**Microsoft**

# Managing Machine Learning Project with Visual Studio

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Microsoft MVP
Microsoft Certified Trainers
Microsoft Certified for DevOps Expert
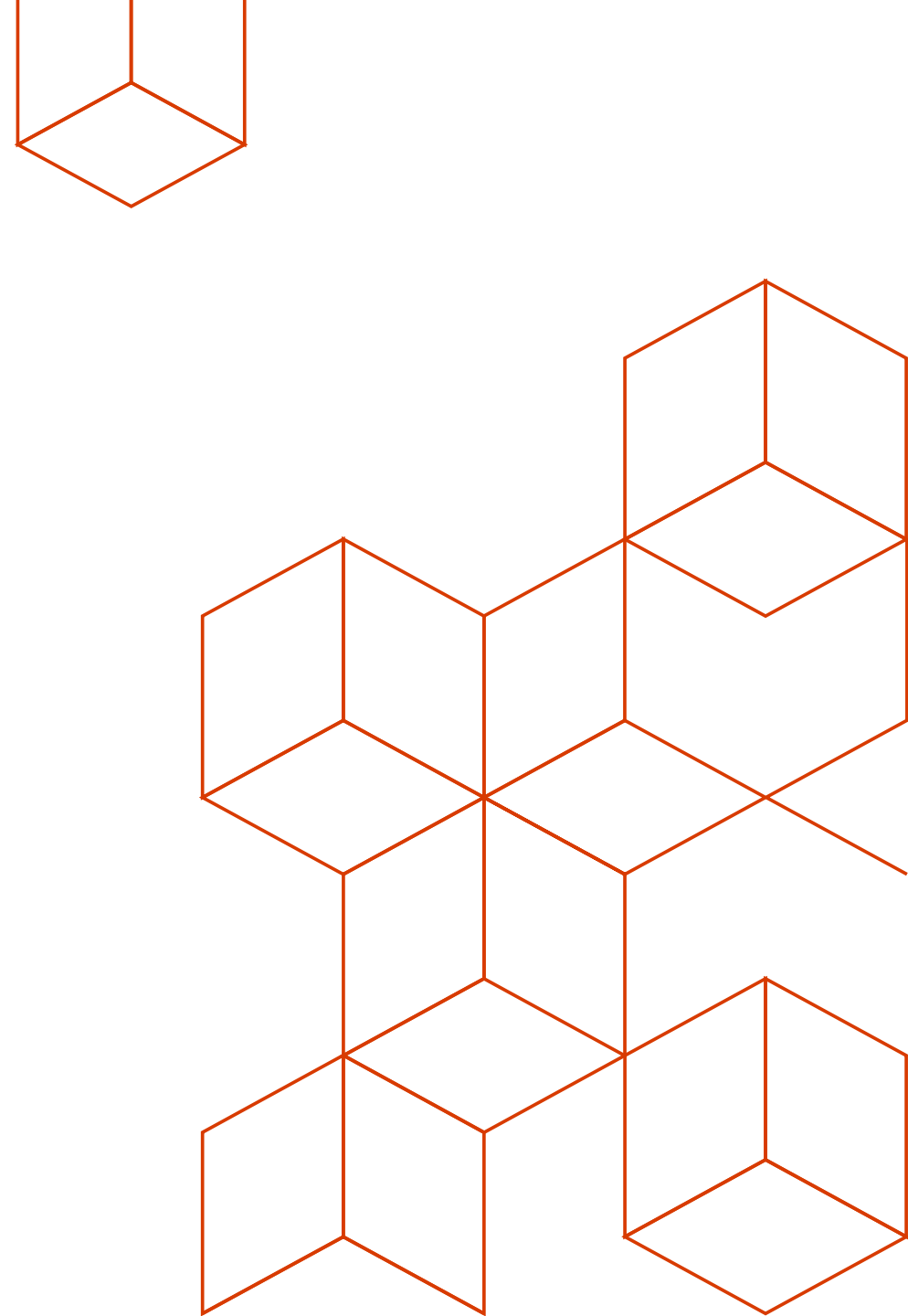
https://mic.ms/ridi

