

Module 6 - Unsupervised Learning
Deep Learning

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Objectives of This Module

Upon completion of this module, you will understand:

1. Unsupervised Learning
2. Deep Learning
3. MLOps

Fall 2022

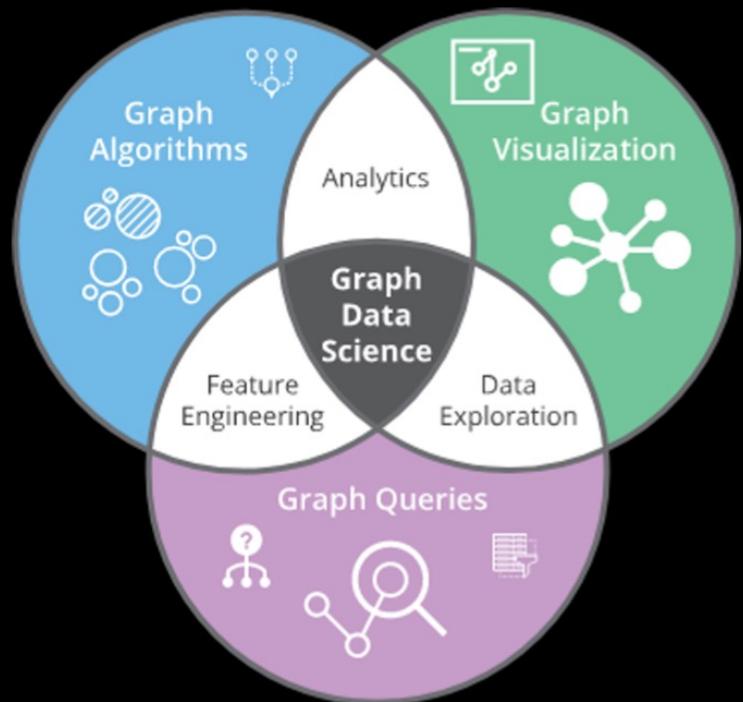
BAIM 4200 Advanced Business Analytics

- This course will give students the language, knowledge, and actionable methods to work alongside technical and non-technical members of your team to create AI solutions.
- Students will explore what it means to design artificial intelligence systems as a team, guided by a clear intent and a focus on people. This course will give you the framework and tools you need to recognize responsible AI design, align your team, and work with data sources to start building AI solutions.
- Students will learn the tools, technology, and practices that enable cross-functional AI teams to efficiently deploy, monitor, retrain, and govern models in production systems.

Re-cap

1. Graph Data Science
2. Agile Development
3. Ethical (Responsible) AI

What is Graph Data Science?



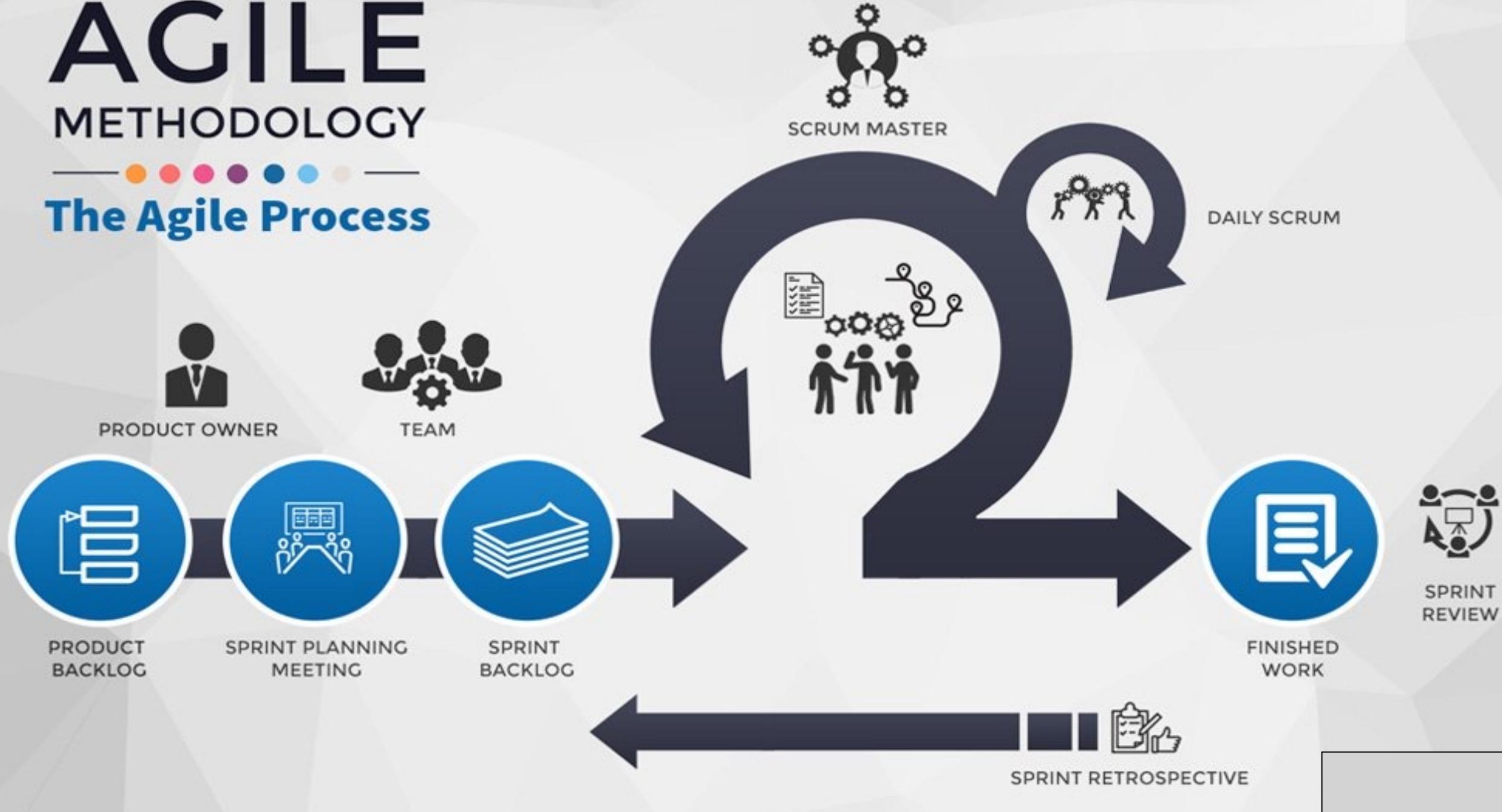
Graph Data Science is a science-driven approach to gain knowledge from the relationships and structures in **data**, typically to power predictions.

Data scientists use relationships to answer questions.

