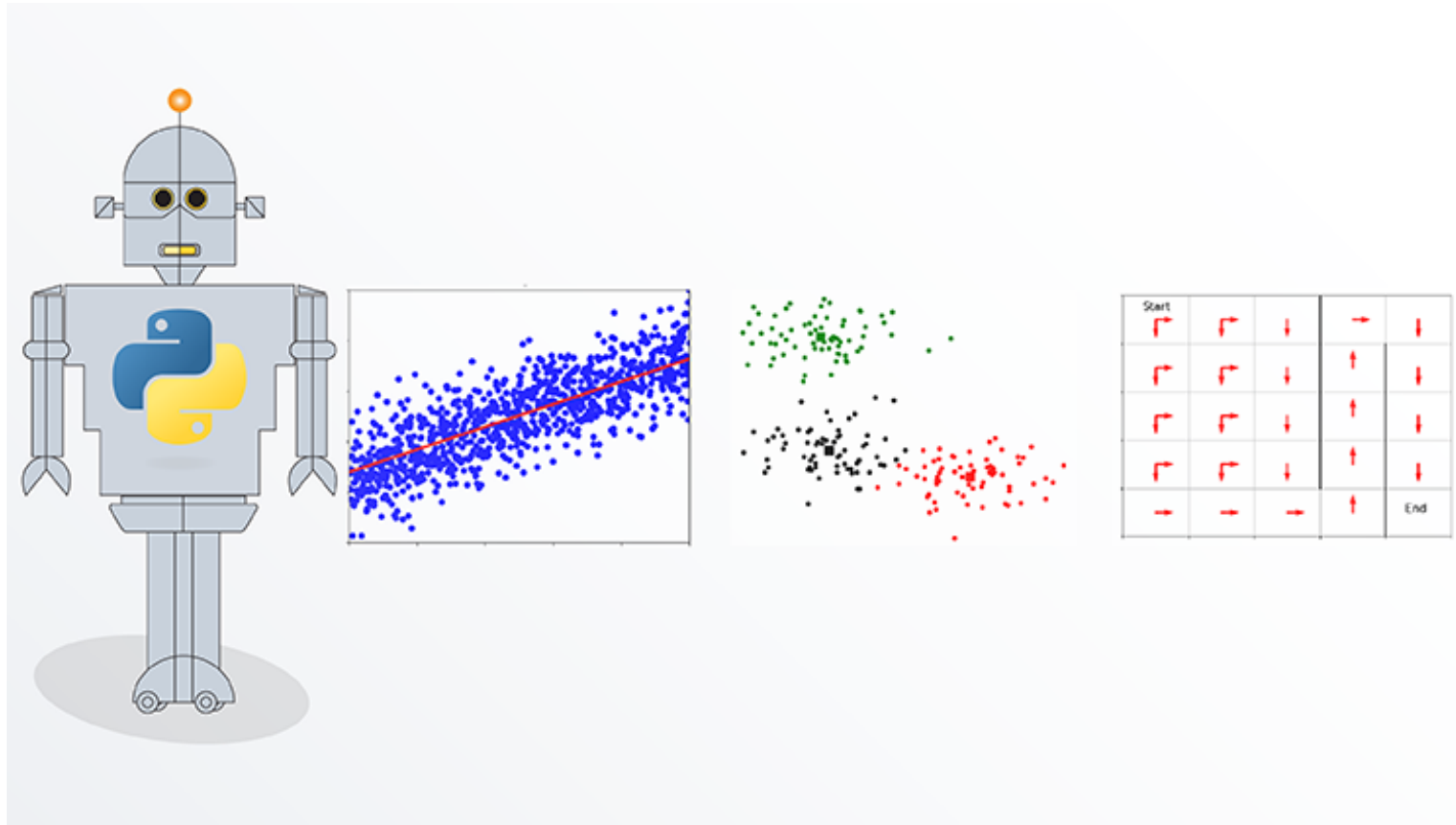# What is Machine Learning?

Chapter 6: Concluding Remarks and Useful Resources

What was Covered in this Course?

