
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Search resources, services, and docs (G+/)
joslat@gmail.com
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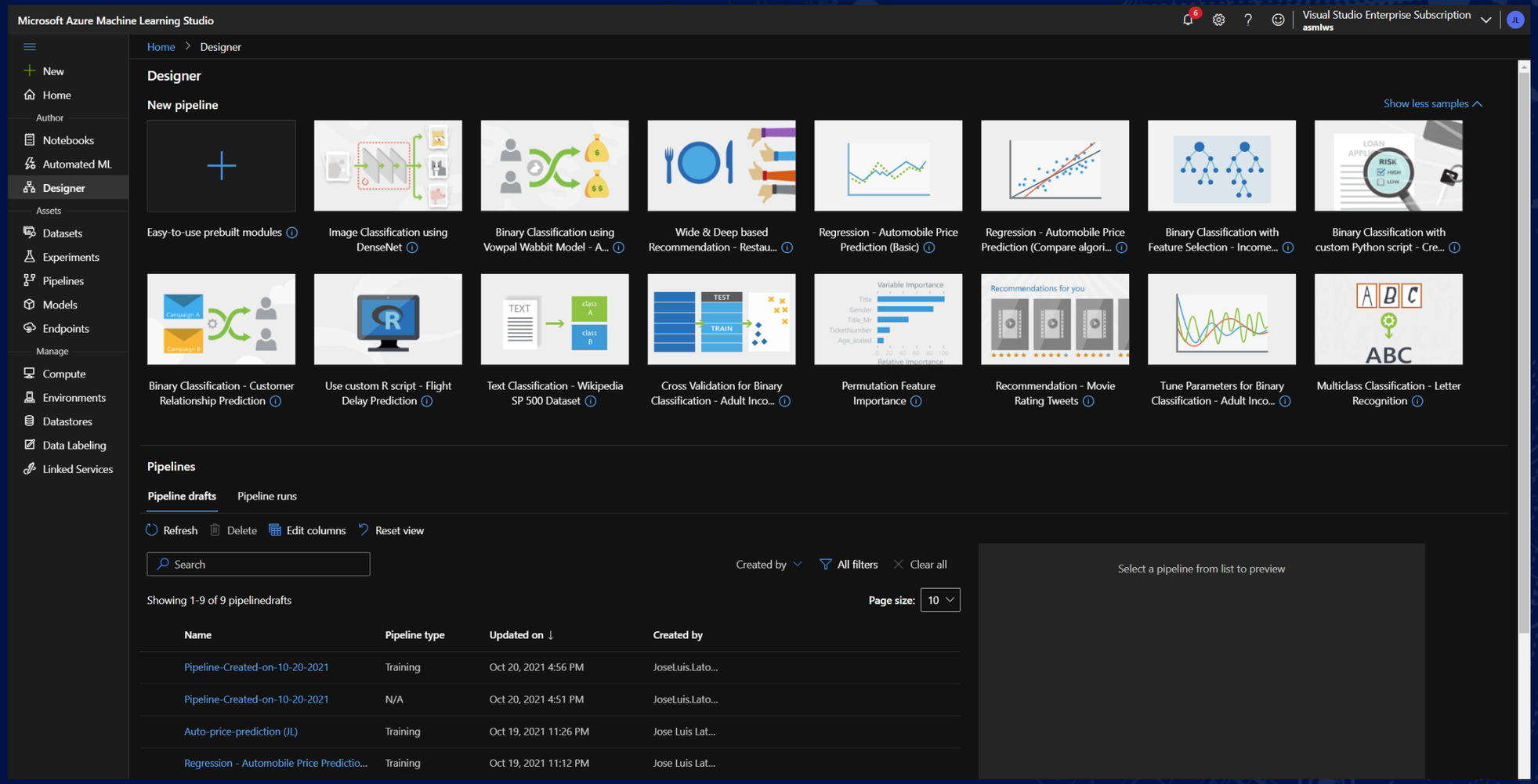
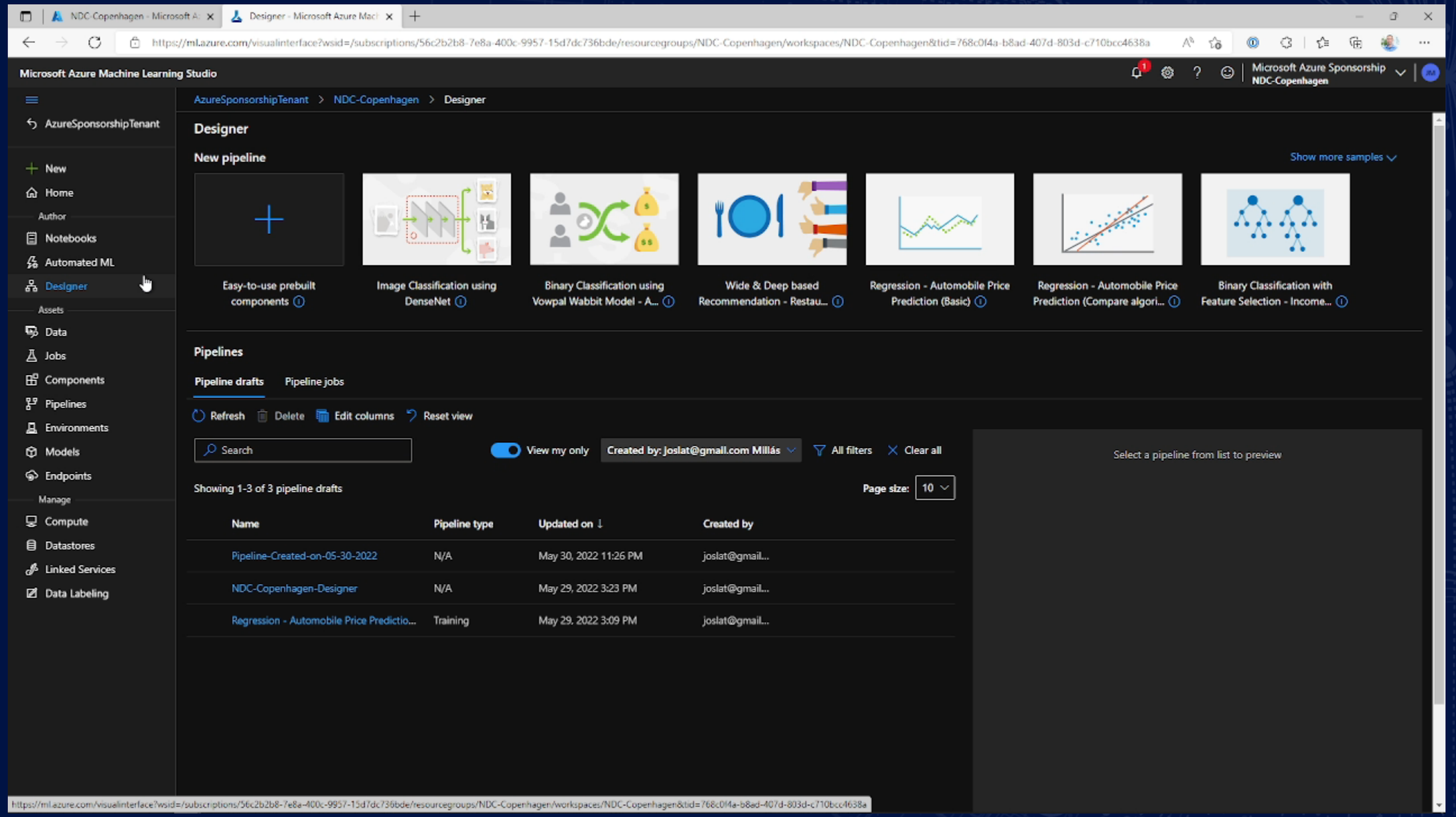
Home
Dashboard
All services
FAVORITES
All resources
Resource groups
App Services
Function App
SQL databases
Azure Cosmos DB
Virtual machines
Load balancers
Storage accounts
Virtual networks
Azure Active Directory
Monitor
Advisor
Microsoft Defender for Cloud
Cost Management + Billing
Help + support