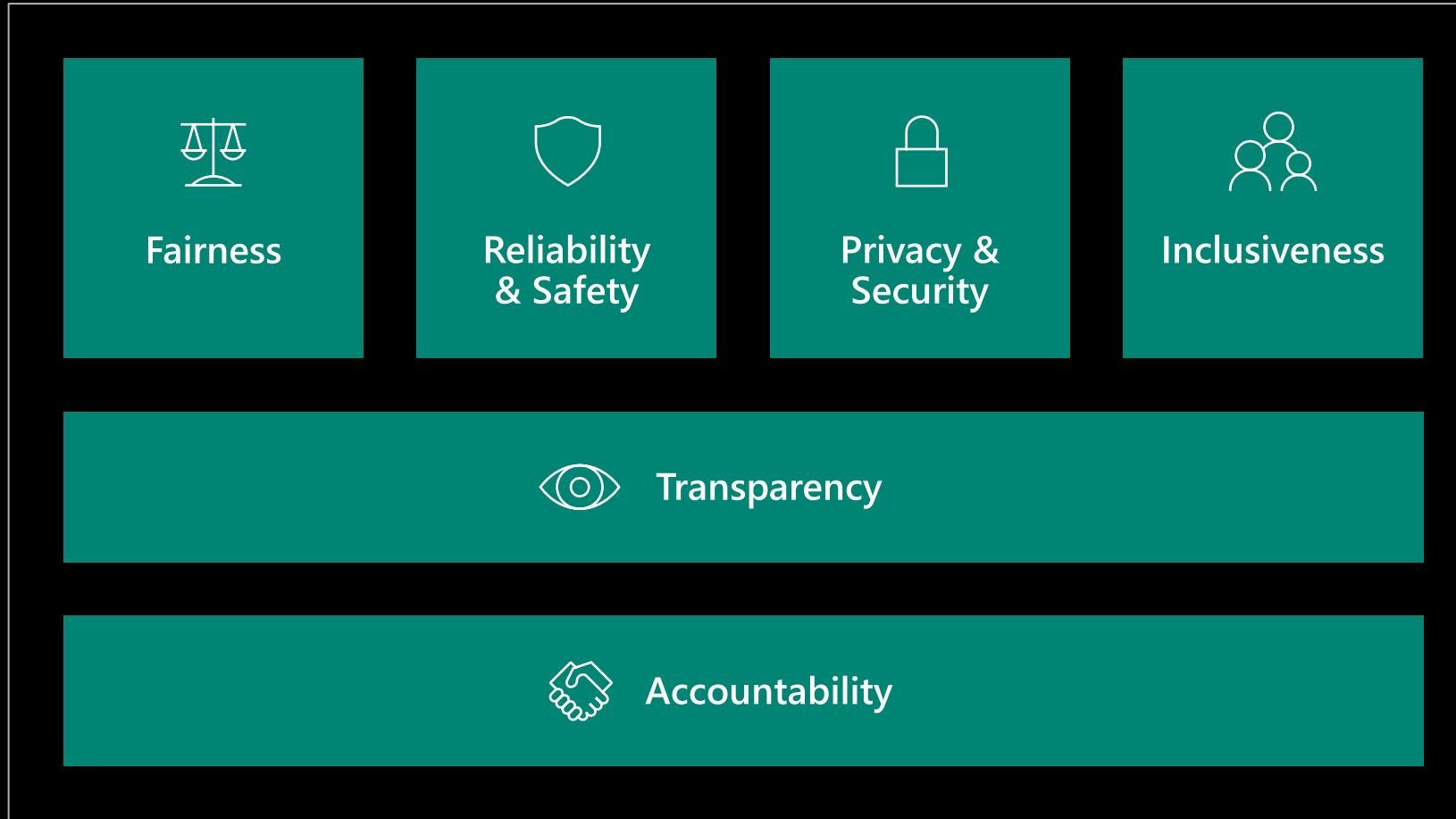
AGILE METHODOLOGY

The Agile Process

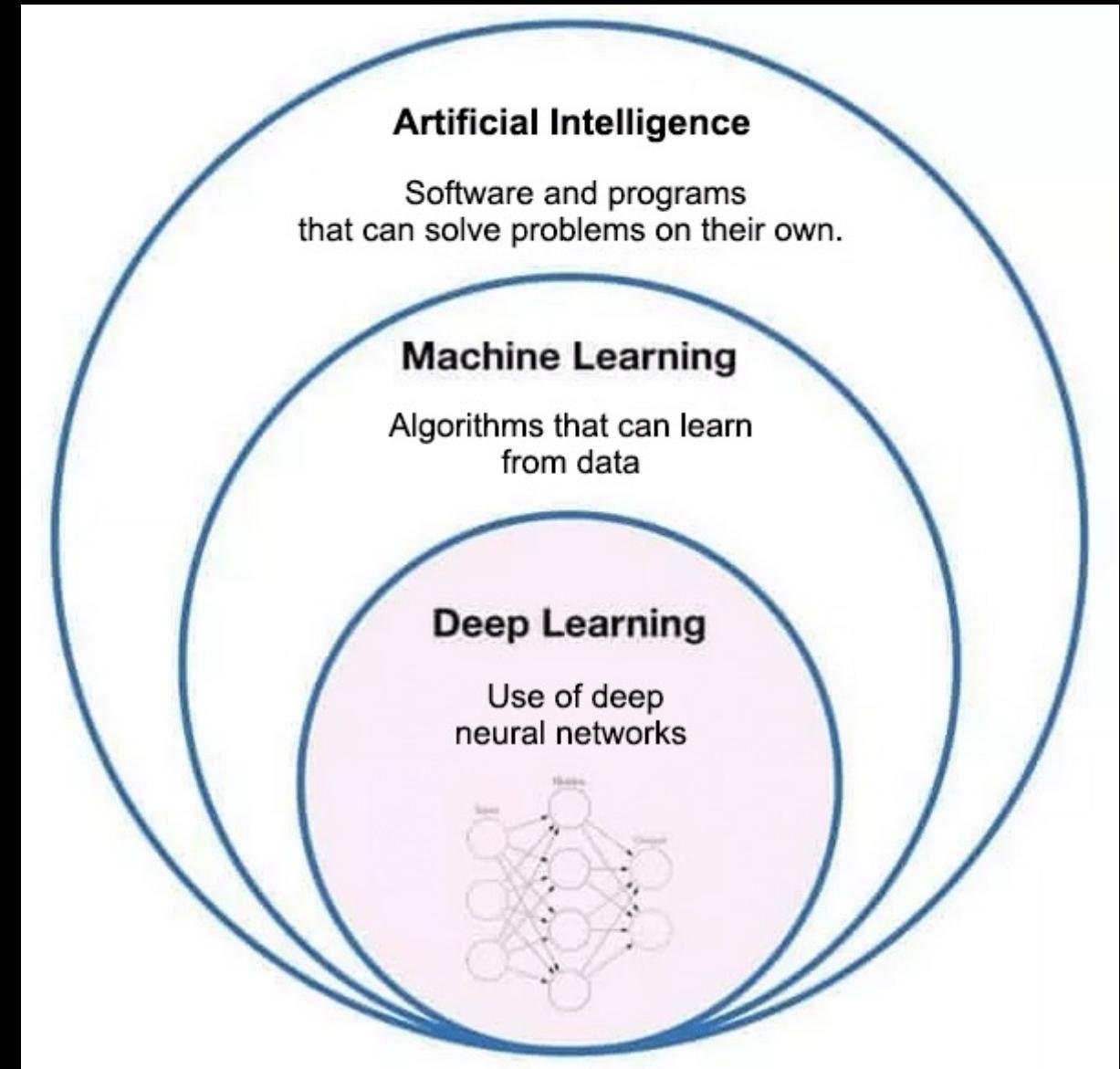
<https://www.youtube.com/watch?v=OJflDE6OaSc>



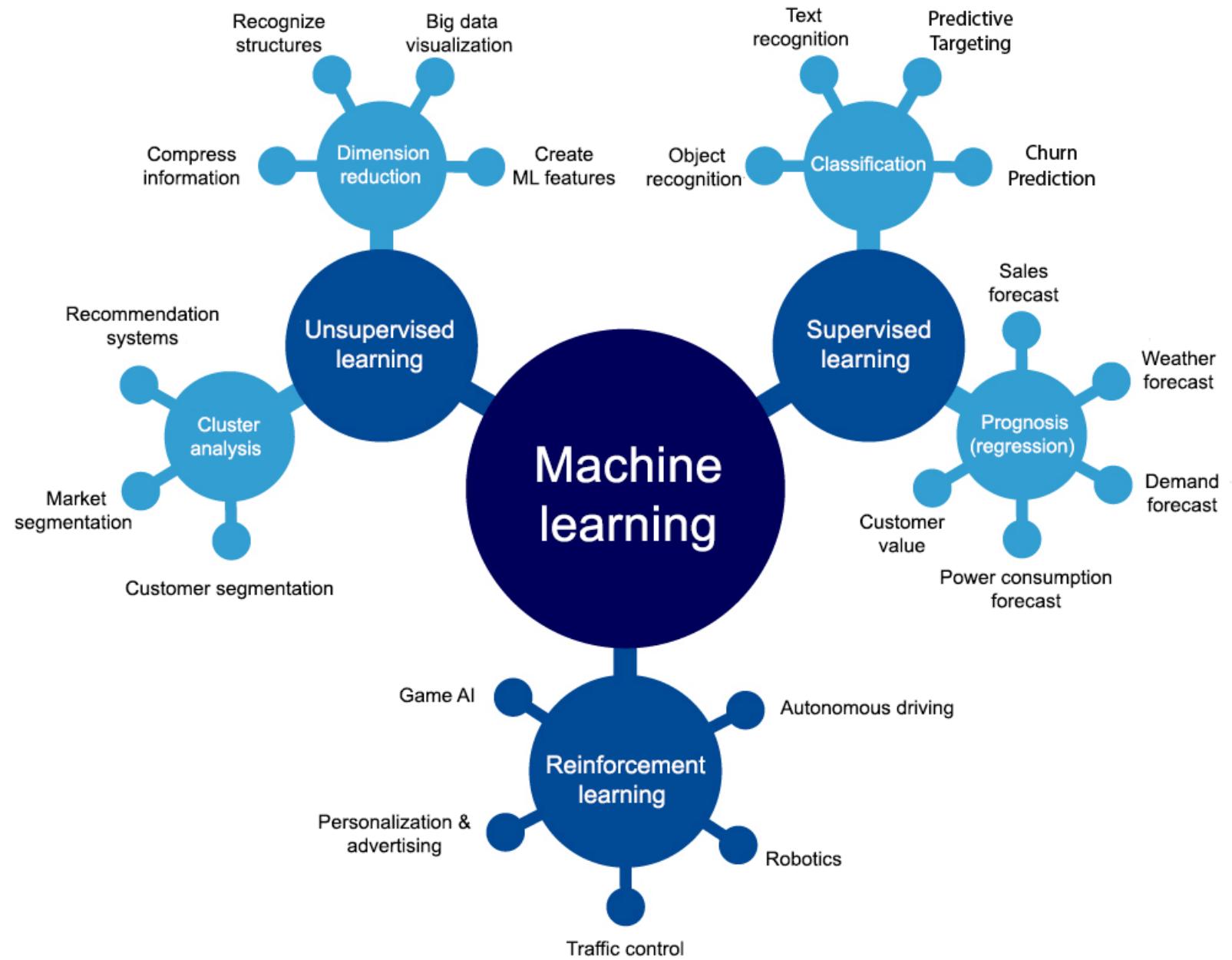
Microsoft's Responsible AI principles



What we know

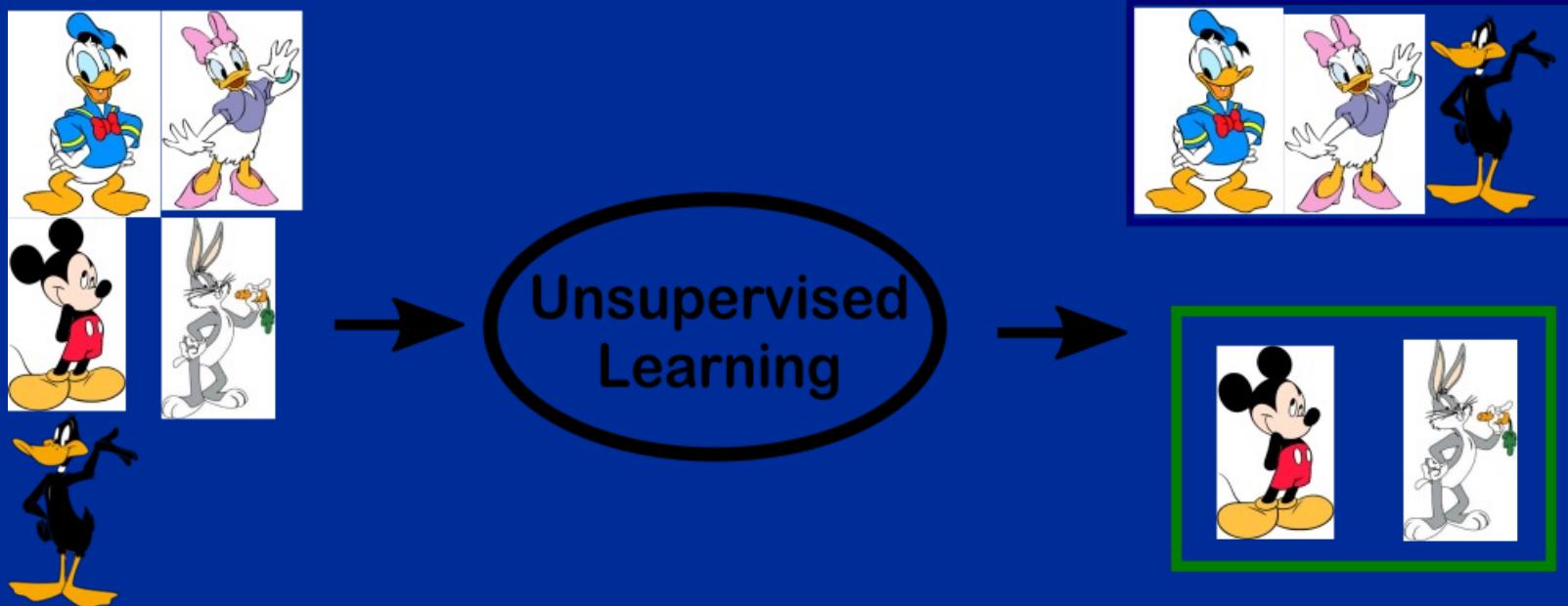


Machine Learning



Unsupervised Learning

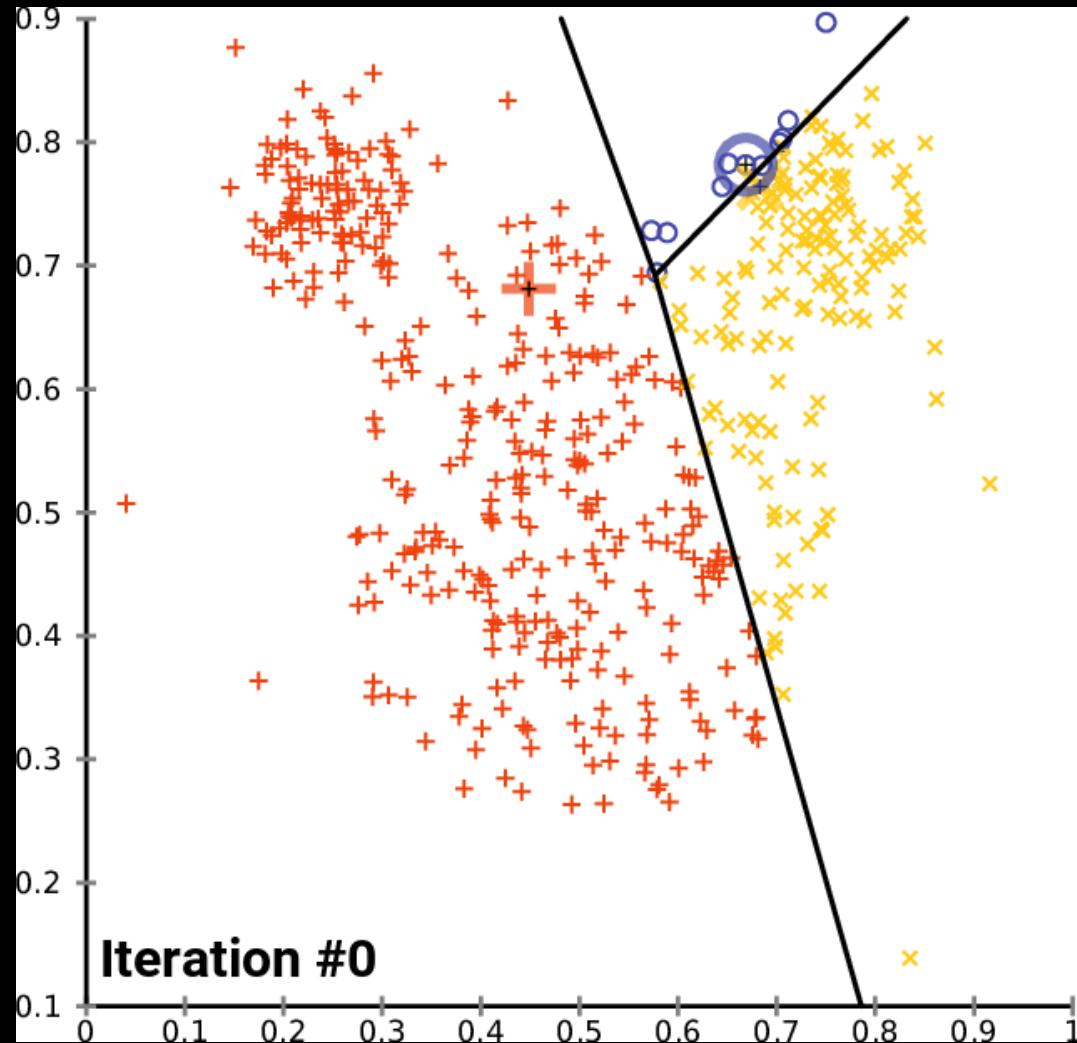
Machine learning task of inferring a function to describe hidden structure from “unlabeled” data



