# Advanced Analytics & AI on Azure

# Advanced Analytics & AI represents a growing opportunity

Global business value derived from **AI in 2022** will reach

"Forecast: The Business Value of Artificial Intelligence, Worldwide, 2017-2025", Gartner, April 2018.

# 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

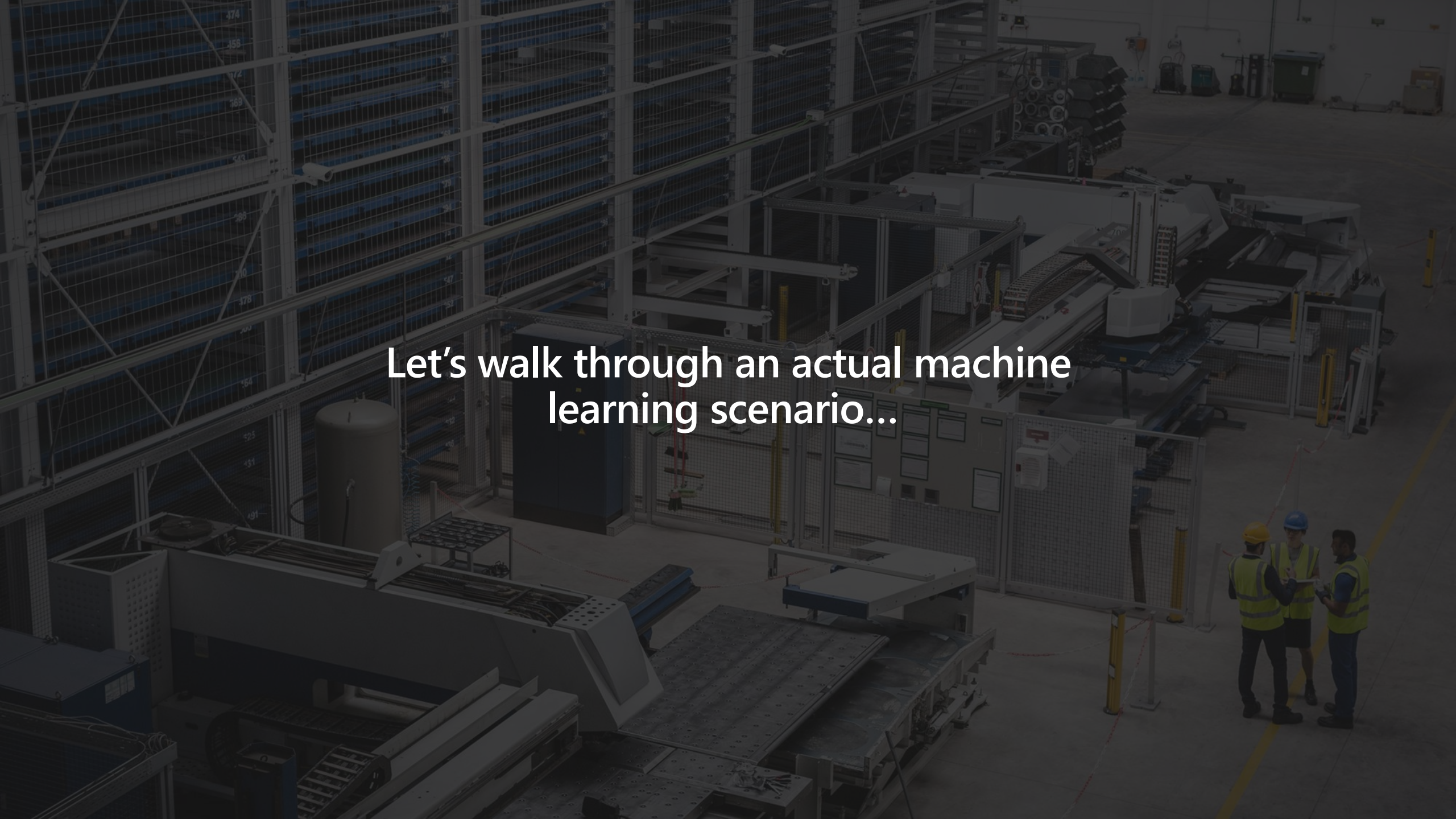
## Powerful infrastructure
To accelerate deep learning

CPU

GPU

FPGA

From the Intelligent Cloud to the Intelligent Edge



Let’s walk through an actual machine learning scenario…

Missing equipment
Flammable equipment near heat source
No hardhat

No hardhat

How can we accurately identify hazardous situations with machine learning?

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# Sophisticated pretrained models

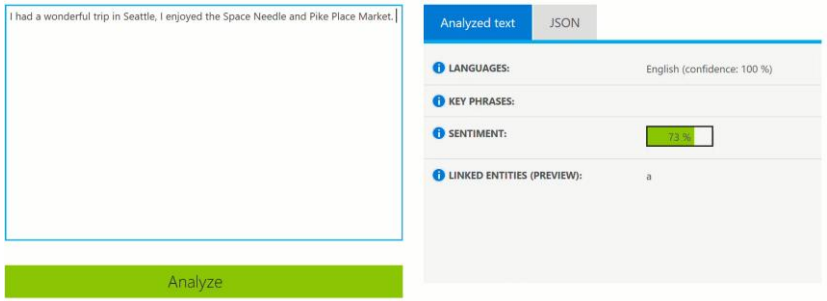
## Infuse apps with powerful, pre-trained AI models

## Customize easily and tailor to your needs

Vision

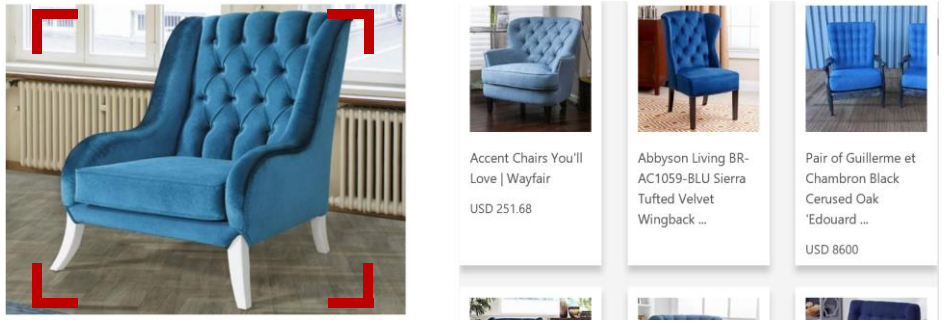
Computer Vision | Video Indexer | Face | Content Moderator

Language



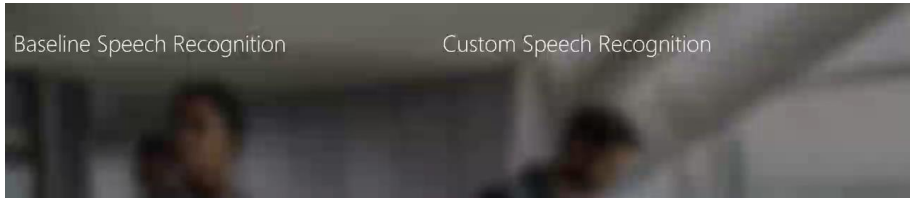

Text Analytics | Spell Check | Language Understanding | Text Translation | QnA Maker

Bing Search




Big Web Search | Video Search | Image Search | Visual Search | Entity Search | News Search | Autosuggest

Speech




Speech to Text | Text to Speech | Speech Translation | Speaker Recognition

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# Familiar Data Science tools