Azure Machine Learning Designer

Drag-and-drop interface to create pipelines for training models, inferencing or data processing.



Designer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New pipeline
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Binary Classification with Feature Selection - Income...
Pipelines
Pipeline drafts
Pipeline jobs
Refresh
Delete
Edit columns
Reset view
Search
View my only
Created by: joslat@gmail.com Millás
All filters
Clear all
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Showing 1-3 of 3 pipeline drafts
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Automated ML, aka AutoML

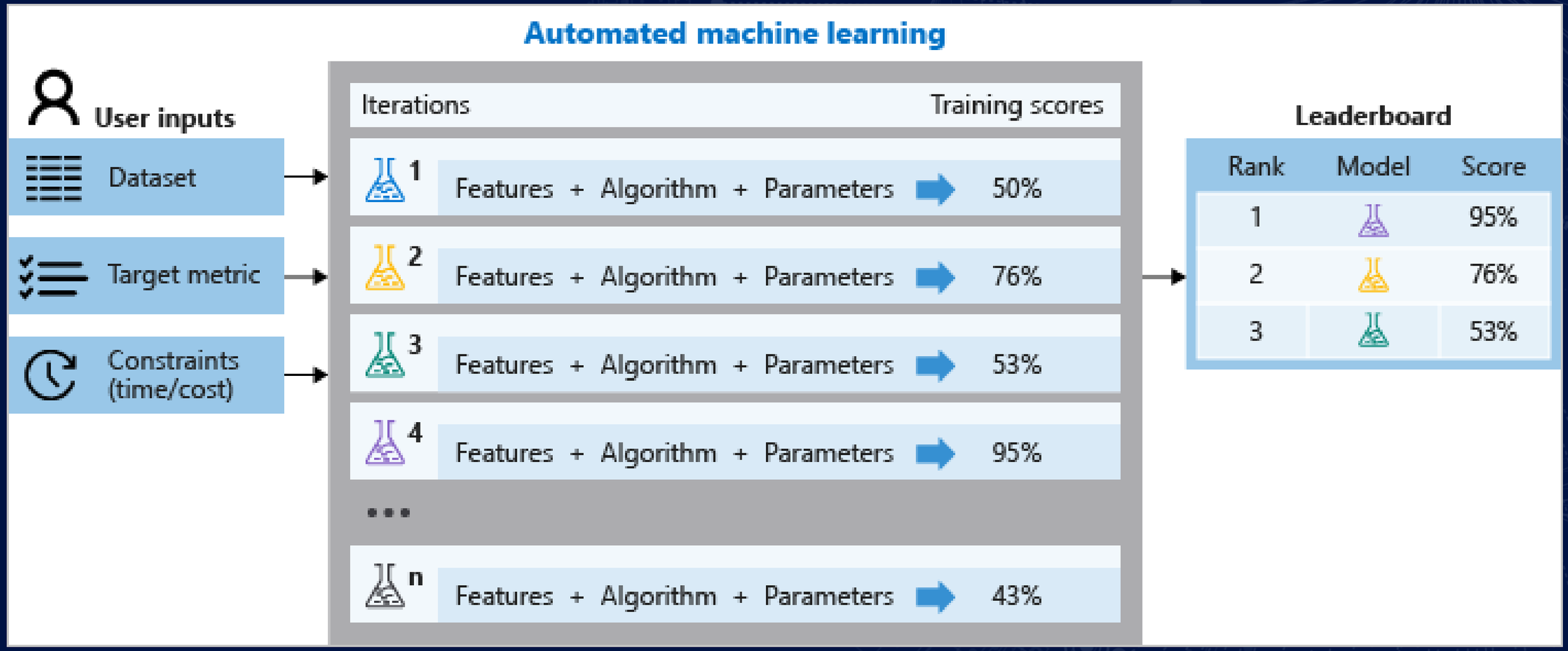
Machine Learning to create Machine Learning, ETL, Model Selection, Hyperparameter tuning and more done for you.