Microsoft

I am not an expert on Machine Learning, so I can say "I don't know"
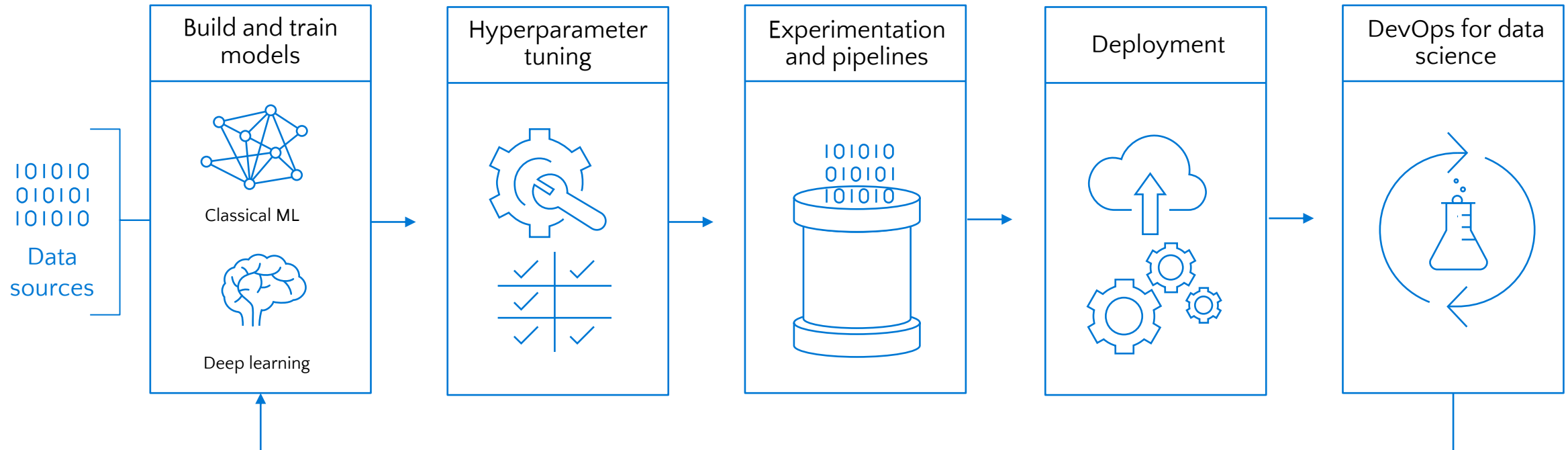
– Ridi

# Our Agenda in 30 Minutes

- Data Science Project on Microsoft Ecosystem
- DevOps for Machine Learning (MLOps)

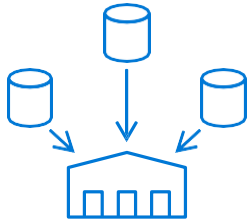# Data Science Project on Microsoft Ecosystem

# Building blocks for a Data Science Project

# Company point of view

Serving business users and end users with **intelligent** and **dynamic** applications

**Build a unified and usable data pipeline**

**Train ML and DL models to derive insights**

**Operationalize models and distribute insights at scale**

# Machine Learning on Microsoft Ecosystem

**Domain Specific Pretrained Models**
To reduce time to market

| | | | |
|---|---|---|---|
| Vision | Speech | Language | Search |

**Familiar Data Science Tools**
To simplify model development

| | | | |
|---|---|---|---|
| PyCharm | Jupyter | Visual Studio Code | Command line |

**Popular Frameworks**
To build machine learning and 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 Hardware**
To accelerate deep learning

| | | |
|---|---|---|
| CPU | GPU | FPGA |

**From the Intelligent Cloud to the Intelligent Edge**

# Cognitive Services

## Vision

Recognize, identify, caption, index, and moderate your pictures, videos, and digital ink content.

- Computer Vision
- Custom Vision
- Face
- Form Recognizer
- Ink Recognizer (Retiring)
- Video Indexer

## Language

Allow your apps to process natural language with pre-built scripts, evaluate sentiment and learn how to recognize what users want.

- Immersive Reader
- Language Understanding (LUIS)
- QnA Maker
- Text Analytics
- Translator

## Speech

Convert speech into text and text into natural-sounding speech. Translate from one language to another and enable speaker verification and recognition.

- Speech service
- - Customize with Speech Studio

## Decision

Build apps that surface recommendations for informed and efficient decision-making.

- Anomaly Detector
- Content Moderator
- Metrics Advisor (preview)
- Personalizer

## Search

Add Bing Search APIs to your apps and harness the ability to comb billions of webpages, images, videos, and news with a single API call.

- Bing Search APIs hub page

## Cognitive Service Containers

Container support in Azure Cognitive Services allows developers to use the same rich APIs that are available in Azure, and enables flexibility in where to deploy and host the services that come with Docker containers.

- Cognitive Services containers documentation
- What are Cognitive Service containers?
- Create containers for reuse
- Deploy and run container on Azure Container Instance
- Deploy to Azure Kubernetes Service
- Use Docker Compose to deploy multiple containers
- Cognitive Services containers FAQ

## Cognitive Services for Big Data

The Cognitive Services for Big Data allows developers to use cognitive services within databases to apply intelligent algorithms over large datasets

- Cognitive Services for Big Data
- Use Cognitive Services within Azure Databricks and Synapse Analytics
- Python Samples

# If you really need a custom solution

Empower data science and development teams



**Integrated data science & data engineering teams**

Desktop solutions not adequate

Need a unified big data & machine learning solution



Azure Databricks + Azure Machine Learning service



**Individual data scientists**

Desktop solutions adequate

Need cloud for sporadic compute needs

Machine Learning VMs

# Data Science Virtual Machines (DSVM)

Pre-Configured environments in the cloud for
Data Science & AI Modeling,
Development & Deployment.