## Choose any python development environment

Visual Studio Code

Azure Notebooks

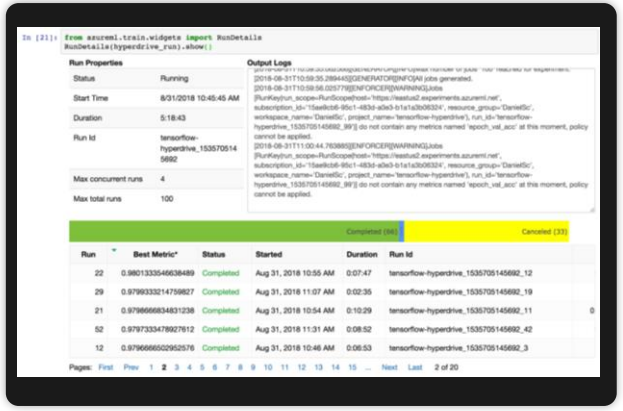
Jupyter

PyCharm

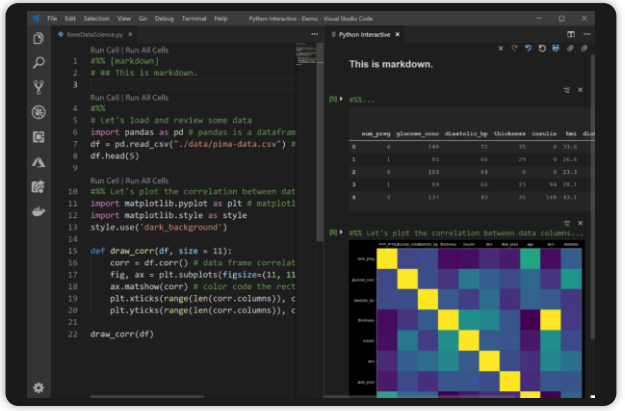
Zeppelin

Command line

## And improve data science productivity



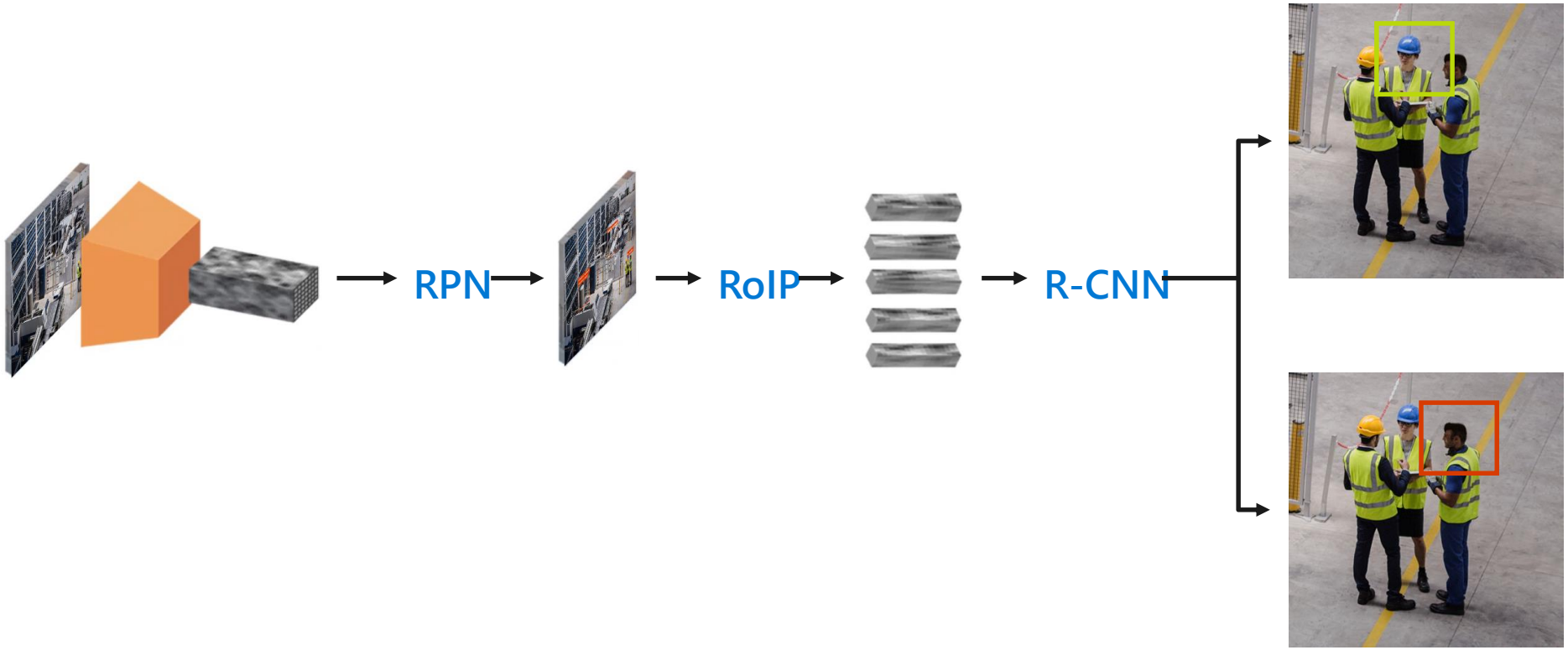
Interactive widgets for Jupyter Notebooks



Azure Machine Learning for Visual Studio Code extension

Get started with AML on Azure Notebooks: http://aka.ms/aznotebooks-aml

# Next challenge is to build a model




Time-consuming

Needs specialized knowledge

Complex

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# Powerful frameworks

## Build advanced deep learning solutions

### Use your favorite deep learning frameworks

TensorFlow

PyTorch

Scikit-Learn

MXNet

Chainer

Keras

+

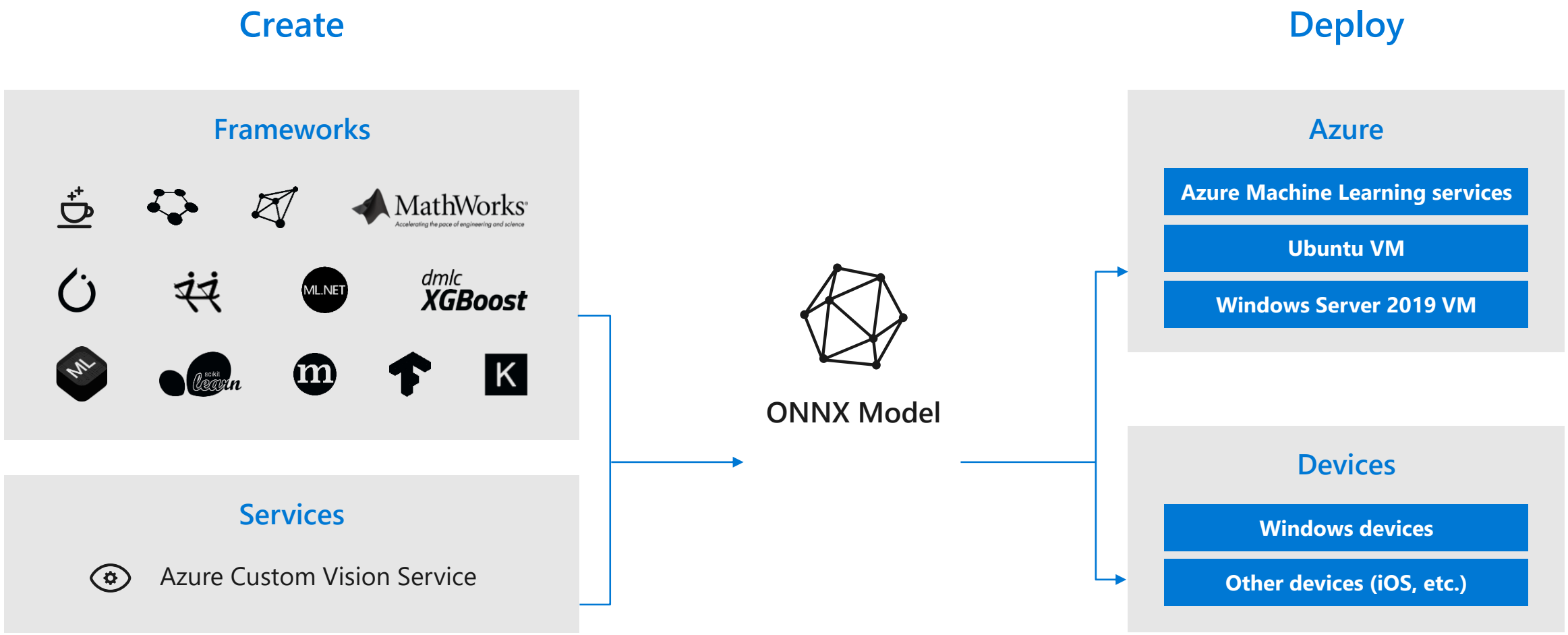
### without getting locked into one framework

ONNX

**Community project created by Facebook and Microsoft**

**Use the best tool for the job. Train in one framework and transfer to another for inference**

# ONNX is the new open ecosystem for AI models



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# Productive Services

## To empower data science and development teams

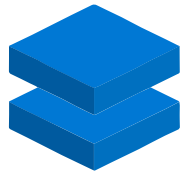
## Azure Machine Learning

### Python-based machine learning service

**Develop models faster with automated machine learning**

**Use any Python environment and ML frameworks**

**Manage models across the cloud and the edge.**



## Azure Databricks

### Apache Spark-based big-data service

**Prepare data clean data at massive scale**

**Enable collaboration between data scientists and data engineers**

**Access machine learning optimized clusters**

# Azure Machine Learning service

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

Seamlessly integrated with the Azure Portfolio

# Azure Databricks

Fast, easy, and collaborative Apache Spark™-based analytics platform

**Increase productivity**

**Build on a secure, trusted cloud**

**Scale without limits**

**Built with your needs in mind**

- Optimized Apache Spark environmnet
- Collaborative workspace
- Integration with Azure data services
- Autoscale and autoterminate
- Optimized for distributed processing
- Support for multiple languages and libraries

Seamlessly integrated with the Azure Portfolio

# Leverage deep learning services and frameworks

## AZURE ML SERVICE

Bring AI to the edge

Increase your rate of experimentation

Deploy and manage your models everywhere

## AZURE DATABRICKS

Accelerate processing with the fastest Apache Spark engine

Integrate natively with Azure services

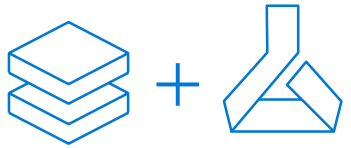
Access enterprise-grade Azure security

### Leverage your favorite deep learning frameworks

TensorFlow | MS Cognitive Toolkit | PyTorch | Scikit-Learn | ONNX | Caffe2 | MXNet | Chainer

# Productive Services

## What to use when?

| Customer journey | Data Prep | Build and Train | Manage and Deploy |
| --- | --- | --- | --- |
| Python ML developer | **Azure ML service** (Pandas, NumPy etc. on AML Compute) | **Azure ML service** (OSS frameworks, Hyperdrive, Pipelines, Automated ML, Model Registry) | **Azure ML service** (containerize, deploy, inference and monitor) |
| Apache Spark / Big Data | **Azure Databricks** (Apache Spark Dataframes, Datasets, Delta, Pandas, NumPy etc.) |  **Azure Databricks + Azure ML service** (Spark MLib and OSS frameworks + Automated ML, Model Registry) | **Azure ML service** (containerize, deploy, inference and monitor) |

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# Powerful infrastructure

Accelerate deep learning

## CPUs

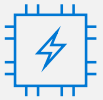
General purpose machine learning

D, F, L, M, H Series

## GPUs

Deep learning

N Series



## FPGAs

Specialized hardware accelerated deep learning

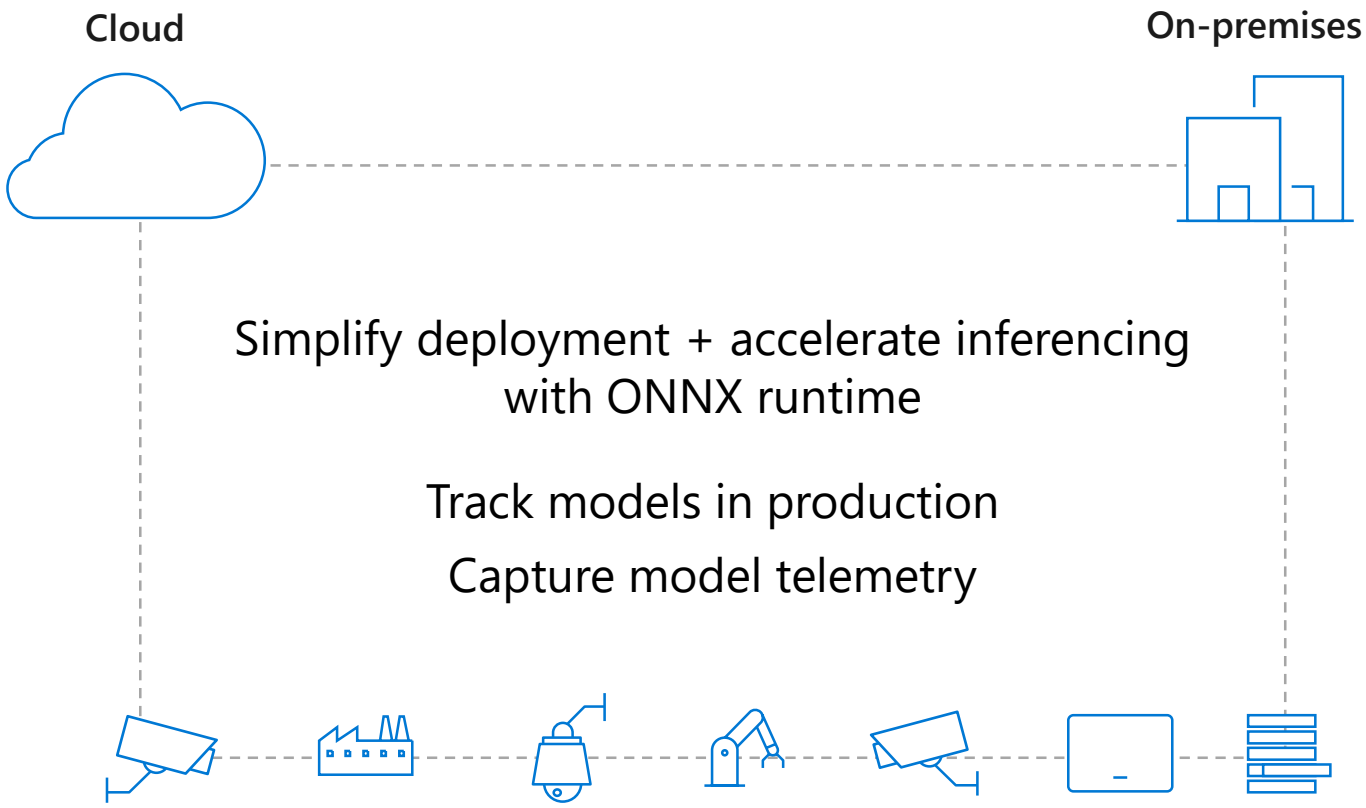
AML hardware accelerated models (Project Brainwave)