Common scenarios include:

- Data Exploration
- Outlier Detection
- Pattern Recognition

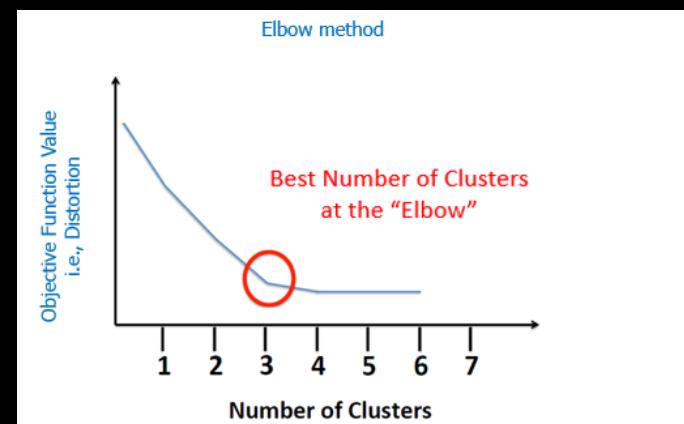
Unsupervised Learning



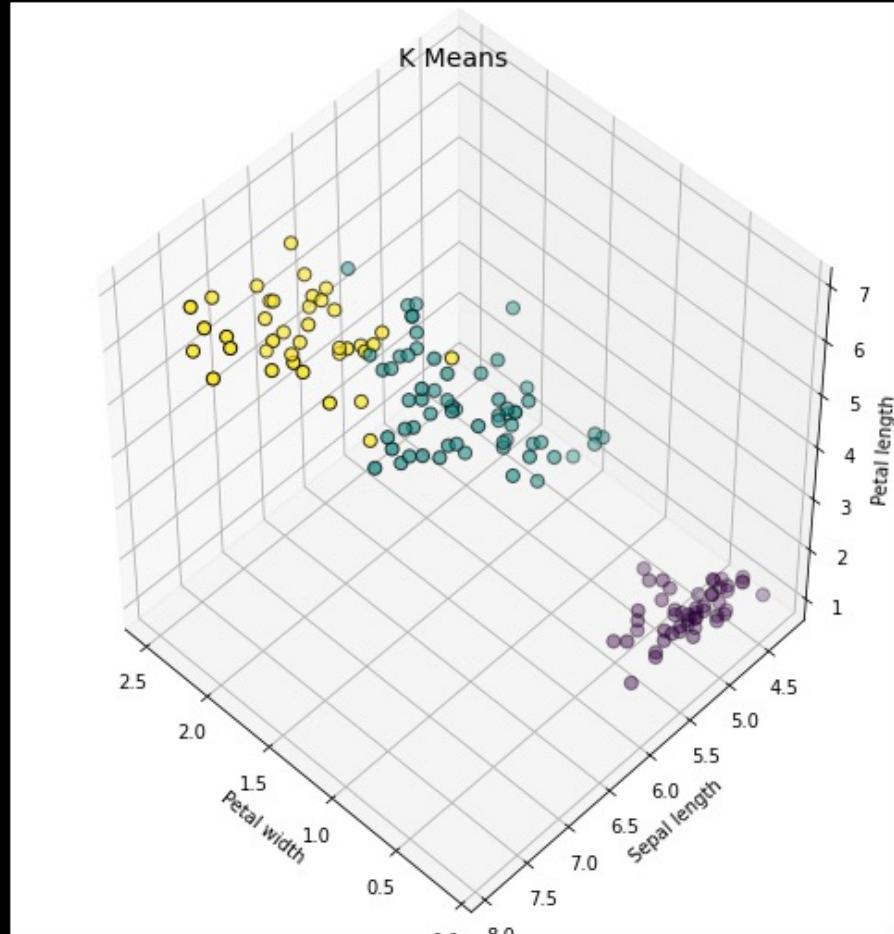
K-Means clustering:

This algorithms involve you telling the algorithms how many possible cluster (or K) there are in the dataset.

The algorithm then iteratively moves the k-centers and selects the datapoints that are closest to that centroid in the cluster.



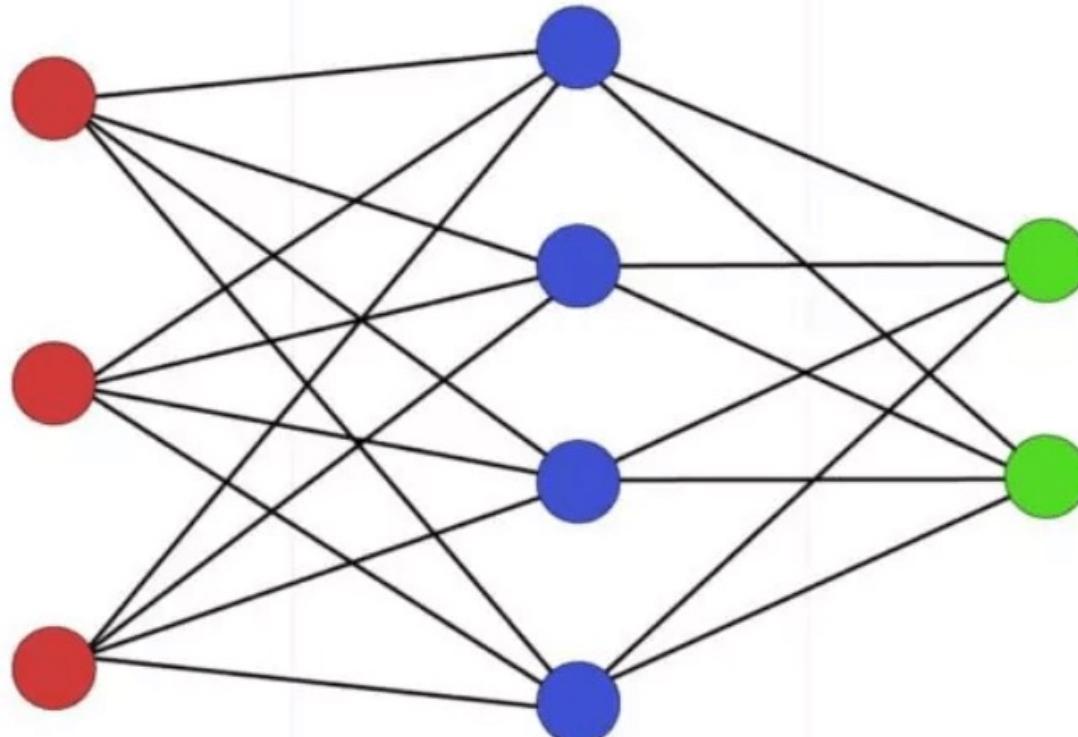
Unsupervised Learning



```
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
import numpy as np
%matplotlib inline
from sklearn import datasets#Iris Dataset
iris = datasets.load_iris()
X = iris.data#KMeans
km = KMeans(n_clusters=3)
km.fit(X)
km.predict(X)
labels = km.labels_#Plotting
fig = plt.figure(1, figsize=(7,7))
ax = Axes3D(fig, rect=[0, 0, 0.95, 1], elev=48, azim=134)
ax.scatter(X[:, 3], X[:, 0], X[:, 2],
c=labels.astype(np.float), edgecolor="k", s=50)
ax.set_xlabel("Petal width")
ax.set_ylabel("Sepal length")
ax.set_zlabel("Petal length")
plt.title("K Means", fontsize=14)
```