Samples to get started
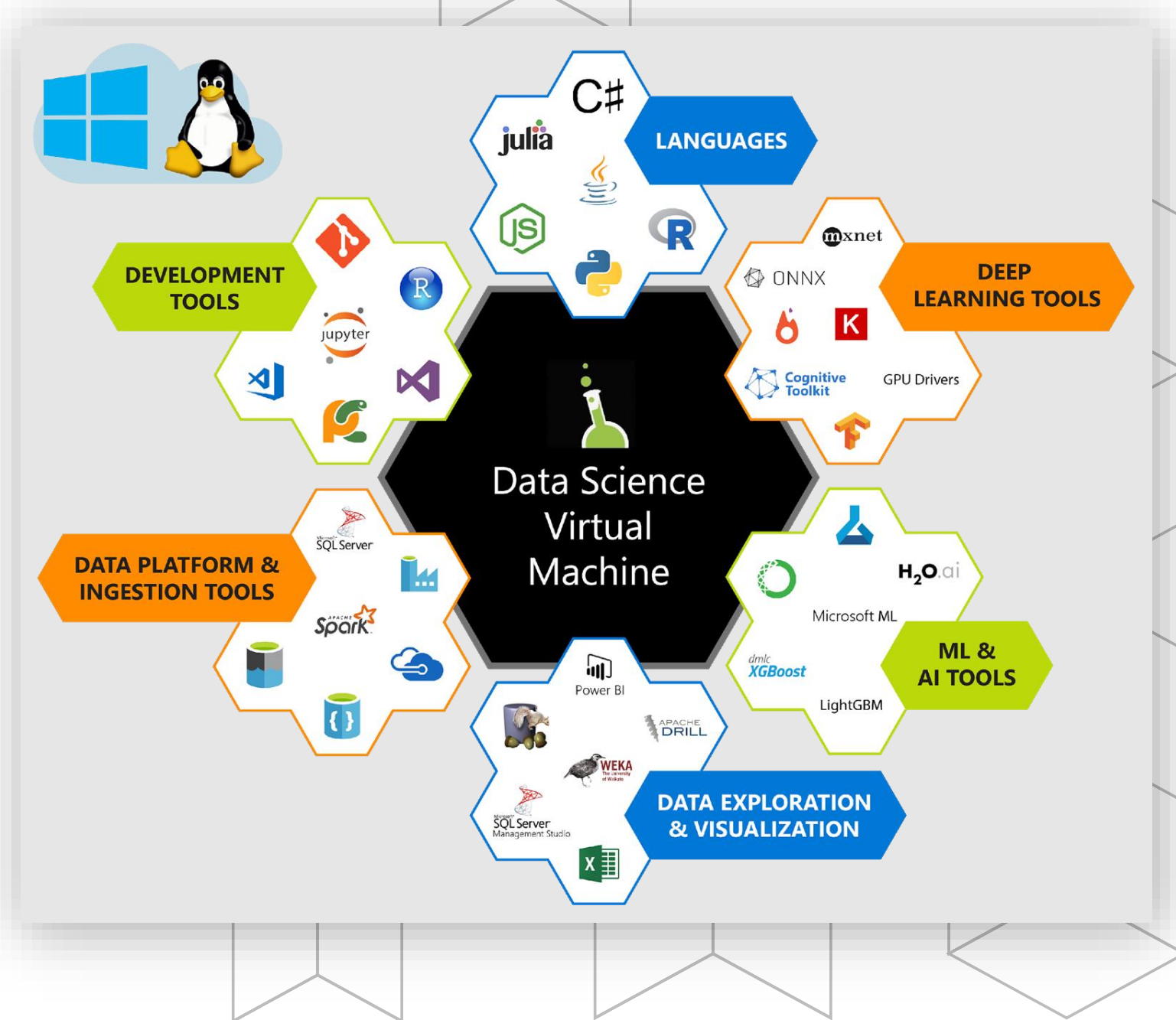
# Why Data Science VMs?


Elastic analytics desktop in the cloud
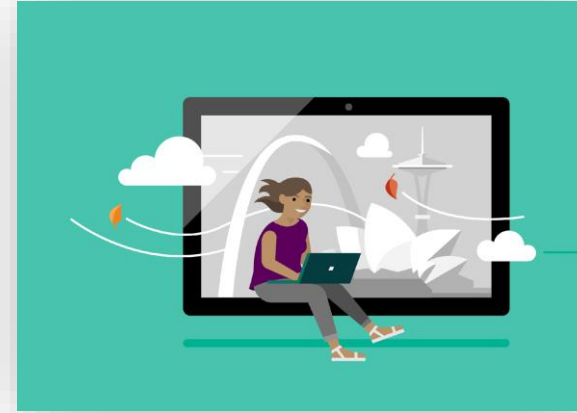

Get started quickly on Azure Machine Learning
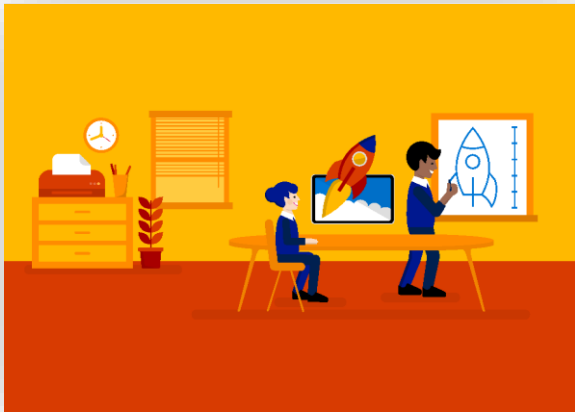