- Feature selection & engineering
- Data guardrails
- Best Model selection
- Hyperparameter tuning
- Model explanation & insights (feature importance)

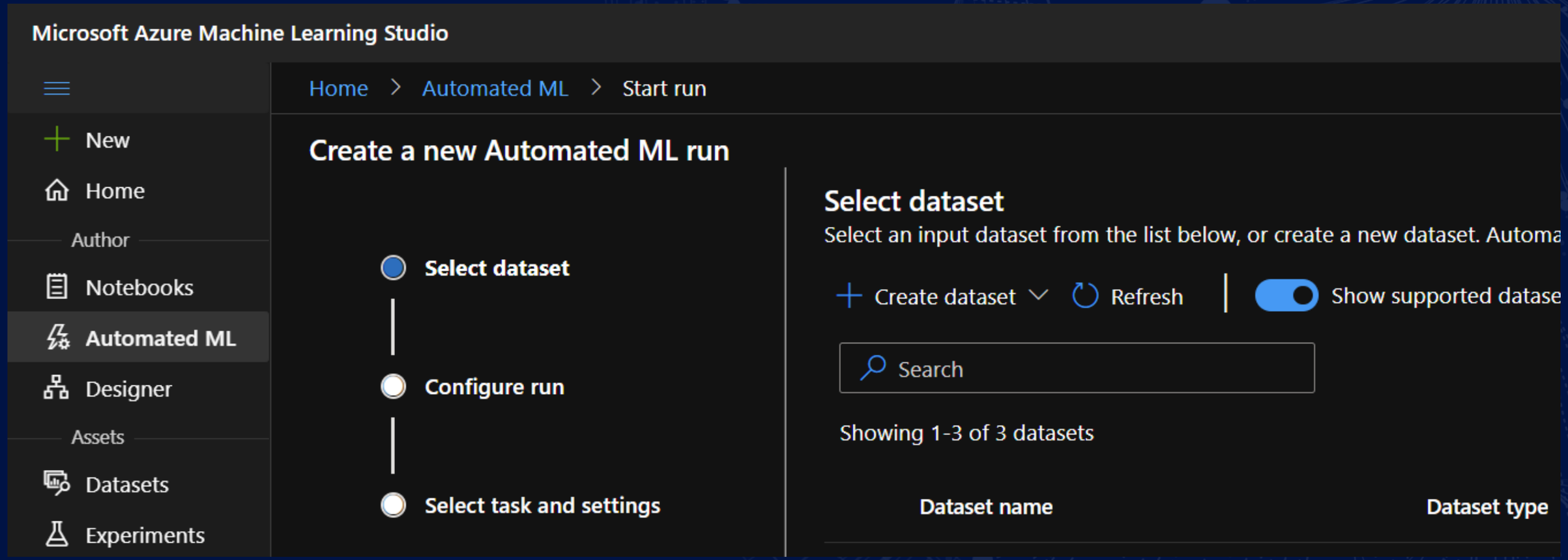
- Different supported tasks (Classification, Regression, time series)
- A Data Scientist “in a box”
- To me, the dream of an “aficionado” Data Scientist