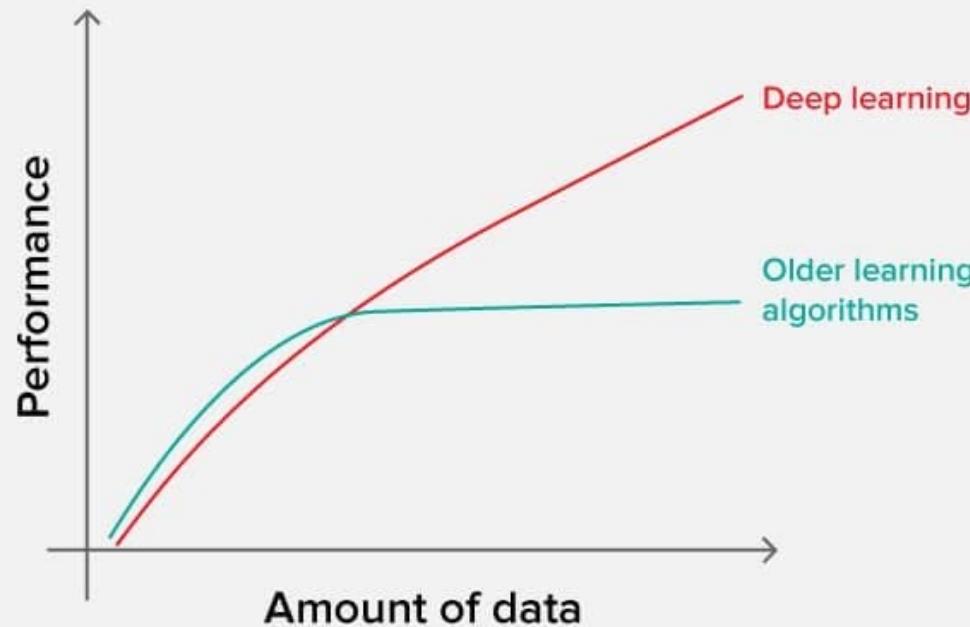
Deep Learning

input layer hidden layer output layer



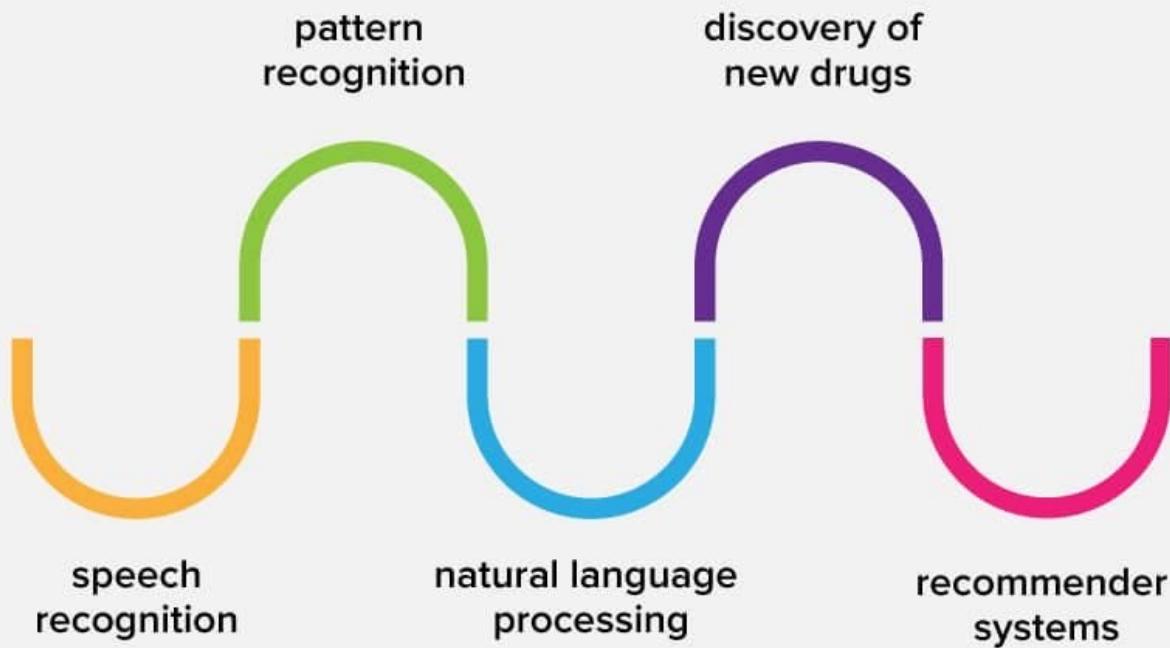
Deep Learning

Why deep learning

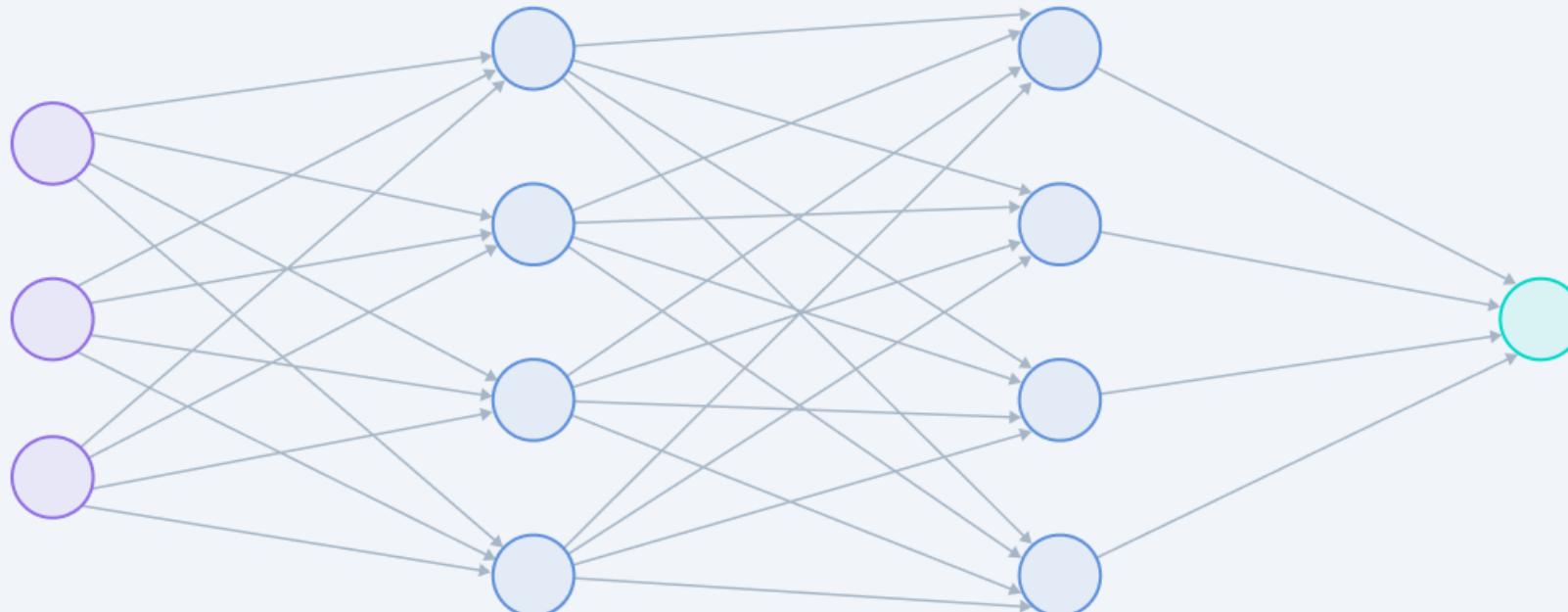


Deep Learning

Applications of deep learning



Deep Learning



Input Layer

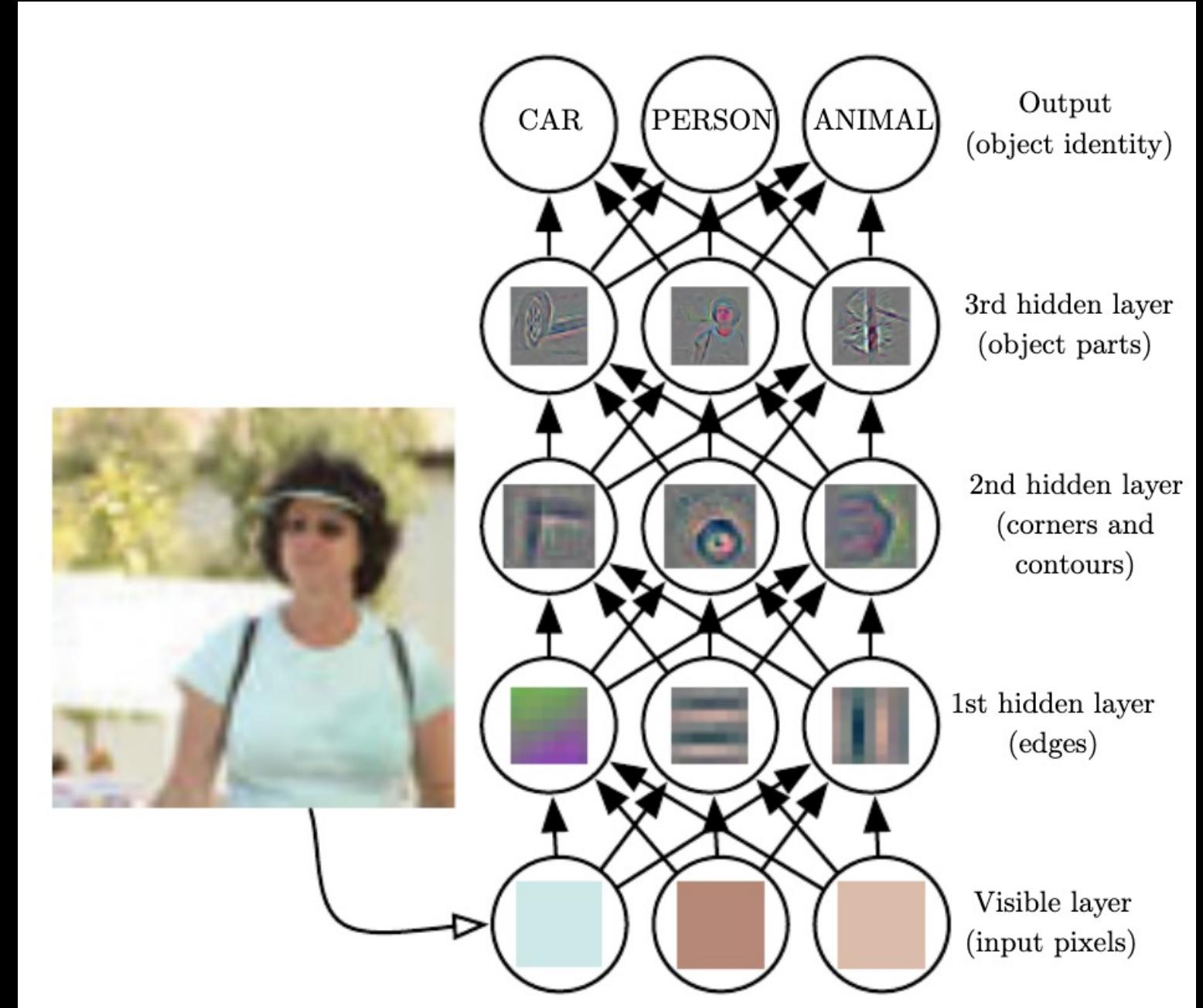
Hidden Layer 1

Hidden Layer 2

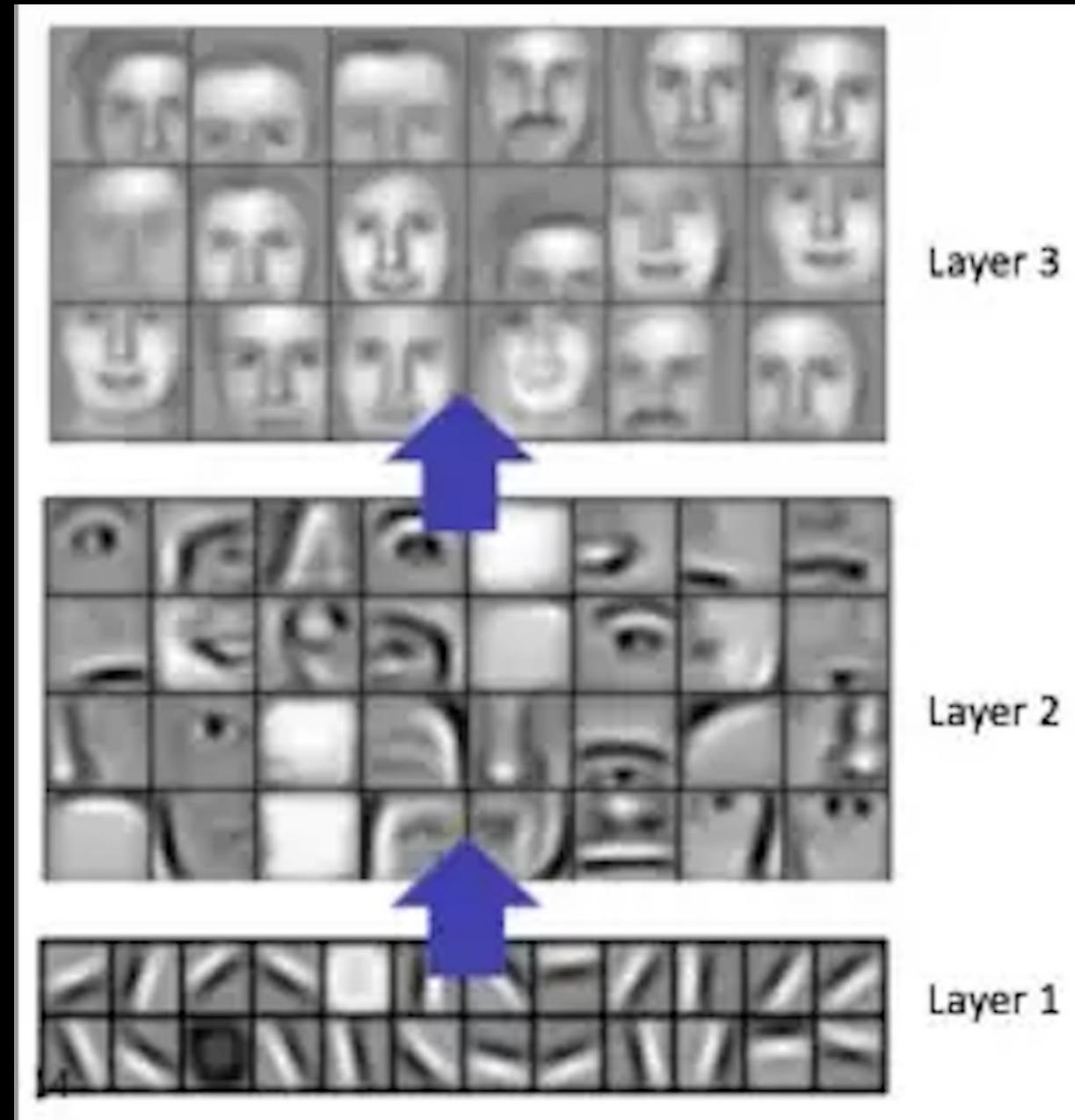
Output Layer

V7 Labs