Pre-setup environment at work and school
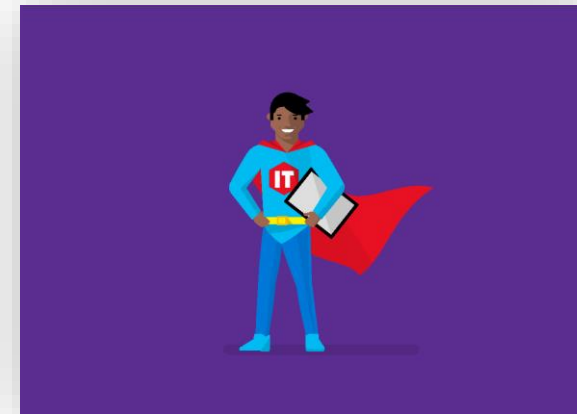

Enterprise Ready and globally available

DEMO

Preparing Data Science Virtual Machine on Azure

# Azure Machine Learning Service

Set of Azure Cloud Services **+** Python SDK

That enables you to:

✓ Prepare Data
✓ Build Models
✓ Train Models

✓ Manage Models
✓ Track Experiments
✓ Deploy Models

# Azure Databricks

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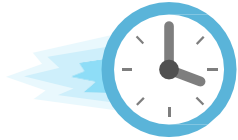
**Increase productivity**

**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

# 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

# Powerful infrastructure

## Accelerate deep learning

**CPUs**

General purpose machine learning

D, F, L, M, H Series

**GPUs**

Deep learning

N Series
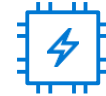
**FPGAs**

Specialized hardware accelerated deep learning

Project Brainwave

**Optimized for flexibility**                                        **Optimized for performance**

Microsoft

DEMO

Azure Machine Learning Studio

# DevOps for Machine Learning

# DevOps loop for data science



**Prepare**  **Experiment**  **Deploy**

Prepare
Data

Build model
(your favorite IDE)

Train &
Test Model

Register and
Manage Model

Build
Image

Deploy Service
Monitor Model

# DevOps loop for data science



Prepare

Prepare Data

Build model (your favorite IDE)

Train & Test Model

Register and Manage Model

Build Image

Deploy Service Monitor Model
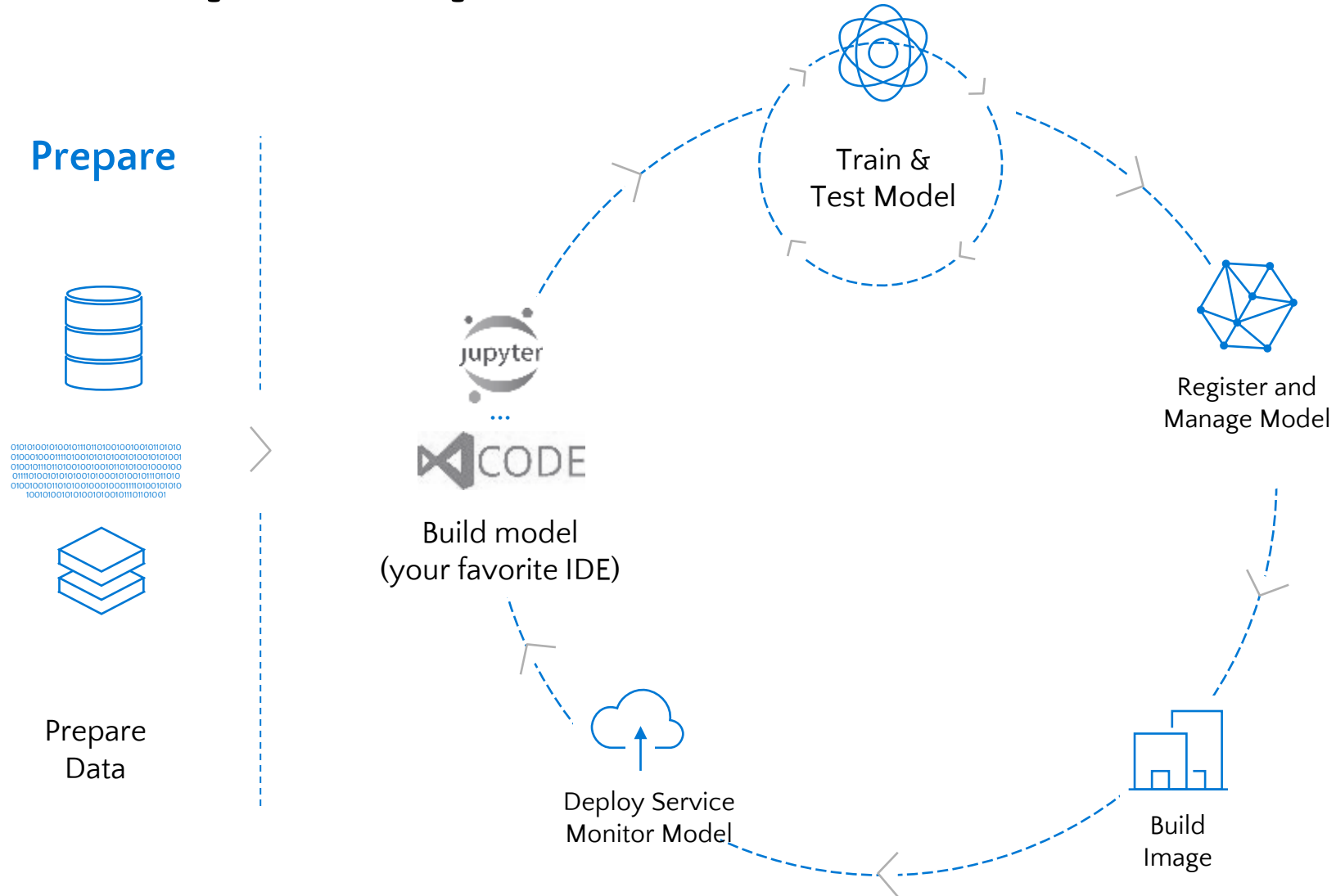
# Advantages of Azure ML Pipelines

