# Welcome!

## Machine Learning Decal

Hosted by Machine Learning at Berkeley

ML@B

# Agenda

Who are we?

What is Machine Learning?

Class Logistics

General Overview and Context

Machine Learning Pipeline

Python/Numpy

Scikit-Learn

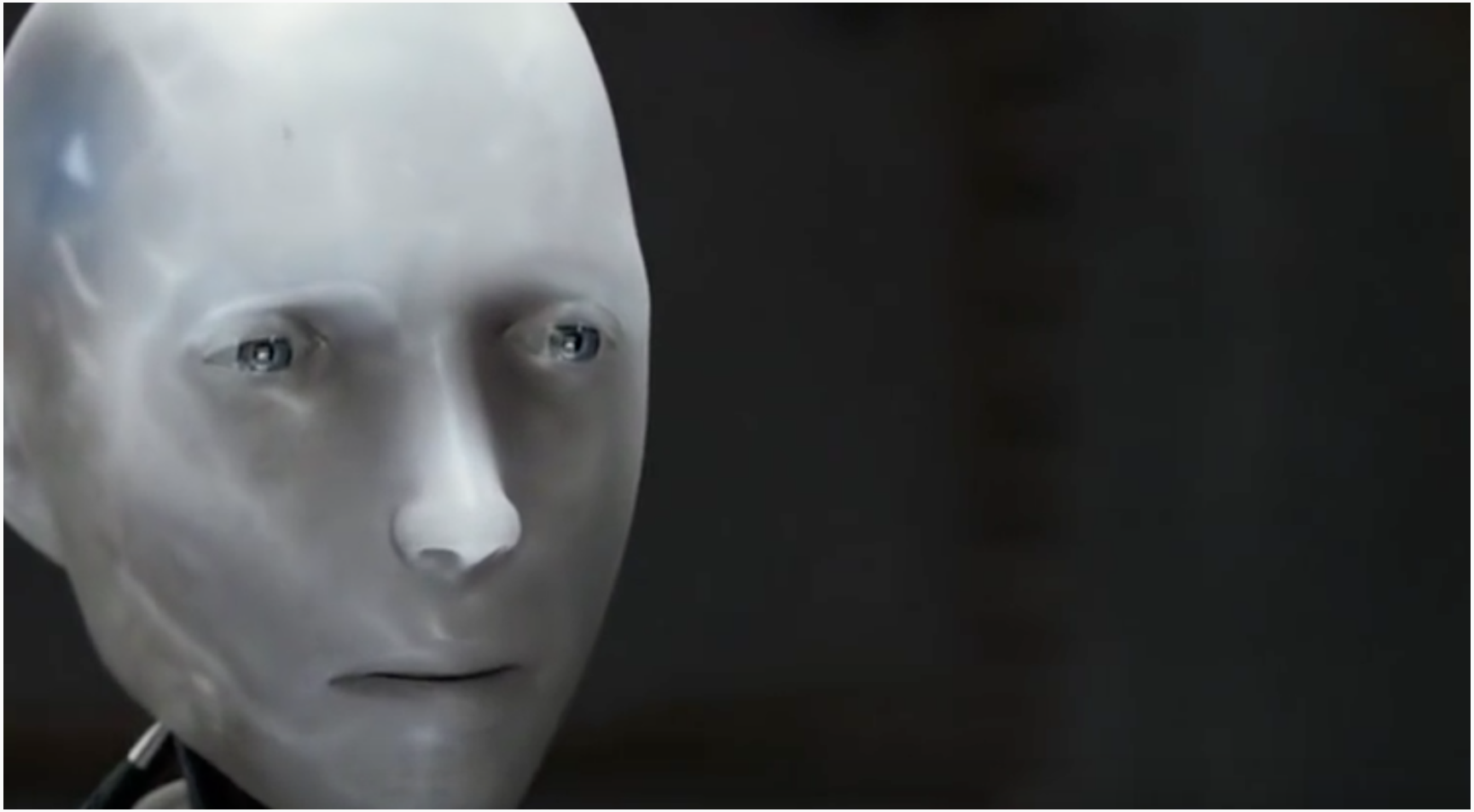
Questions

# Who are we?

# Machine Learning @ Berkeley Education Team

# What is Machine Learning?

# Age Old Question



# Can AI compose music?

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# Can AI paint a canvas?