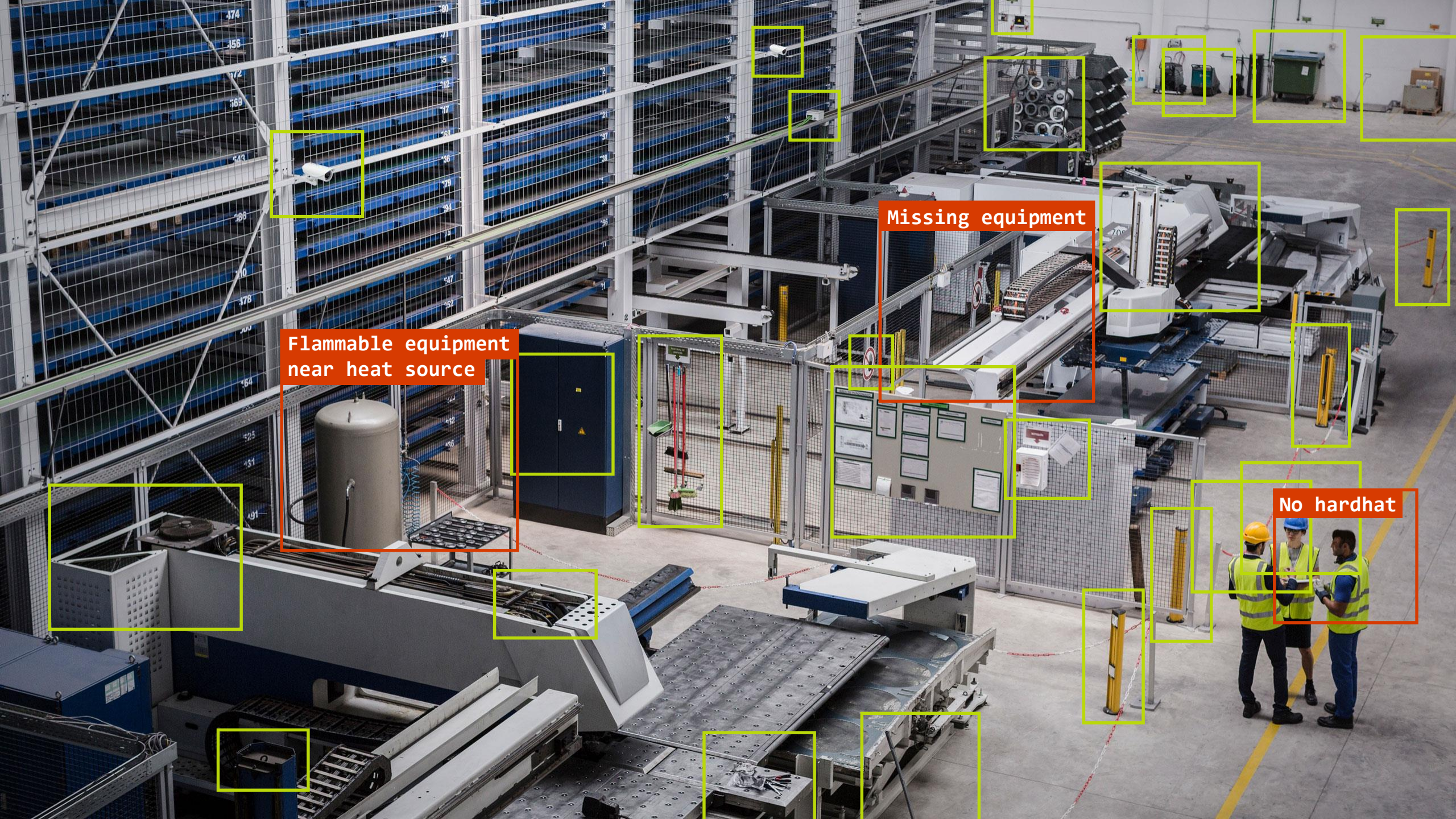
**Optimized for flexibility**

**Optimized for performance**

# Flexible deployment

## From the Intelligent Cloud to the Intelligent Edge

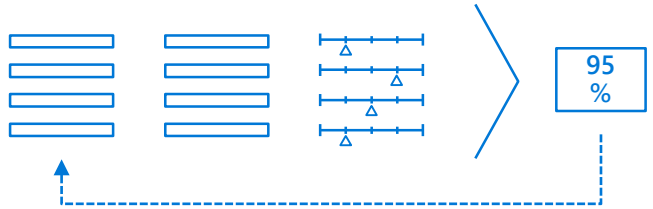



Missing equipment
Flammable equipment
near heat source
No hardhat

# Differentiators

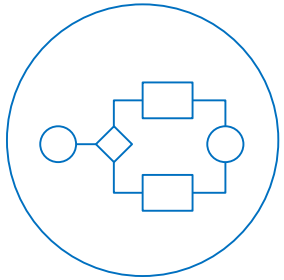
Machine Learning

## Automated machine learning




Accelerated model building

## Machine learning DevOps

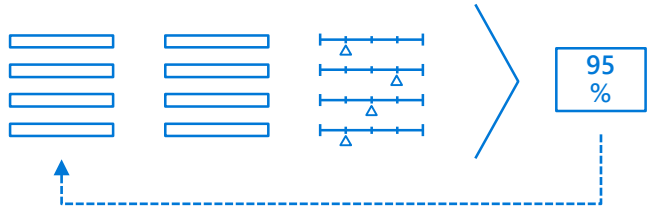


Azure DevOps integration for CI/CD

# Differentiators

## Machine Learning

### Automated machine learning




Accelerated model building

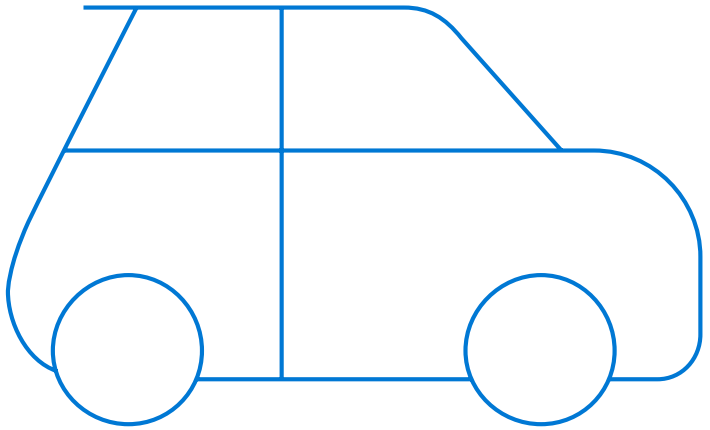
### Machine learning DevOps



Azure DevOps integration for CI/CD

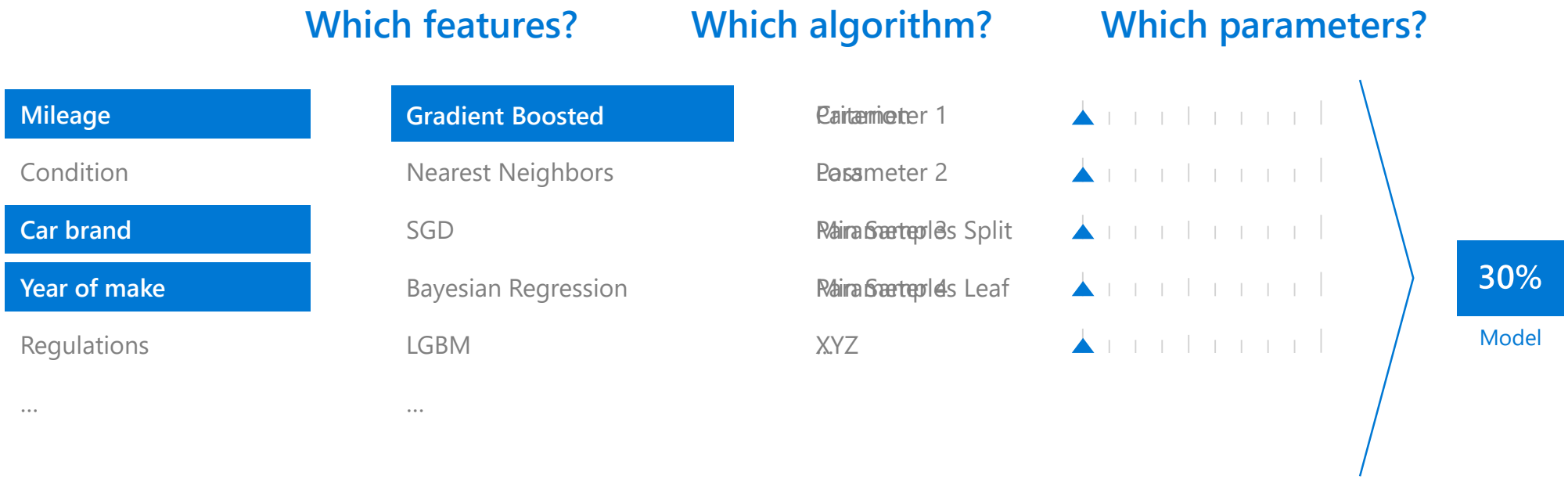
# Azure Machine Learning

## Automated machine learning



## How much is this car worth?

# Model creation is typically a time consuming process



# Model creation is typically a time consuming process

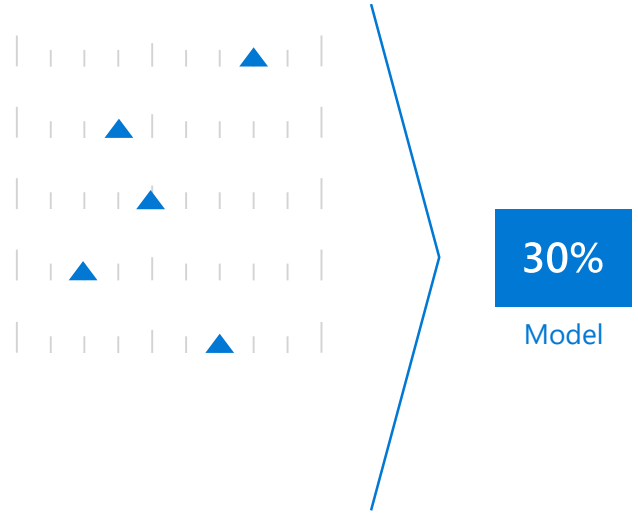
## Which features?

- Mileage
- Condition
- Car brand
- Year of make
- Regulations
- ...

## Which algorithm?

- Gradient Boosted
- Nearest Neighbors
- SGD
- Bayesian Regression
- LGBM
- ...

