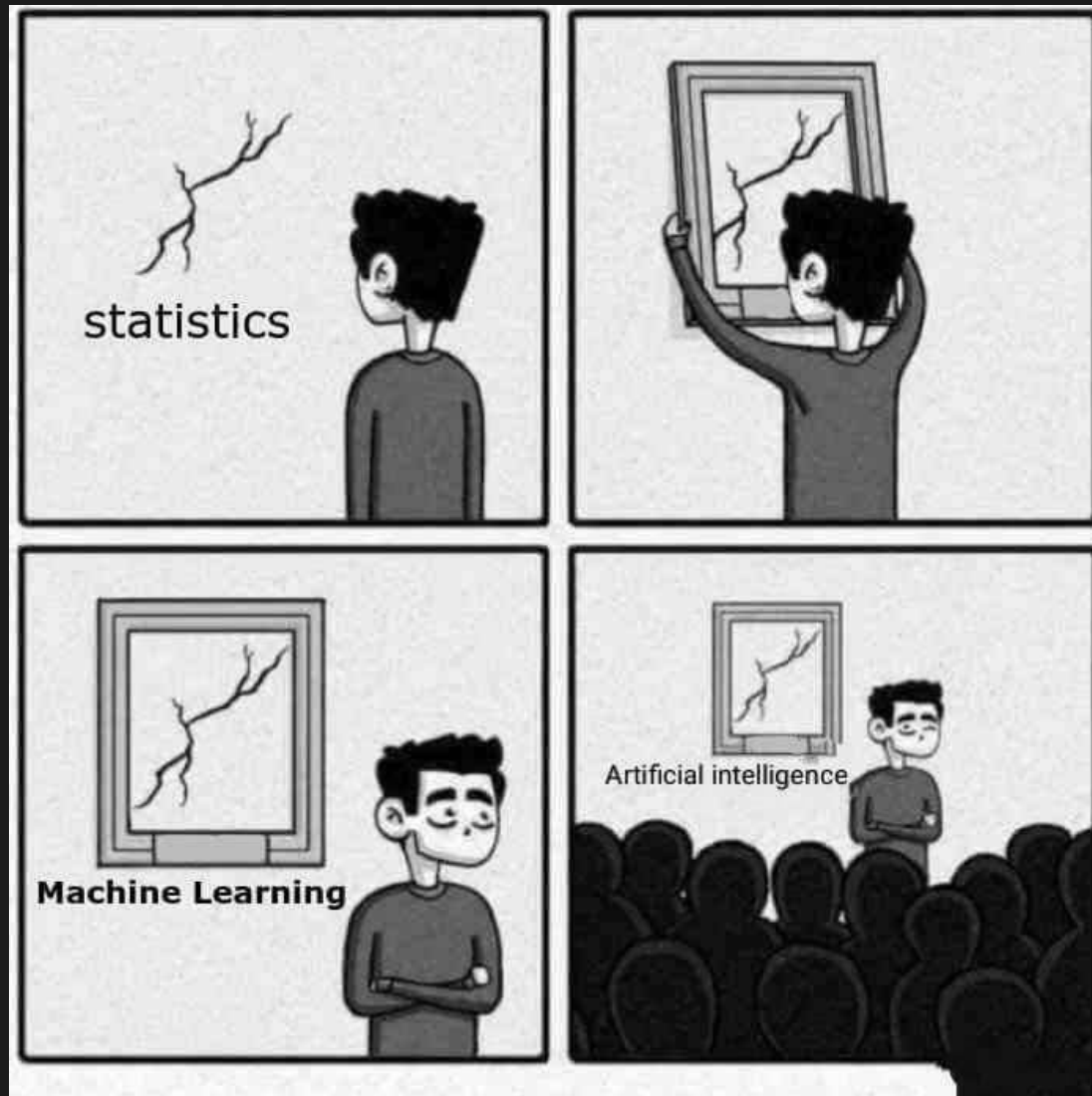