# Can AI paint a canvas?

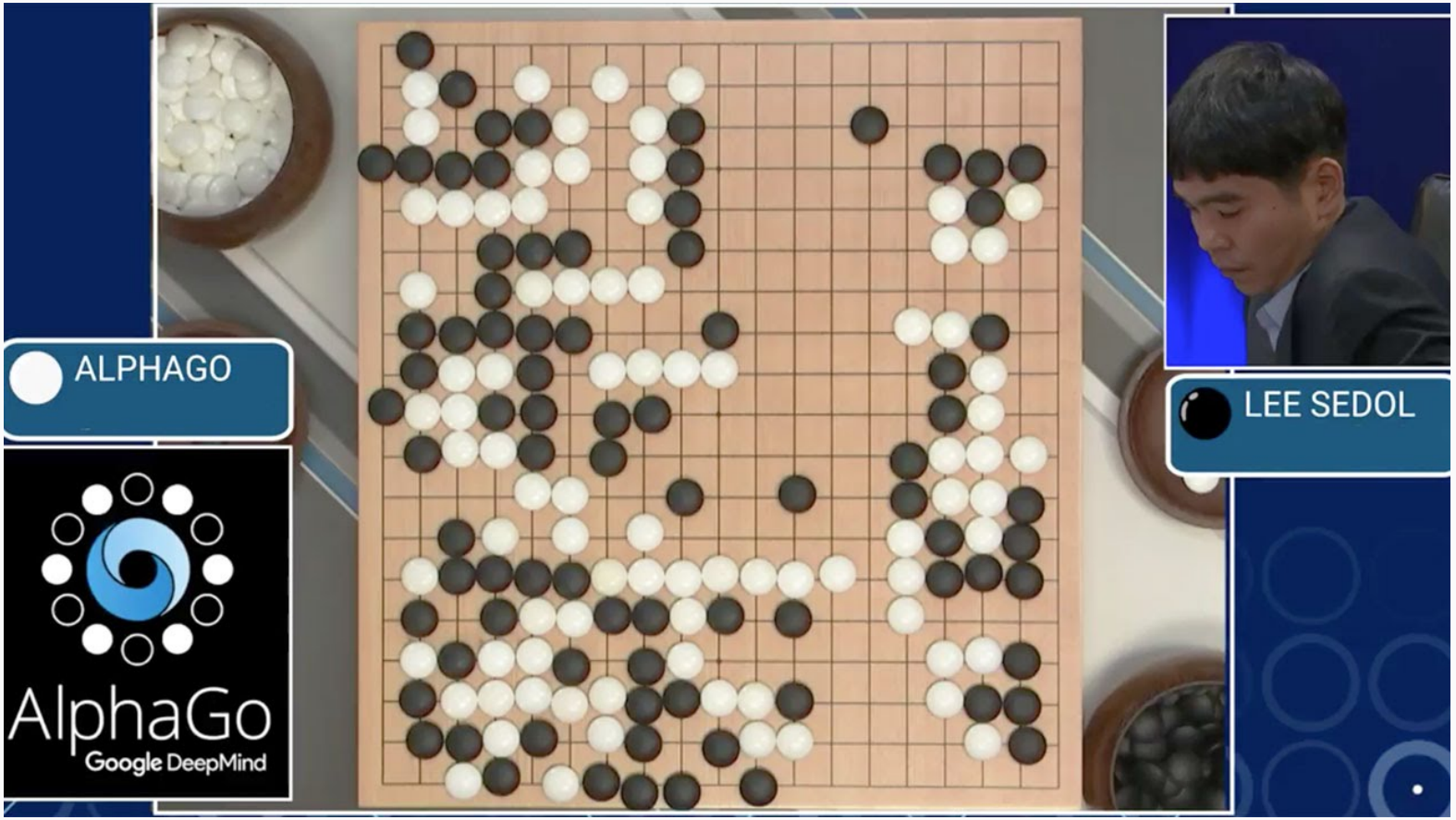
# Dancing!


Source Video
Detected Pose
Source to Target 1 Result
Source to Target 2 Result

# FAKE NEWS!

# Pose tracking!

# Superhuman reasoning



# Selfdriving Cars

# Class Logistics

# Goal

Goals:

- Understand the major concepts in machine learning
- Understand the tradeoffs between different approaches (what do I use when and why?)
- Gain familiarity with code to solve ML problems

How we accomplish this:

- Lecture (2 hrs/week) - theoretical intro to various techniques, along with demos
- Homeworks (3-6 hrs/week) - practice implementing different models on different datasets

# Enrollment

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- Some of you here are in the class, others on the waitlist
- Must show up to first lecture if you wish to be enrolled
- We will give out course enrollment codes tonight - first to all enrolled students who showed up to this class, then waitlist students who showed up

# Logistical

**Join Piazza**: https://piazza.com/class/jr5mpmbjvaa9w
All communication will be through Piazza.

**Join Gradescope**:

**Clone the github**: https://github.com/mlberkeley/Machine-Learning-Decal-Spring-2019

- All homeworks, lecture slides, and lecture recordings will be posted here
- Also check out the calendar which has all important dates (homework deadlines, office hours, etc.) for the class

# Attendance

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- Attendance is mandatory and will be taken at every lecture
- You may miss up to 3 classes [not including first class]
- After your 3rd missed day of class, you will automatically be assigned a no pass

# Grades

- 70 % average on all homework assignments
- Submit final project
- Automatic "no pass" for insufficient attendance

# Assignments

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- 7 Homework Assignments
  - Work in groups up to 3
  - 1-2 week timeline
- Final Project/Hackathon
  - Can either submit a final project on own time or can attend and submit a project through the decal hackathon at the end of the semester
  - All the instructors will be there to answer questions and guide you through projects

# Late Assignments

- Each assignment will have 1 week late turn in period
- Small penalty for turning in late
- No submissions allowed after late turn in period over!

Homework 1 is out NOW, due next Tuesday (in one week)!

# Office Hours

Date/Time/Location of office hours for the next two weeks will be posted on Piazza and on the calendar

# Got Questions?

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During lecture:

- Raise your hand!
- Ask on the lecture questions thread on Piazza!

Outside lecture / about anything else:

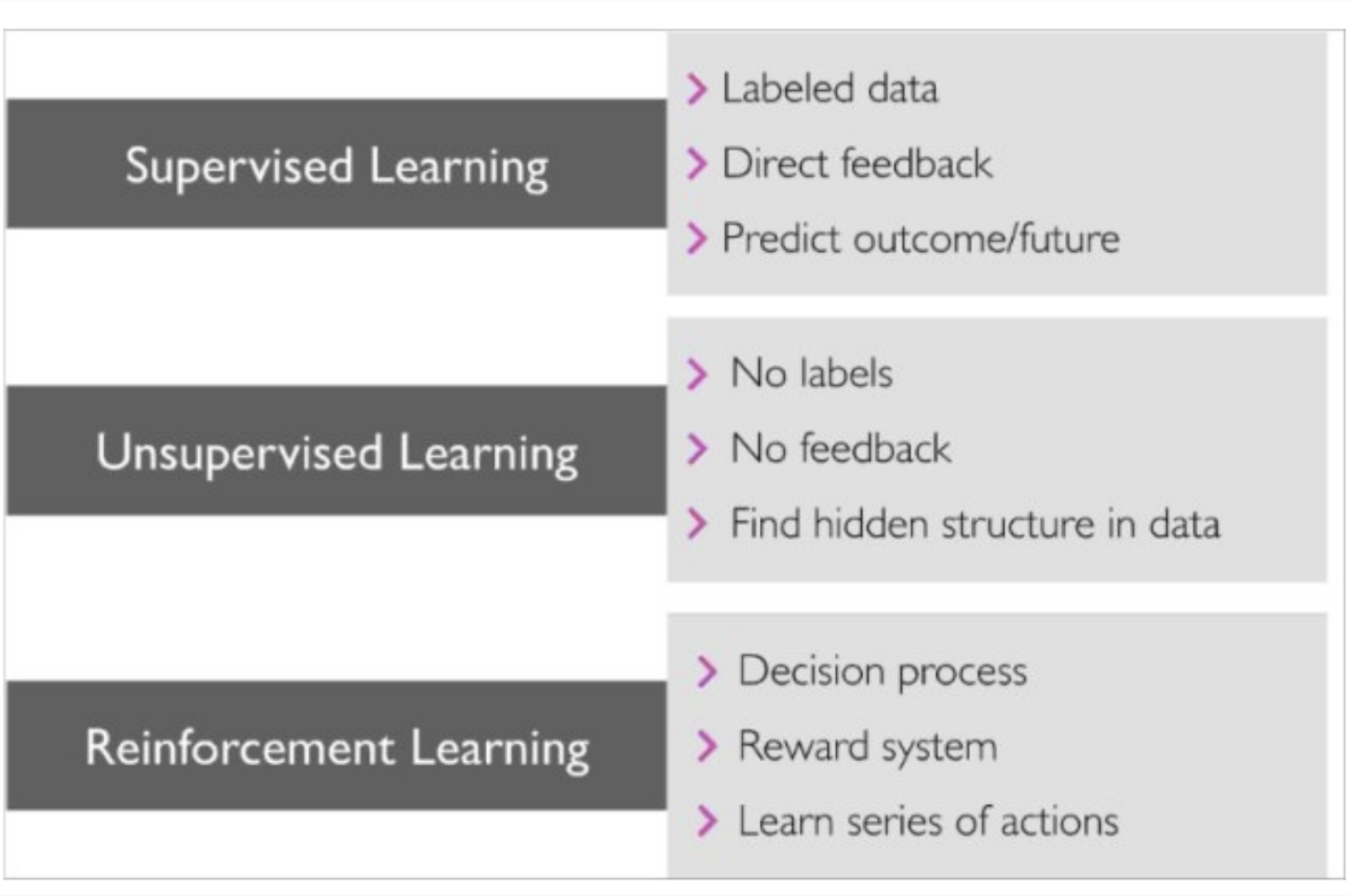
- Please don't email
- PIAZZA IS YOUR FRIEND!!!

