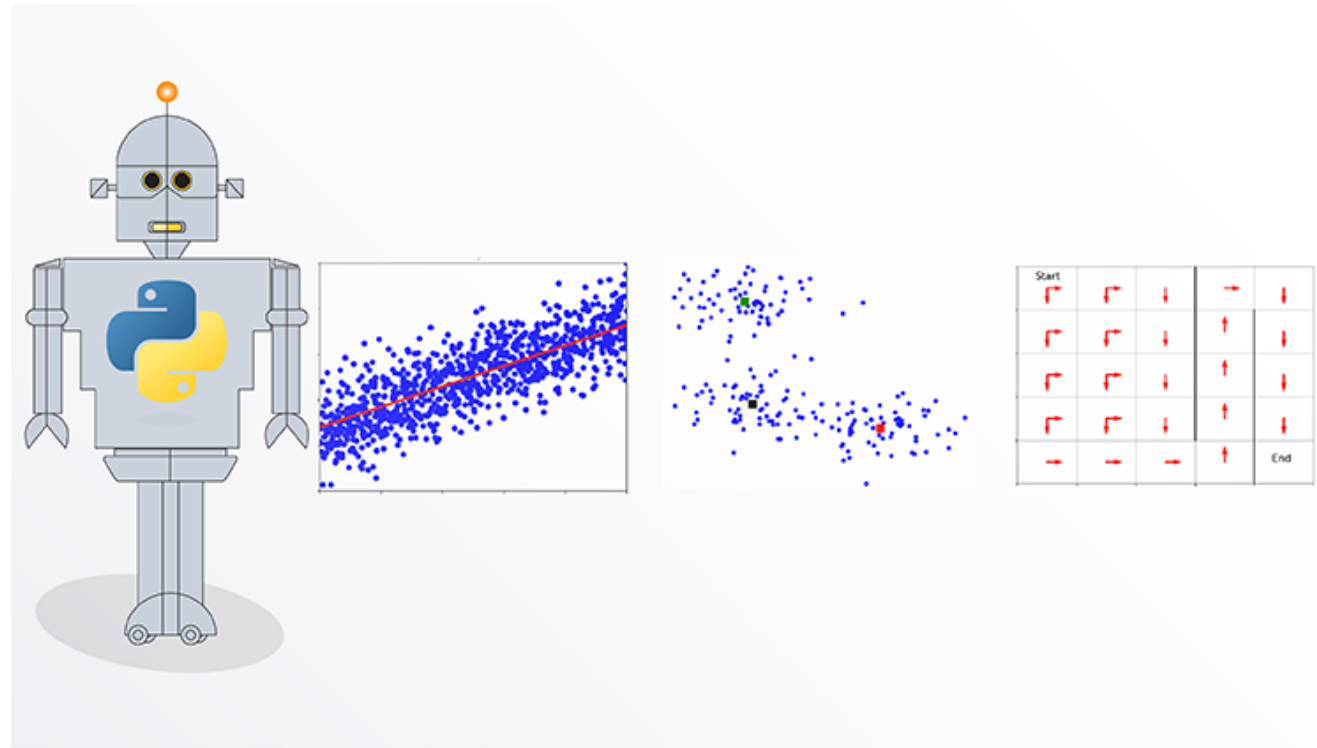# What is Machine Learning?

Chapter 6: Concluding Remarks

What was Covered in this Course?

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

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

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 function definitions
- Unsupervised Learning: singular value decomposition used for PCA

Probability and Statistics

- Reinforcement Learning: tracking sample means
- 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 needed for optimization

Machine Learning Resources

- List of resources and links given in file have been collected in file: WhatisML_Resources.pdf

- See course Github site: https://github.com/satishchandrareddy/WhatisML

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 to allow one to build 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
- Host for data science competitions (often with prize money)
- Each competition comes with freely available data
- Many tutorials and practice/learning competitions
- Participants share notebooks which have codes and explanations
- 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)

Machine Learning: Proposal for Learning

(1) Learn a programming language

- Python is most popular, but others used R, Java, Javascript, C/C++
- Lots of online courses to learn these languages