## Which parameters?

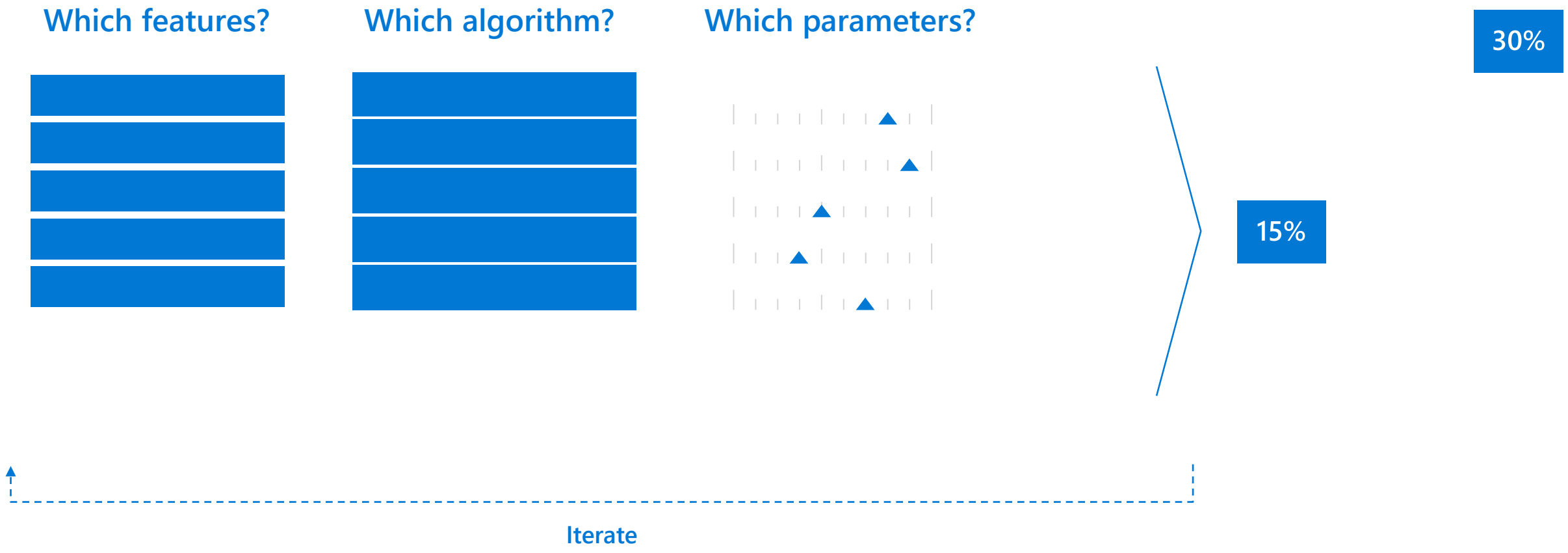



30%

Model

Iterate

# Model creation is typically a time consuming process



# Azure Machine Learning accelerates model development

## with automated machine learning

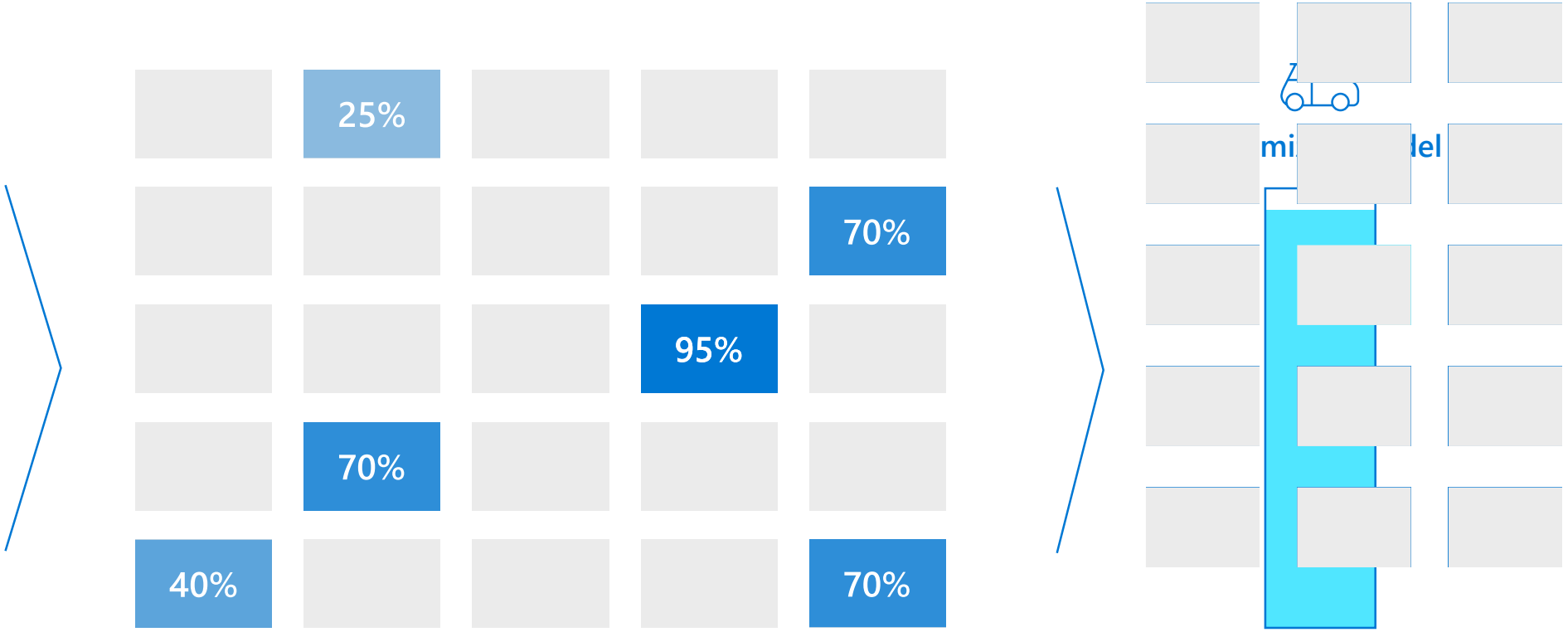
### Input

Enter data

Define goals

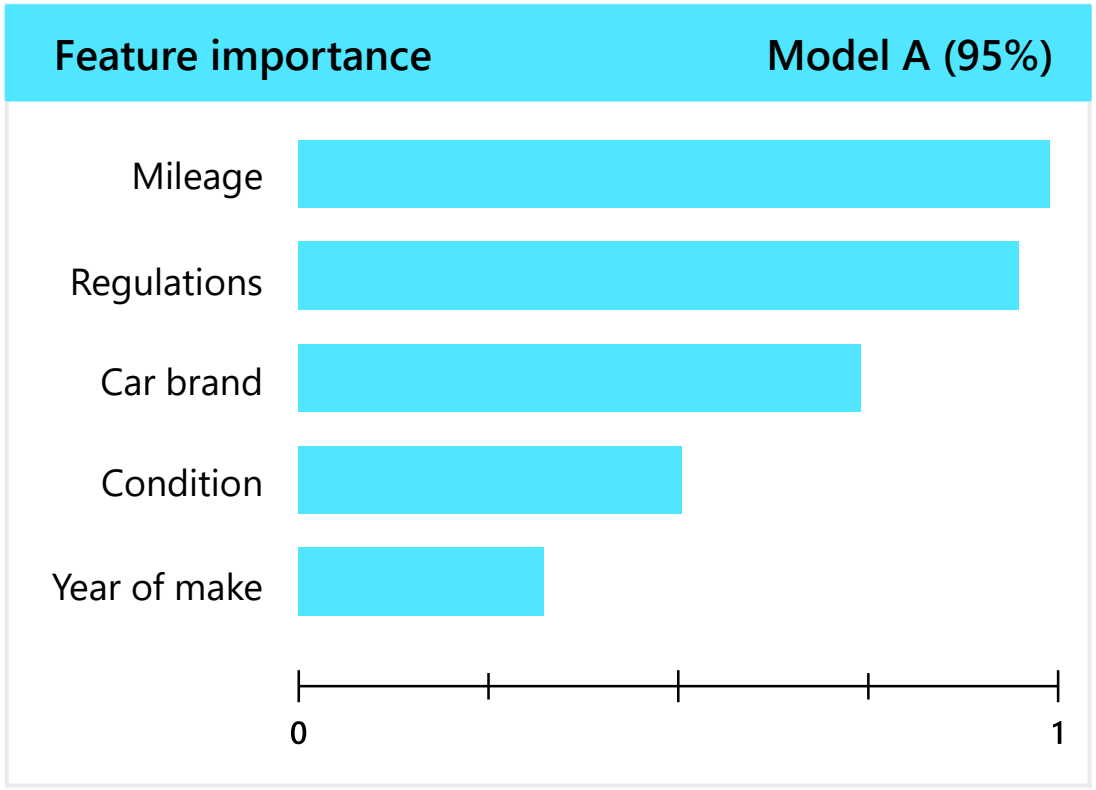
Apply constraints

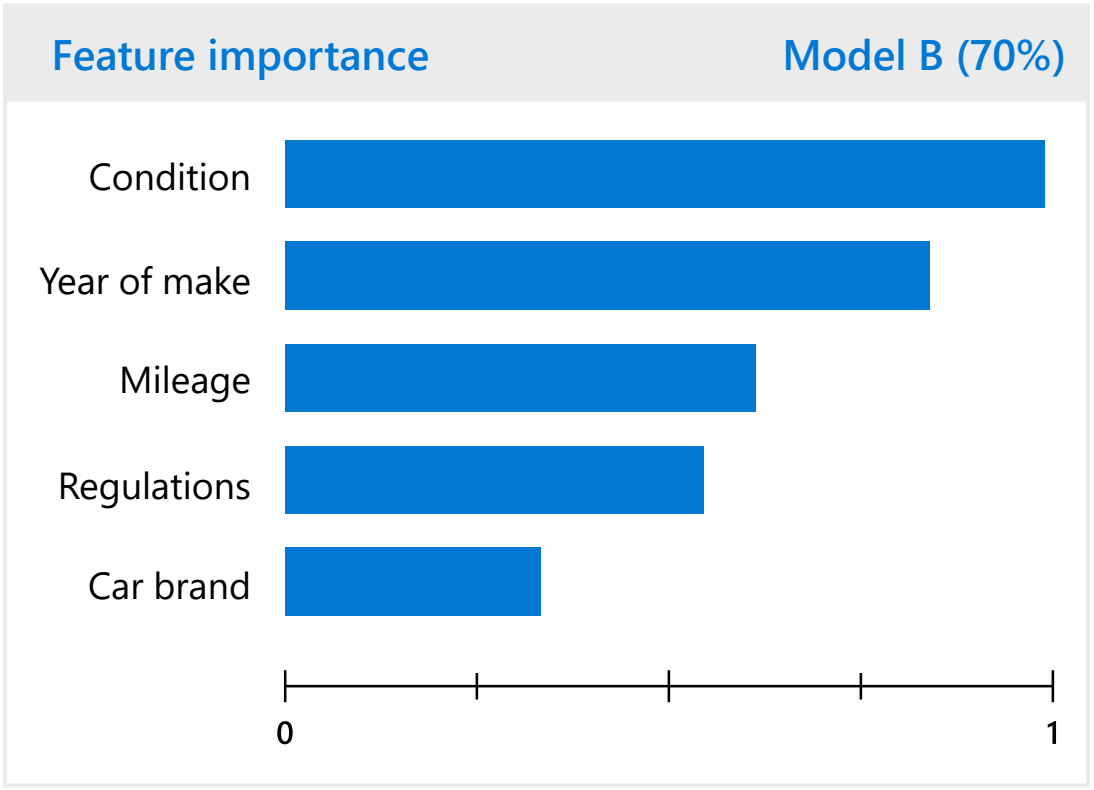
