



Présentation Azure ML

Date



Vos interlocuteurs



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- AI&ML specialist
- serge.retkowsky@microsoft.com

Version du document

- V 1.0
- 12 mars 2020

Machine Learning on Azure

Domain specific pretrained models

To simplify solution development



Vision



Speech



Language



Search

Familiar Data Science tools

To simplify model development



Visual Studio Code



Azure Notebooks



Jupyter



Command line

Popular frameworks

To build advanced deep learning solutions



PyTorch



TensorFlow



Scikit-Learn



ONNX

Productive services

To empower data science and development teams



Azure
Databricks



Azure Machine
Learning



Machine
Learning VMs

Powerful infrastructure

To accelerate deep learning



CPU



GPU



FPGA



From the Intelligent Cloud to the Intelligent Edge

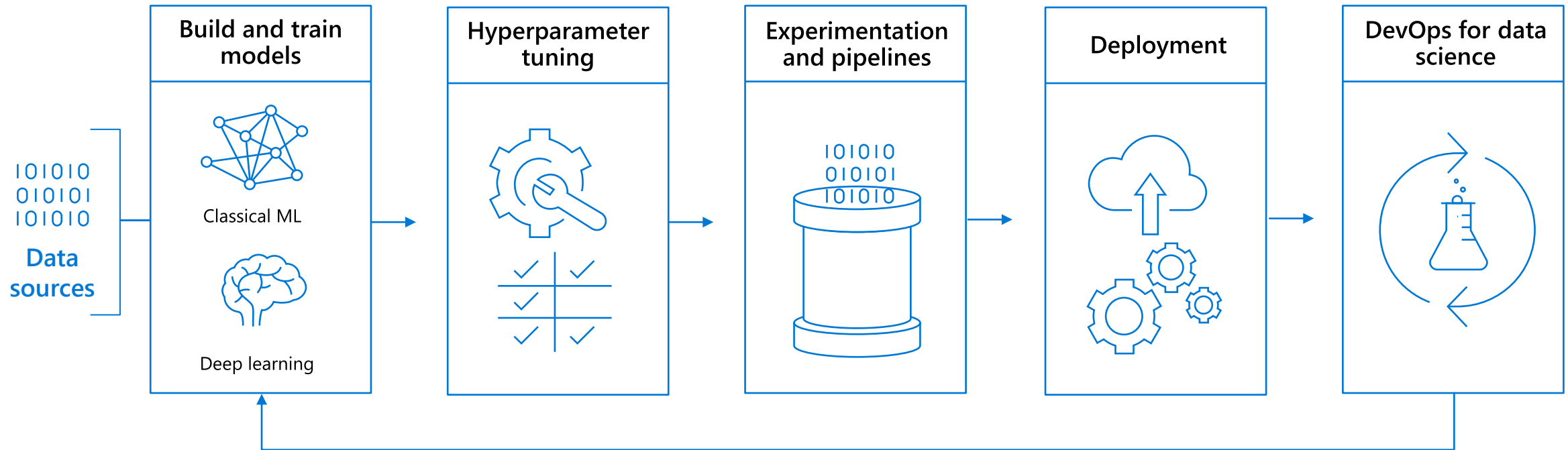




Azure Machine Learning

<https://azure.microsoft.com/fr-fr/services/machine-learning/>

Building blocks for a Data Science Project



Azure Machine Learning

Set of Azure Cloud
Services



Python
& R SDK, CLI, UX

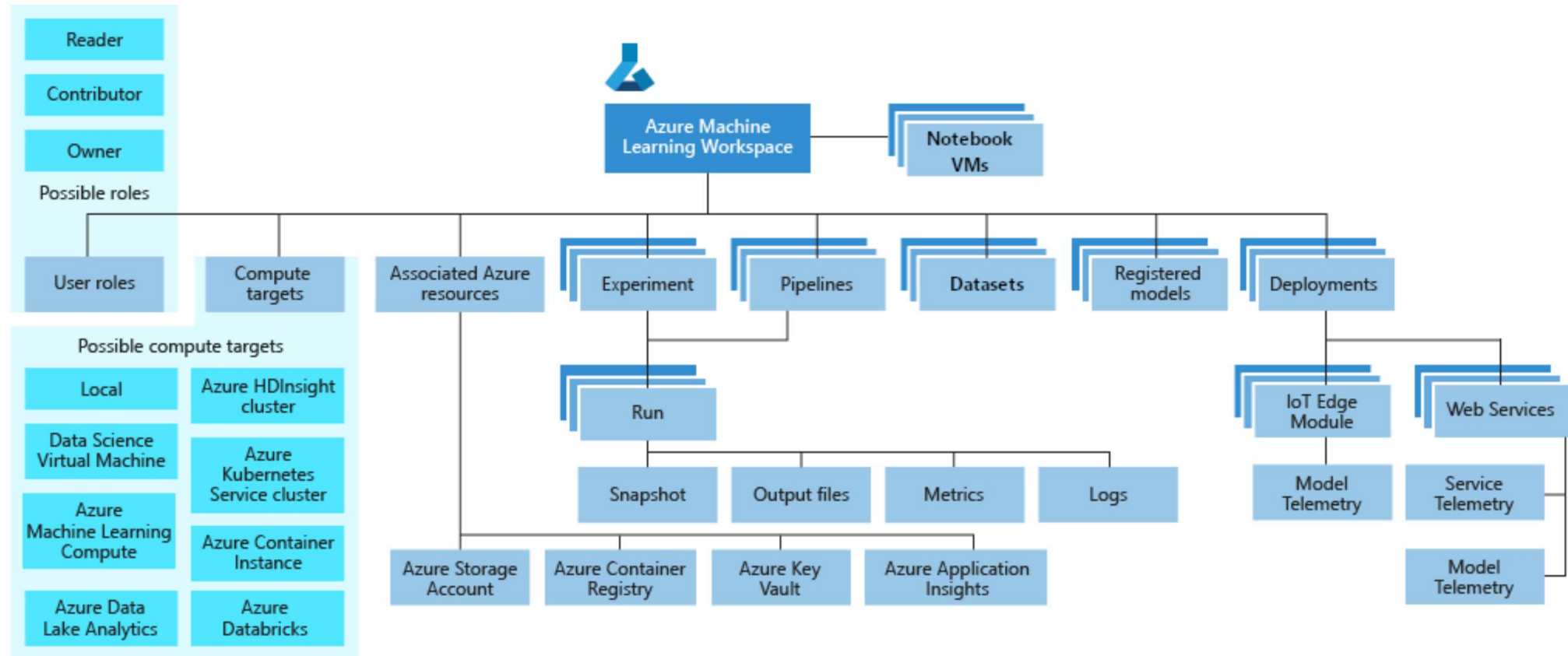
That enables you to:

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

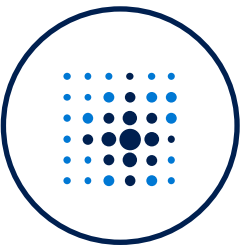
- ✓ Manage Models
- ✓ Track Experiments
- ✓ Deploy Models

Composants Azure ML

Azure Machine Learning components



Azure ML Studio



Azure ML Studio

For all skill levels
studio web experience

The screenshot displays the Azure ML Studio web interface. On the left is a navigation sidebar with categories: Author (New, Home, Notebooks, Automated ML, Designer), Assets (Datasets, Experiments, Pipelines, Models, Endpoints), and Manage (Compute, Datastores, Data Labeling). The main content area shows the breadcrumb 'workshop-aml-2020 > Home' and a 'Welcome to the studio!' message. Below this are four cards for 'Create new', 'Notebooks', 'Automated ML', and 'Designer', each with a 'Start now' button. At the bottom, a 'My recent resources' section contains a 'Runs' table and a 'Compute' table.

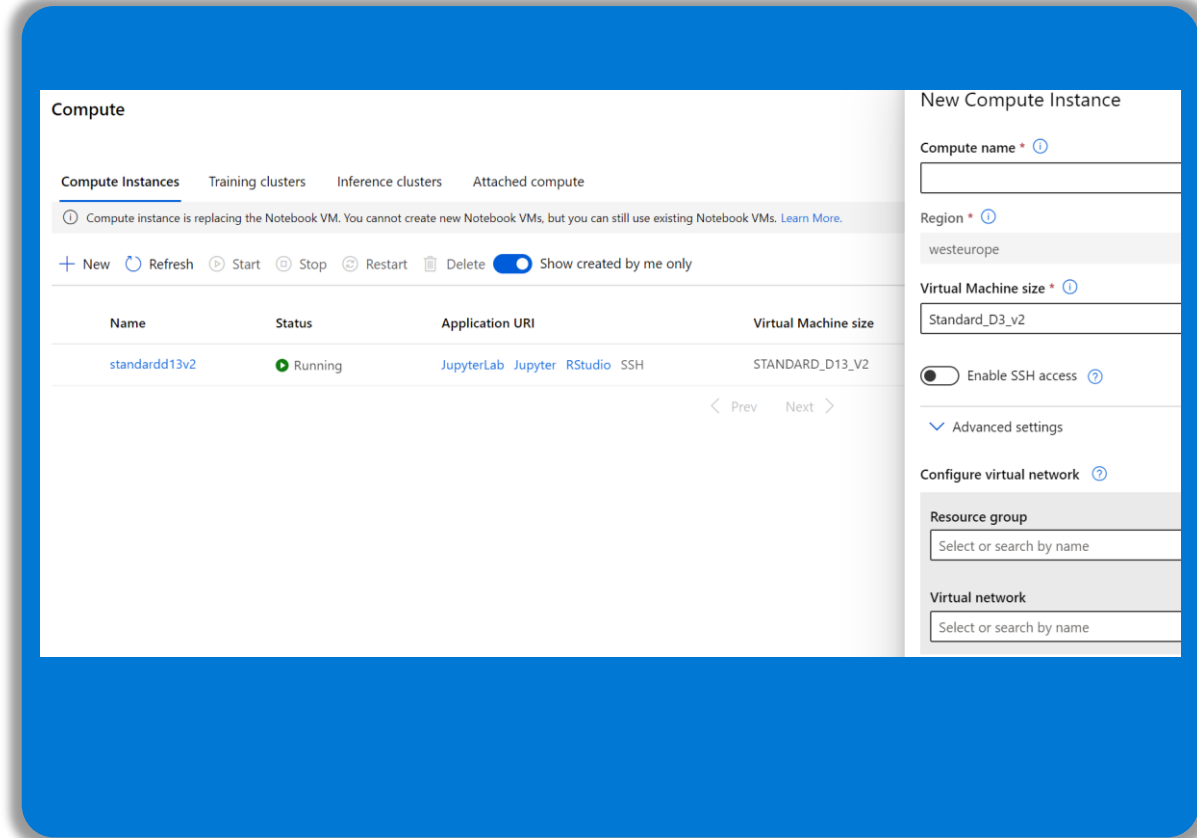
Run number	Experiment	Updated time	Status
2	workshop5-amlcompute	Feb 18, 2020 2:56 PM	Completed

Name
AKSML

Notebooks

Machine Learning notebooks

- Fully managed cloud-based solution for data scientists to get started with ML machine learning
- Deeply integrated with Azure ML workspaces and datastores
- First-class experience for model authoring through integrated notebooks using Azure ML Python and R SDK.
- Management and enterprise readiness capabilities for IT administrators.