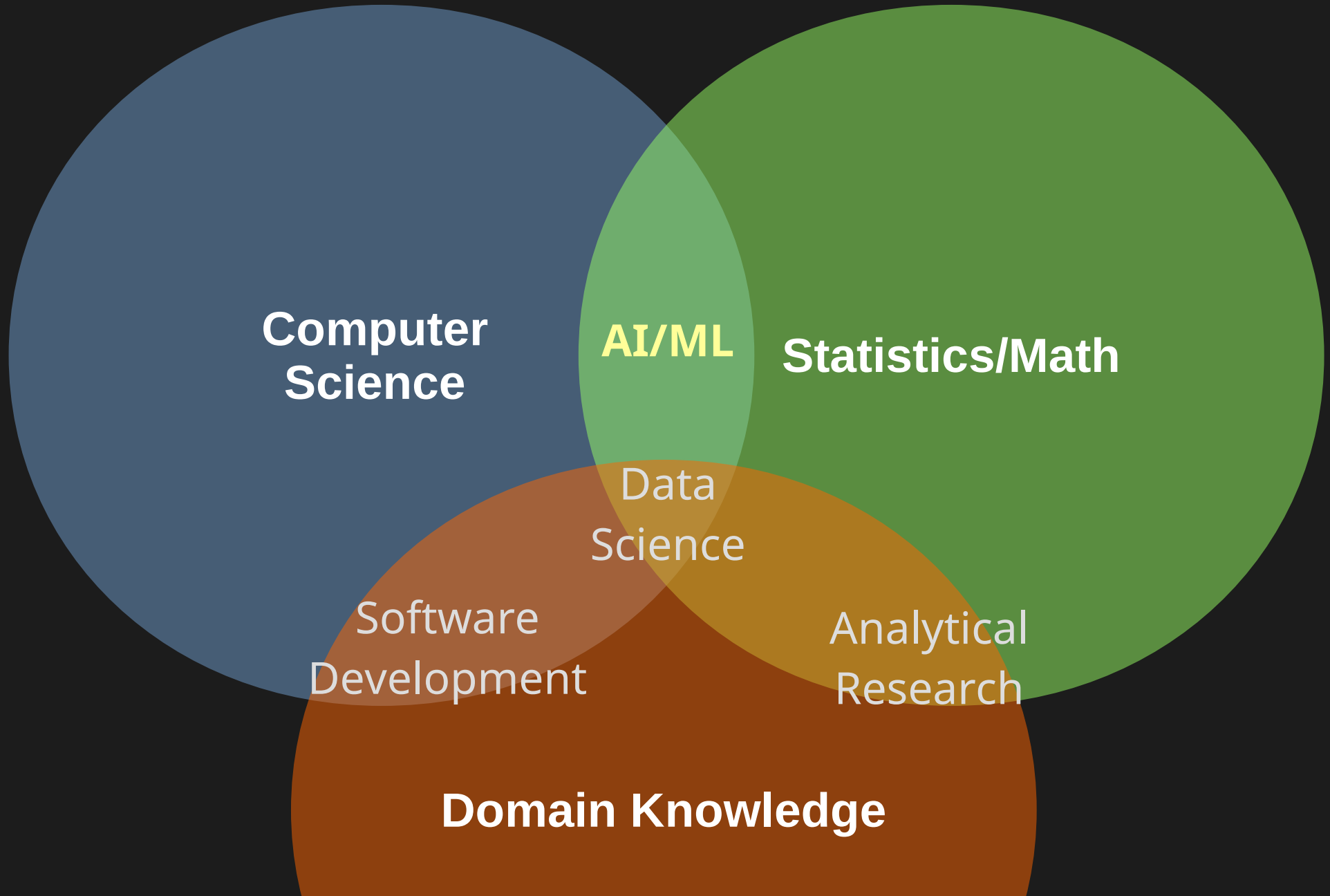# Introduction to Machine Learning