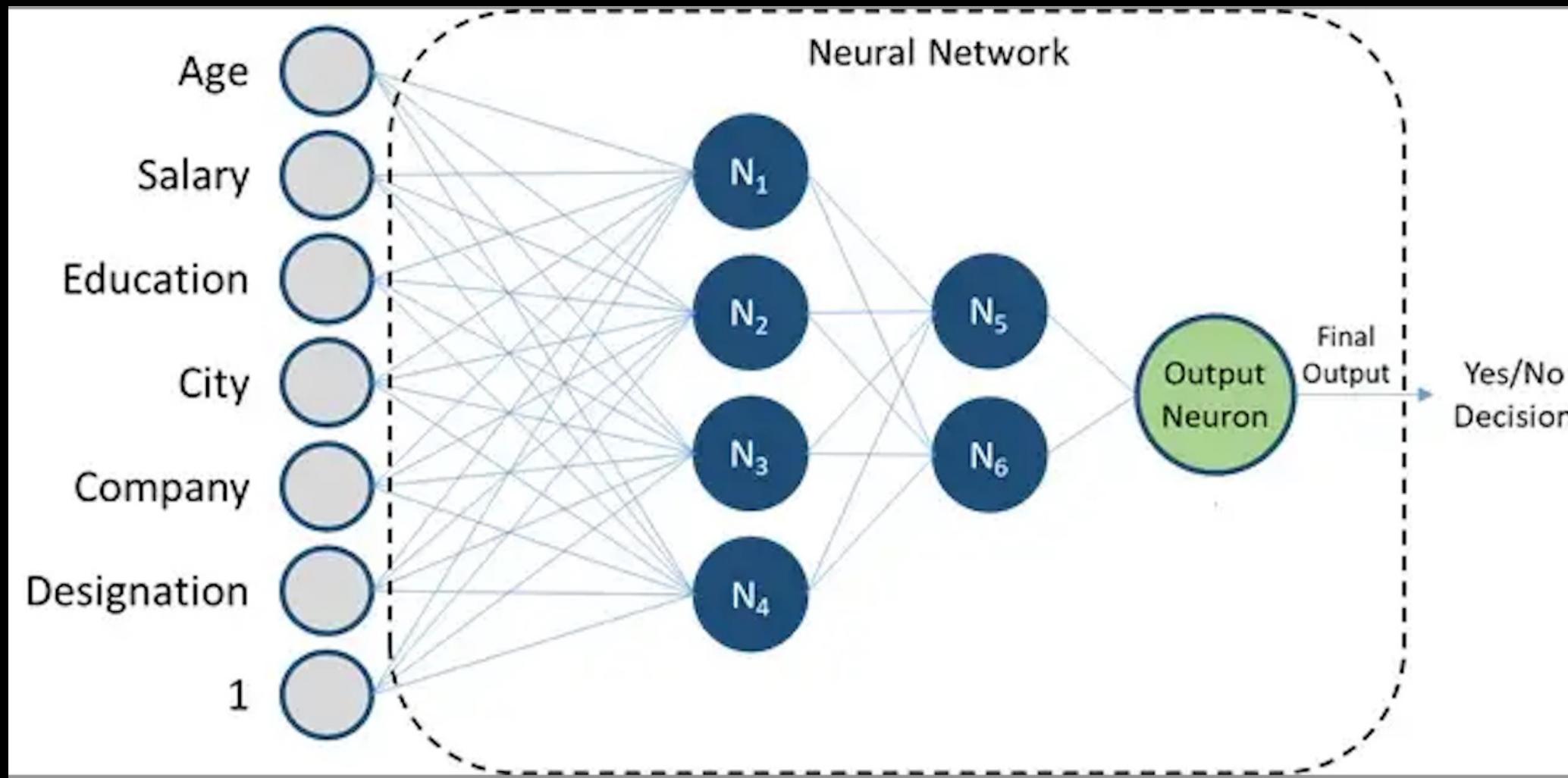
Deep Learning



Deep Learning

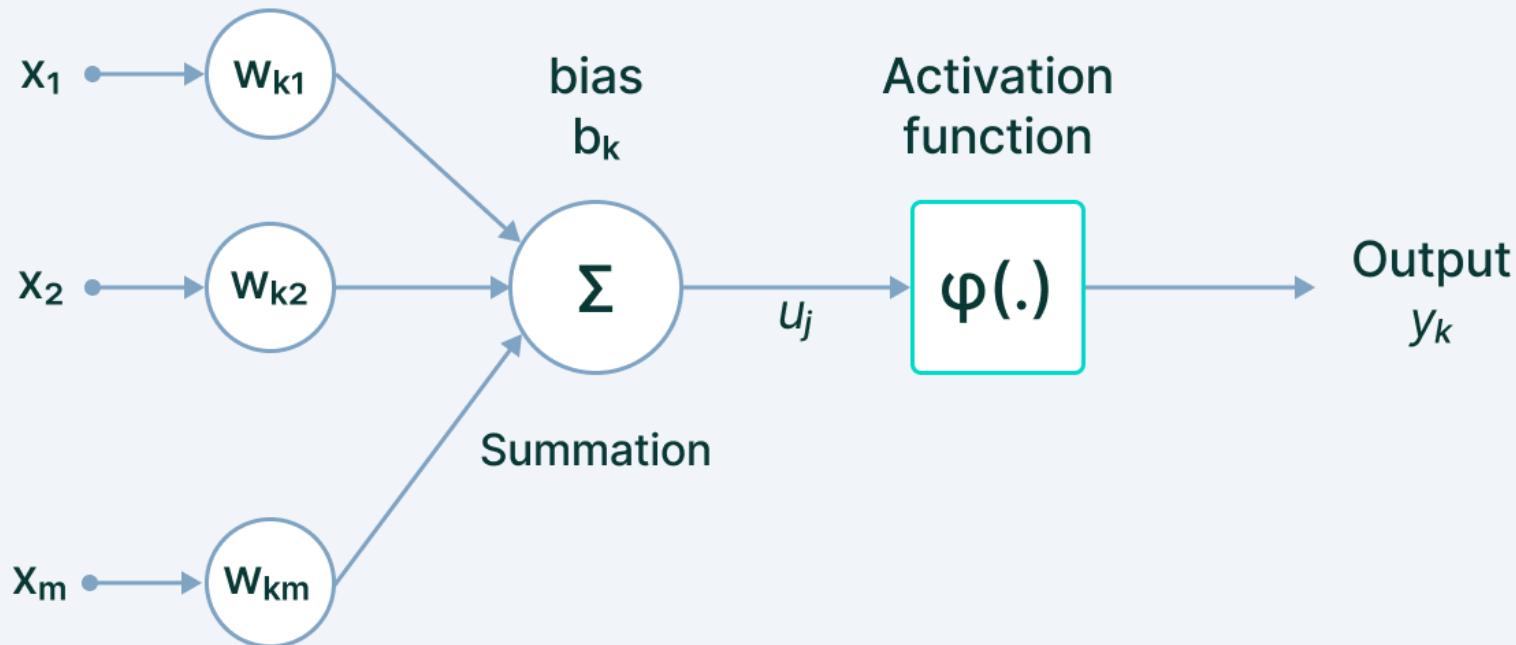


Deep Learning



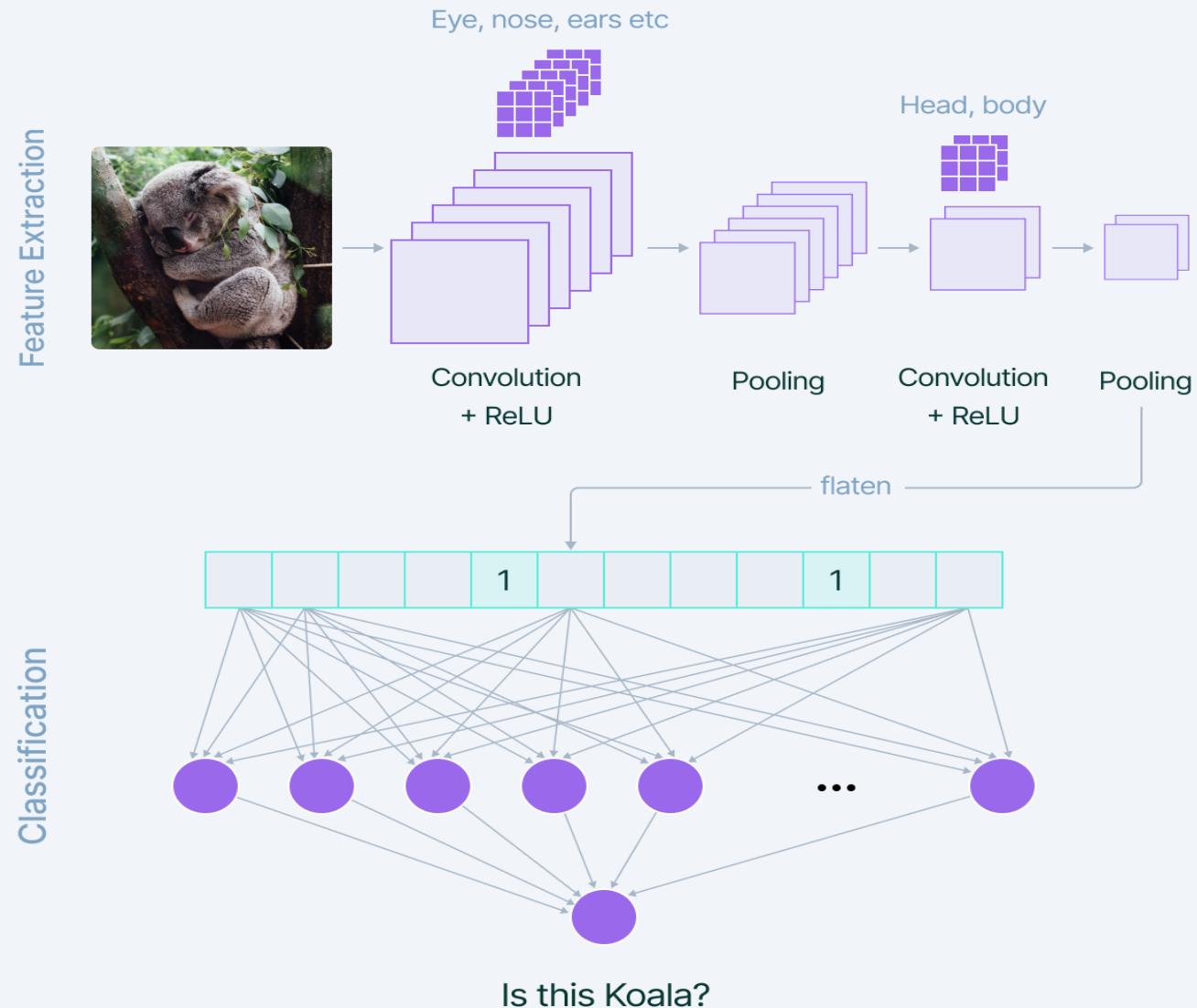
Deep Learning

Neuron



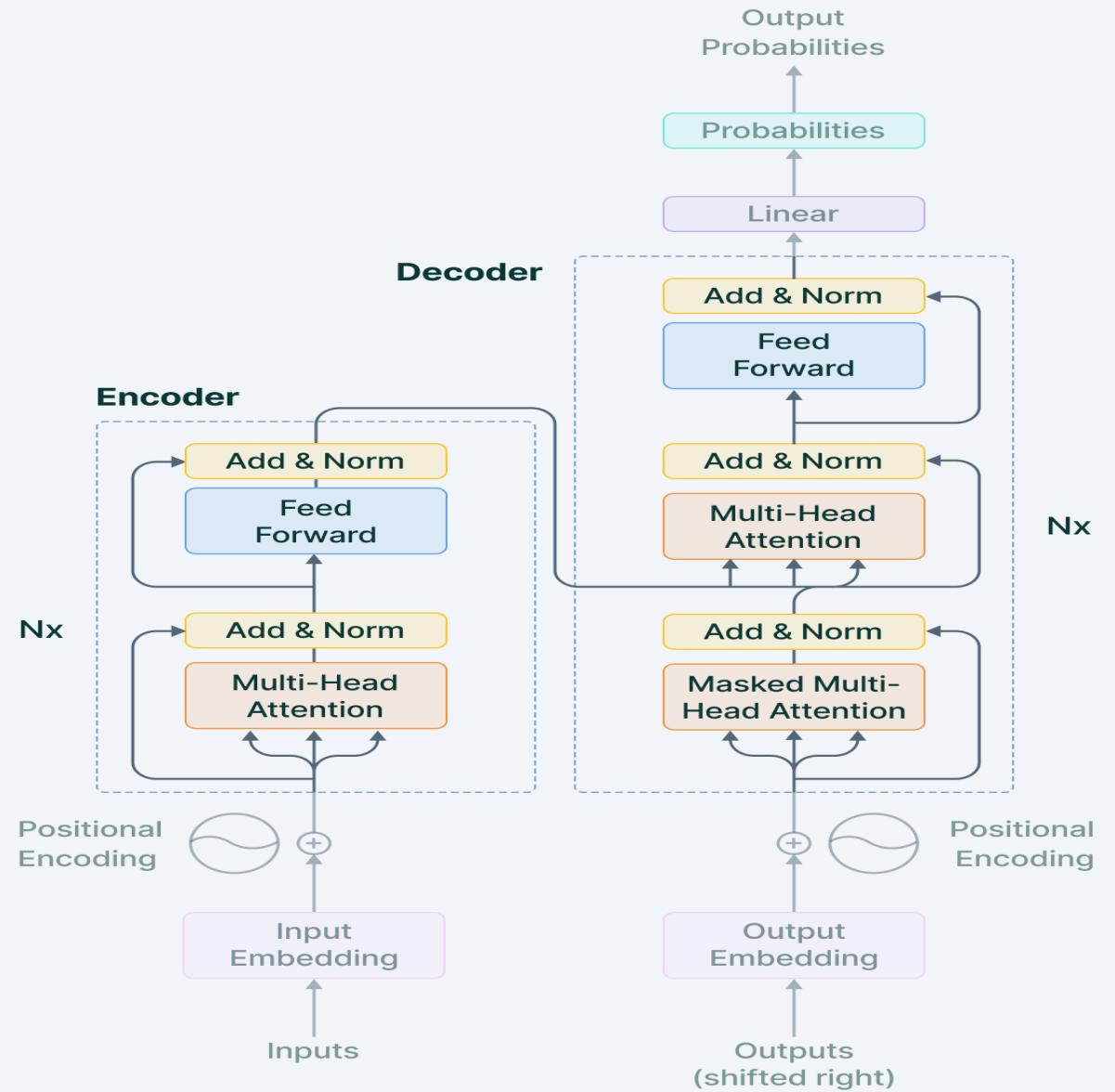
Deep Learning

Convolutional Neural Networks

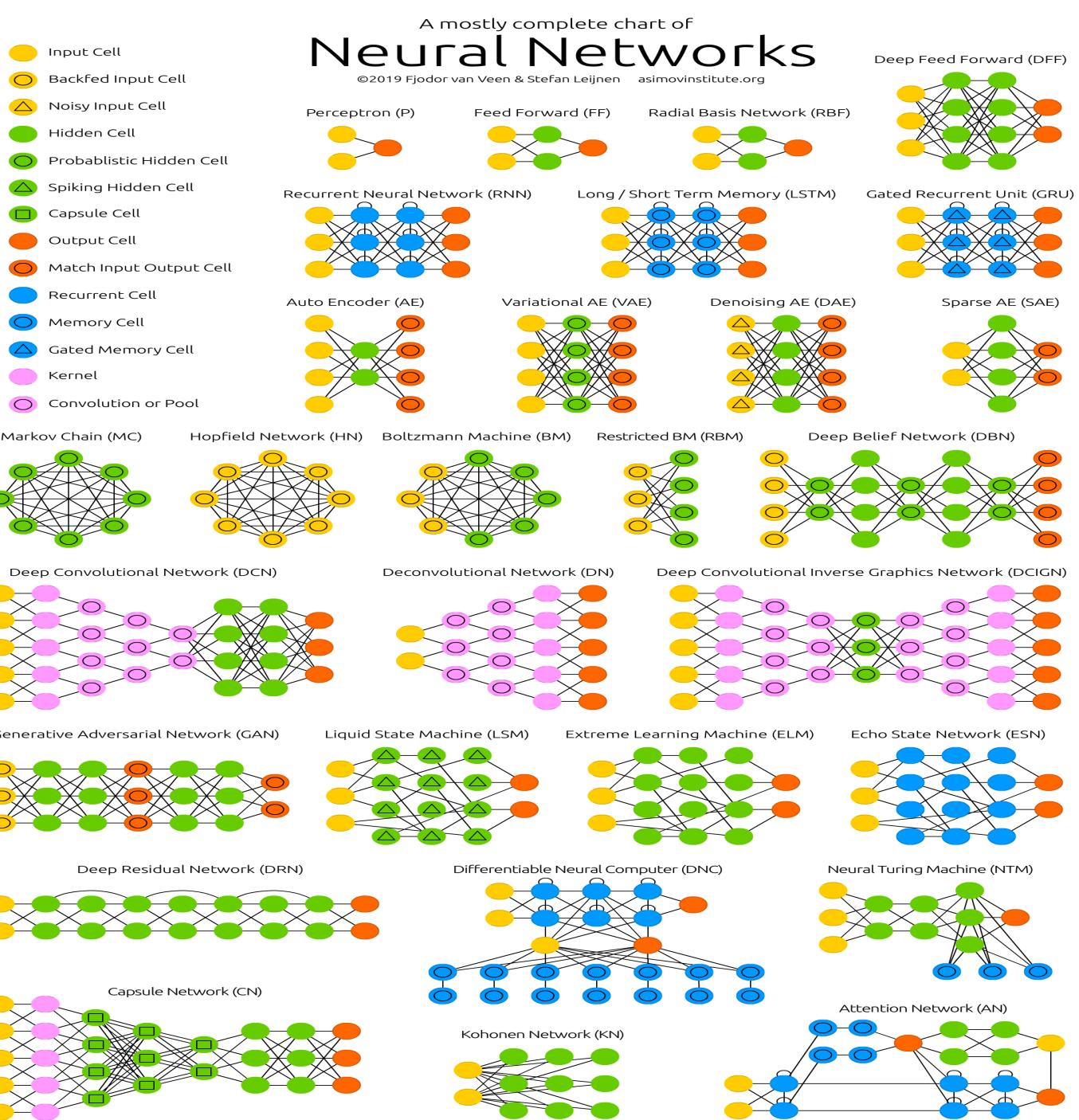


Deep Learning

Transformer Neural Networks



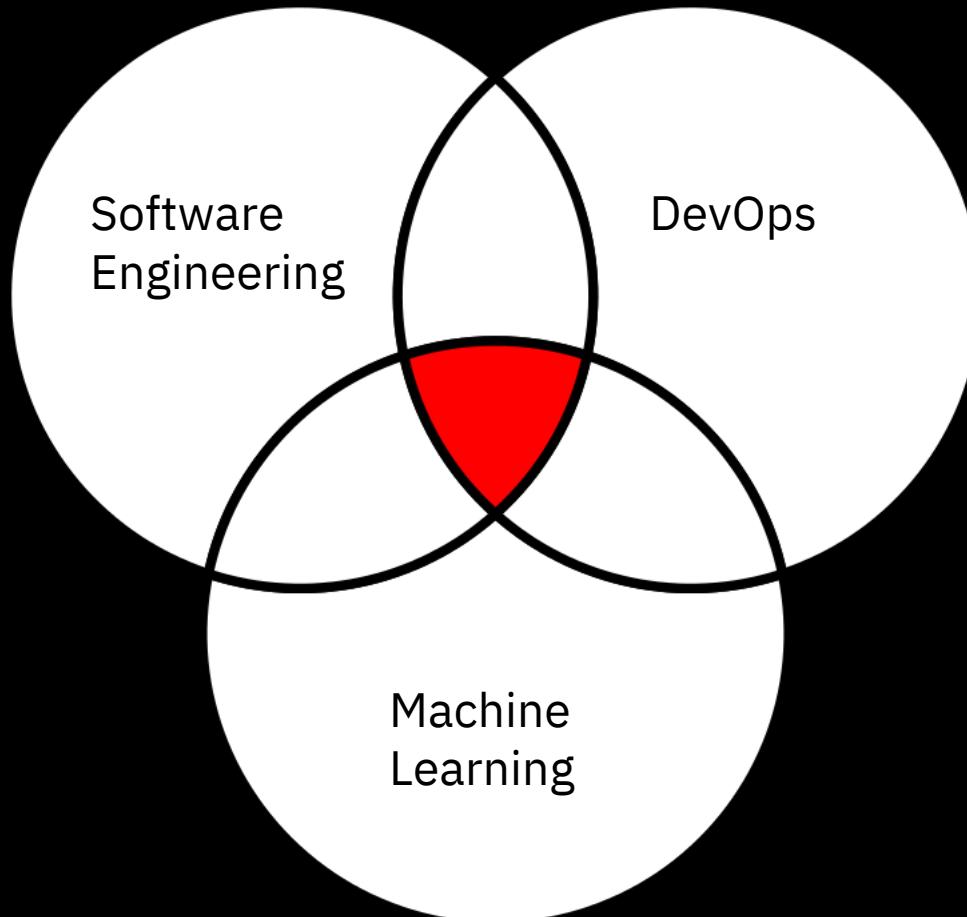
Deep Learning



MLOps