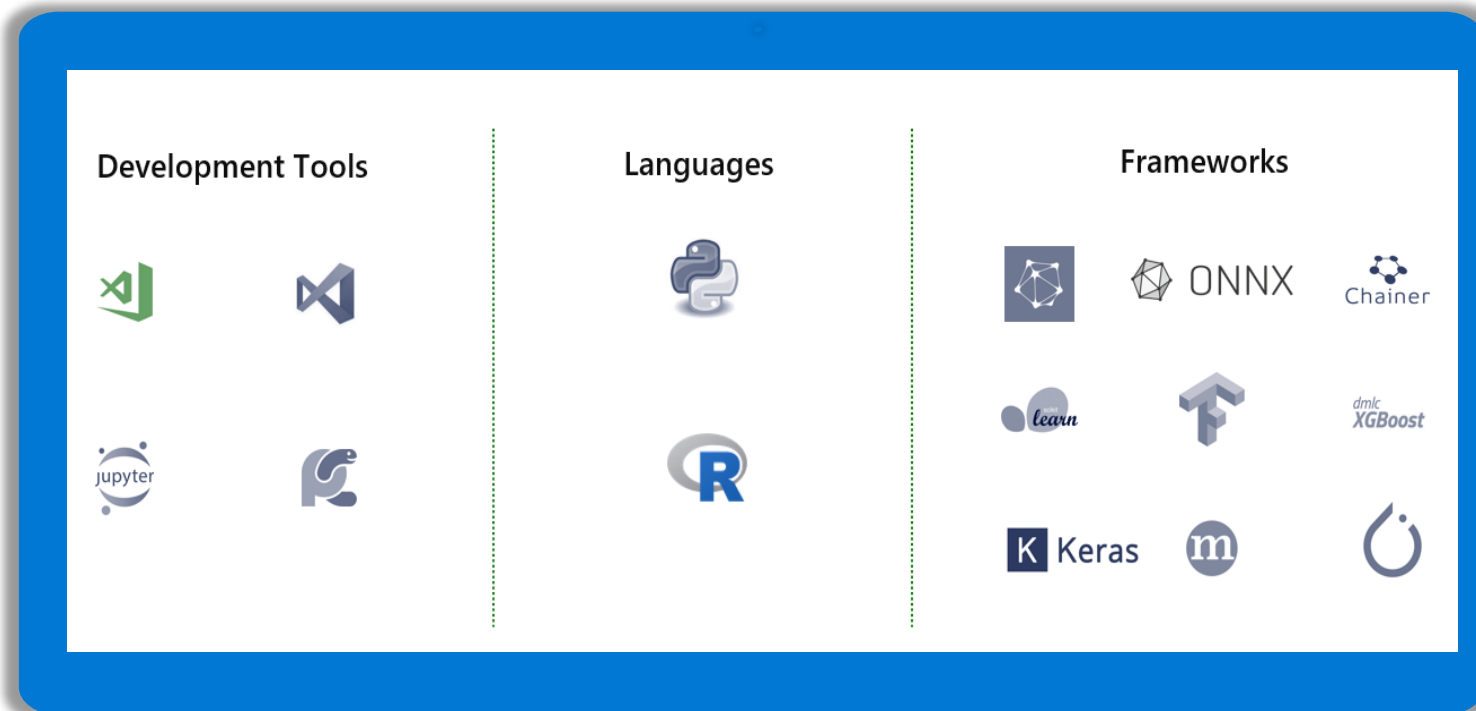


Platform



Azure Machine Learning

Open and interoperable platform



Powerful infrastructure

Accelerate deep learning



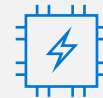
CPUs

General purpose
machine learning
D, F, L, M, H Series



GPUs

Deep learning
N Series



FPGAs

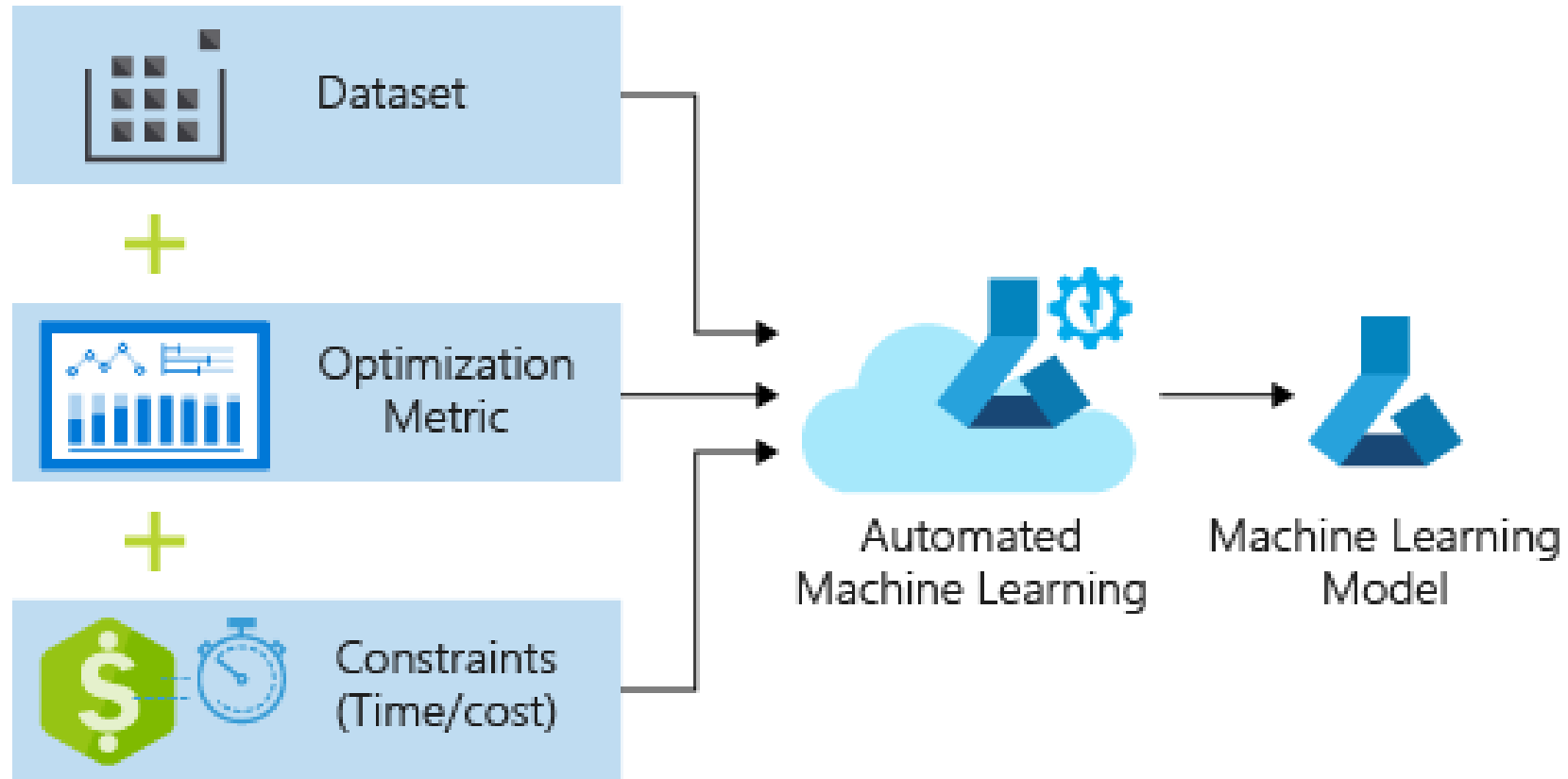
Specialized hardware
accelerated deep learning
AML hardware accelerated
models (Project Brainwave)

← Optimized for flexibility

→ Optimized for performance

AutoML

Automated ML



Azure Machine Learning accelerates model development

with automated machine learning

Input

Intelligently test multiple models in parallel

101010
010101
101010

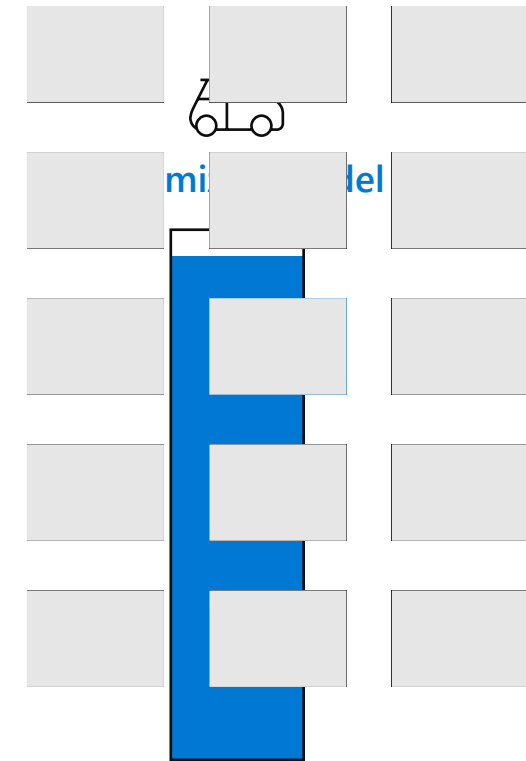
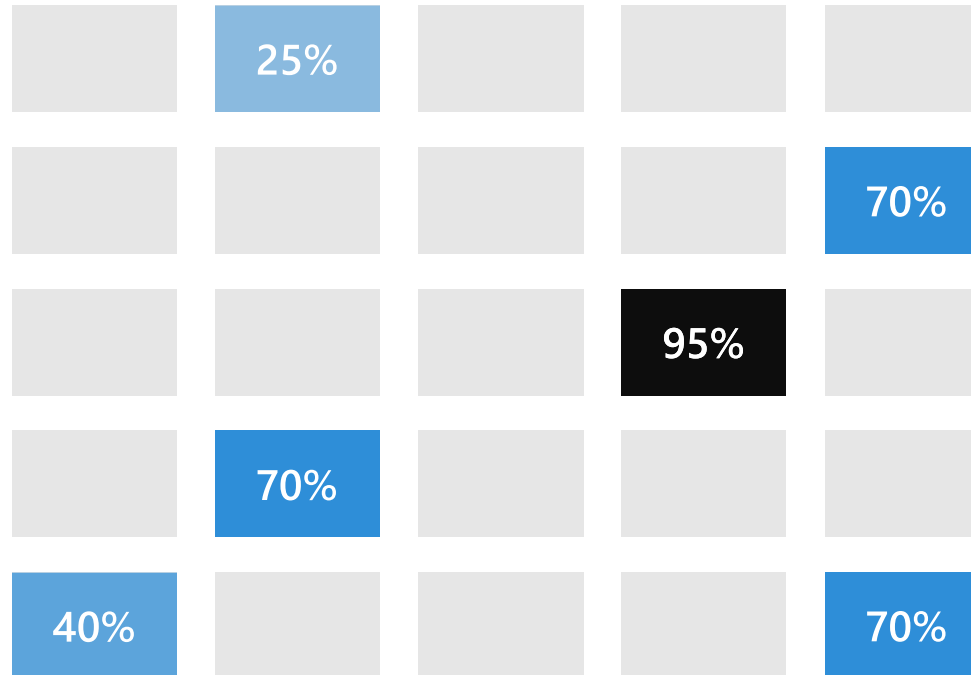
Enter data



Define goals



Apply constraints



Automated 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.

Create a new Automated ML run


✓ Select dataset

✓ Configure run


● Task type and settings


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 (preview) ⓘ

 **Regression**
To predict continuous numeric values

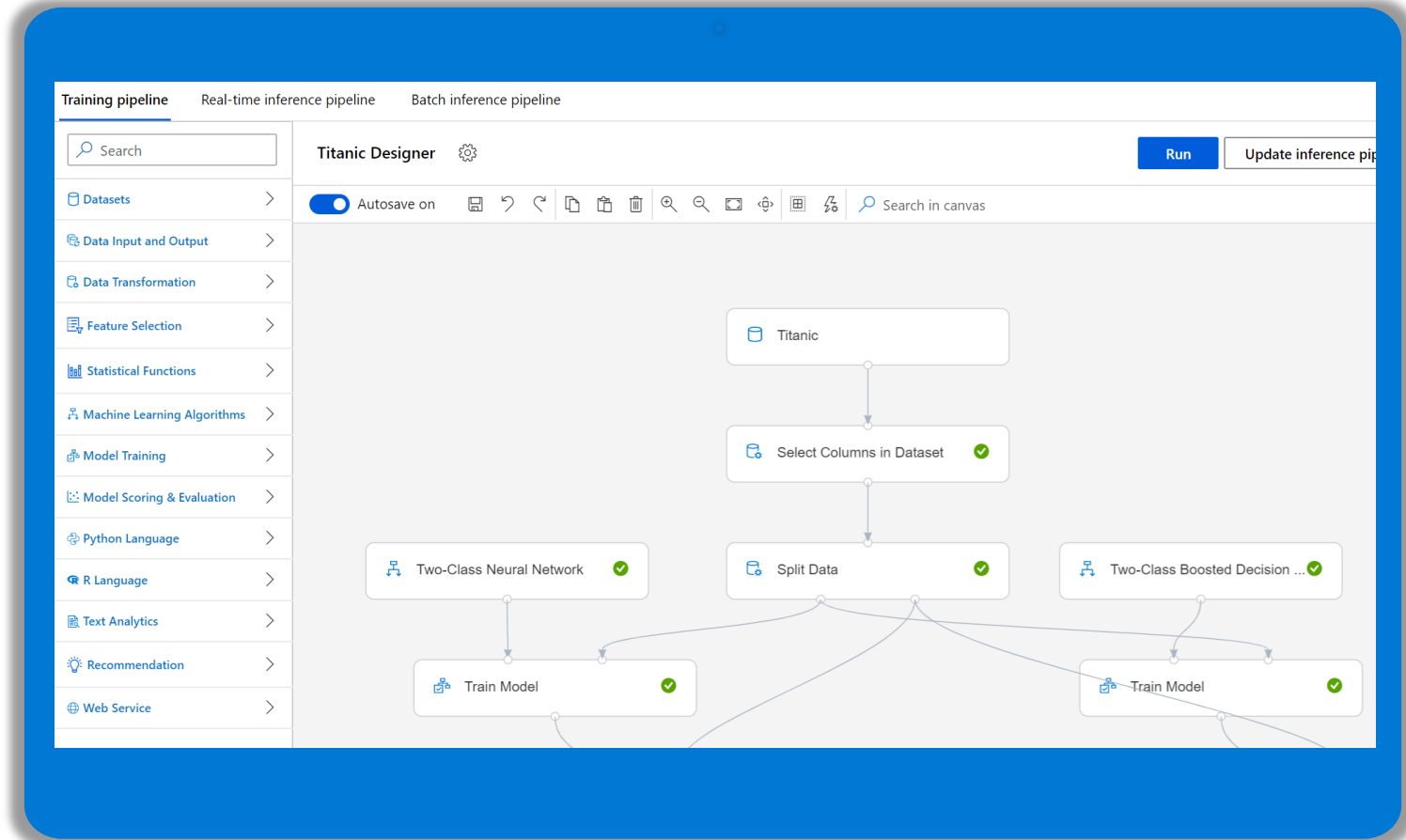
 **Time series forecasting**
To predict values based on time