# Course Content

Syllabus

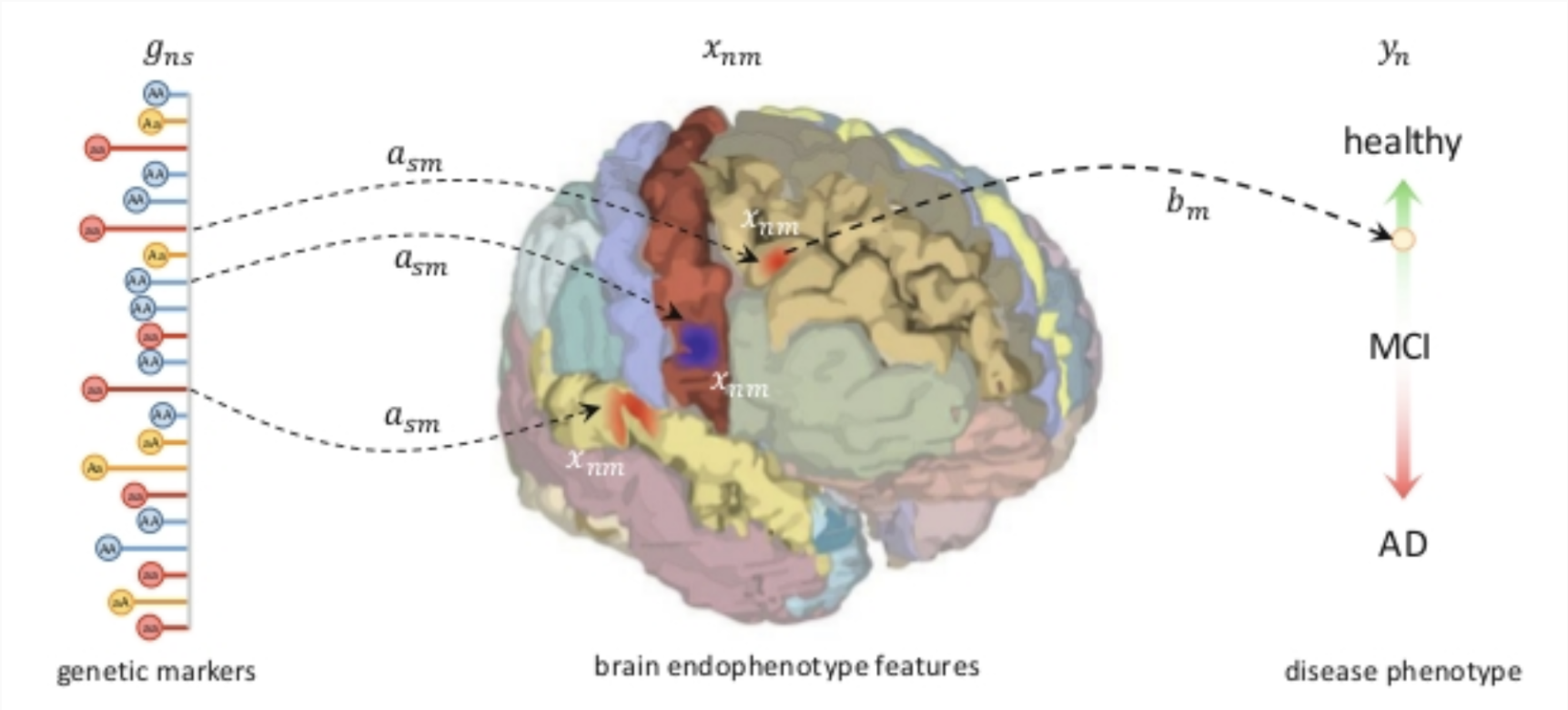
# General Overview and Context

# 3 Different Classes of Machine Learning Problems



# Supervised Learning (Classification) Ex: ImageNet (10M+ ages), 1000 classes

# Supervised Learning (Regression) Ex: Imaging Genetics and Genome-Wide Association Studies



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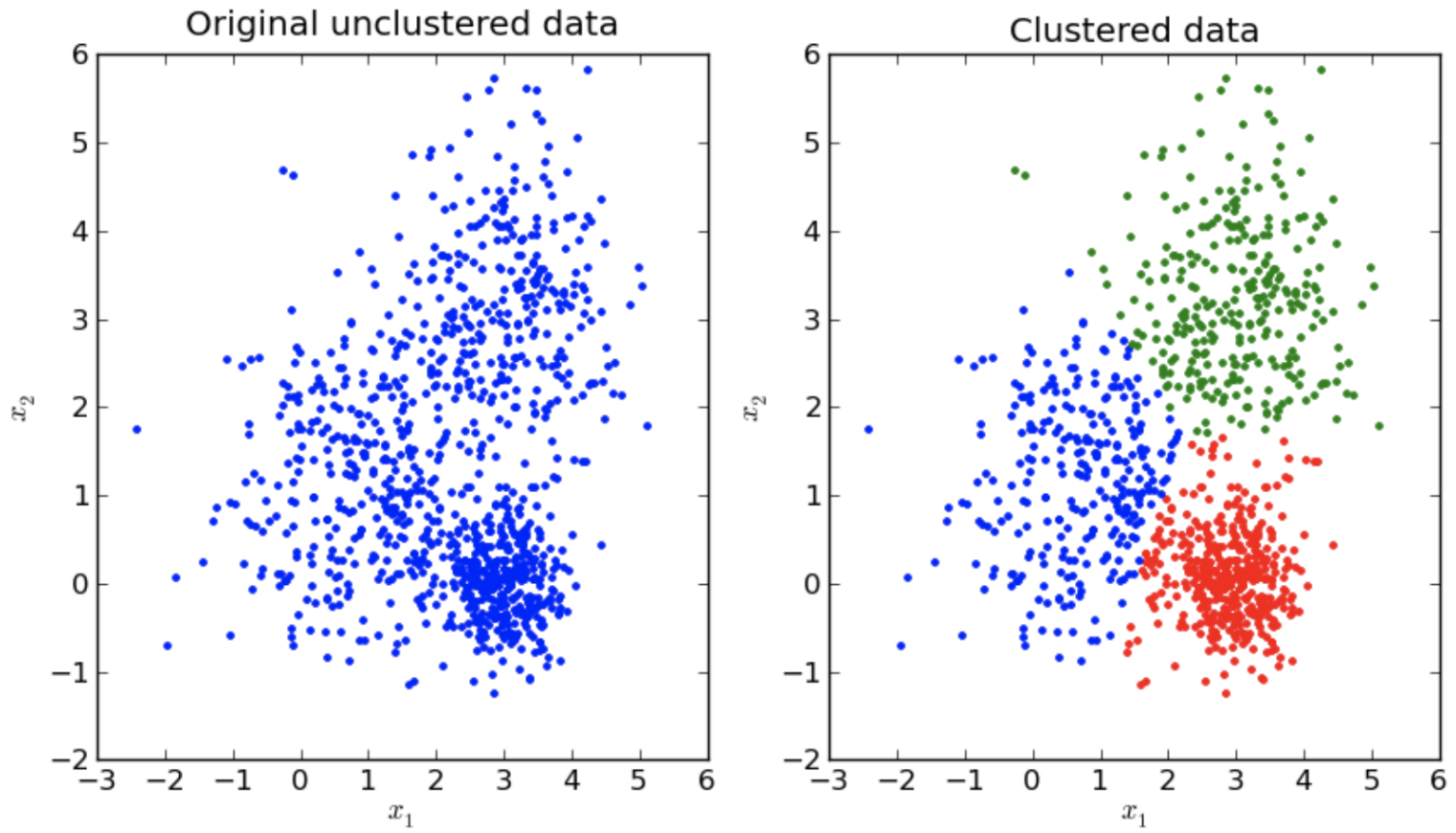
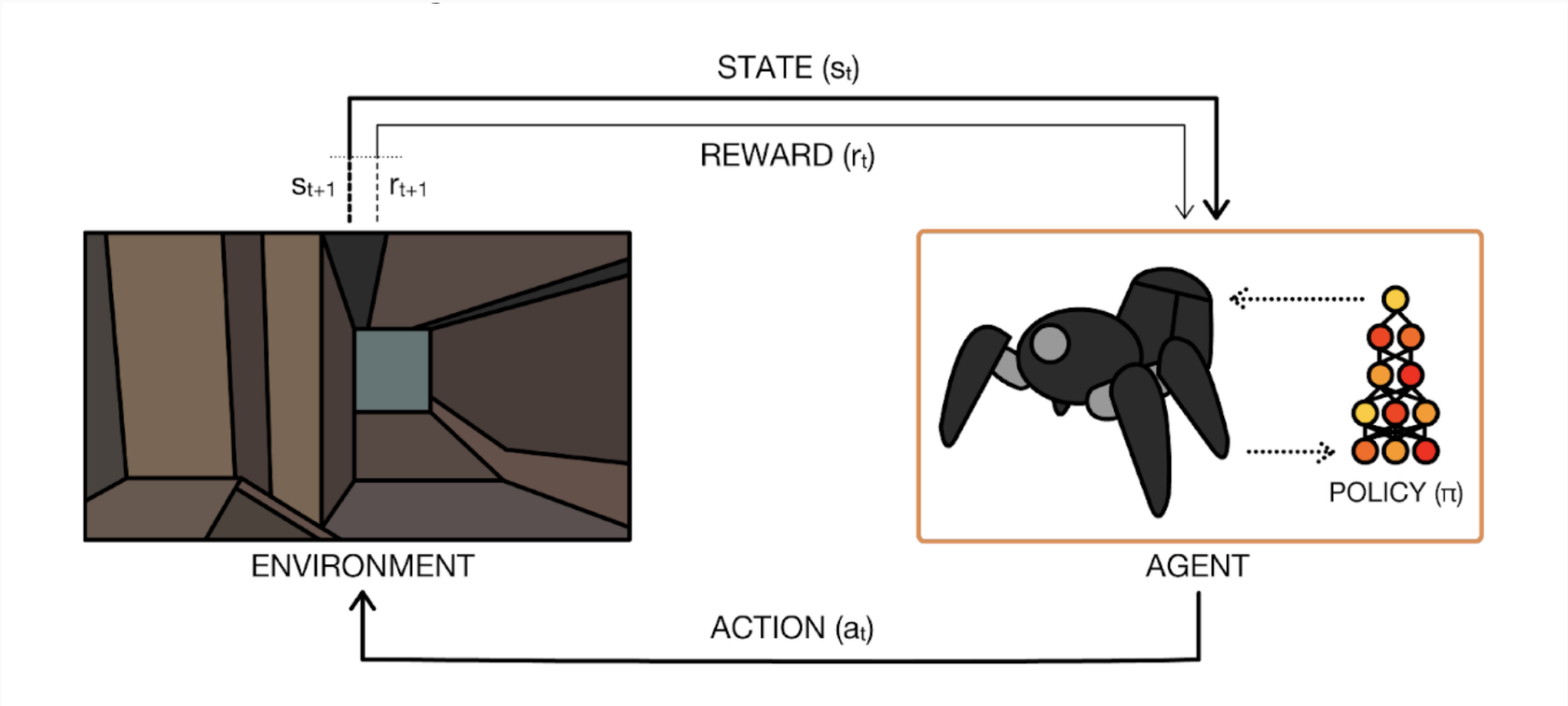
# Unsupervised Learning (Clustering)