### Unattended runs
Schedule a few steps to run in parallel or in sequence to focus on other tasks while your pipeline runs
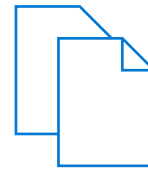
### Tracking and versioning
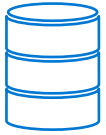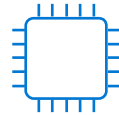Name and version your data sources, inputs and outputs with the pipelines SDK
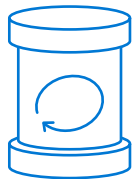
### Reusability
Create templates of pipelines for specific scenarios such as retraining and batch scoring
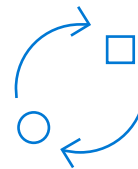
### Mixed and diverse compute
Use multiple pipelines that are reliably coordinated across heterogeneous and scalable computes and storages

# Azure Machine Learning Pipelines

**Prepare data** > **Build & train models** > **Deploy & predict**

Data ingestion

Data storage locations

Data Preparation
- Normalization
- Transformation
- Validation
- Featurization

Model building & training
- Hyper-parameter tuning
- Automatic model selection
- Model testing
- Model validation

Model deployment
- Deployment
- Batch scoring
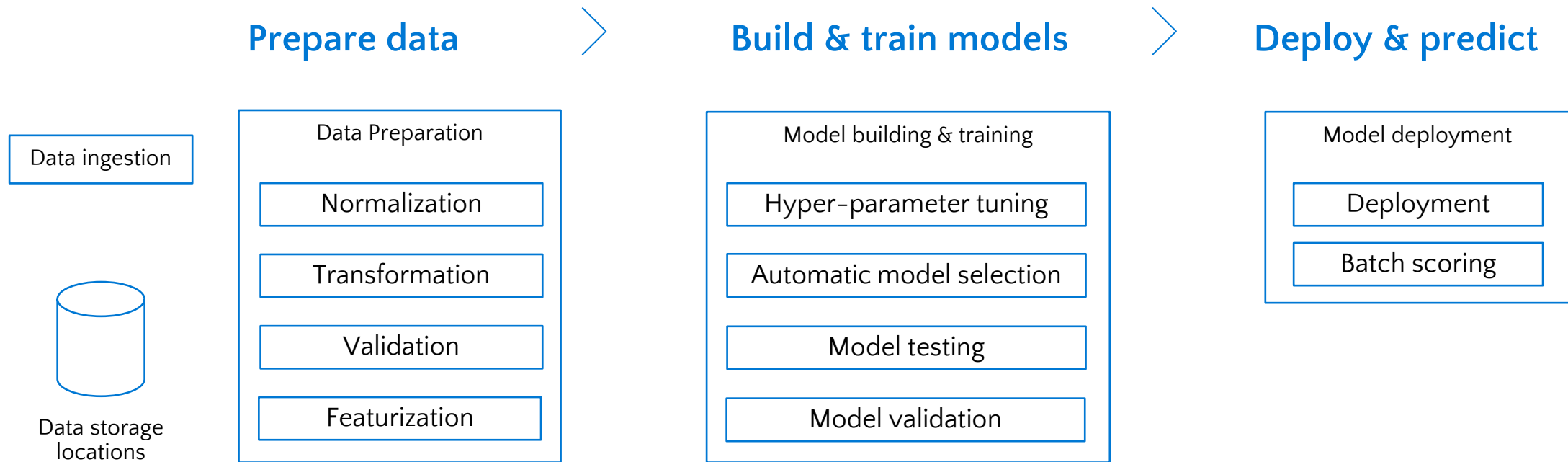
# Deployments to Compute Targets