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

Designer

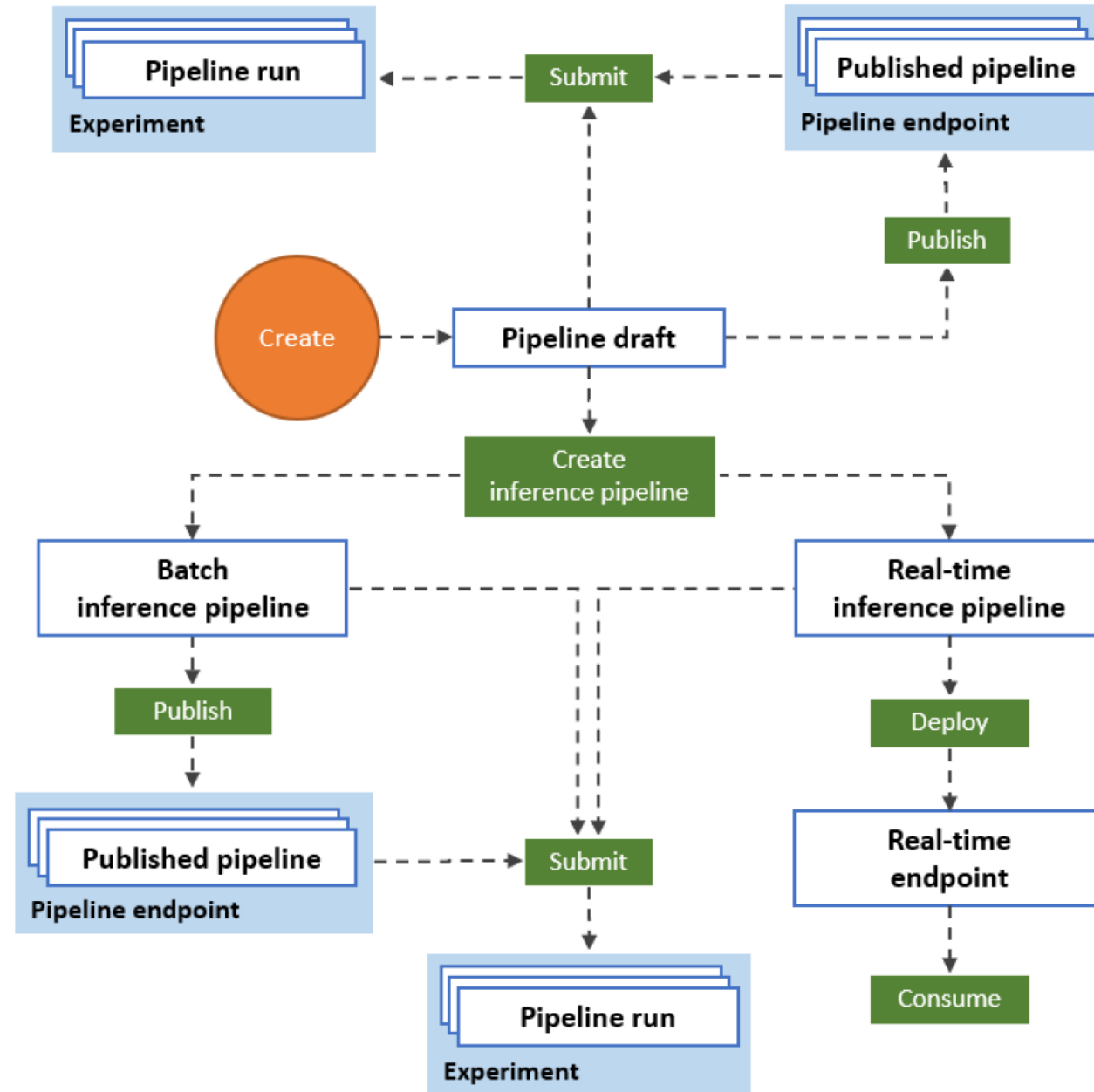
Designer

- Drag-n-drop workflow capability
- Simplify the process of building, testing, and operating machine learning models
- Create new pipelines

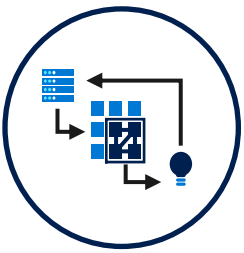


Pipelines

Pipelines

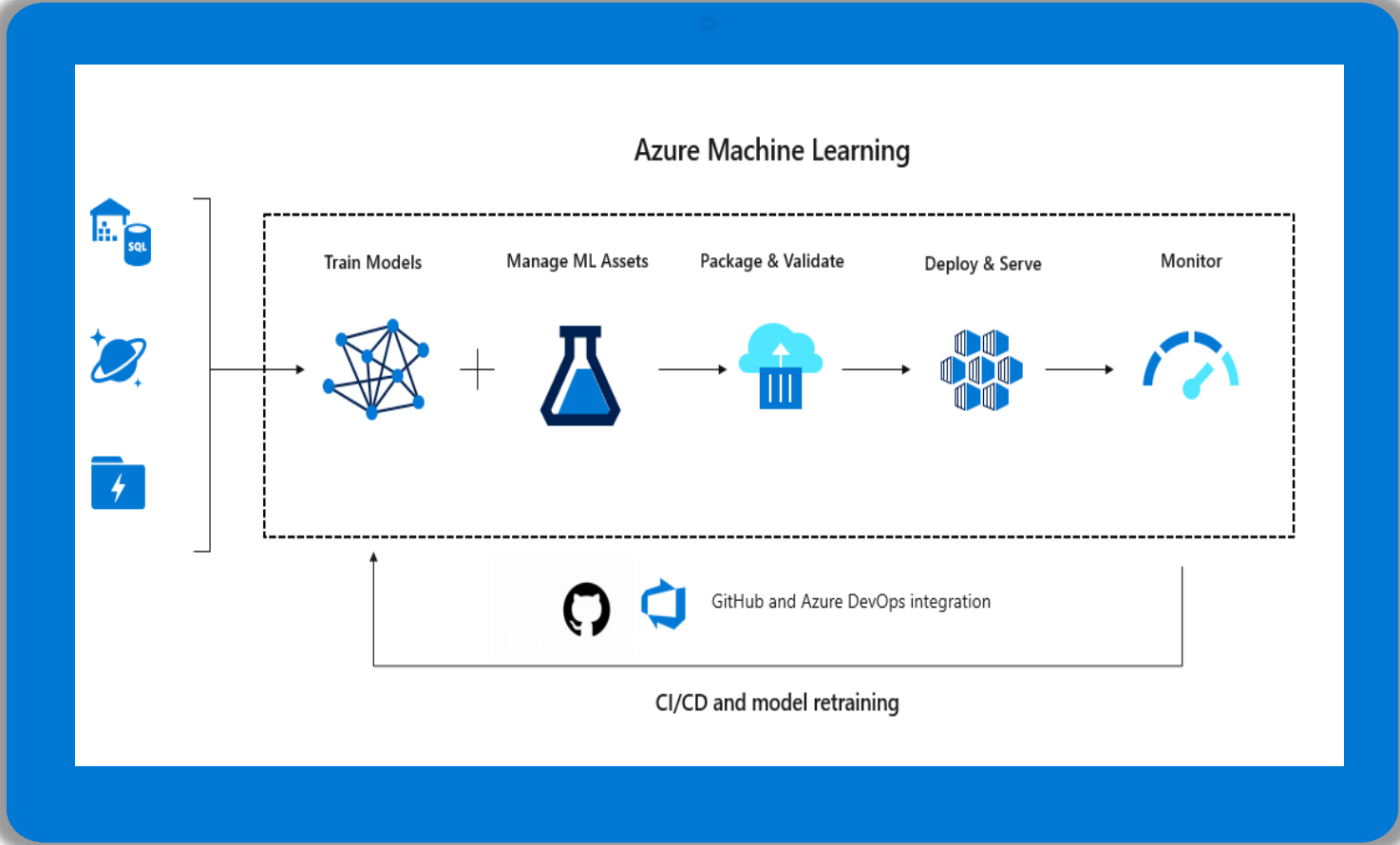


MLOps



Azure Machine Learning

Industry leading MLOps



DevOps



Code reproducibility



Code testing



App deployment

MLOps



Model reproducibility



Model validation



Model deployment

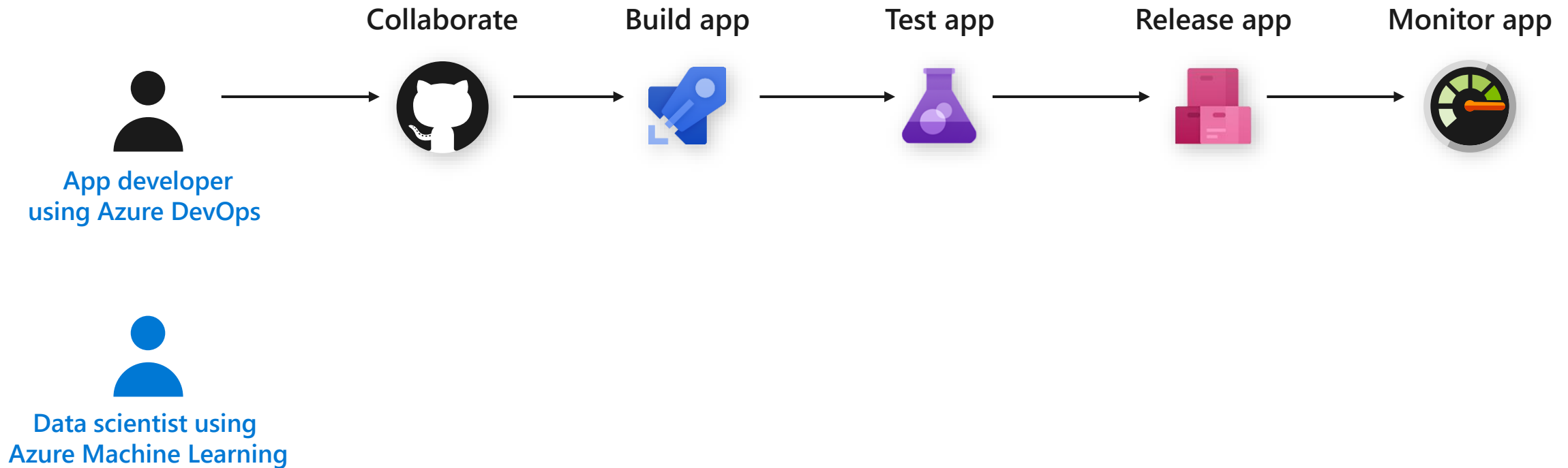


Model retraining

MLOps

- **Create reproducible ML pipelines.**
Pipelines allow you to define repeatable and reusable steps for your data preparation, training, and scoring processes.
- **Register, package, and deploy models** from anywhere and track associated metadata required to use the model.
- **Capture the governance** data required for capturing the end-to-end ML lifecycle, including who is publishing models, why changes are being made, and when models were deployed or used in production.
- **Notify and alert on events in the ML lifecycle** such as experiment completion, model registration, model deployment, and data drift detection.
- **Monitor ML applications** for operational and ML-related issues.
Compare model inputs between training and inference, explore model-specific metrics, and provide monitoring and alerts on your ML infrastructure.
- **Automate the end-to-end ML lifecycle with Azure Machine Learning and Azure DevOps** to frequently update models, test new models, and continuously roll out new ML models alongside your other applications and services.