### Intelligently test multiple models in parallel



# Azure Machine Learning accelerates model selection

## with model explainability



V1

V2

v3

# Differentiators

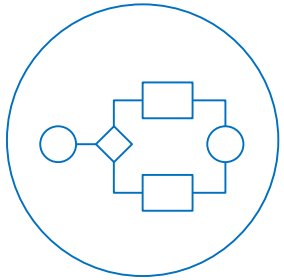
## Machine Learning

### Automated machine learning




Accelerated model building

### Machine learning DevOps



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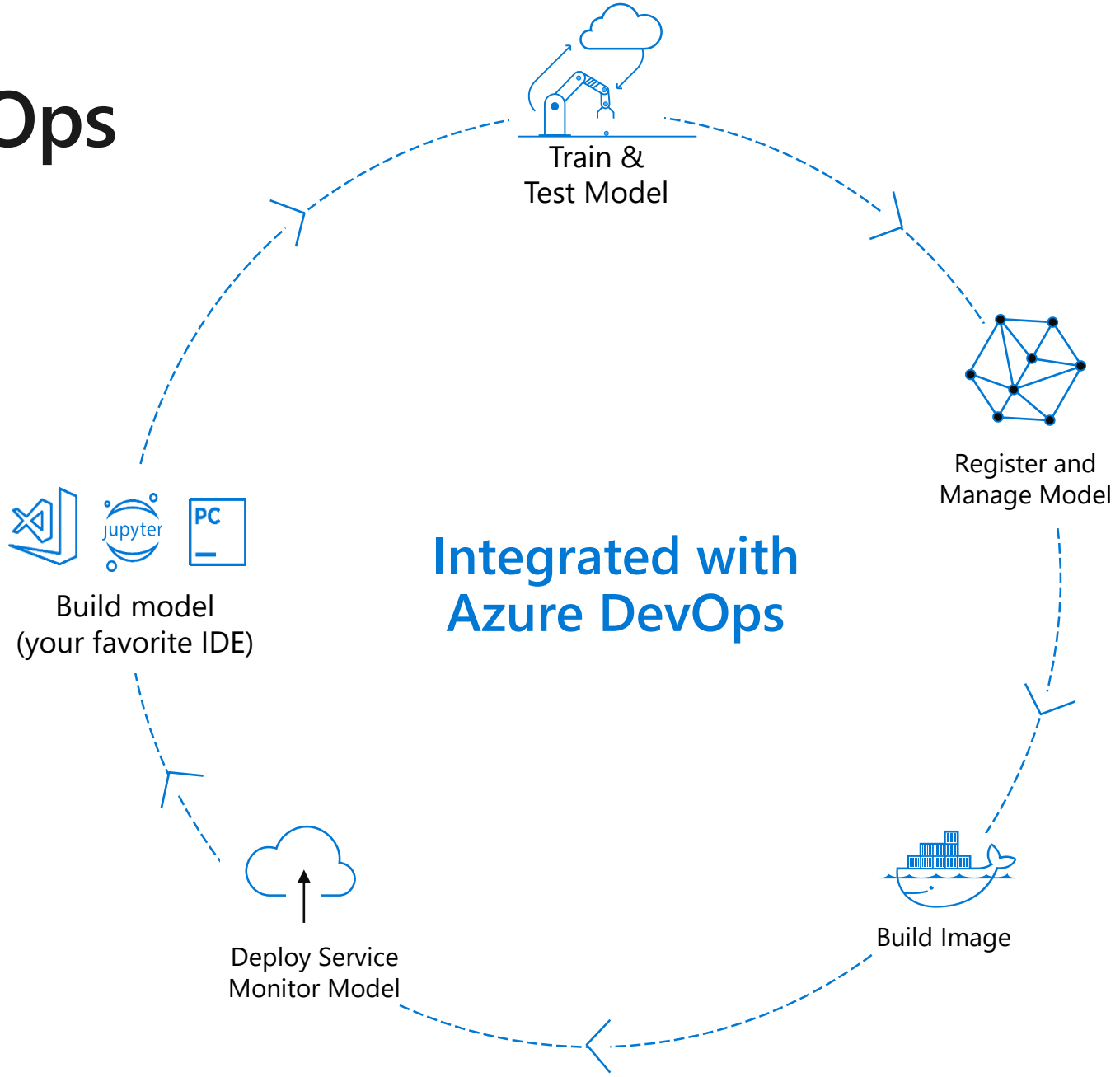
# Machine Learning DevOps