A Gentle Introduction
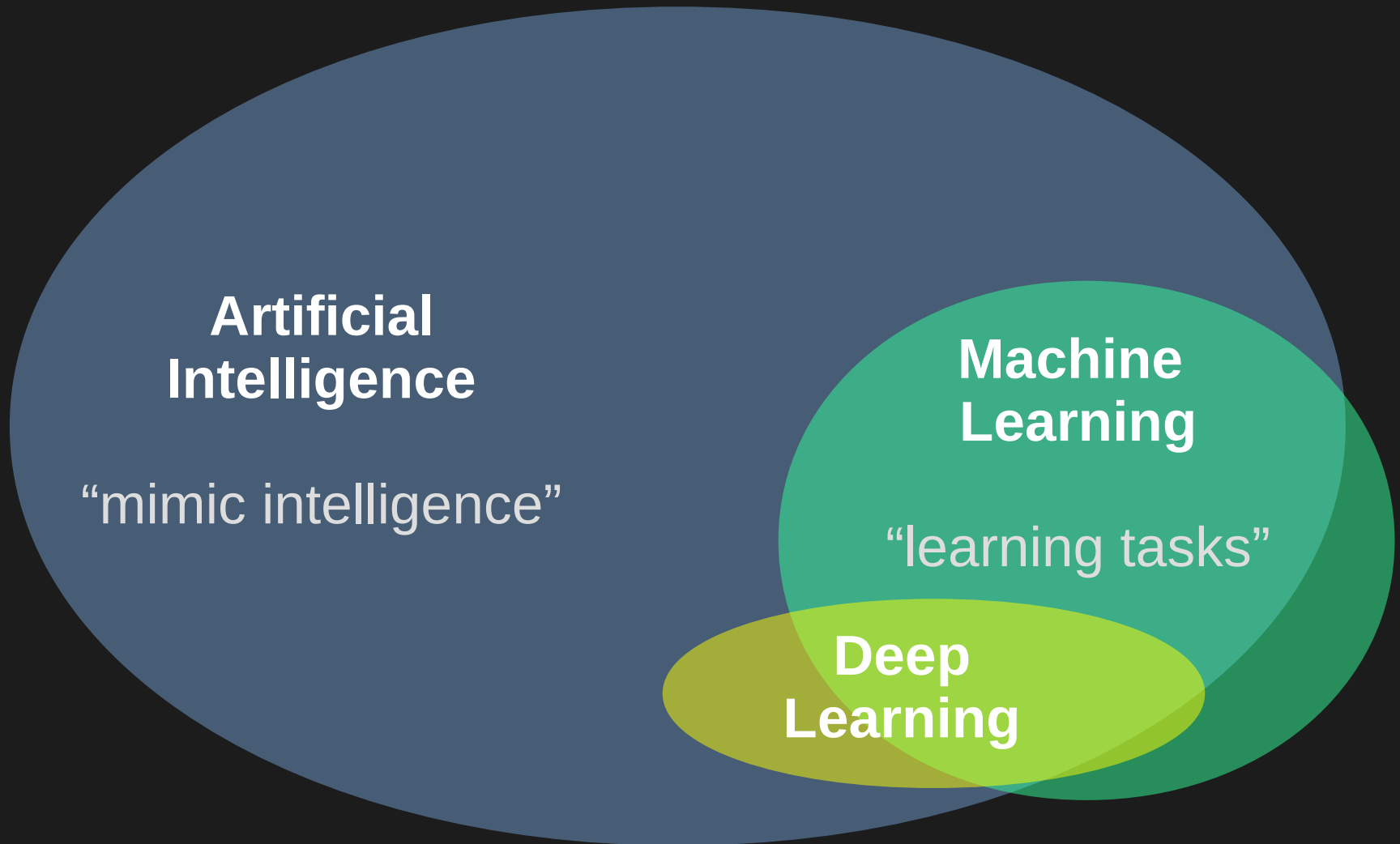
What is ML?