Automated ML, aka AutoML

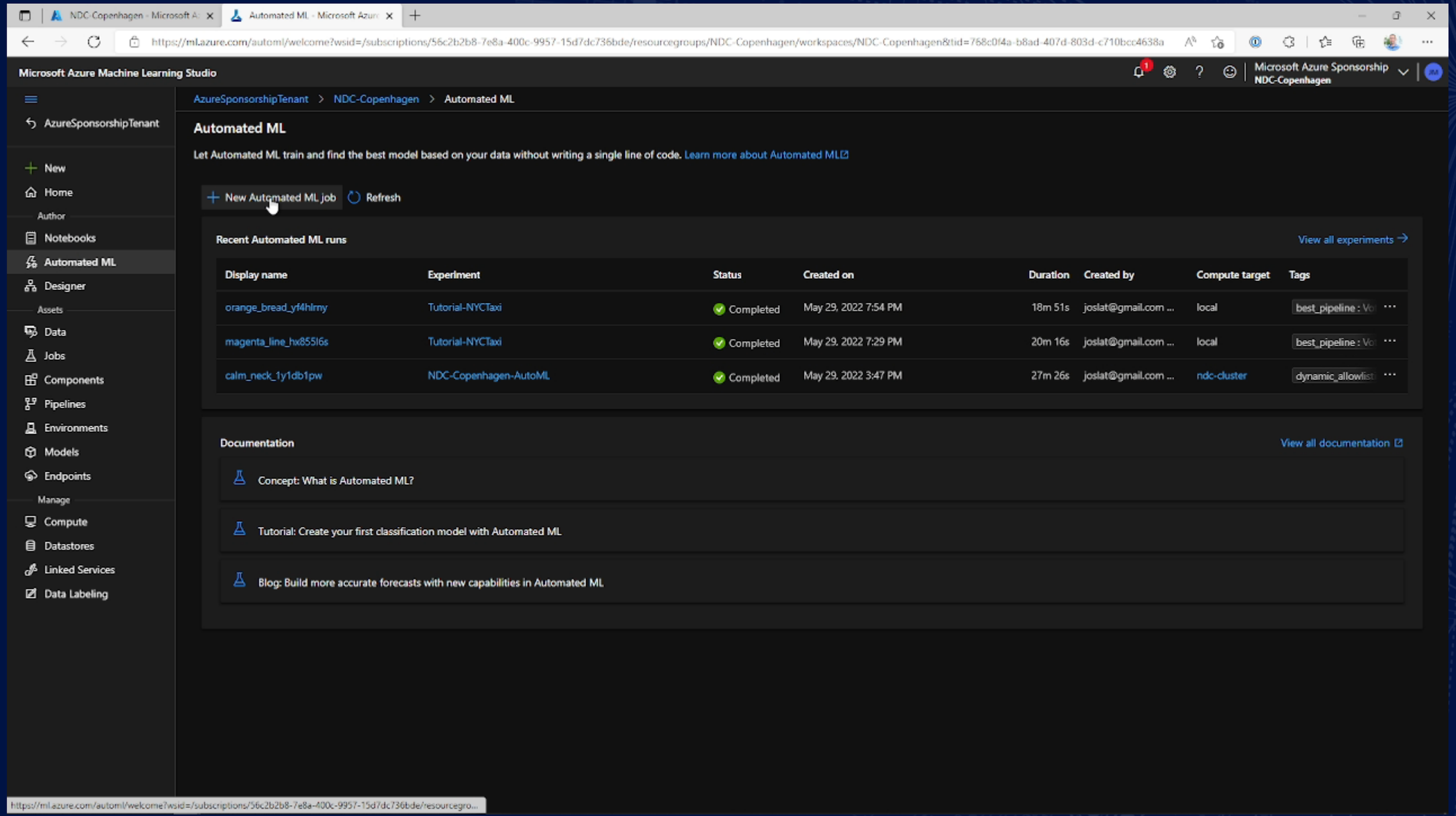
AutoML Simplifies the ML training process greatly, doing the feature engineering, model selection, hyperparameter tuning…



Let the machine do the work!



AutoML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Documentation
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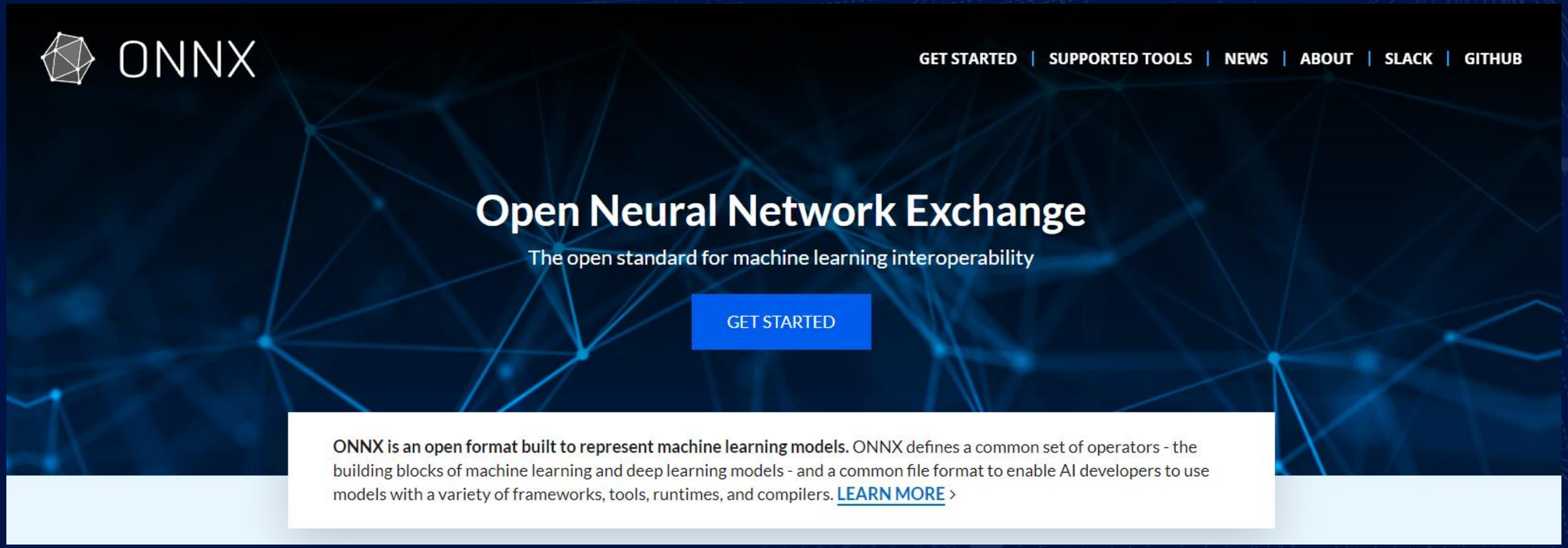
Concept: What is Automated ML?
Tutorial: Create your first classification model with Automated ML
Blog: Build more accurate forecasts with new capabilities in Automated ML