End-to-end ML lifecycle management

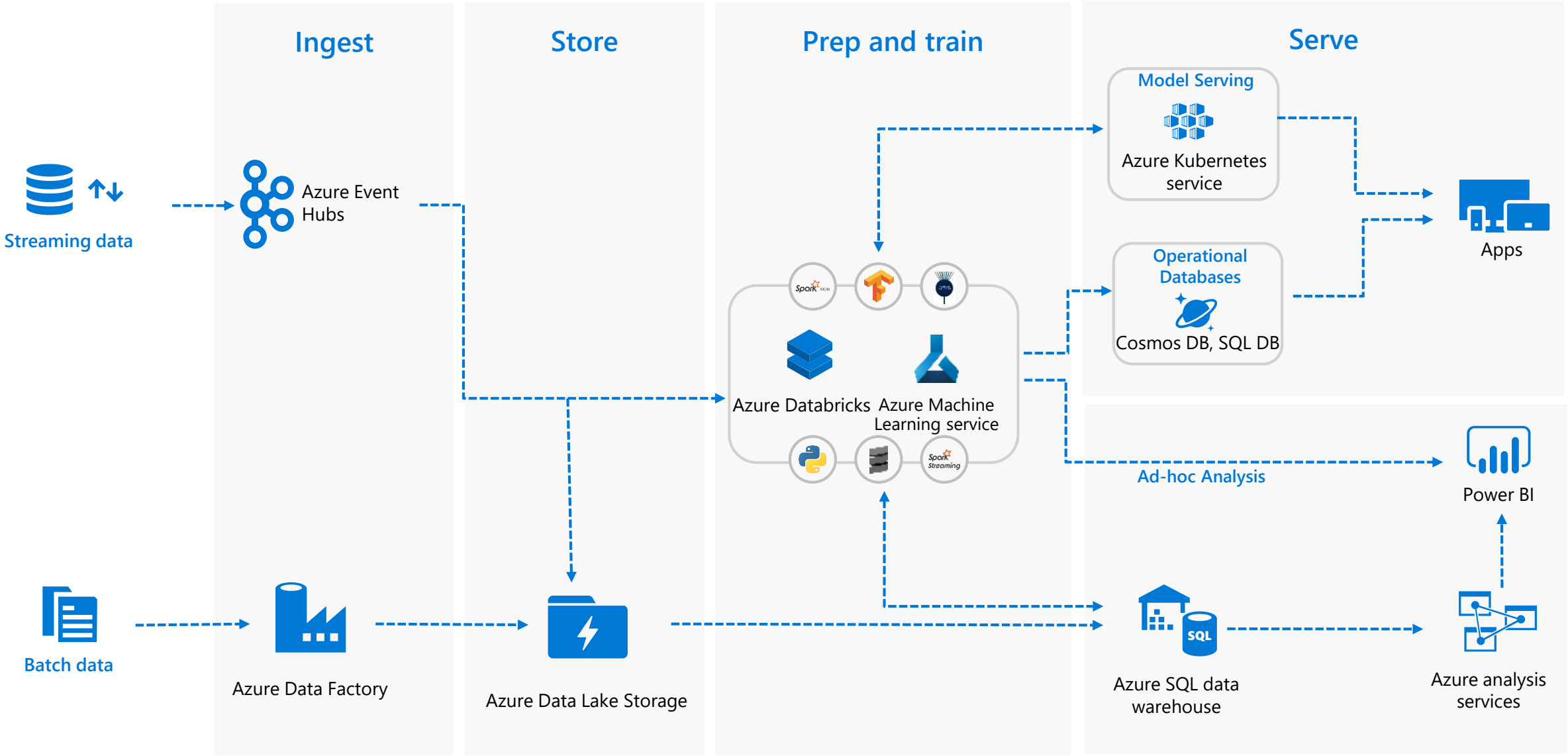
CI/CD for ML pipelines

Feedback loop

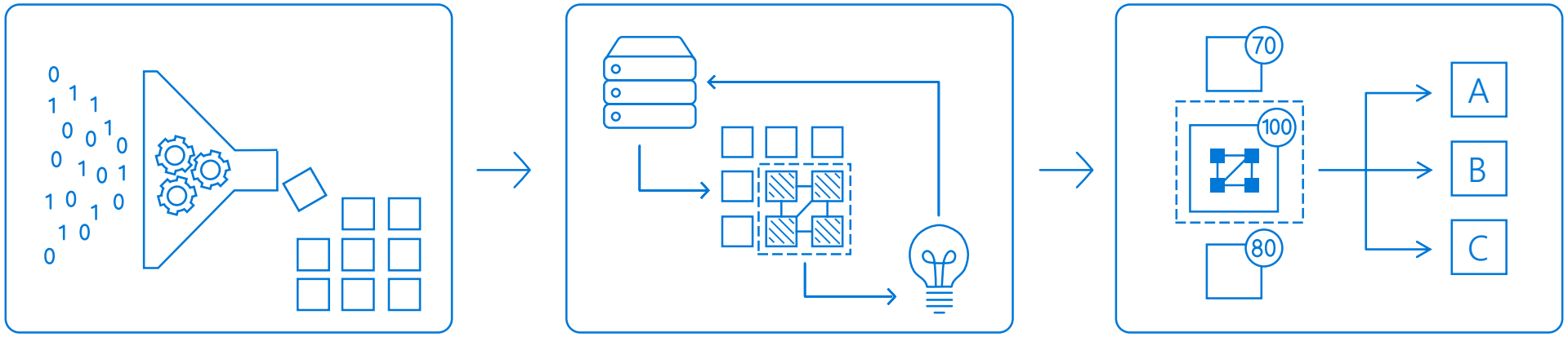


# Understanding the Data Science Process on Azure

# Recommended architecture to build e2e ML solutions



# PREP & TRAIN

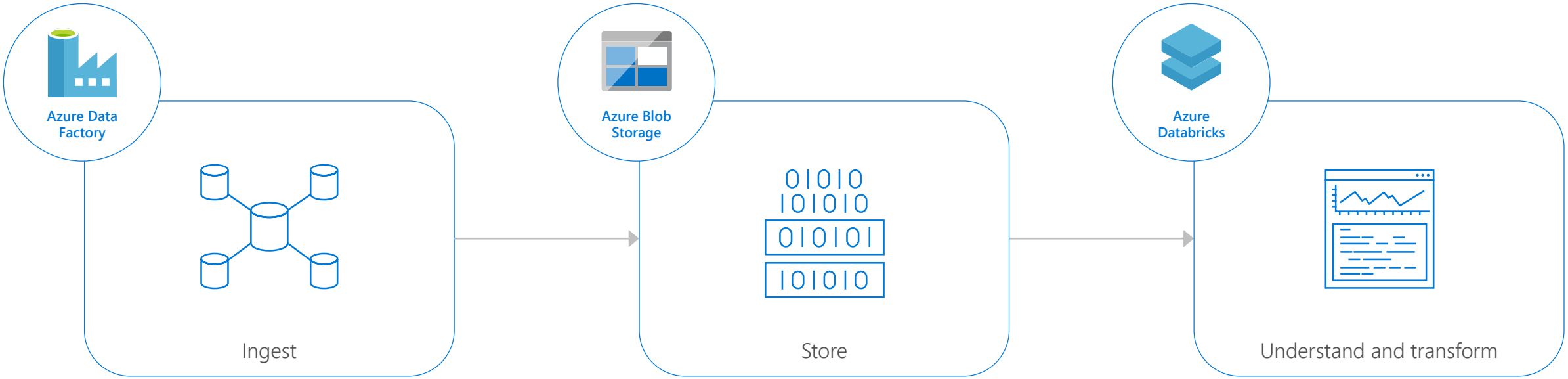



Collect and prepare data

Train and evaluate model

Operationalize and manage

# Collect and prepare all of your data at scale




## Connect to data from any source

- Integrate with all of your data sources
- Create hybrid pipelines
- Orchestrate in a code-free environment

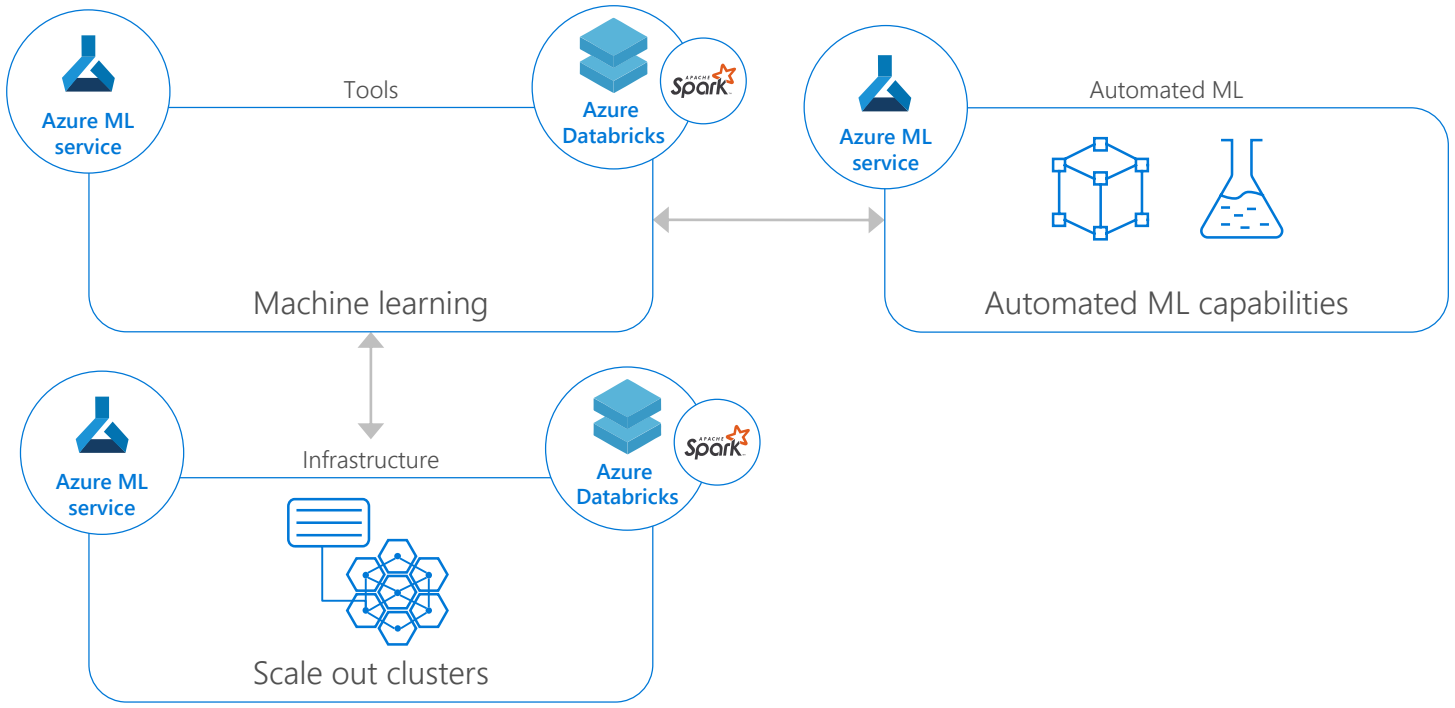
## Leverage best-in-class analytics capabilities

- Leverage open source technologies
- Collaborate within teams
- Use ML on batch streams

## Scale without limits

- Build in the language of your choice
- Leverage scale out topology
- Scale compute and storage separately

# Train and evaluate machine learning models




## Simplify model development

- Collaborate in interactive workspaces
- Access a library of battle-tested models
- Automate job execution

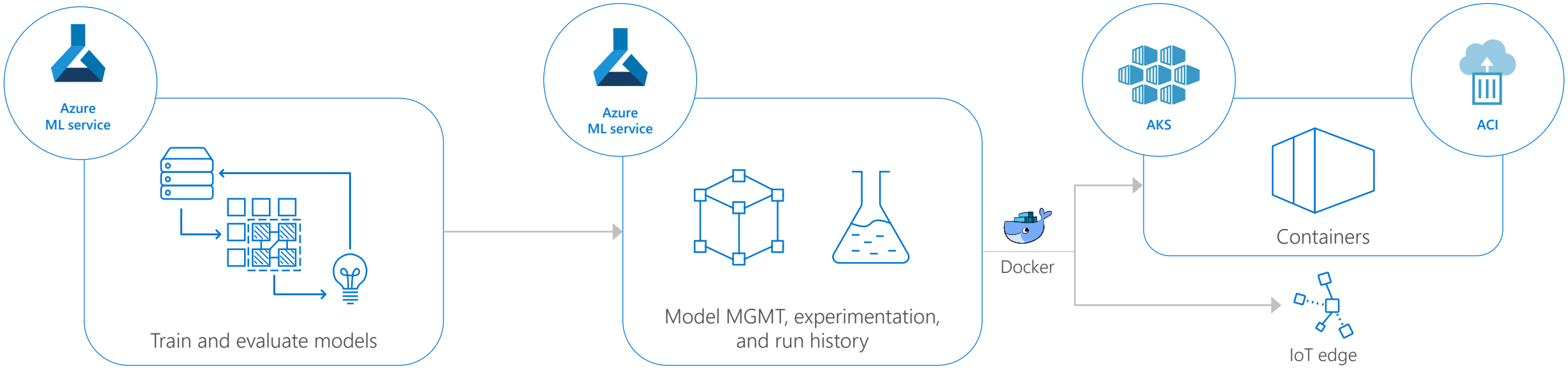
## Scale compute resources to meet your needs