# Reinforcement Learning



# Machine Learning Pipeline

# Typical Pipeline

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- Acquire the data
- Prepare/Visualize Data
- Choose a Model
- Train a Model on the Training Set
- Evaluate Model Performance
- Tune Model Hyperparameters
- Prediction!

# STEP ONE: Acquire the Data

# STEP TWO: Prepare and Visualize Data

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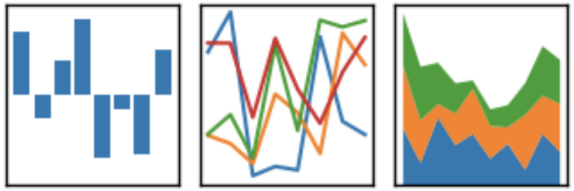
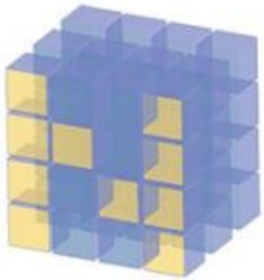
pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$





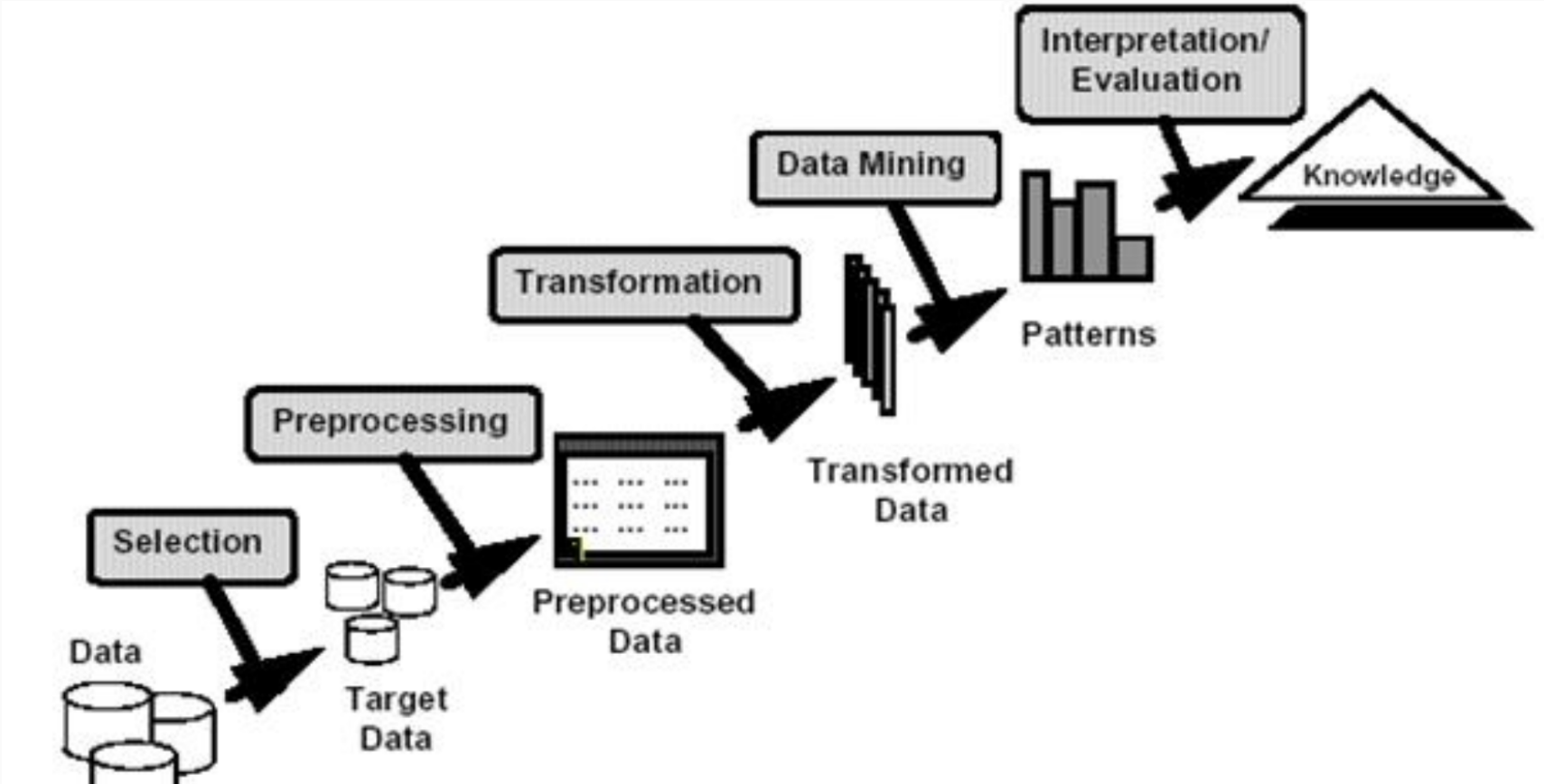
NumPy

scikits learn

machine learning in Python

# Importance of Feature Selection and Data Preprocessing in ML problems

- Data Preprocessing and Feature Selection must be performed before proceeding to actual data mining and ML analyses.