| Compute target | Deployment type | Description |
|---|---|---|
| Azure Container Instances (ACI) | Web service | Fast deployment. Good for development or testing. |
| Azure Kubernetes Service (AKS) | Web service | Good for high-scale production deployments. Provides autoscaling, and fast response times. |
| Azure IoT Edge | IoT module | Deploy models on IoT devices. Inferencing happens on the device. |
| Field-programmable gate array (FPGA) | Web service | Ultra-low latency for real-time inferencing. |

# Case Study
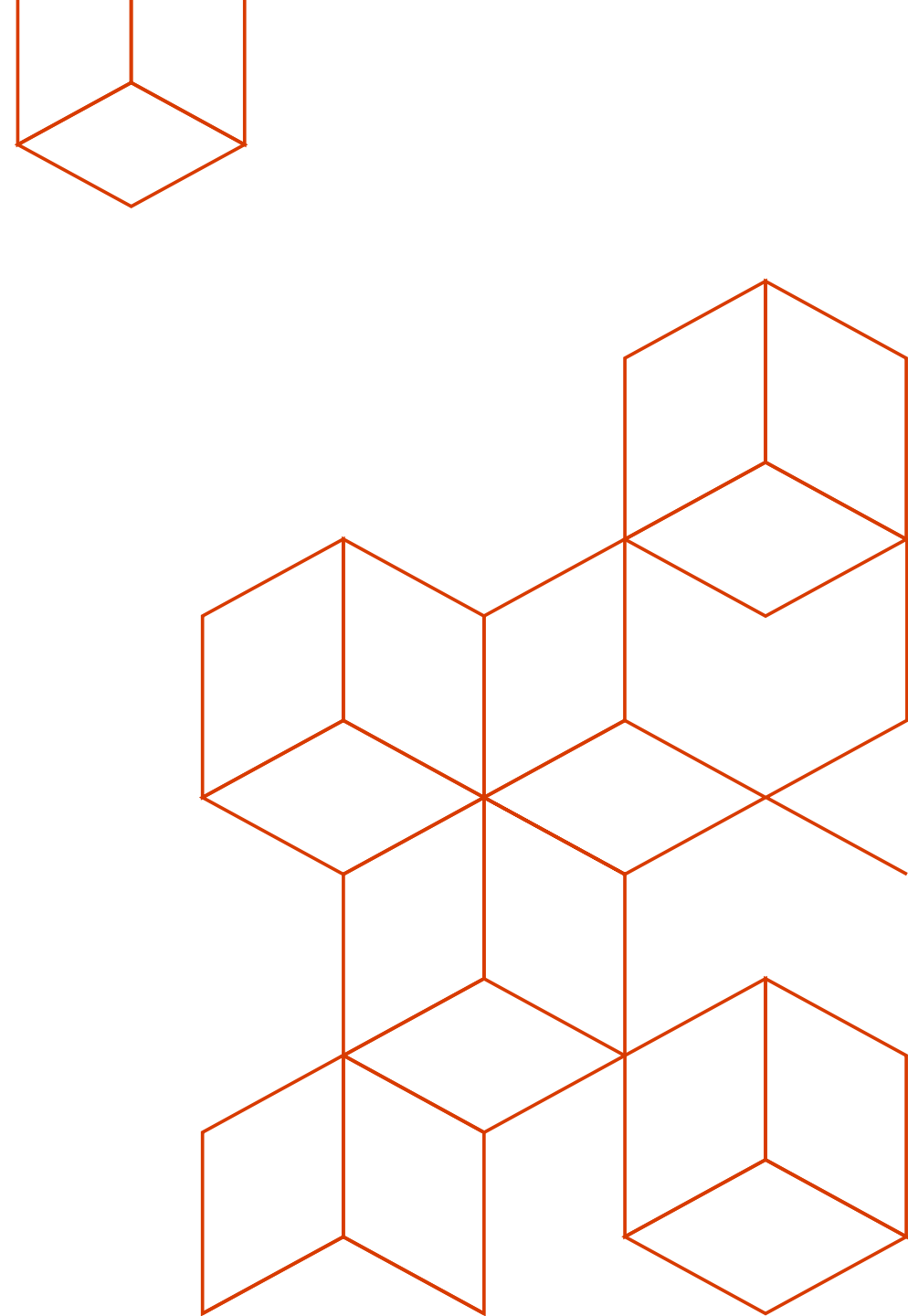
# Requirement
# Azure ML Studio

- Azure Data Blob
- Compute Instance (Standard_DS1_v2) for Notebook
- Compute Cluster (Standard_DS11_v2) for Pipeline

# Collecting the Dataset

## Dataset Collection

- **Data Resource:** Youtube Audio collected by Audioset.
- **Data Type:** An audio file (.flac) with a duration of 10 seconds
- **Amount of data :** 484
- **Data Label:** happy, sad, relaxed, tense, angry.