What is ML – in more detail

AI vs. ML?

Artificial Intelligence

"mimic intelligence"

Machine Learning

"learning tasks"

Deep Learning
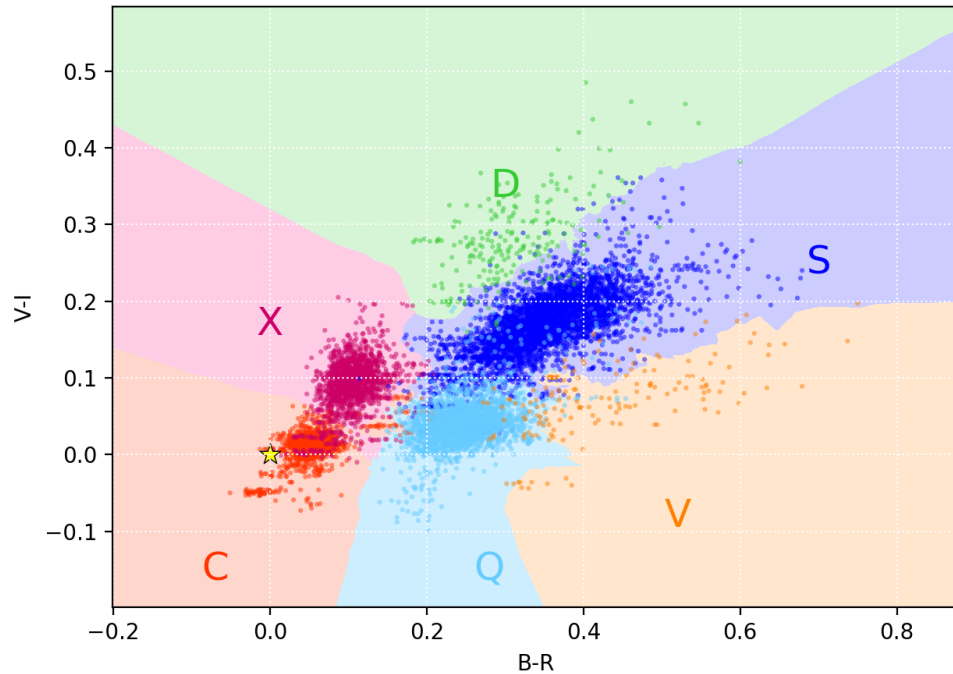
What tasks can ML solve?

- **Unsupervised Learning**
  find structure in data ("insight") without guidance

- **Supervised Learning**
  predict ("target") variable based on a "training sample"