- Easily scale up or scale out
- Autoscale on serverless infrastructure
- Leverage commodity hardware

## Quickly determine the right model for your data

- Determine the best algorithm
- Tune hyperparameters to optimize models
- Rapidly prototype in agile environments

# Operationalize and manage models with ease




## Bring models to life quickly

- Build and deploy models in minutes
- Iterate quickly on serverless infrastructure
- Easily change environments

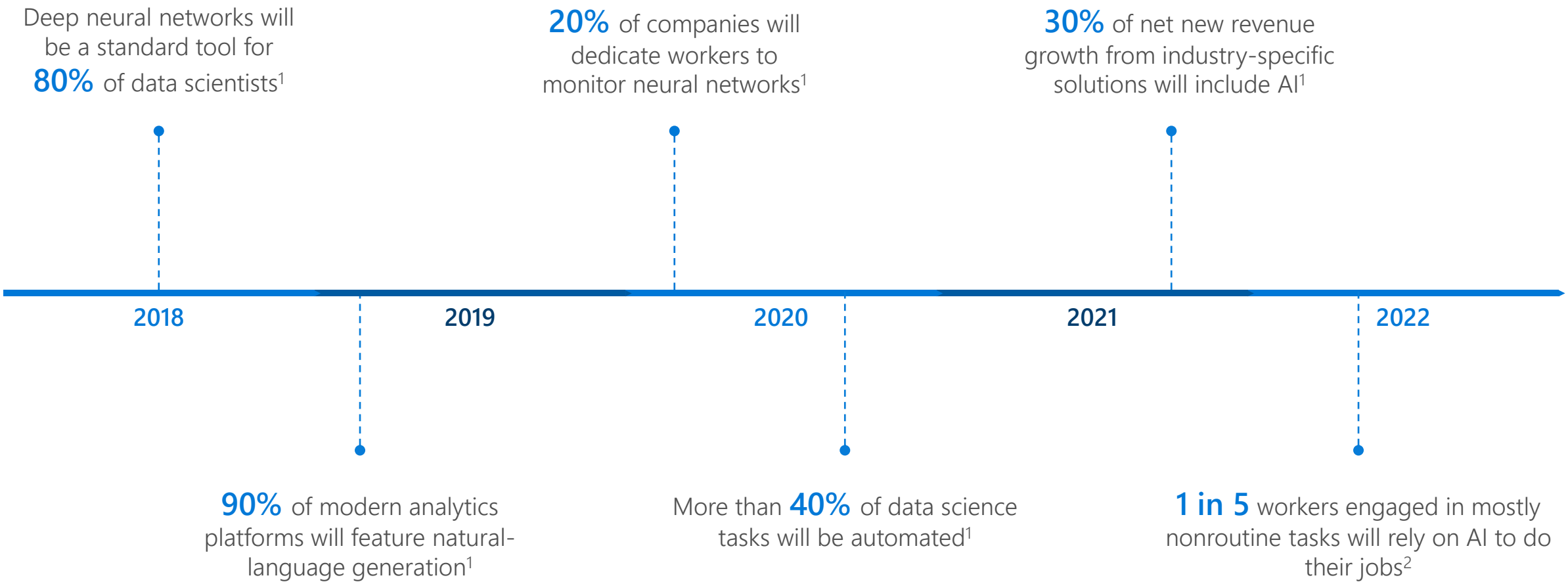
## Proactively manage model performance

- Identify and promote your best models
- Capture model telemetry
- Retrain models with APIs

## Deploy models closer to your data

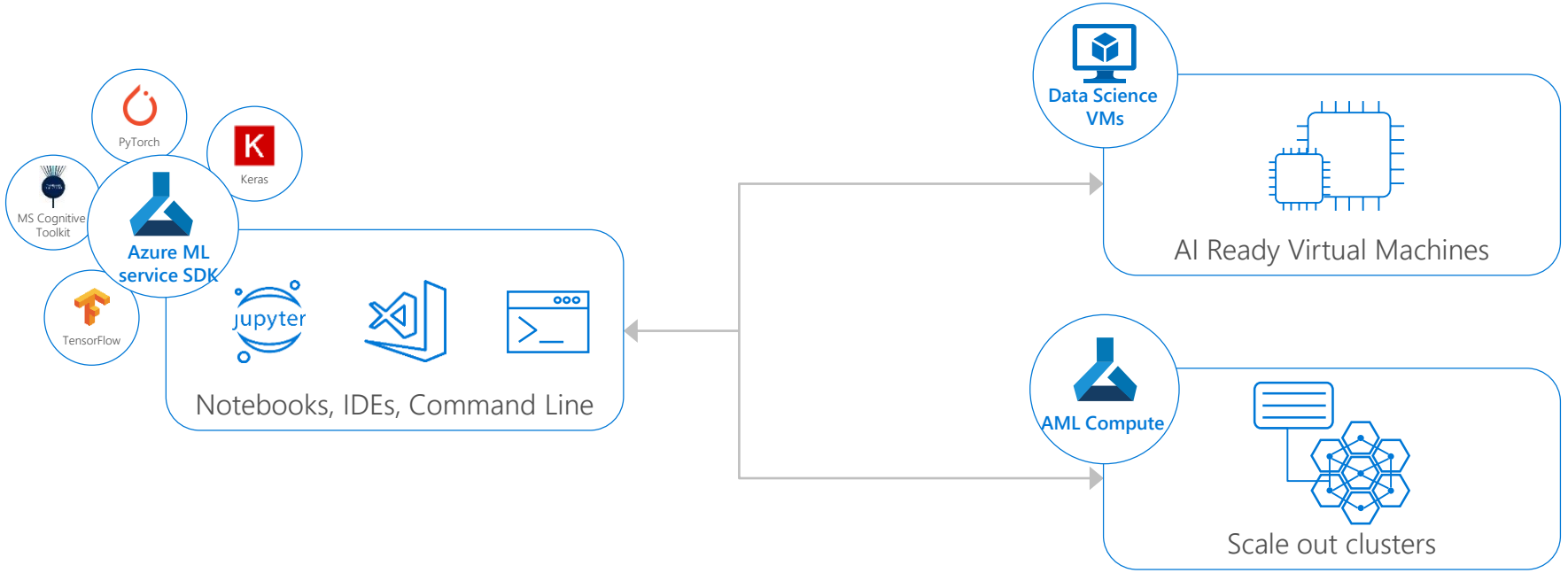
- Deploy models anywhere
- Scale out to containers
- Infuse intelligence into the IoT edge

# What are companies looking to do next?




[1] "100 Data and Analytics Predictions Through 2021", Gartner, 2017. [2] "Predicts 2018: AI and the Future of Work", Gartner, 2018.

# Build and deploy deep learning models




## Streamline AI development efforts

- Leverage popular deep learning toolkits
- Develop your language of choice

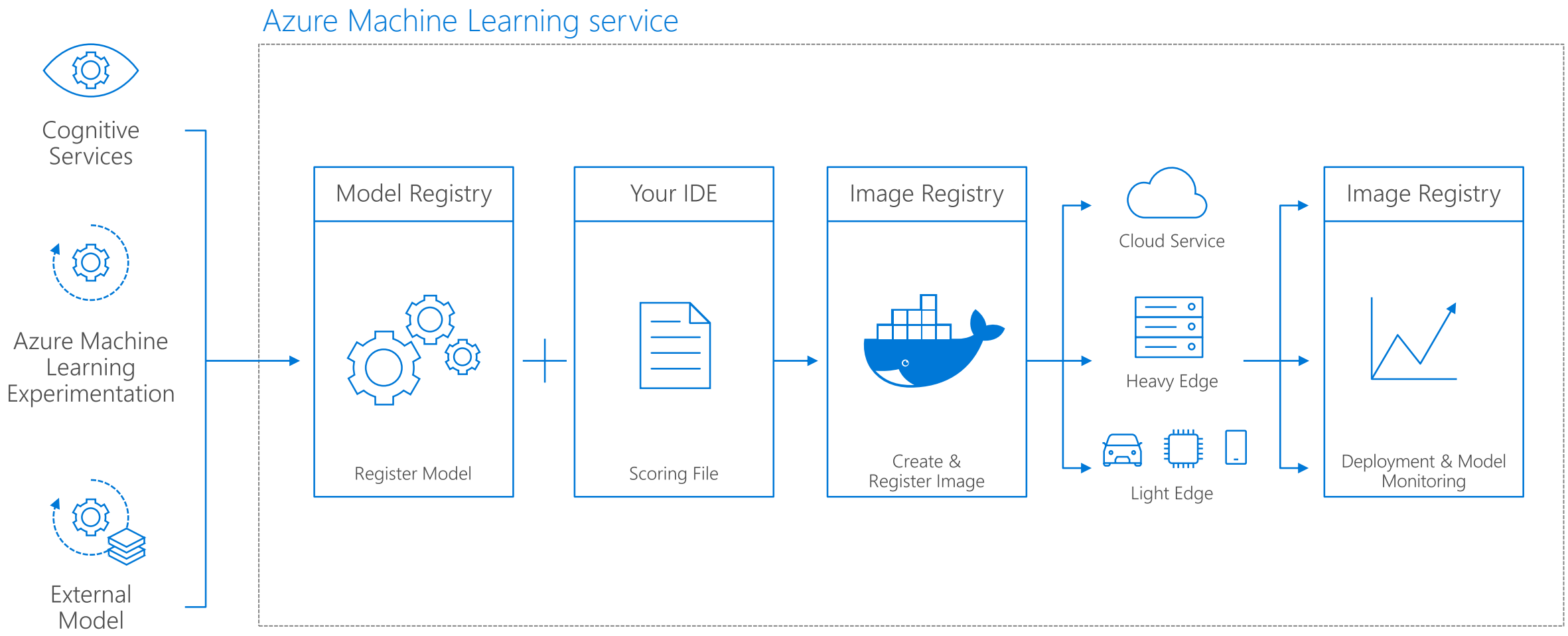
## Scale compute resources in any environment