ONNX

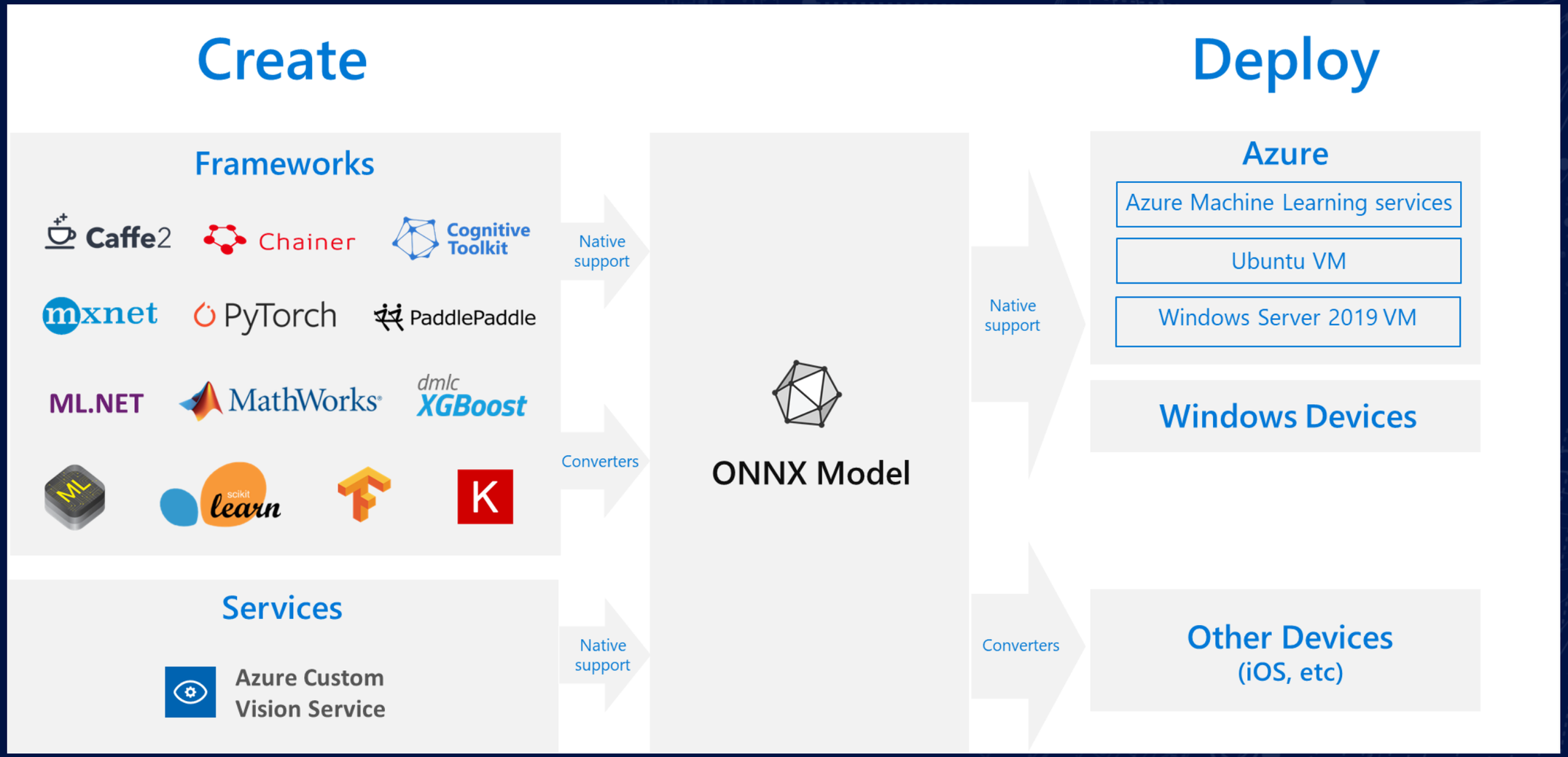
Open Neural Network exchange



"It's like NuGet for AI Models" – Jose L. Latorre, 2021

ONNX

Open Neural Network exchange

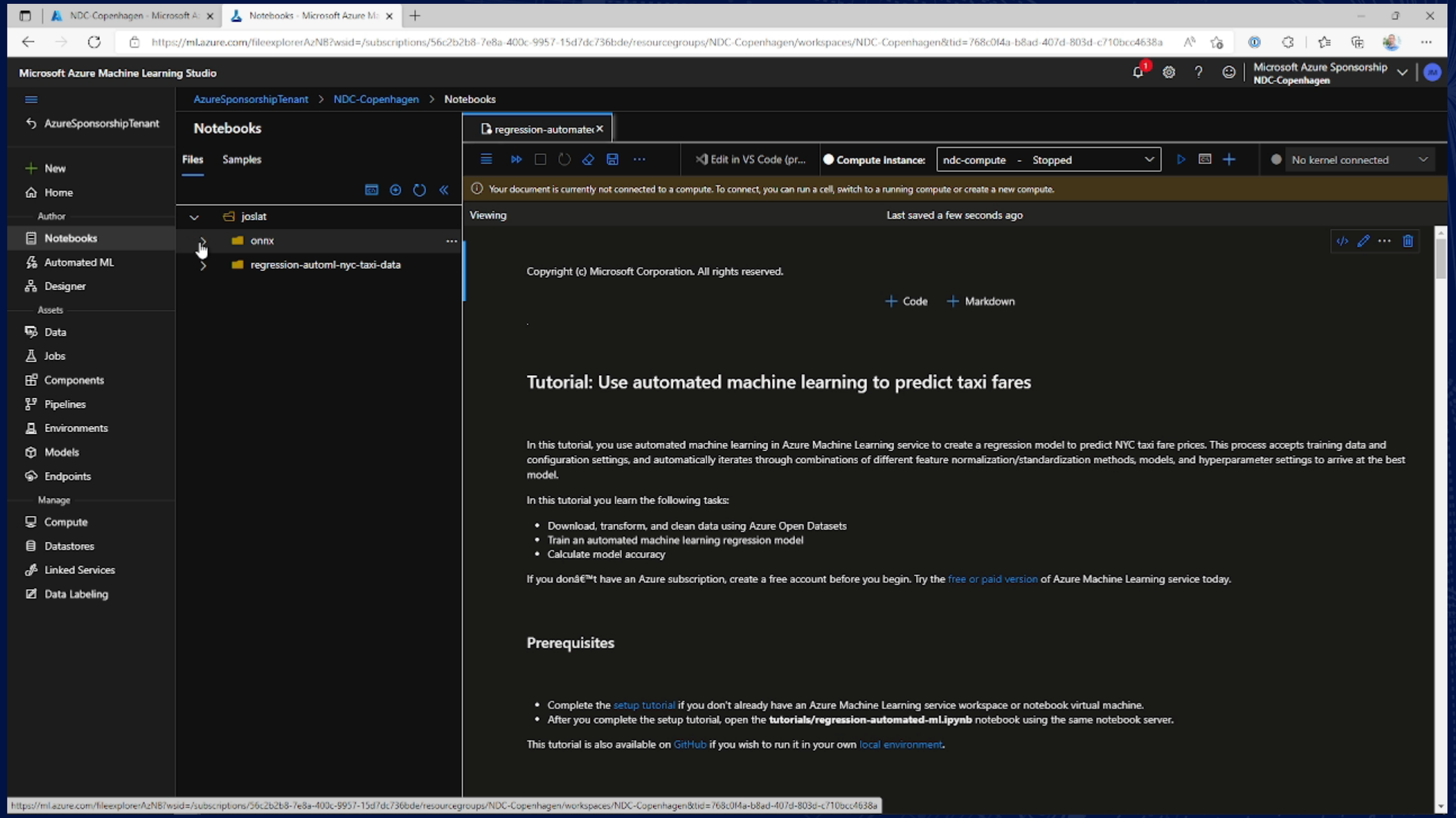


ONNX

Let’s build an ONNX model

Based on:
https://docs.microsoft.com/en-us/azure/machine-learning/tutorial-auto-train-models