## Dataset Transformation

- **Transformation Method:** Mel-Frequency Cepstral Coefficients (MFCC)
- **Data training and testing:** Divide by the ratio of 8: 2
- **Data stored in Json form**

# Importing dataset to AMLS

- Azure Machine Learning Studio datasets can be added via the menu Assets → Datasets.

- The dataset will be stored on Azure Blob Storage.

- As the data changes, you can add new versions to existing dataset assets.

- The registered dataset can be used in Automated ML and Machine Learning Designer
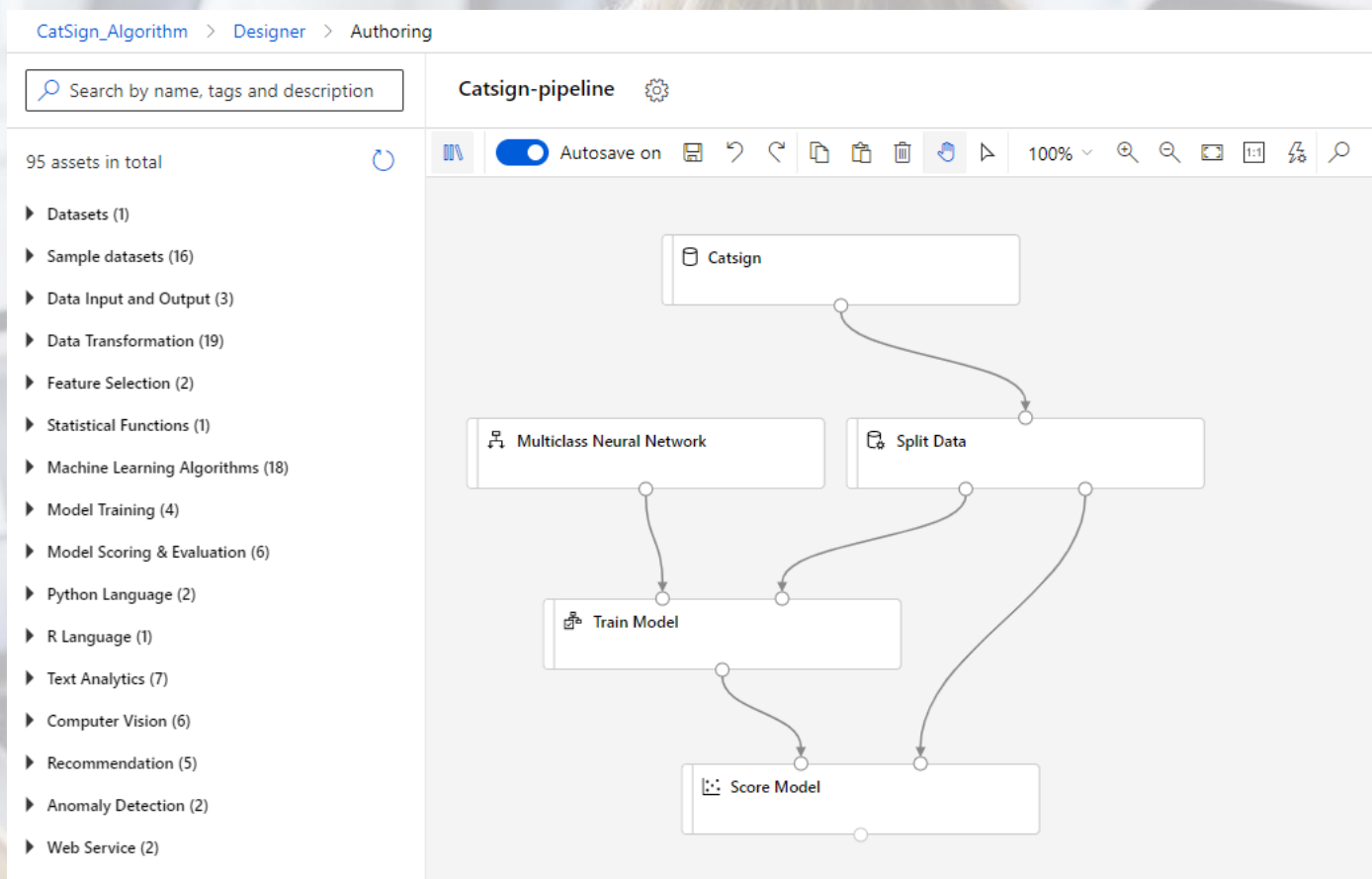
# Make a CatSign model with ML Designer