  - Regression: predict continuous variable

  - Classification: predict discrete categories

- Reinforcement Learning
  learn rules through rewards

Supervised Learning: Examples
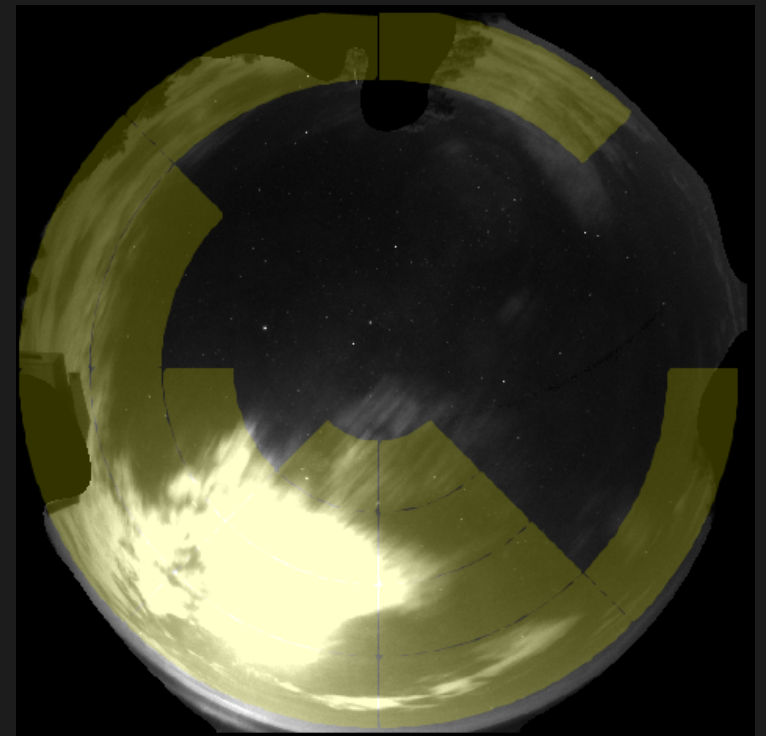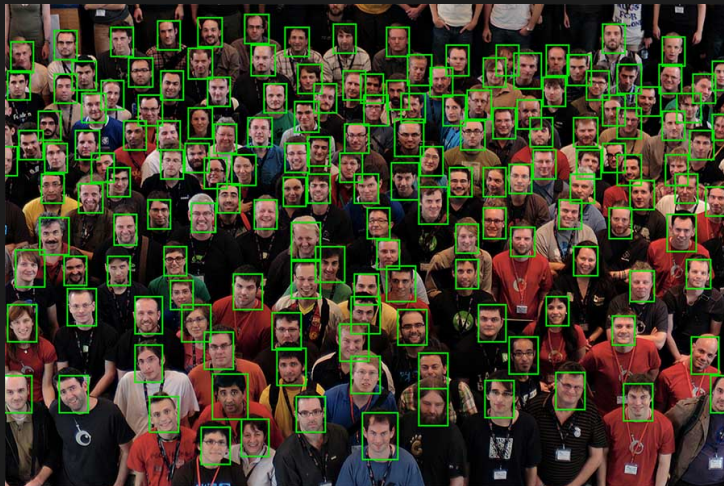