MLOps is

Mlops is the
convergence of
Software
Engineering,
Machine learning
& DevOps



Requirements to Achieve MLOps

Reproducible

Must be able to **re-train** a 9-month-old model to within few %

Accountable

Must be able to **track back** from model in Production to its provenance

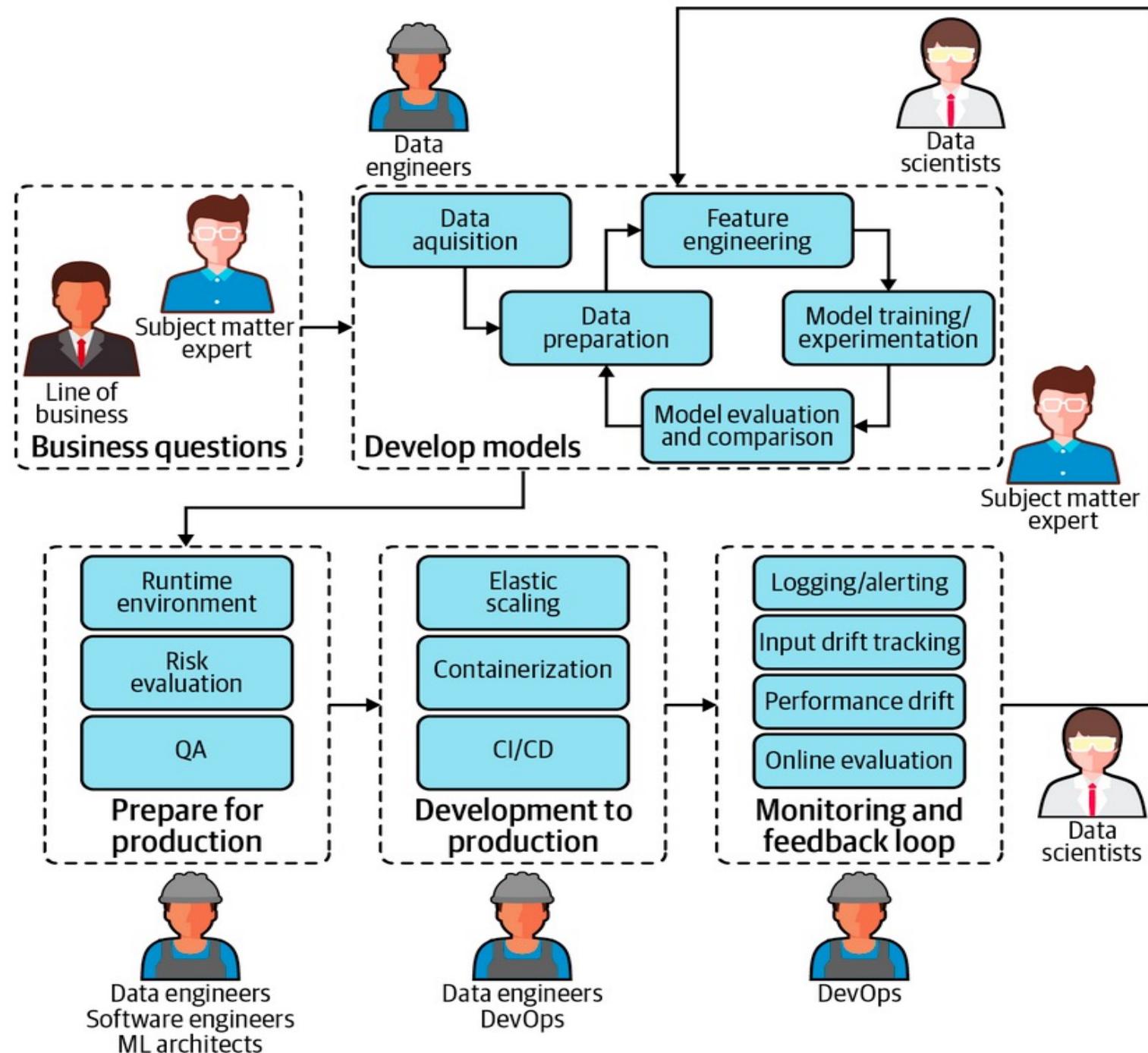
Collaborative

Must be able to do **asynchronous** collaboration

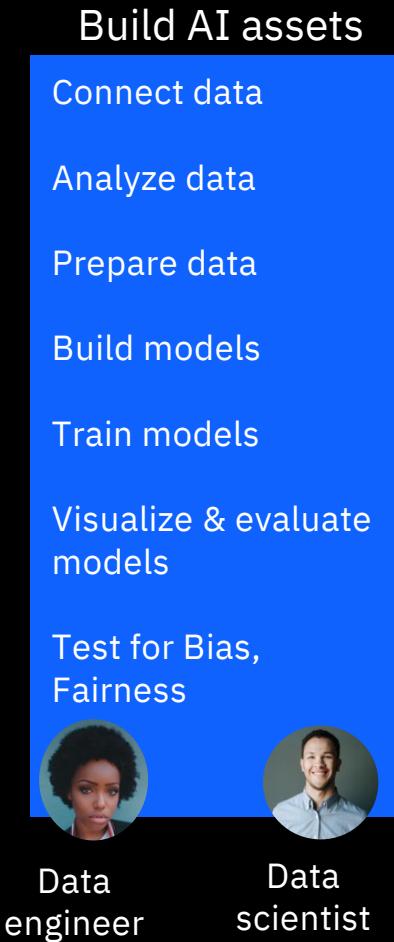