(2) Take a course

- If new to machine learning, probably best to take a course, which will give a "guided tour"
- Can also take courses on relevant math topics underlying machine learning
- Can look up best machine learning courses on internet to get a listing of potential courses to try

(3) Write code yourself

- Can get started with machine learning frameworks
- To truly understand what is going on program algorithms yourself (neural networks, K means, PCA, Bandit, Q Learning, …)
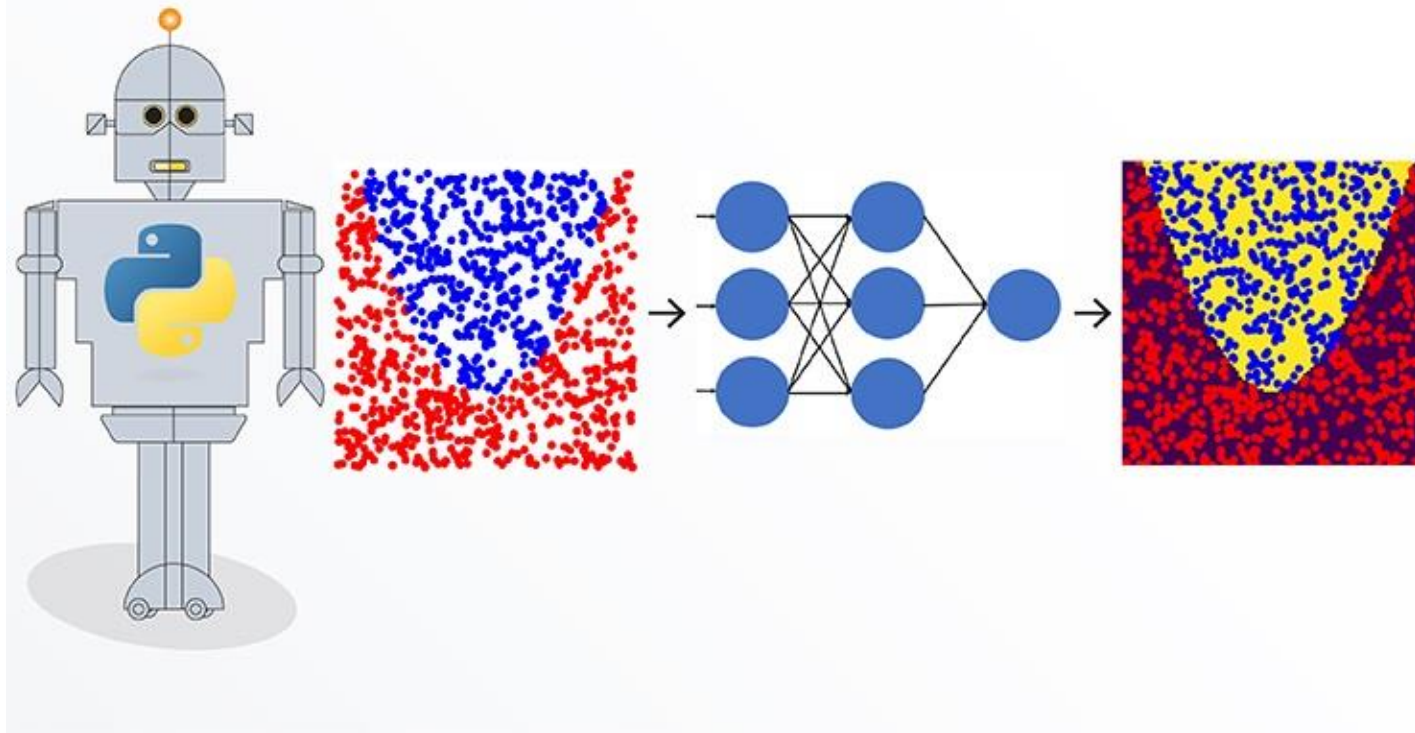
Supervised Learning: Udemy Course

Course Title: Introduction to Machine Learning

Instructor: Satish Reddy

Subtitle: Linear and Logistic Regression and Neural Networks Using Python

Covers: underlying math, algorithms, and development of framework in Python for supervised machine 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!