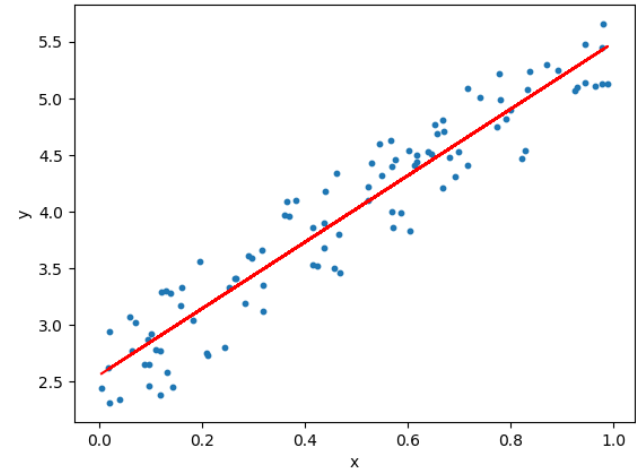
Unsupervised Learning: Examples
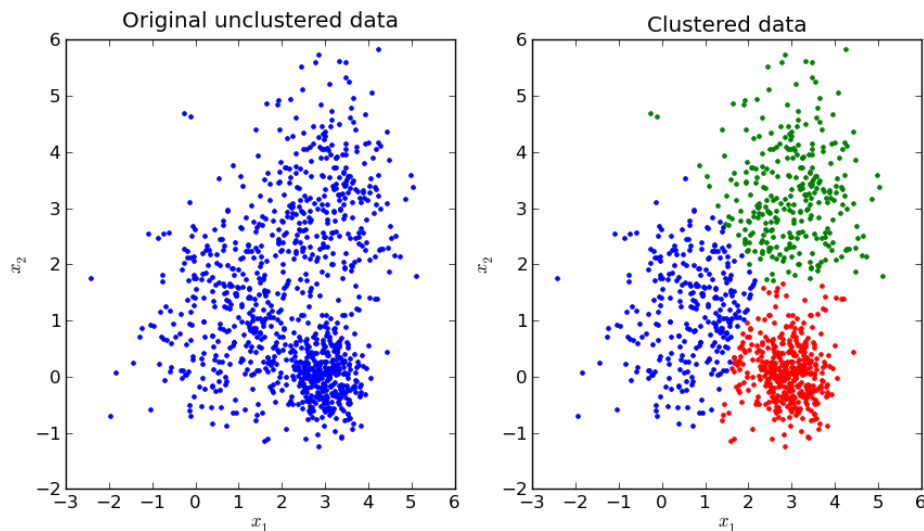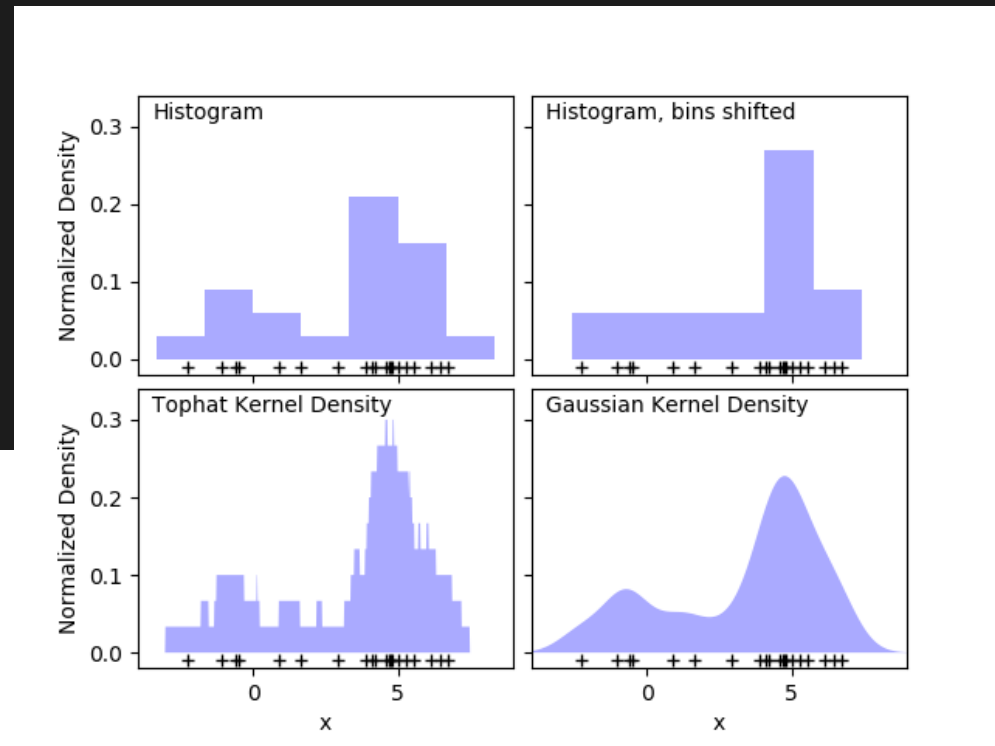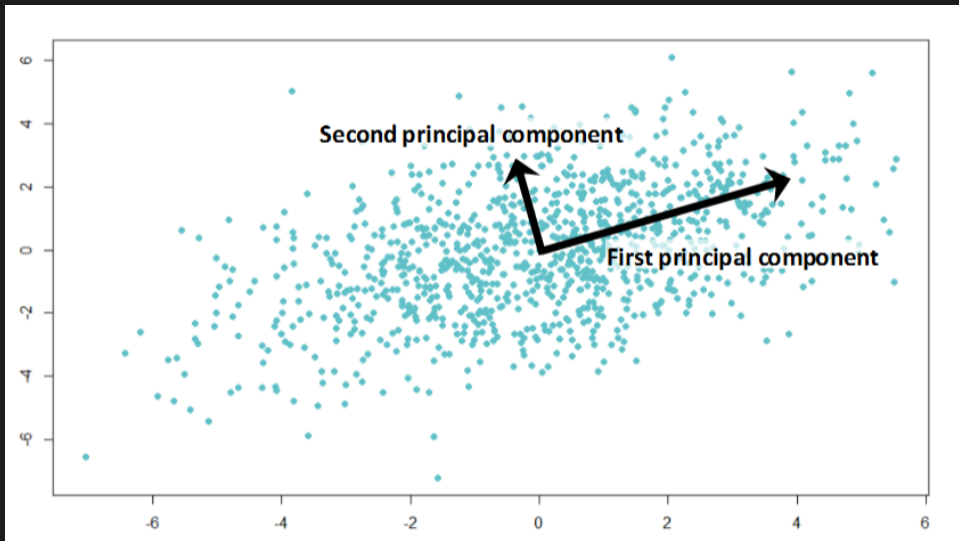
Reinforcement Learning: Examples