MLOps with Azure Machine Learning



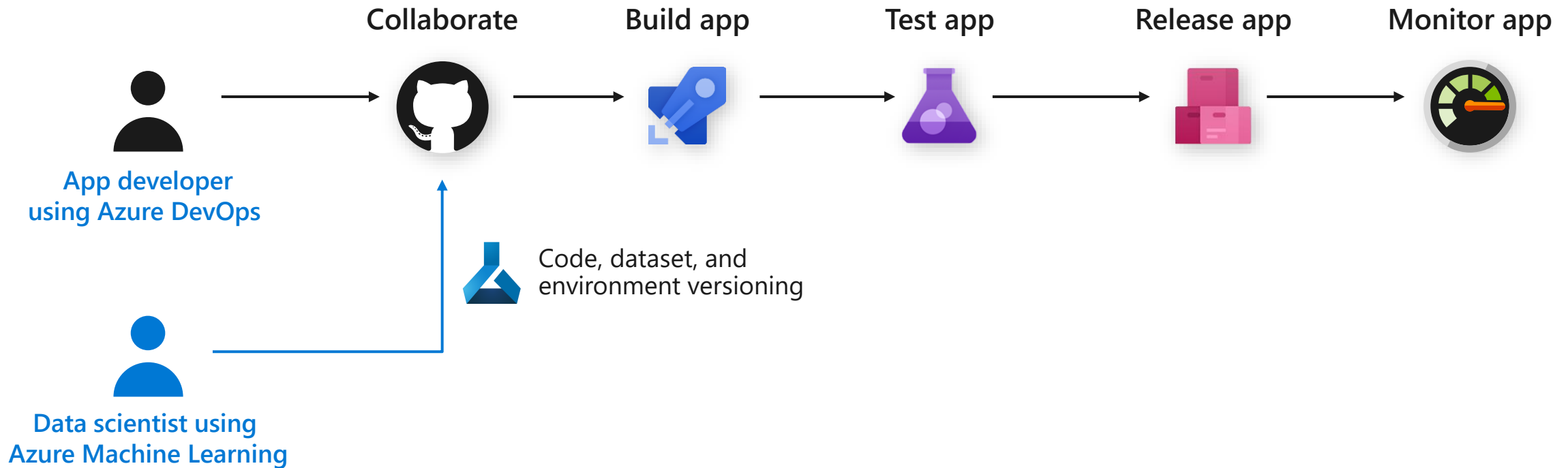
☐ Model reproducibility

☐ Model validation

☐ Model deployment

☐ Model retraining

MLOps with Azure Machine Learning



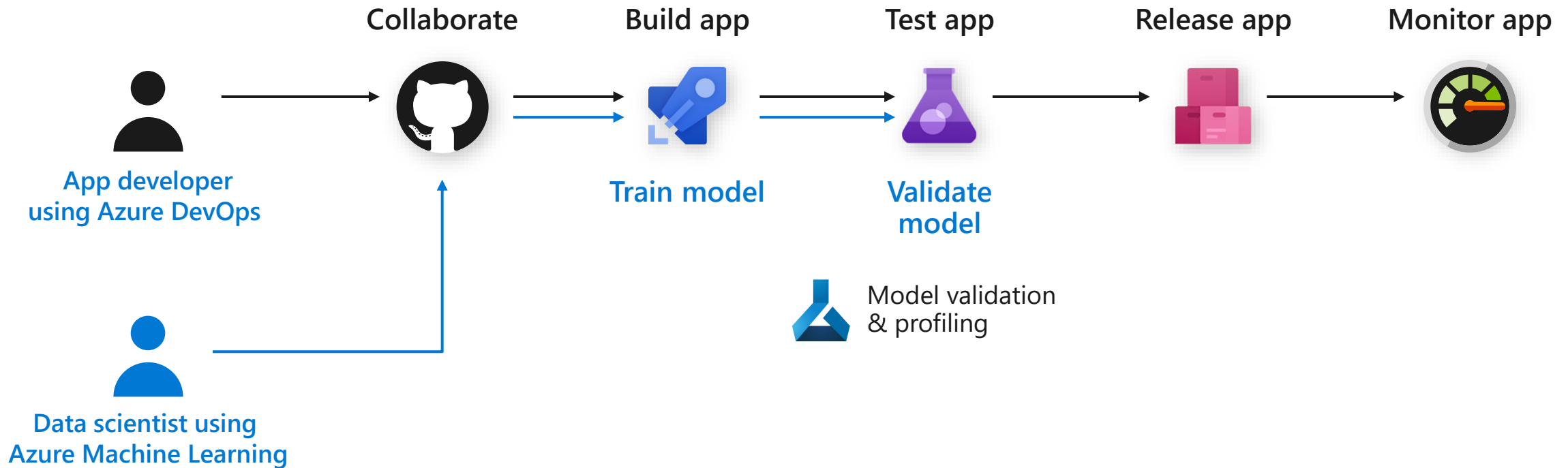
☒ Model reproducibility

☐ Model validation

☐ Model deployment

☐ Model retraining

MLOps with Azure Machine Learning



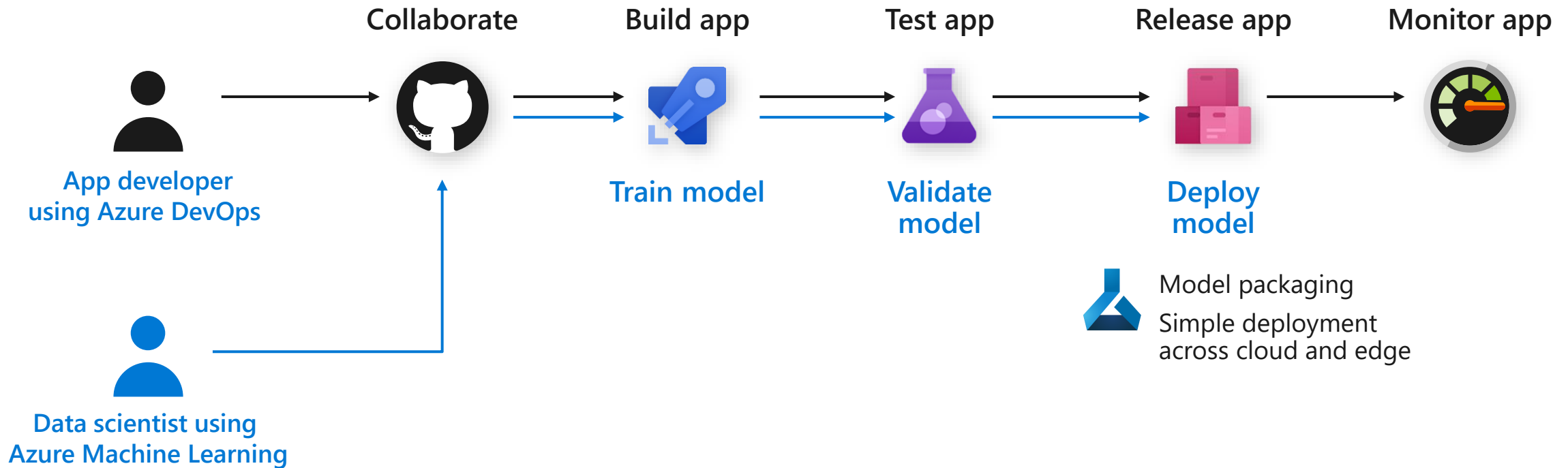
☒ Model reproducibility

☒ Model validation

☐ Model deployment

☐ Model retraining

MLOps with Azure Machine Learning



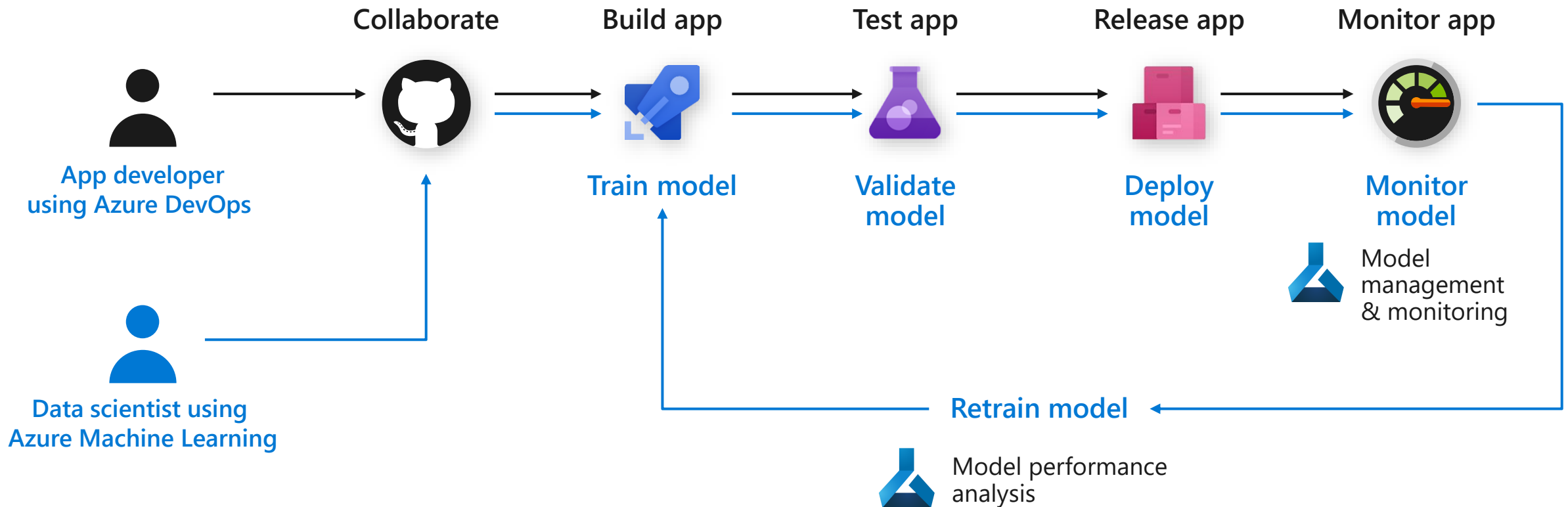
☒ Model reproducibility

☒ Model validation

☒ Model deployment

☐ Model retraining

MLOps with Azure Machine Learning



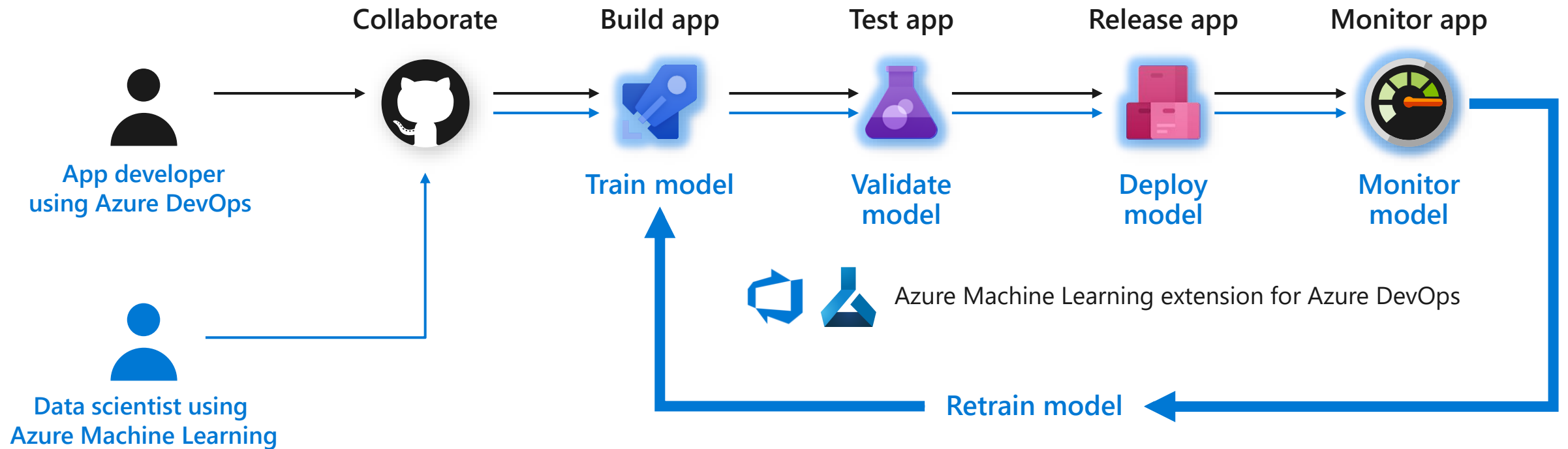
☑ Model reproducibility

☑ Model validation

☑ Model deployment

☑ Model retraining

MLOps with Azure Machine Learning



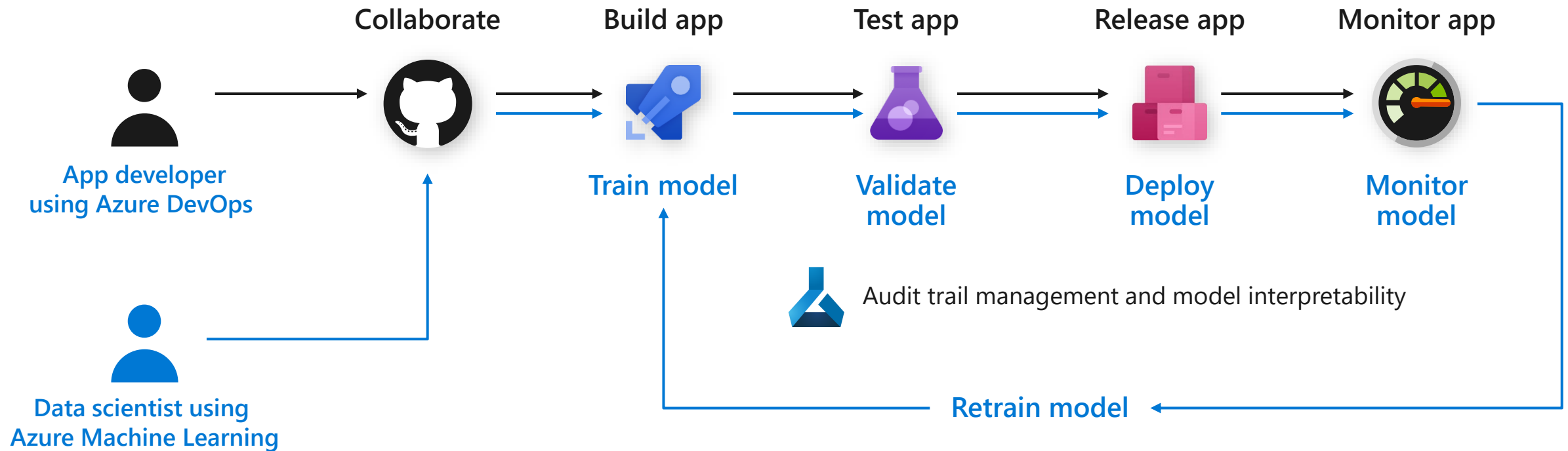
✓ Model reproducibility

✓ Model validation

✓ Model deployment

✓ Model retraining

MLOps with Azure Machine Learning

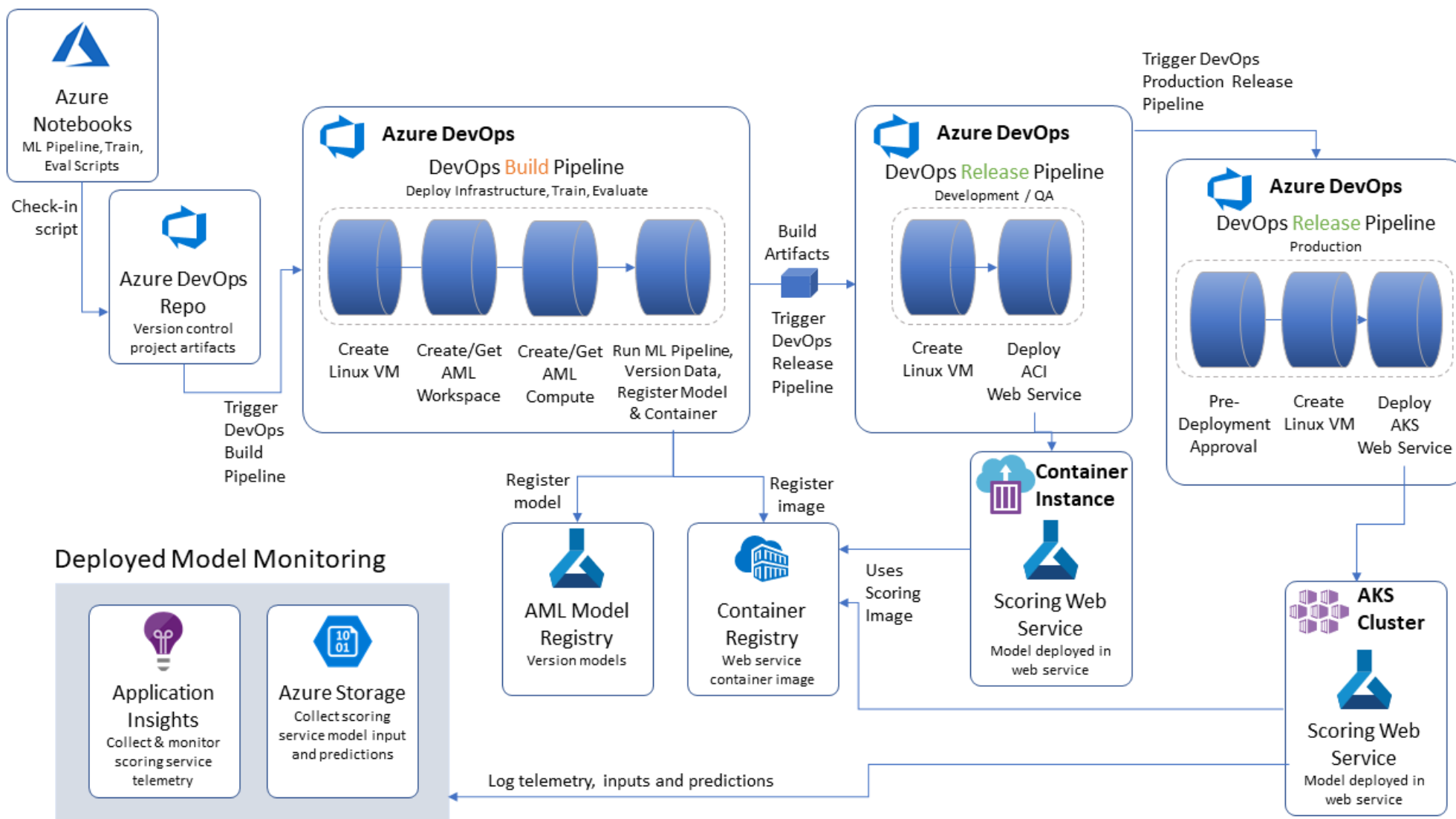


☒ Model reproducibility

☒ Model validation

☒ Model deployment

☒ Model retraining



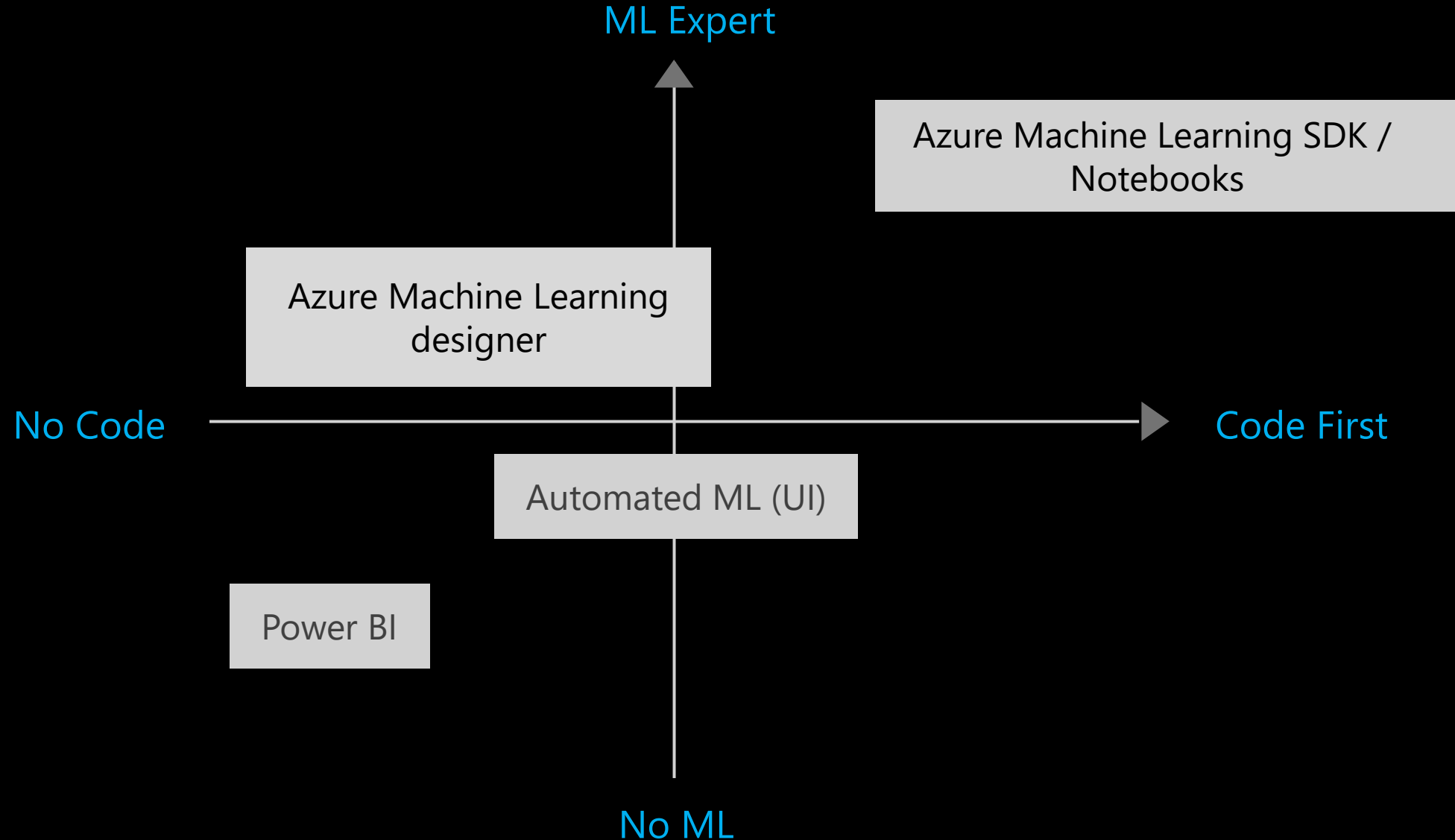
✓ Model reproducibility

✓ Model validation

✓ Model deployment

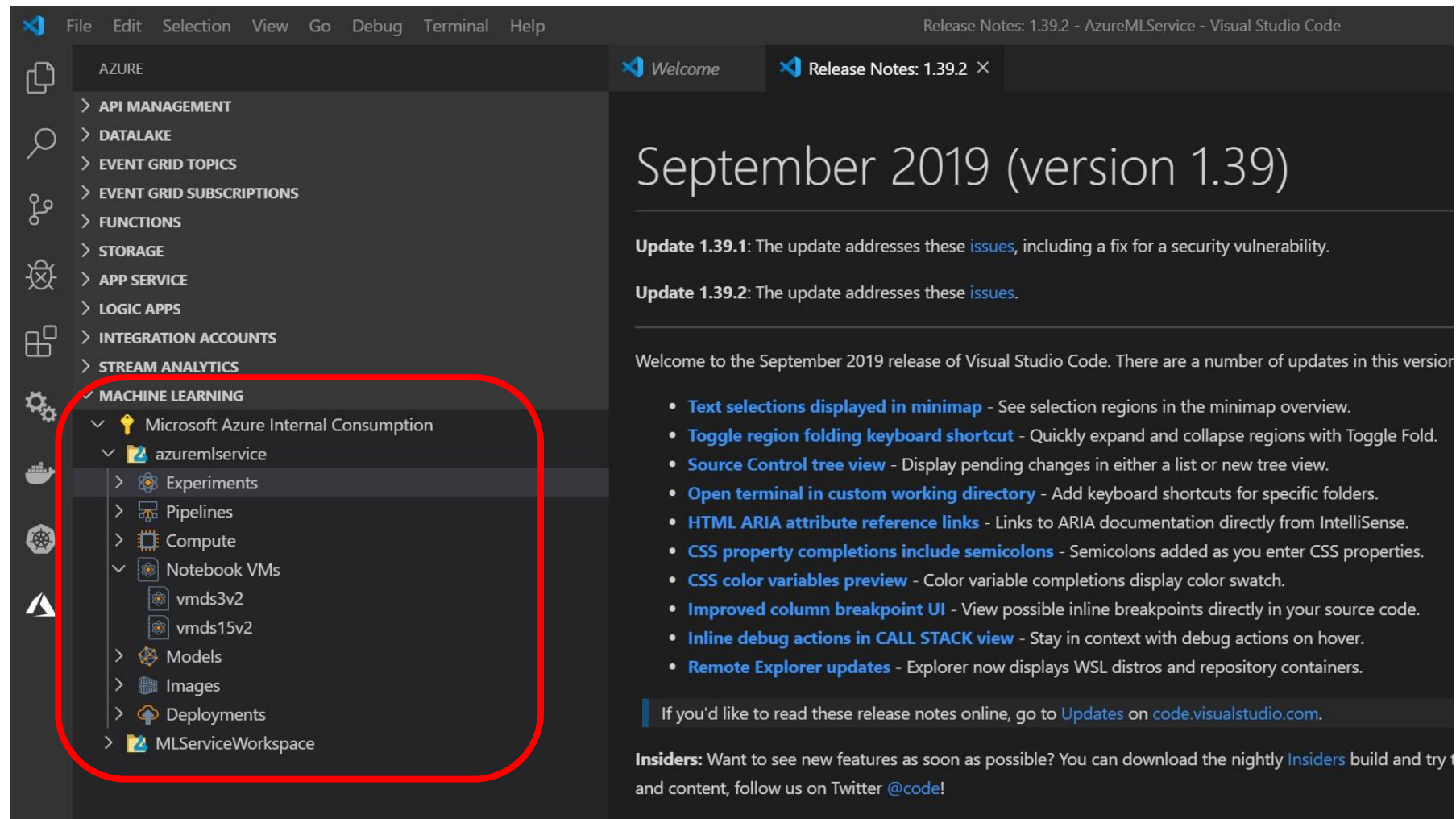