This course has given an overview of machine learning algorithms and the types of problems that can be solved

Three broad areas of machine learning:

- Supervised Learning: Fit function to data and use for prediction
- Unsupervised Learning: Find patterns in data
- Reinforcement Learning: Find strategy to maximize cumulative reward

Common theme:

- Machine Learning algorithms are iterative: make an initial guess for function, pattern, or strategy and then improve

Mathematics Underlying Machine Learning

Linear Algebra

- Supervised Learning: matrix multiplication key part of Neural Network approach

- Unsupervised Learning: singular value decomposition used for PCA

Probability and Statistics

- Reinforcement Learning: tracking sample means for K bandit problem

- Reinforcement Learning: Markov processes used for underlying model (maze example)

Simulation:

- Reinforcement Learning: simulate episodes in Q Learning

Optimization:

- Supervised Learning: minimize loss function (Gradient Descent/Adam algorithms)

Multi-Variable Calculus:

- Supervised Learning: compute derivatives to be used in optimization algorithms

Machine Learning Resources: Learning Material

Search Internet for articles and book references based on terms in course:

- Supervised Learning: Linear Regression, Classification, Neural Networks, Gradient Descent, Adam
- Unsupervised Learning: Hierarchical Clustering, K Means, PCA
- Reinforcement Learning: K Bandit Problem, Explore vs Exploit, Q Learning

Many informative Machine Learning Communities:

- Medium
- Towards Data Science
- Machine Learning Mastery
- Analytics Vidhya

Online Courses:

- Coursera
- Udemy
- Other outlets

Machine Learning Resources: Codes

A Machine Learning Framework is an interface, library or tool which allows one to build machine learning models, without needing to know all details of underlying algorithms – [See link at www.euredeka.com for reference](http://www.euredeka.com)

Many publicly available machine learning frameworks

- Good starting point is scikit-learn https://scikit-learn.org/stable/
  - Functions for supervised and unsupervised learning (Python)
  - Can do learning and prediction in a few lines of code
- Many other frameworks that have low level routines for building neural networks and do learning: Tensorflow, Pytorch, Caffe, …
  - See https://en.wikipedia.org/wiki/Comparison_of_deep-learning_software
  - Many of these run on GPU, which can be much faster than CPU
- Specialized frameworks for Reinforcement Learning: KerasRL, Dopamine, Tensorforce, OpenAI, …

Machine Learning Resources: Data

Kaggle

- www.kaggle.com
- Site for data science competitions (often with prize money)
- Each competition comes with freely available data
- Can learn from tutorials, practice competitions, and notebooks created by participants
- Most codes in Python

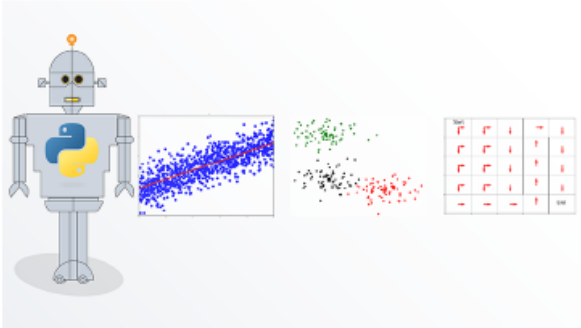University of California, Irvine Machine Learning Data Repository

- https://archive.ics.uci.edu/ml/index.php
- Contains 100s of machine learning datasets (supervised learning)

Resources File

WhatisML\Resources\WhatisML_Resources_v1.0.pdf

Machine Learning: Proposal for Learning

(1) Learn a programming language

• Python is most popular, but others used R, Java, Javascript, C++, …

• Lots of online courses to learn these languages

(2) Take a course

• If new to machine learning, start with a course

(3) Write code yourself

• Start with machine learning frameworks

• To truly understand what is going on program algorithms yourself (neural networks, K means, PCA, Bandit, Q Learning, …)

Thank You

- Thank you for taking this course
- I hope that it has been a worthwhile experience and that it has increased your interest in machine learning
- Best wishes for your future learning and endeavours!