# STEPs THREE and FOUR: Choose A Model (3) and Train It! (4)

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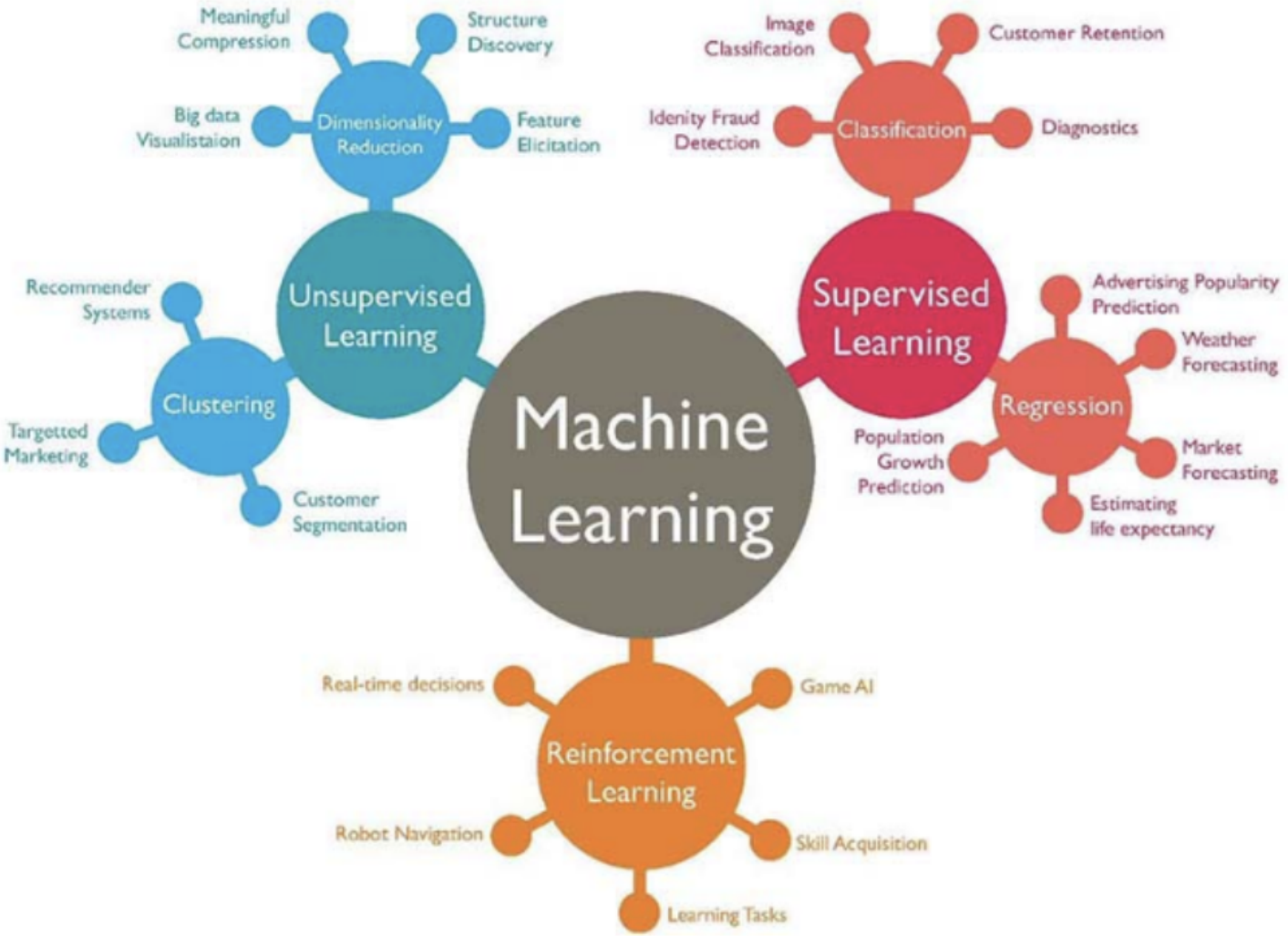
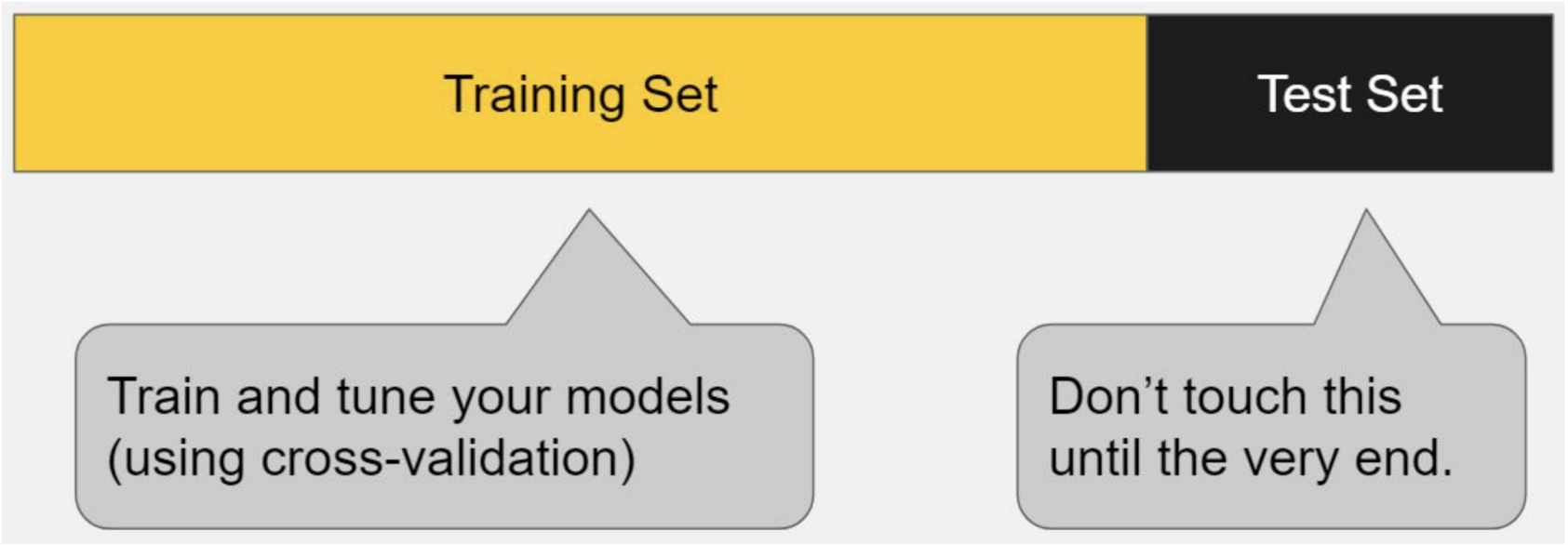
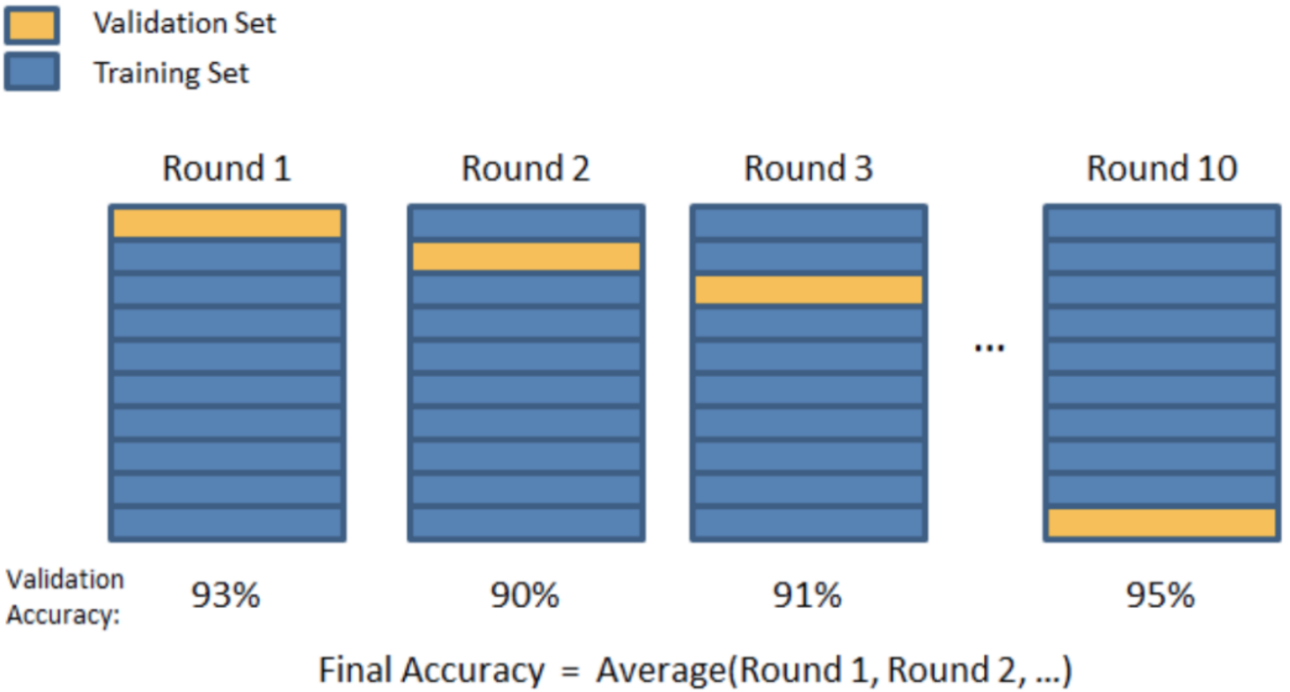