✓ Model retraining

Build across skill levels with Azure Machine Learning



Integration with VS Code

Integration with Visual Studio



The screenshot displays the Visual Studio Code interface with the Azure extension sidebar on the left and the release notes for September 2019 (version 1.39) on the right. The sidebar is categorized into several sections: API MANAGEMENT, DATALAKE, EVENT GRID TOPICS, EVENT GRID SUBSCRIPTIONS, FUNCTIONS, STORAGE, APP SERVICE, LOGIC APPS, INTEGRATION ACCOUNTS, STREAM ANALYTICS, and MACHINE LEARNING. The MACHINE LEARNING section is expanded, showing a tree view of resources including Microsoft Azure Internal Consumption, azuremlservice, Experiments, Pipelines, Compute, Notebook VMs (vmds3v2, vmds15v2), Models, Images, Deployments, and MLServiceWorkspace. A red rounded rectangle highlights the MACHINE LEARNING section and its sub-items. The right pane shows the release notes for September 2019 (version 1.39), detailing updates 1.39.1 and 1.39.2, and a list of new features and improvements.

File Edit Selection View Go Debug Terminal Help

Release Notes: 1.39.2 - AzureMLService - Visual Studio Code

WELCOME

September 2019 (version 1.39)

Update 1.39.1: The update addresses these [issues](#), including a fix for a security vulnerability.