**01** Start by creating a pipeline via the Pipelines menu on the sidebar.
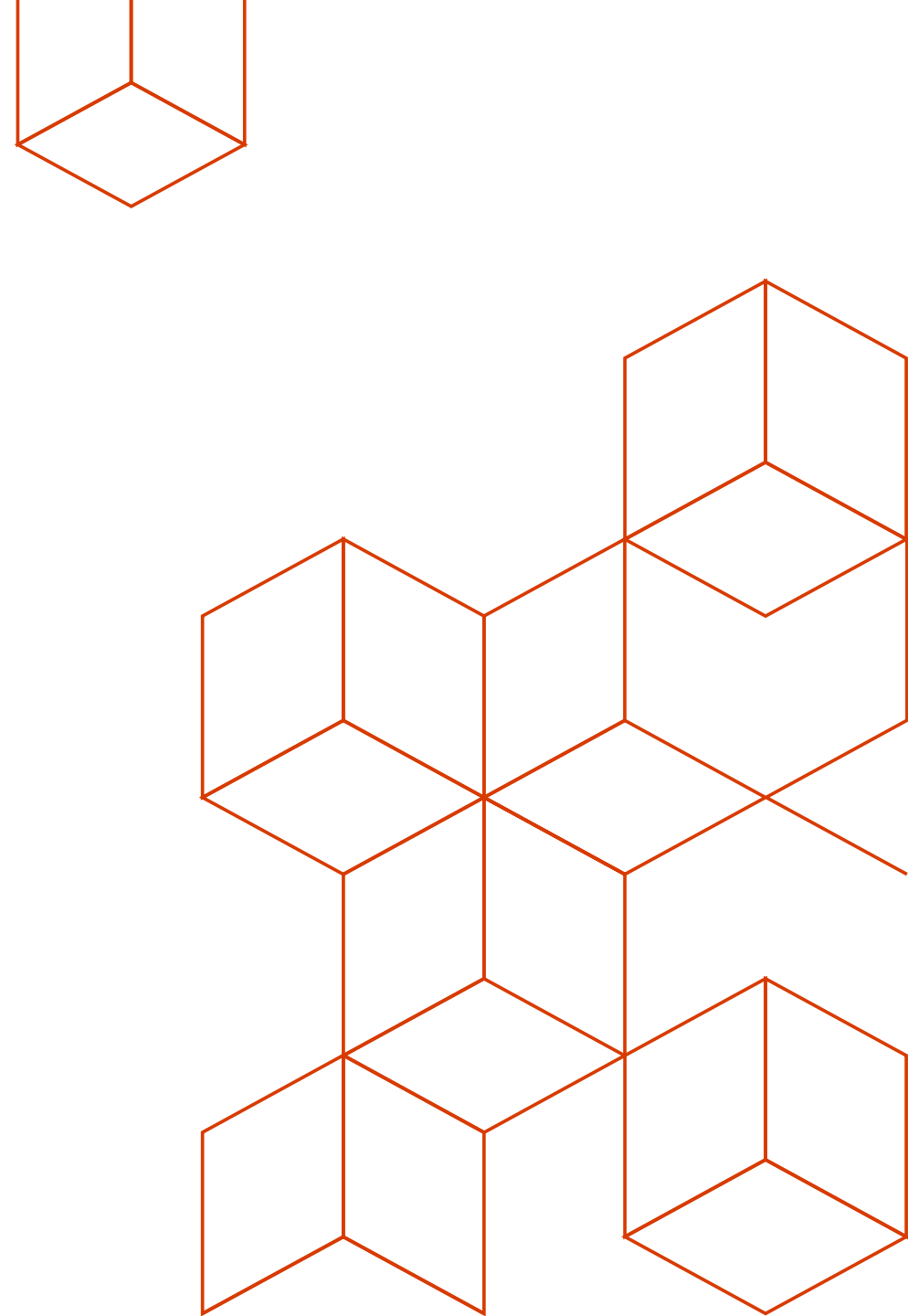
**02** Select the Compute Cluster created for the compute source

**03** Select datasets, model algorithms, and tasks for training and evaluation



CatSign_Algorithm > Designer > Authoring

Search by name, tags and description

**Catsign-pipeline**

Autosave on    100%

95 assets in total

- Datasets (1)
- Sample datasets (16)
- Data Input and Output (3)
- Data Transformation (19)
- Feature Selection (2)
- Statistical Functions (1)
- Machine Learning Algorithms (18)
- 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)

Catsign

Multiclass Neural Network

Split Data
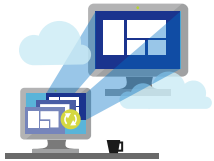
Train Model

Score Model

# Summary

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

Seamlessly integrated with the Azure Portfolio

# Resources beyond this AI Airlift

**Azure Machine Learning with Azure Databricks**
**https://aka.ms/aml-notebook-databricks-e2e**

**Azure Notebooks**
**https://notebooks.azure.com/azureml/projects/azureml-getting-started**

**Azure ML Docs**
**https://docs.microsoft.com/en-us/azure/machine-learning/service/**