- Choose VMs for your modeling needs
- Process video using GPU-based VMs

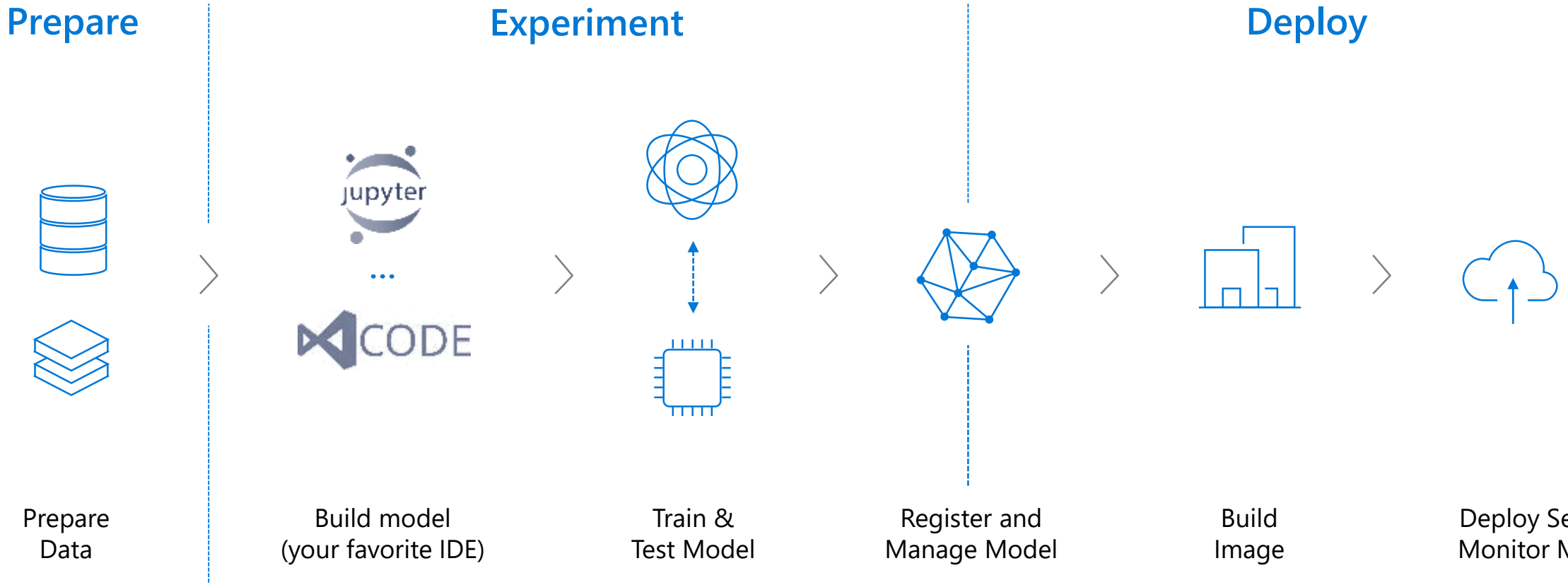
## Quickly evaluate and identify the right model

- Run experiments in parallel
- Provision resources automatically

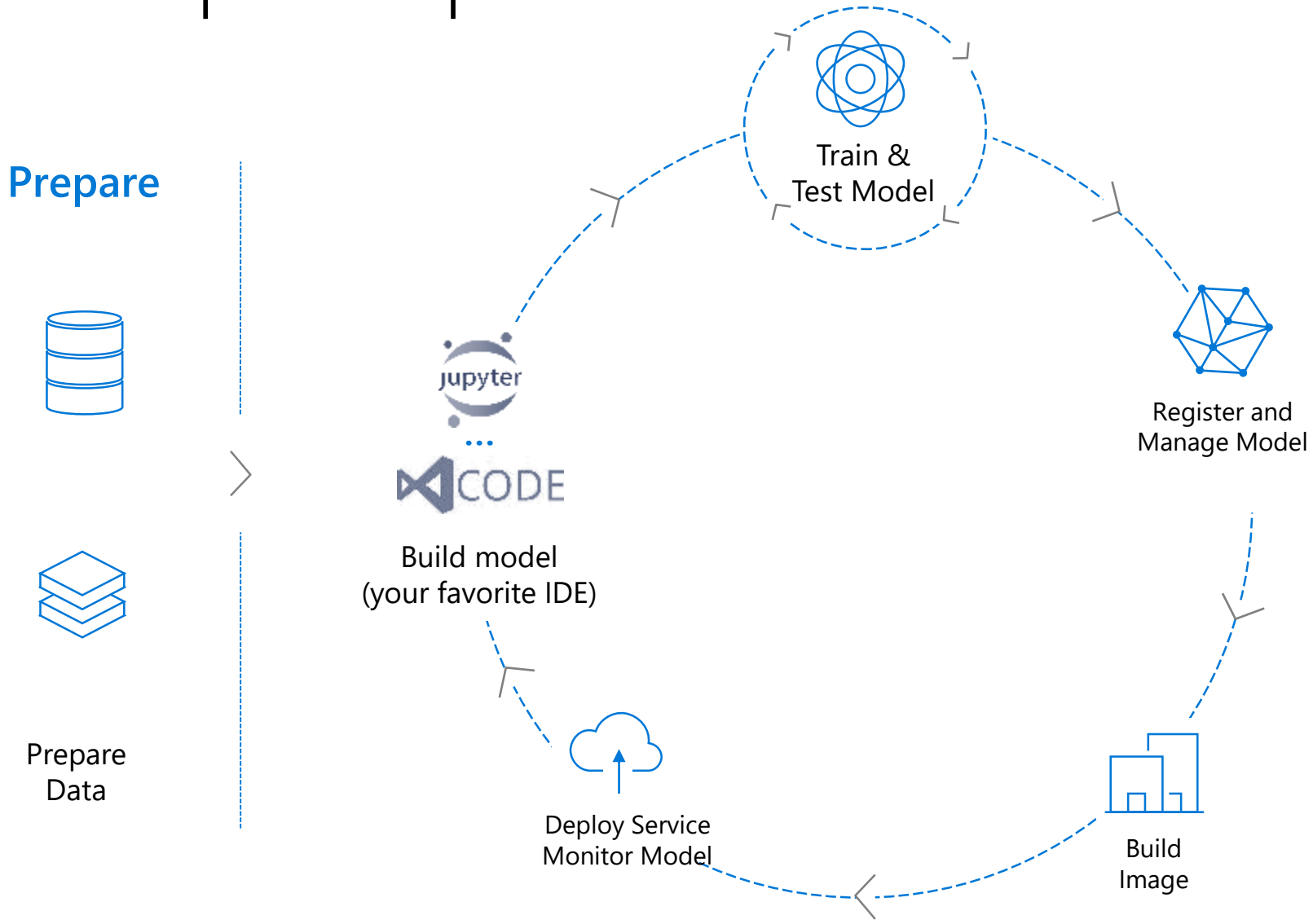
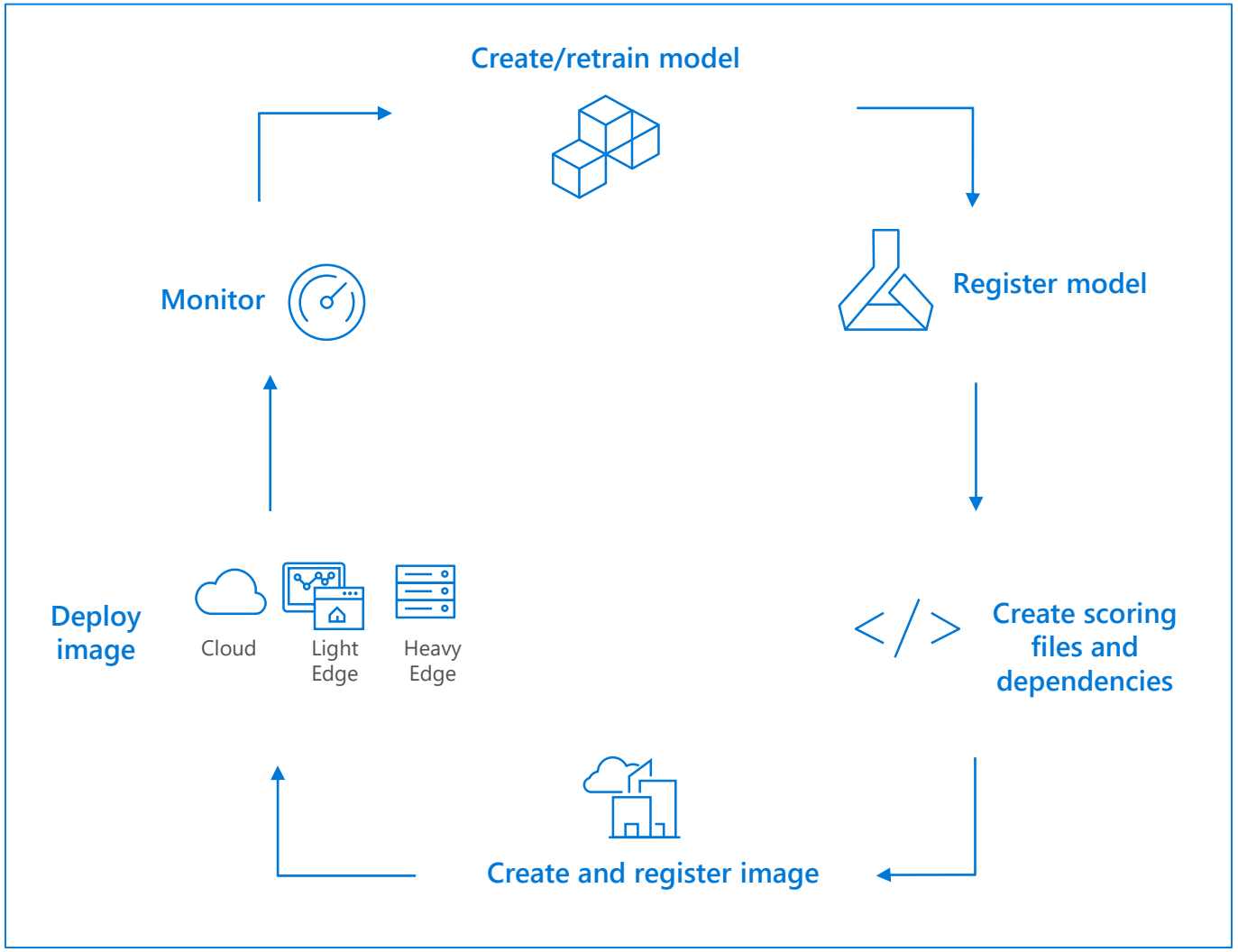
# Deploy Azure ML models at scale



# DevOps loop for data science



# DevOps loop for data science



# Model management in Azure Machine Learning