Update 1.39.2: The update addresses these [issues](#).

Welcome to the September 2019 release of Visual Studio Code. There are a number of updates in this version

- **Text selections displayed in minimap** - See selection regions in the minimap overview.
- **Toggle region folding keyboard shortcut** - Quickly expand and collapse regions with Toggle Fold.
- **Source Control tree view** - Display pending changes in either a list or new tree view.
- **Open terminal in custom working directory** - Add keyboard shortcuts for specific folders.
- **HTML ARIA attribute reference links** - Links to ARIA documentation directly from IntelliSense.
- **CSS property completions include semicolons** - Semicolons added as you enter CSS properties.
- **CSS color variables preview** - Color variable completions display color swatch.
- **Improved column breakpoint UI** - View possible inline breakpoints directly in your source code.
- **Inline debug actions in CALL STACK view** - Stay in context with debug actions on hover.
- **Remote Explorer updates** - Explorer now displays WSL distros and repository containers.

If you'd like to read these release notes online, go to [Updates](#) on [code.visualstudio.com](#).

Insiders: Want to see new features as soon as possible? You can download the nightly [Insiders](#) build and try it out. For more information and content, follow us on Twitter [@code](#)!

Roles

Roles

- Standard roles
- Custom roles

Azure Machine Learning operation	Owner	Contributor	Reader
Create workspace	✓	✓	
Share workspace	✓		
Upgrade workspace to Enterprise edition	✓		
Create compute target	✓	✓	
Attach compute target	✓	✓	
Attach data stores	✓	✓	
Run experiment	✓	✓	
View runs/metrics	✓	✓	✓
Register model	✓	✓	
Create image	✓	✓	
Deploy web service	✓	✓	
View models/images	✓	✓	✓
Call web service	✓	✓	✓


Roles

```
{
  "Name": "Data Scientist Demo",
  "Description": "Can create experiments, submit runs, deploy models to test environments; Cannot create compute or register datastores",
  "Actions": [
    "Microsoft.MachineLearningServices/workspaces/*/read",
    "Microsoft.MachineLearningServices/workspaces/*/action"
  ],
  "NotActions": [
    "Microsoft.MachineLearningServices/workspaces/computes/listKeys/action",
    "Microsoft.MachineLearningServices/workspaces/listKeys/action"
  ],
  "DataActions": [
    "Microsoft.MachineLearningServices/workspaces/*/read",
    "Microsoft.MachineLearningServices/workspaces/*/write",
    "Microsoft.MachineLearningServices/workspaces/*/delete",
    "Microsoft.MachineLearningServices/workspaces/*/action"
  ],
  "NotDataActions": [
    "Microsoft.MachineLearningServices/workspaces/services/aks/prod/write",
    "Microsoft.MachineLearningServices/workspaces/services/aks/prod/delete",
    "Microsoft.MachineLearningServices/workspaces/endpoints/pipelines/write",
    "Microsoft.MachineLearningServices/workspaces/endpoints/pipelines/delete",
    "Microsoft.MachineLearningServices/workspaces/datastores/write"
  ],
  "AssignableScopes": [
    "/subscriptions/e9b2ec51-5c94-4fa8-809a-dc1e695e4896"
  ]
}
```

<https://docs.microsoft.com/en-us/azure/machine-learning/service/how-to-assign-roles>

Monitoring Azure ML

Monitoring Azure ML with Azure Monitor

 **workshopmlRG - Insights (preview)**
Resource group

[Refresh](#) [Collapse all](#) [Feedback](#) [Help](#)

Deployments

Policies

Properties

Locks

Export template

Cost Management

Cost analysis

Cost alerts

Budgets

Advisor recommendations

Monitoring

Insights (preview)

Alerts

Metrics

Diagnostic settings

Logs

Total resources
19

Active alerts
1

[Application map](#)

Local : Last 24 hours

Group by app layer and resource type

Alerts Severity

NAME	TOTAL ALERTS	SEV 0 ALERTS	SEV 1 ALERTS	INSIGHTS	ACTIONS
workshopmlRG	1 (-)	—	—		
Compute	1 (-)	—	—		
Virtual machine	1 (-)	—	—		
standardd2v224d142833d	—	—	—		...
standardds13v244d198275	1 (-)	—	—		...
Container registry	—	—	—		
Application	—	—	—		
Networking	—	—	—		
Other	—	—	—		
Storage and Databases	—	—	—		

Monitoring Azure ML with Azure Monitor

Show data for last:

1 hour

6 hours

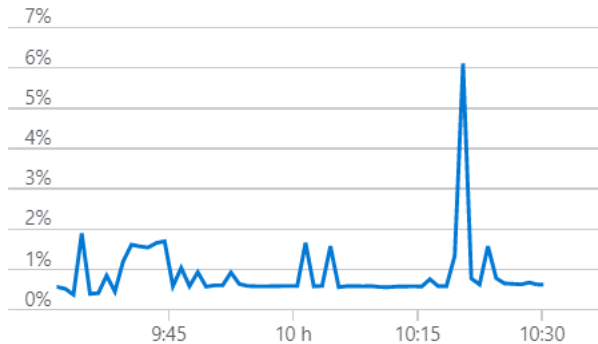
12 hours

1 day

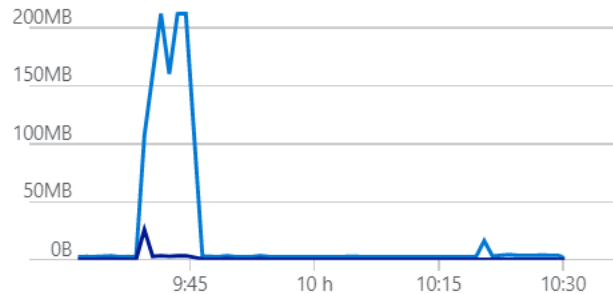
7 days

30 days

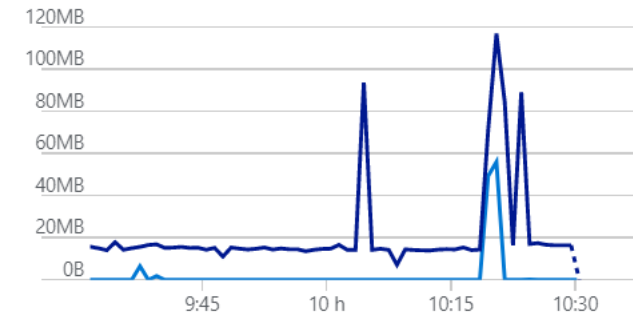
CPU (average)



Network (total)



Disk bytes (total)



Monitoring Azure ML models

The screenshot displays the Azure ML Metrics dashboard for 'AMLServiceWS - Metrics'. The left sidebar contains a 'Monitoring' section with a red border, which includes 'Alerts', 'Metrics' (highlighted), 'Diagnostic settings', and 'Logs'. The main area shows a chart configuration interface with a 'Chart Title' field, 'Add metric', 'Add filter', and 'Apply splitting' buttons. A 'Line chart' dropdown and a 'New alert rule' button are also visible. A dropdown menu is open for selecting a metric, showing options under 'MODEL' (Model Deploy Failed, Model Deploy Started, Model Deploy Succeeded, Model Register Failed, Model Register Succeeded) and 'QUOTA' (Active Cores). A 'SCOPE' dropdown is set to 'AMLServiceWS' and a 'METRIC NAMESPACE' dropdown is set to 'Machine Learning S...'. A red box highlights the 'New alert rule' button and the metric selection dropdown. A tooltip at the bottom right provides instructions on how to use the dashboard features.

AMLServiceWS - Metrics
Machine Learning

Search (Ctrl+/)

Assets

- Experiments
- Pipelines
- Compute
- Models
- Images
- Deployments
- Activities

Settings

- Properties
- Locks
- Export template

Monitoring

- Alerts
- Metrics**
- Diagnostic settings
- Logs

+ New chart Refresh Share Feedback

Chart Title

Add metric Add filter Apply splitting

Line chart New alert rule

SCOPE: AMLServiceWS METRIC NAMESPACE: Machine Learning S...

METRIC: Select metric AGGREGATION: Select aggregation

MODEL

- Model Deploy Failed
- Model Deploy Started
- Model Deploy Succeeded
- Model Register Failed
- Model Register Succeeded

QUOTA

- Active Cores

Select a metric above to see data appear on this chart or learn more below:

 - Filter + Split**
Apply filters and splits to identify outlying segments
 - Plot multiple metrics**
Create charts with multiple metrics and resources
 - Build custom dashboards**
Pin charts to your dashboards

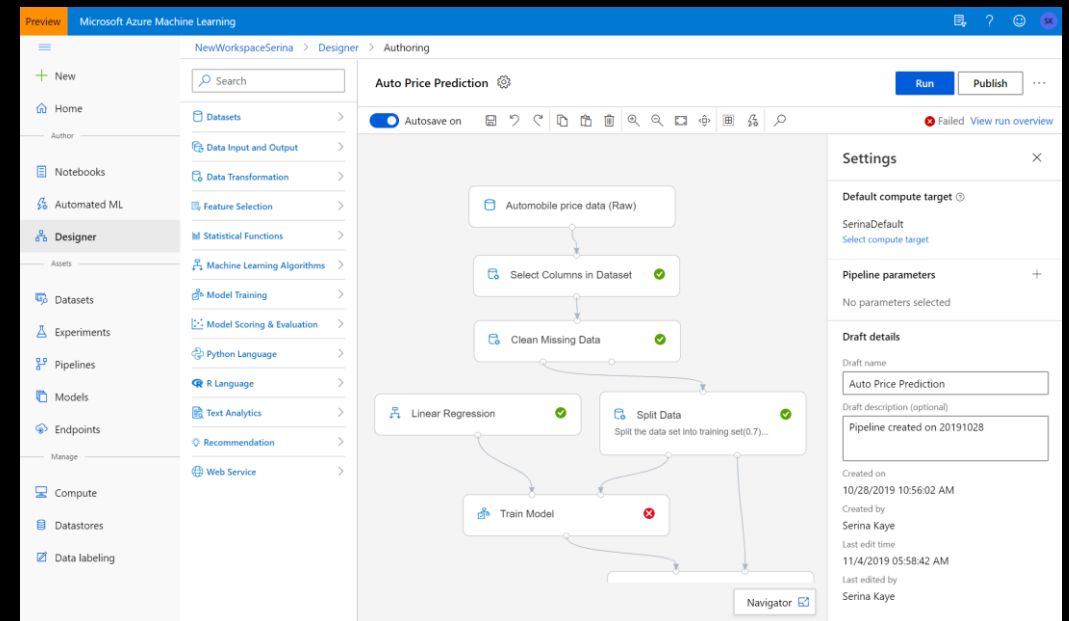
Azure ML Editions

Azure Machine Learning Enterprise Edition

- **Enterprise Edition**

At Ignite, we announced the new Azure Machine Learning Enterprise and Basic editions. The Enterprise edition contains our no-code ML capabilities (AutoML and designer) as well as cutting edge AutoML features such as DNNs, enterprise grade ML Ops capabilities such as data drift monitoring, and cross-workspace compute management

- The Enterprise edition is currently in preview. While in preview, customers with Enterprise workspaces will pay only for Azure resources consumed.
- All capabilities of AzureML that were in general availability before Ignite are now available in the "Basic" edition, now in GA. Basic workspaces will incur costs only for consumed Azure resources.