Continuous

Must be able to **deploy automatically** & monitor statistically

Enterprise ML Lifecycle

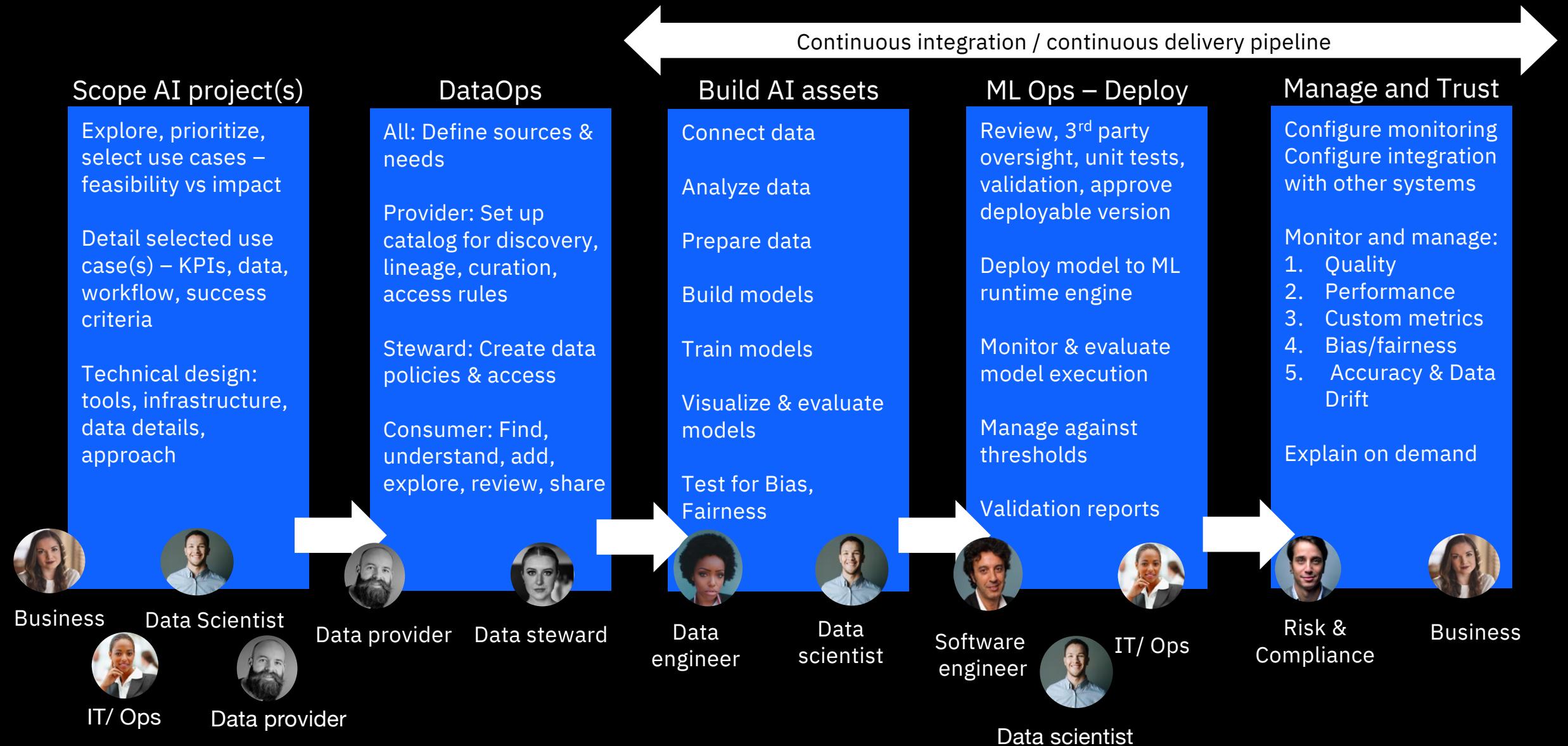


Creating an AI/ML model for a proof-of-concept looks like this...

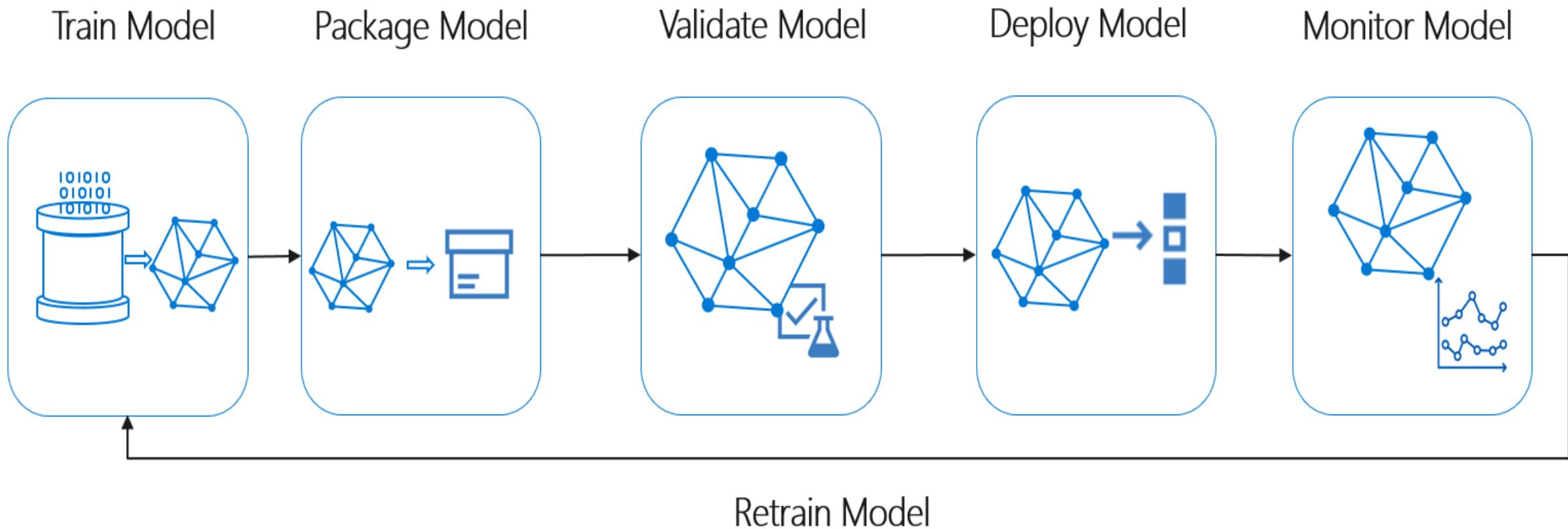


But this is not the complete AI lifecycle!

Stages in Operationalizing AI



Azure MLOps



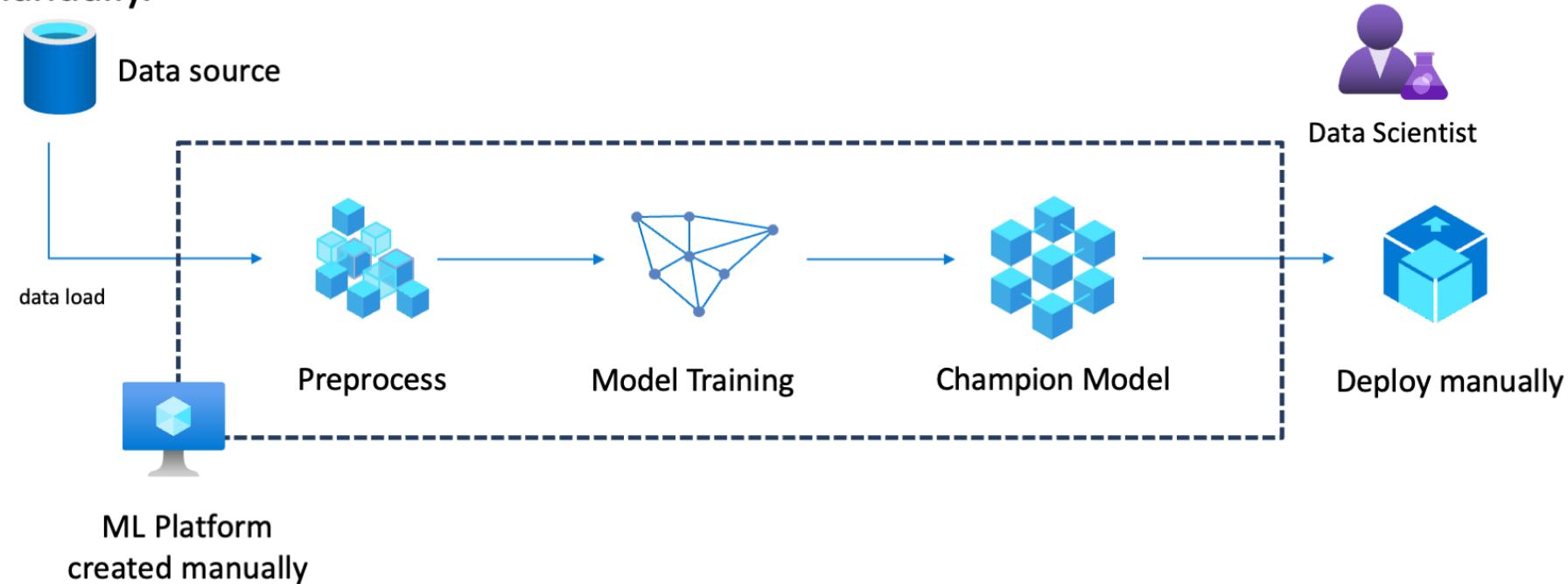
MLOps Maturity Model with Azure Machine Learning