ONNX Model Creation



ONNX generation from Azure ML

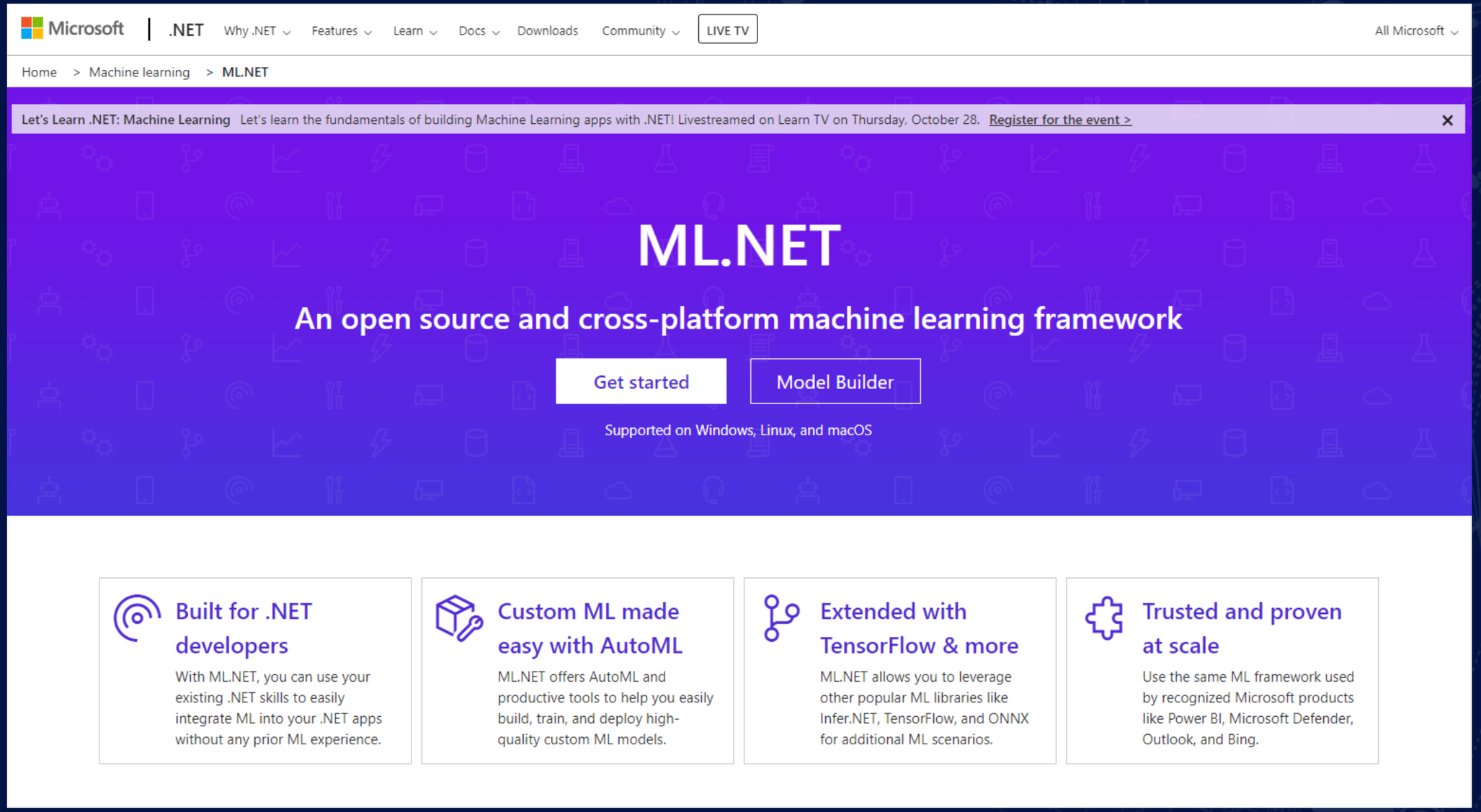
Only supported at the moment from Notebooks

Only the following changes are needed when adapting an existing Notebook that trains a model:

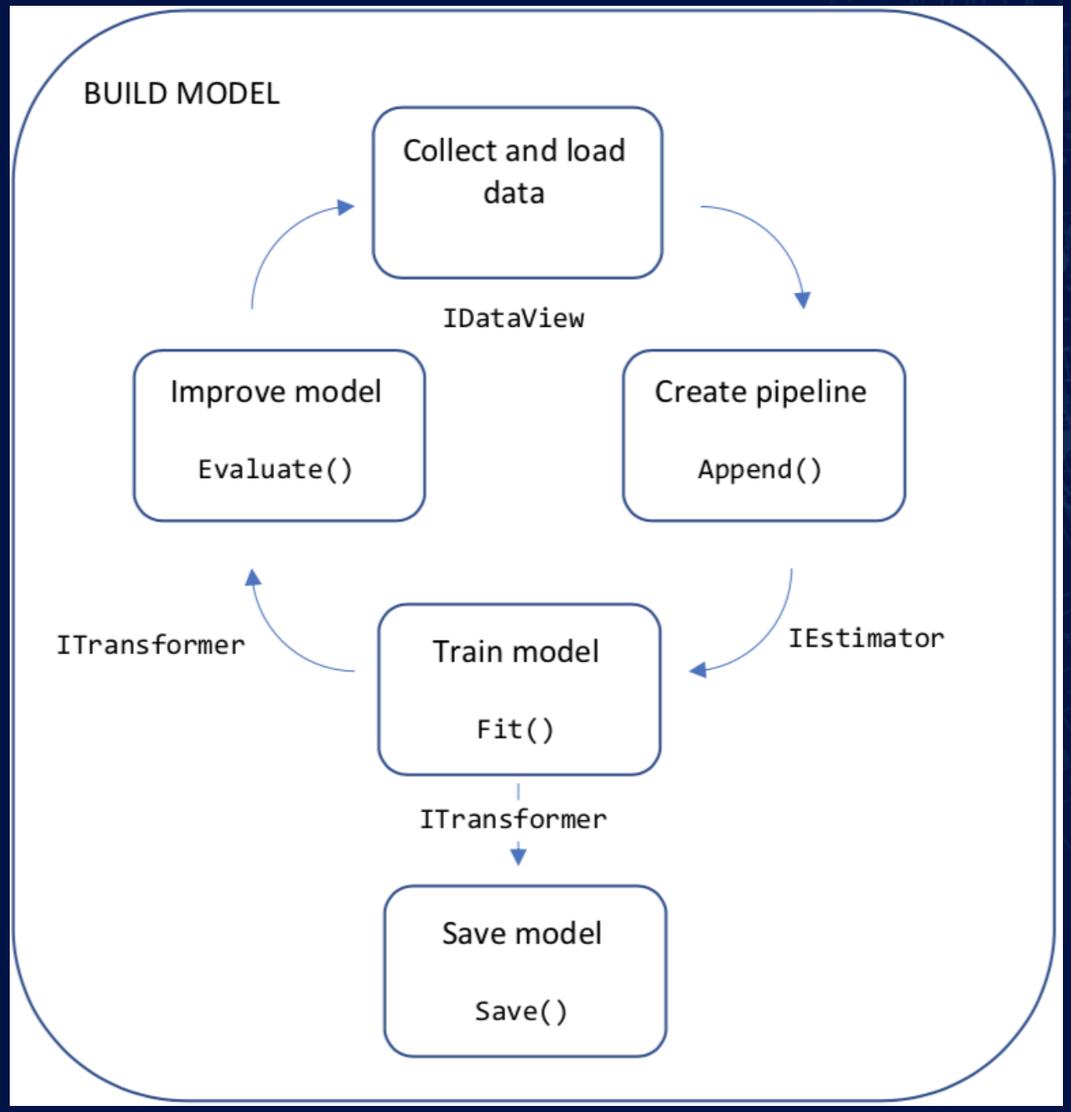
1. Add support for ONNX on the AutoML Configuration, AutoMLConfig:
   - enable_onnx_compatible_models=True,
2. Once the model is built, to export it as ONNX….
   1. First, retrieve the model
      - best_run, onnx_mdl = local_run.get_output(return_onnx_model=True)
   2. Second, convert and save it
      - from azureml.automl.runtime.onnx_convert import OnnxConverter
      - onnx_fl_path = "./best_model.onnx"
      - OnnxConverter.save_onnx_model(onnx_mdl, onnx_fl_path)