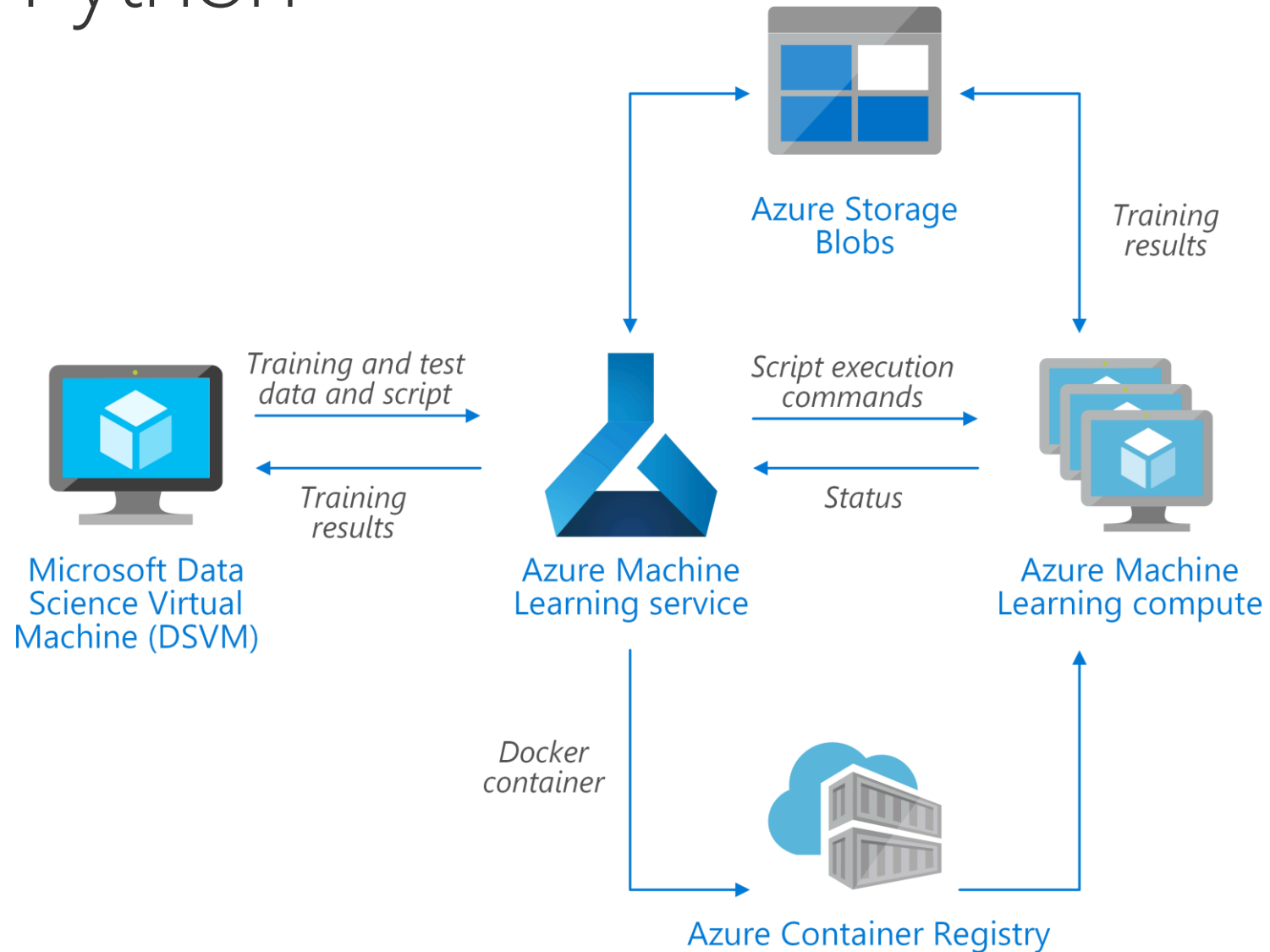
Enterprise and Basic: Summary

- Azure Machine Learning offers two editions: Enterprise and Basic
- Basic edition is available in GA / Enterprise edition currently in preview
- More detail on our pricing page: <https://azure.microsoft.com/en-us/pricing/details/machine-learning/>

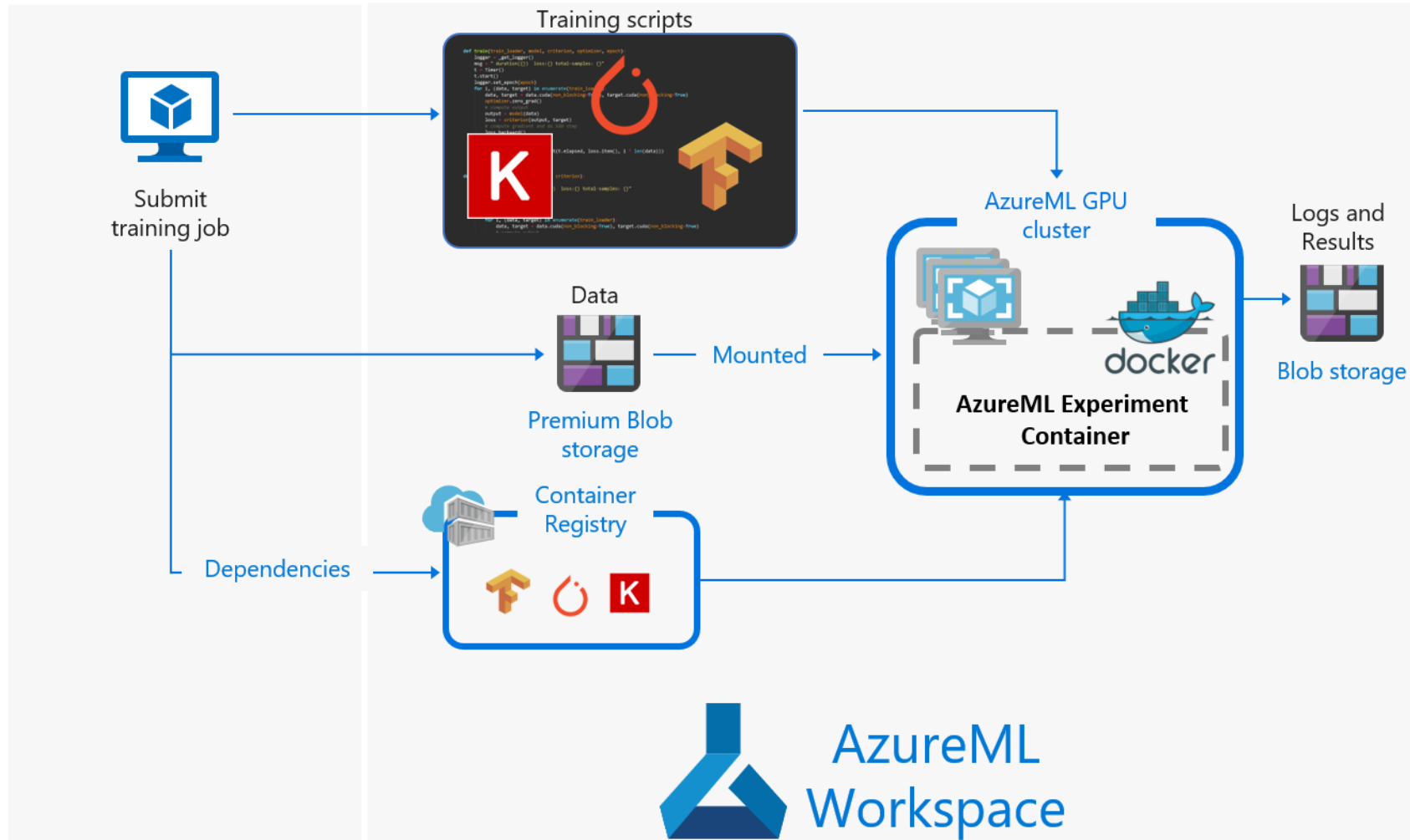
	Basic	Enterprise
Pricing structure	<ul style="list-style-type: none">• Pay only for Azure resources consumed• No charge for AzureML	<ul style="list-style-type: none">• No up-front cost – scale as you need, pay for what you consume• Compute surcharge for ML activities: data prep, training, inferencing
Audience	<ul style="list-style-type: none">• Experienced data scientists who like a code-first environment• Single data scientists or small data science teams who don't need enterprise price controls, or large-scale ML Ops	<ul style="list-style-type: none">• Large enterprises with mixed data science, data engineering and analyst teams who would benefit from both code-forward and drag-and-drop ML• Large data science teams that need to share compute across workspaces, or access other enterprise features
Messages	<ul style="list-style-type: none">• The best place for open source ML• Use your existing tools and IDE when scaling to the cloud• Best in class code-first experience	<p>Basic level +</p> <ul style="list-style-type: none">• Best in class ML for all skill levels including no-code ML• Enterprise-grade security, governance and cost control• Comprehensive ML lifecycle management
[Roadmap features]	<ul style="list-style-type: none">• Responsible AI toolkit• Reinforcement learning• Batch inferencing• Manual data labelling	<ul style="list-style-type: none">• Data drift capabilities• Automated ML ensemble models and deep learning• Automated model retraining• Managed inferencing• ML assisted labelling