Maturity Level	Training Process	Release Process	Integration into app
Level 0 - No MLOps	Untracked, file is provided for handoff	Manual, hand-off	Manual, heavily DS driven
Level 1 - DevOps no MLOps	Untracked, file is provided for handoff	Manual, hand-off to SWE	Manual, heavily DS driven, basic integration tests added
Level 2 - Automated Training	Tracked, run results and model artifacts are captured in a repeatable way	Manual release, clean handoff process, managed by SWE team	Manual, heavily DS driven, basic integration tests added
Level 3 - Automated Model Deployment	Tracked, run results and model artifacts are captured in a repeatable way	Automated, CI/CD pipeline set up, everything is version controlled	Semi-automated, unit and integration tests added, still needs human signoff
Level 4 - Full MLOps Automated Retraining	Tracked, run results and model artifacts are captured in a repeatable way, retraining set up based on metrics from app	Automated, CI/CD pipeline set up, everything is version controlled, A/B testing has been added	Semi-automated, unit and integration tests added, may need human signoff

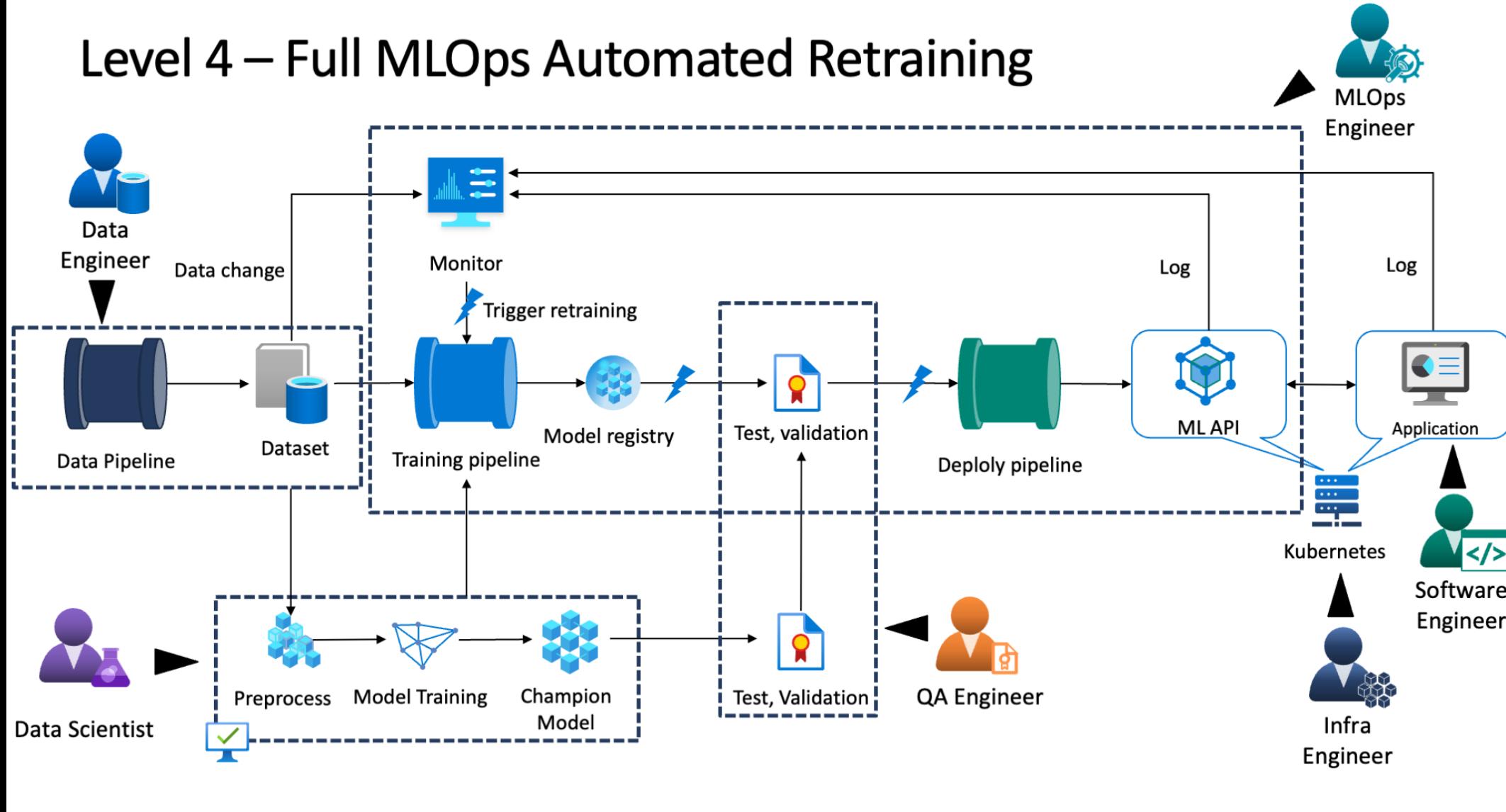
<https://techcommunity.microsoft.com/t5/ai-machine-learning-blog/mlops-maturity-model-with-azure-machine-learning/ba-p/3520625>

Level 0 – No MLOps

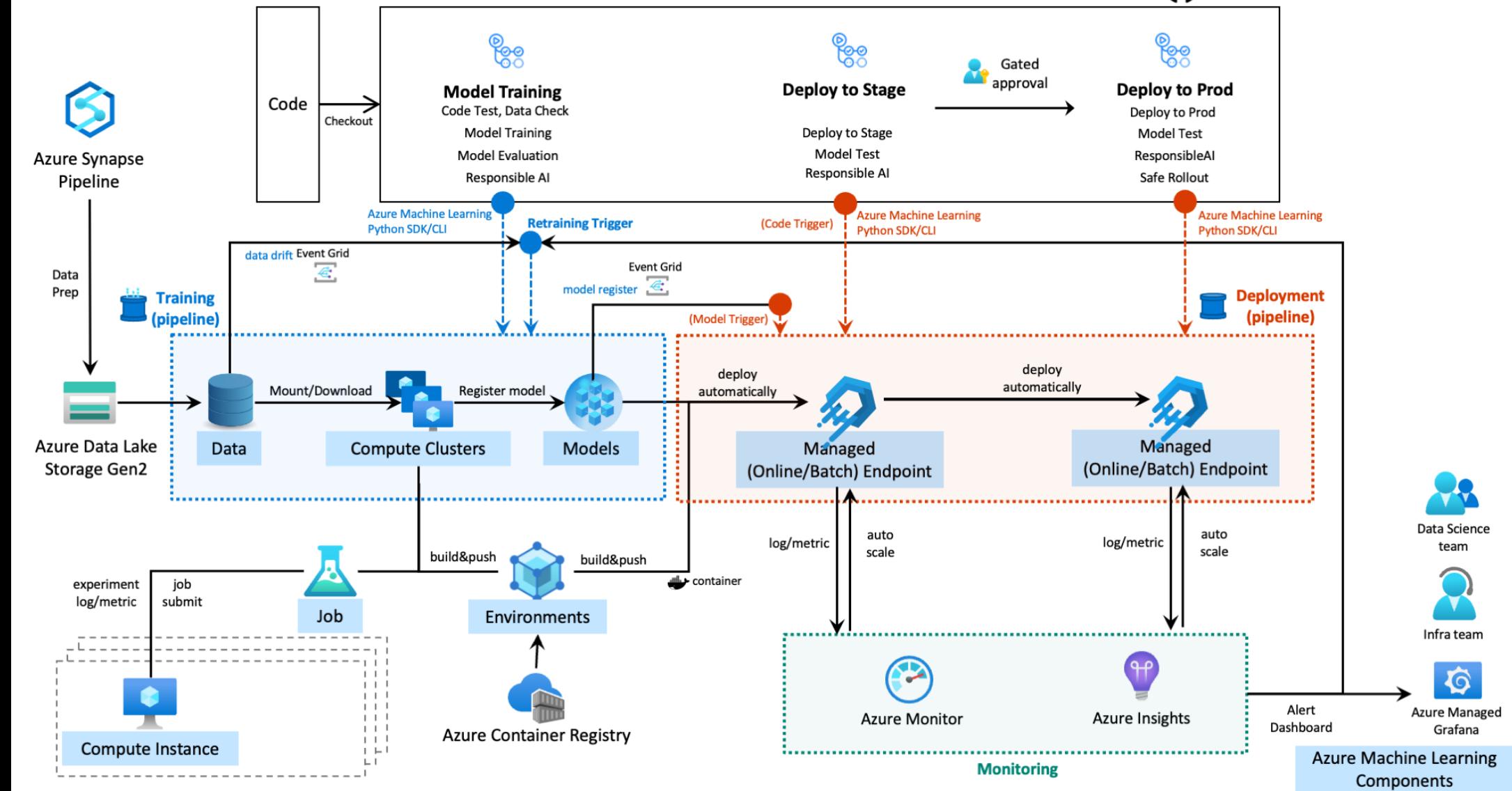
- Find best model interactively and exploratory.
- Create environment, gather and preprocess data, model training, deploy and test manually.



Level 4 – Full MLOps Automated Retraining



Level 4 – Full MLOps Automated Retraining

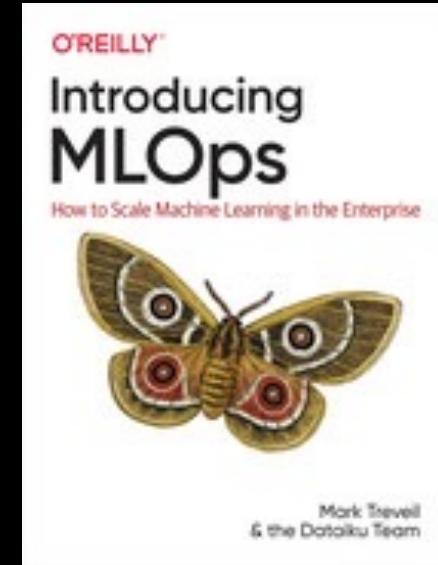
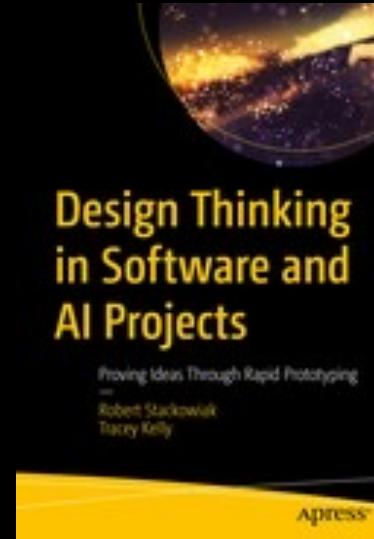
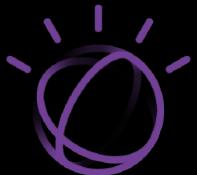


Q & A

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<https://medium.com/inside-machine-learning/ai-ops-managing-the-end-to-end-lifecycle-of-ai-3606a59591b0>