# Dealing with Datasets in Machine Learning



# STEP FIVE: Evaluate the Models Performance in the Validation Step (K-fold Cross-Validation)



# STEP SIX: Tune Model Hyperparameters Via K-Fold Cross-Validation

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- What happens if our cross-validation accuracy is rather low, and we would like to improve it?
- Choose different Hyperparameters to our model!
- While the ML model finds optimal values of the parameters to minimize some type of loss function, the ML practitioner gets to choose values for the hyperparameters.

# STEP SEVEN: Characterize Your Models Performance on a Test Dataset and Predict using Your Model!

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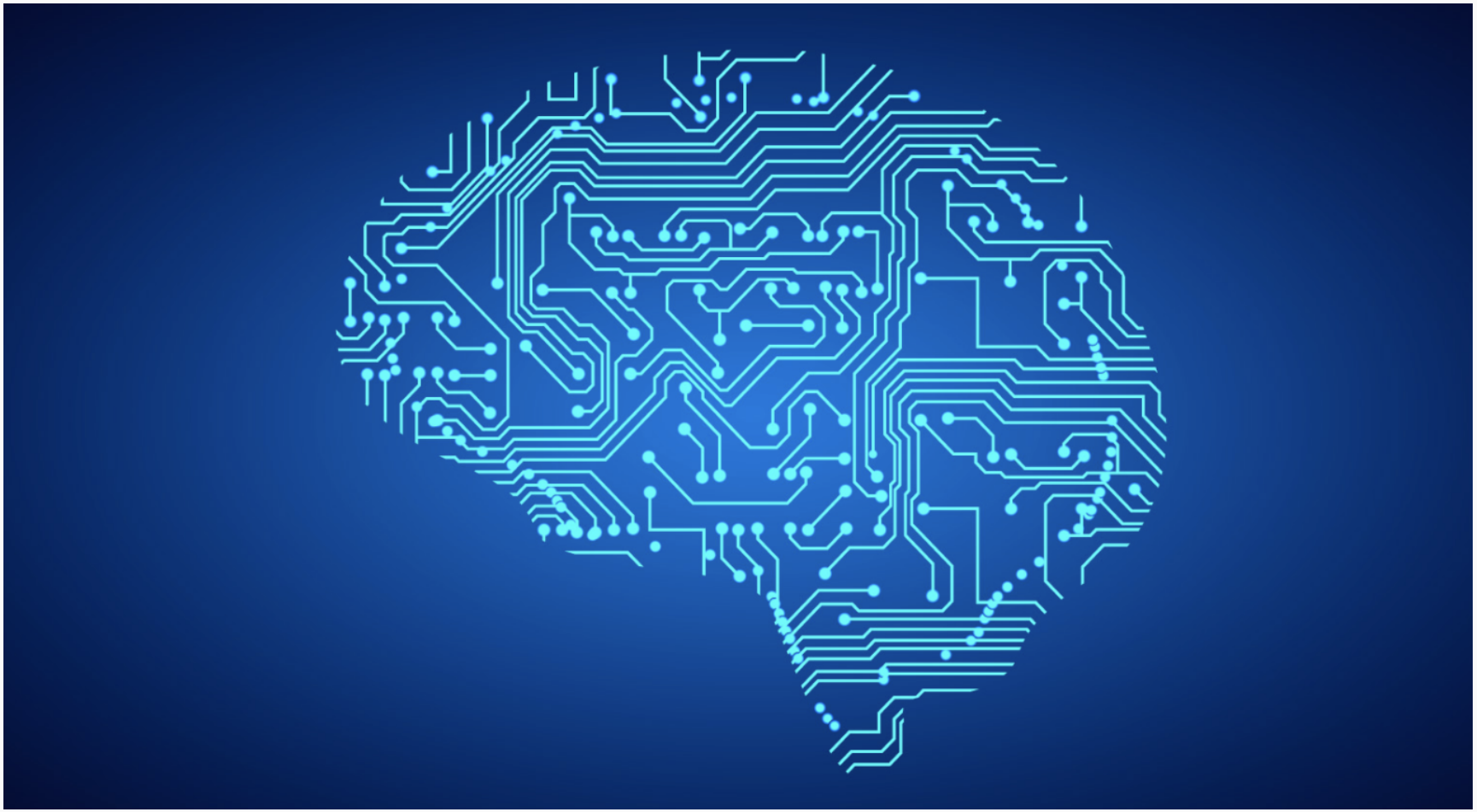

# Python/Numpy

# DEMO

# Scikit-Learn

# DEMO

# Questions

# Questions?