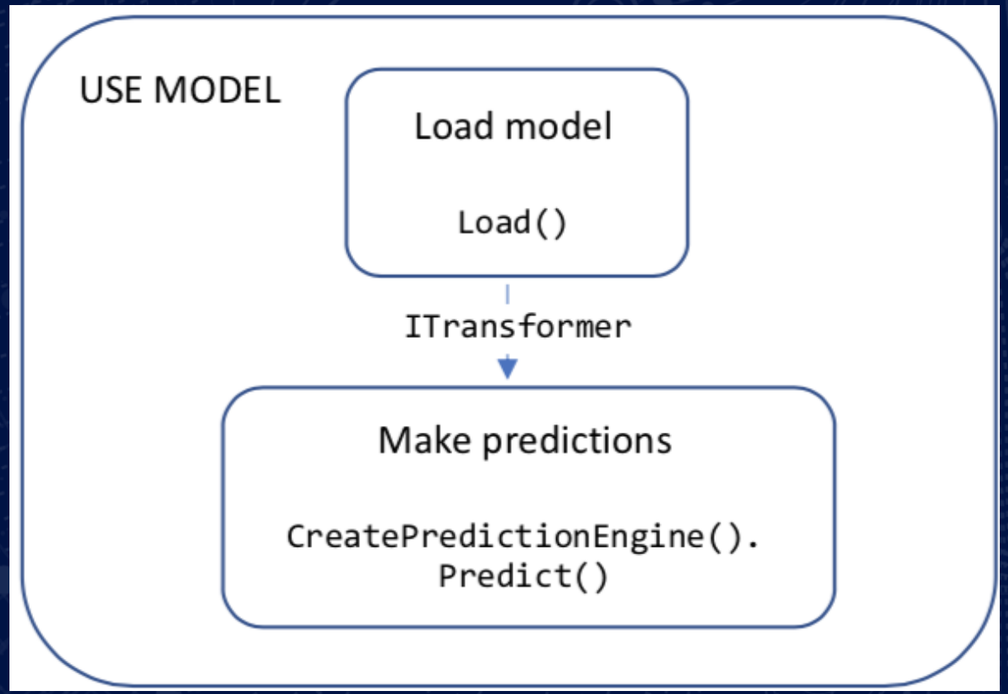
ML.NET

An open source and cross-platform machine learning framework, VS Code & Visual Studio supported.



ML.NET


BUILD MODEL
Collect and load data
IDataView
Create pipeline
Append()
IEstimator
Train model
Fit()
ITransformer
Save model
Save()
ITransformer
Improve model
Evaluate()


USE MODEL
Load model
Load()
ITransformer
Make predictions
CreatePredictionEngine().
Predict()

ML.NET

- Model Builder with AutoML support
- Everything local also cloud in some cases.
- Native Integration with tools & DevOps
- Any .NET app is supported (.NET Standard)

- Open Source Project
- Supports TensorFlow & more
- ONNX is supported
- High Performance & accuracy

Using ONNX on ML.NET

Based on:
https://docs.microsoft.com/en-gb/azure/machine-learning/how-to-use-automl-onnx-model-dotnet

Conclusions & take aways

Some points to remember and take away with you…

- Azure Machine Learning rocks
- ML.NET is also really cool
- We can generate an ONNX model with Notebooks!
- And consume it from ML.NET

Q & A

THANK YOU!

- https://github.com/joslat/NDC-Copenhagen-AML-ML.NET

- https://docs.microsoft.com/en-us/azure/machine-learning/
- https://dotnet.microsoft.com/en-us/apps/machinelearning-ai/ml-dotnet
- https://onnx.ai/
- https://github.com/onnx
- https://docs.microsoft.com/en-us/azure/machine-learning/how-to-use-automl-onnx-model-dotnet
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