Architectures

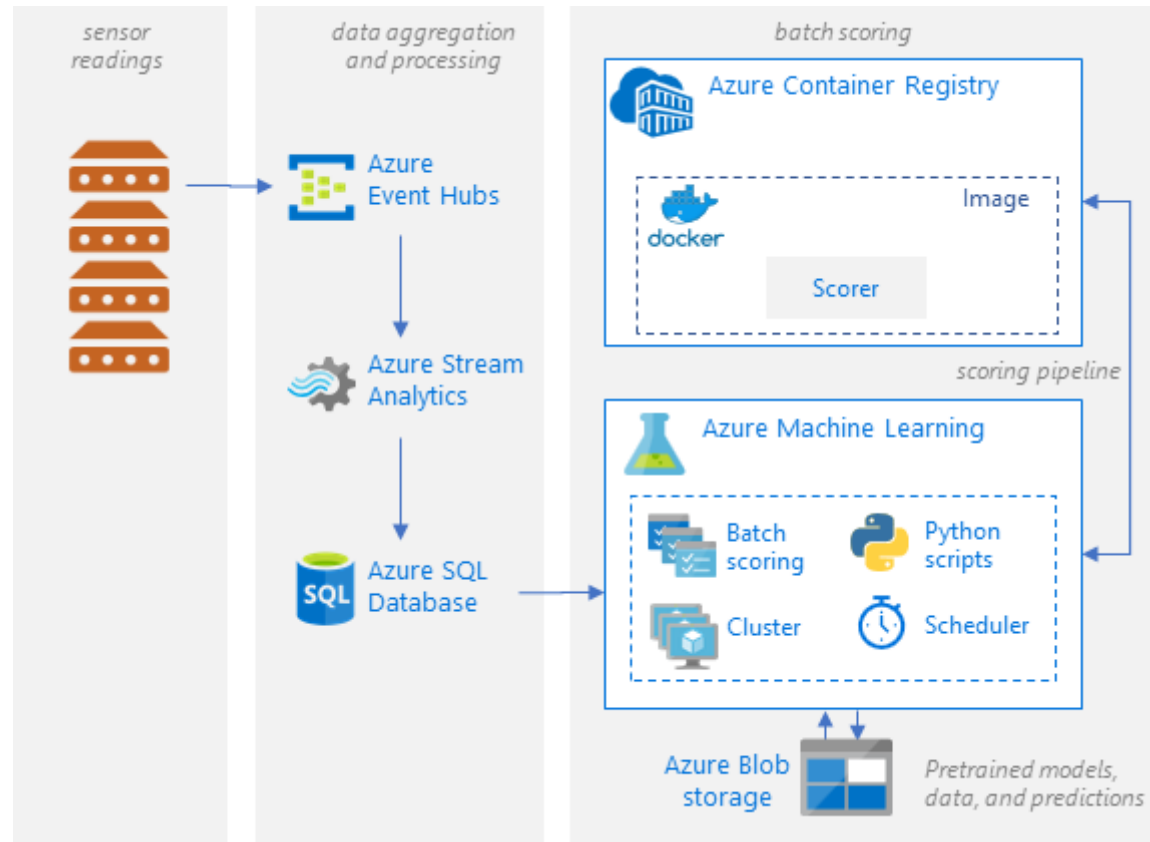
Training Python



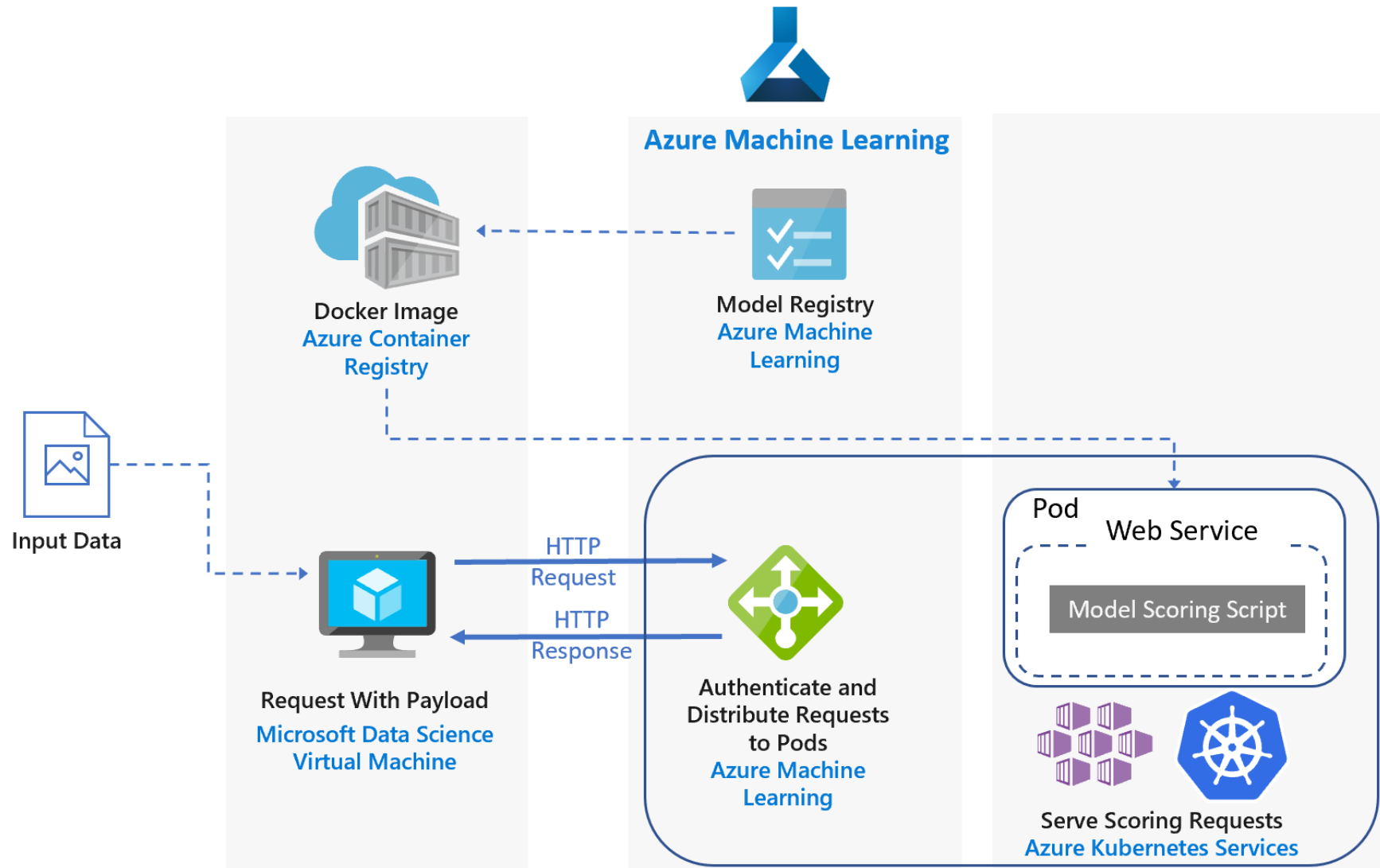
Deep Learning



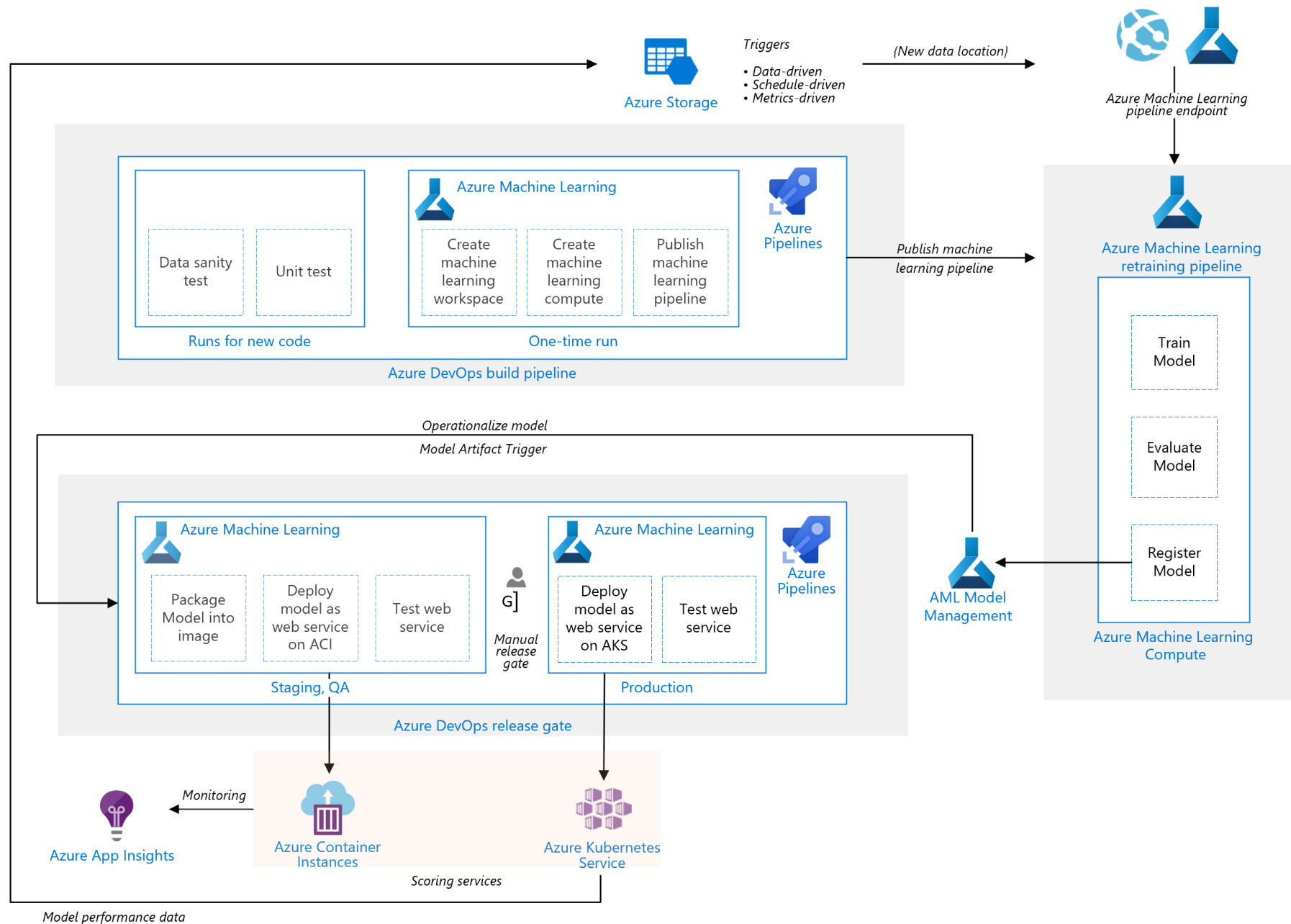
Batch scoring of Python models



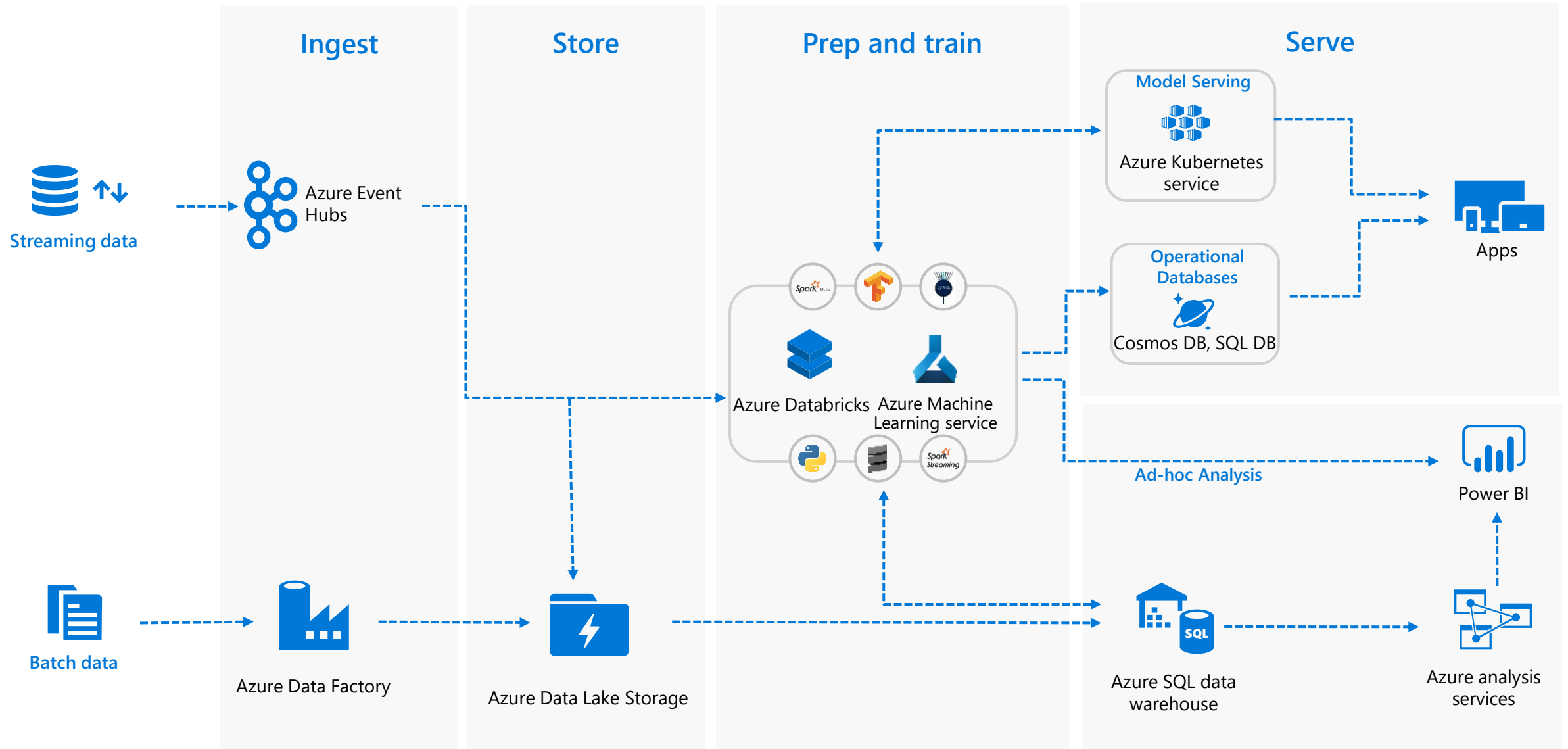
Real time scoring



MLOps



Azure Databricks + Azure ML



Documentation

Documentation Azure ML



Lien général :

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

Pricing :

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

Documentation :

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

Concepts :

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

Forum

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

Addin Visual Studio

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

Power BI Intégration

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

AutoML with Azure ML

References

Schneider Electric :

<https://customers.microsoft.com/en-us/story/schneider-electric-power-utilities-azure>

BP:

<https://news.microsoft.com/transform/bp-ai-drilling-data-fueling-smarter-decisions/>

Boots:

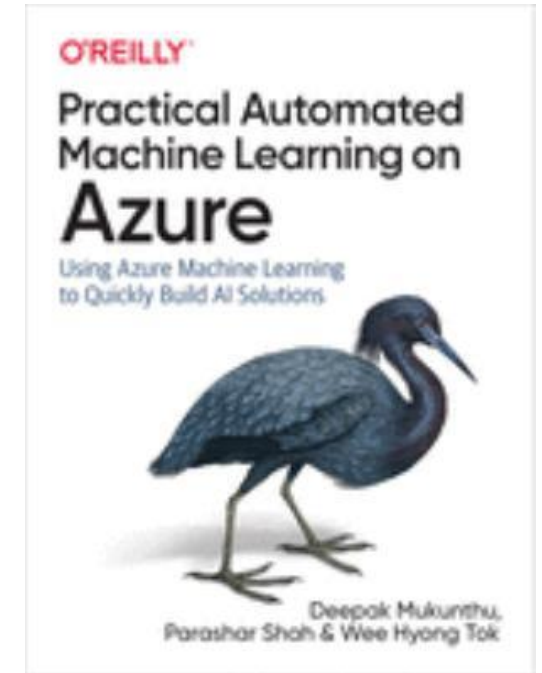
<https://customers.microsoft.com/en-us/story/733091-walgreens-boots-alliance-pharmaceuticals-azure>

AutoML integration with PowerBI:

<https://customers.microsoft.com/en-us/story/724164-macaw-partner-professional-services-power-bi>

Blog : <https://azure.microsoft.com/blog/announcing-automated-ml-capability-in-azure-machine-learning/>

Book: https://www.amazon.com/Practical-Automated-Machine-Learning-Azure-ebook/dp/B07Y8X2HH4/ref=sr_1_1?keywords=automl+azure&qid=1573050215&s=digital-text&sr=1-1

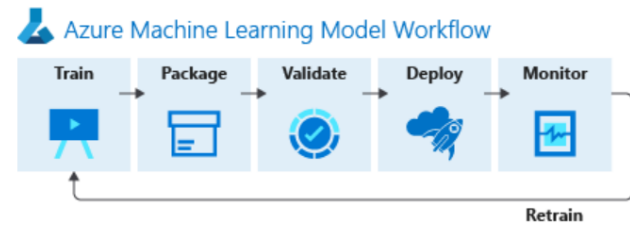


Azure ML Git

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

Azure Machine Learning service example notebooks

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



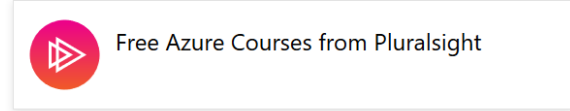
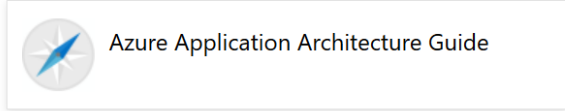
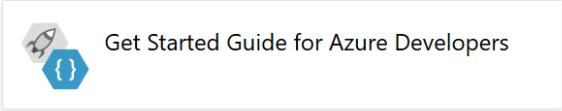
Quick installation

```
pip install azureml-sdk
```

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


How to navigate and use the example notebooks?


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





Architecture

Web

 App Service - Web Apps

 API Management

 Content Delivery Network

 Notification Hubs Azure Search



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Azure Reference Architectures

Our reference architectures are arranged by scenario. Each architecture includes recommended practices, along with considerations for scalability, availability, manageability, and security. Most also include a deployable solution or reference implementation.

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AI and machine learning



Training of Python scikit-learn models

Recommended practices for tuning the hyperparameters of a scikit-learn Python model.



Distributed training of deep learning models

Run distributed training of deep learning models across clusters of GPU-enabled VMs.



Batch scoring of Python models

Batch score many Python models in parallel on a schedule using Azure Machine Learning.



Batch scoring for deep learning models



Real-time scoring of Python and deep learning models



MLOps for Python models using Azure Machine Learning

Architectures Microsoft

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

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