LectureNote1: CS229 (SPRING2022, Stanford)

Definition of Machine Learning

- Arthur Samuel (1959): Machine Learning is the field of study that gives the computer the ability to learn **without being explicitly programmed**
- Tom Mitchell (1998): a computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E
    - experience = data

Taxonomy of Machine Learning(Simplistic View Based on Tasks)

- Supervised Learning
    - given: a dataset that contains n samples (n pairs of (x, y))
    - task: if a residence has x square feet, predict its price y?
        - x can be more than one dimensional ex) $[x_1, x_2]$
    - "Supervision" refers to output y's
    - Regrssion vs Classification
        - regression: if $y \in \mathbb{R}$ is a continuous variable
        - classification: the label y is a discrete variable
- Unsupervised Learning
    - dataset contains **no labels**: no correct answer is given
    - Clustering
    - Latent Semantic Analysis (LSA)
    - Word Embeddings
        - represent words by vectors
        - word $-encode \rightarrow$ vector
        - relation $-encode \rightarrow$ direction
    - Clustering Words with Similar Meanings (Hierarchically)
    - Large Language Models
- Reinforcement Learning

- learning to make sequential decisions
- the algorithm can collect data interactively
  - try the startegy and collect feedbacks $\leftrightarrow$ improve the startegy based on the feedbacks