Snake

Chess

DOTA 2

Scikit-learn

- Module structure

- Example data sets

- *.train, *.fit, *transform

- Random seeds

- a simple linear regression example

Python Resources (Open Source)

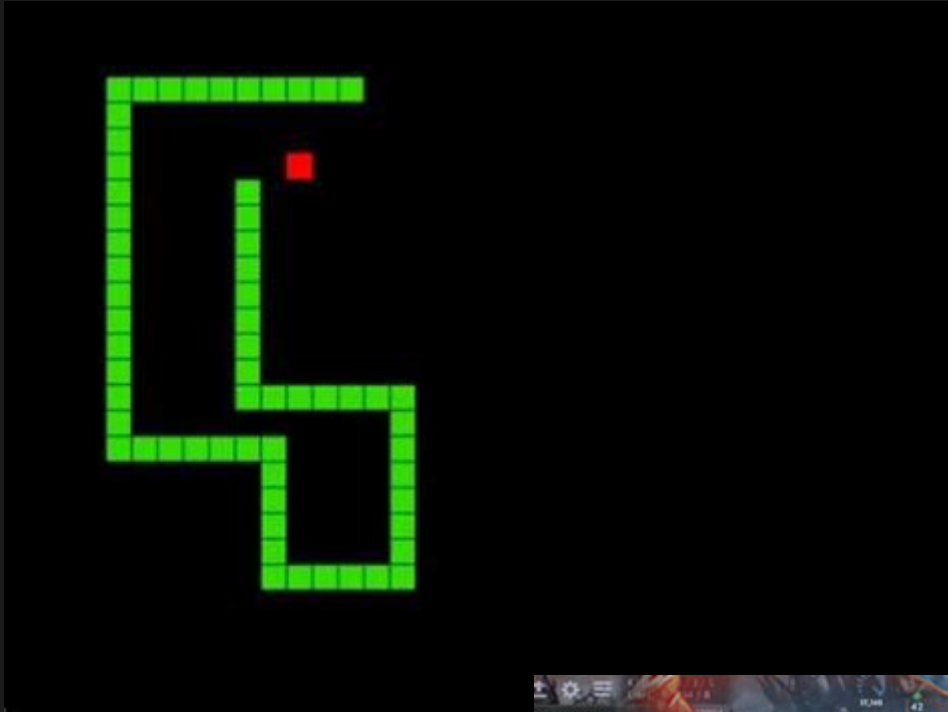- Data handling: **Pandas** (pandas.pydata.org)
  flexible and convenient framework for working
  with large data sets

- Machine Learning: **Scikit-learn** (scikit-
  learn.org)
  probably the largest ML library out there with
  excellent documentation, examples, and huge
  community

- Math framework for ML and Deep Learning:
  pytorch (pytorch.org)
  cuda-compatible framework to build your own
  models; autograd; specialized for computer
  vision

Schedule for this Seminar

Unsupervised Learning Methods

- Clustering methods
- Kernel-density estimation
- Principal Component Analysis

November 22

Supervised Learning Concepts

- Data: training/test/validation data, iid
- Objective functions
- Metrics and Errors
- Regularization and Generalization
- Parameters and Hyperparameters

November 25-27

Supervised Learning Methods

- K-nearest neighbors

- Decision trees

- Ensemble methods: random forests

- Hyperparameter tuning

December 2-4

Deep Learning

- Neurons and perceptrons

- Multi-layer perceptrons

- Stochastic Gradient Descent and Backprop

- Convolutional Neural Networks

- Why Deep Learning is the hot stuff right now…

December 13