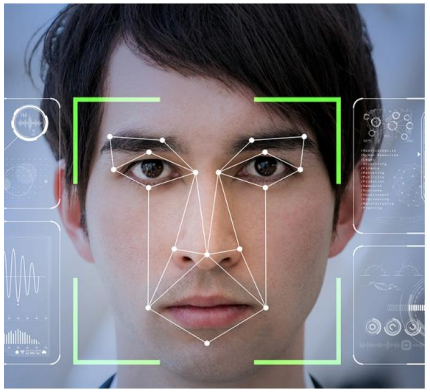
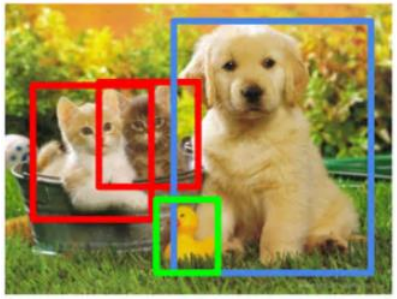


Face Recognition

Speech Recognition

Medical Diagnosis



Object Detection

Strategic Planning

Problem Detection

Introduction to Machine Learning

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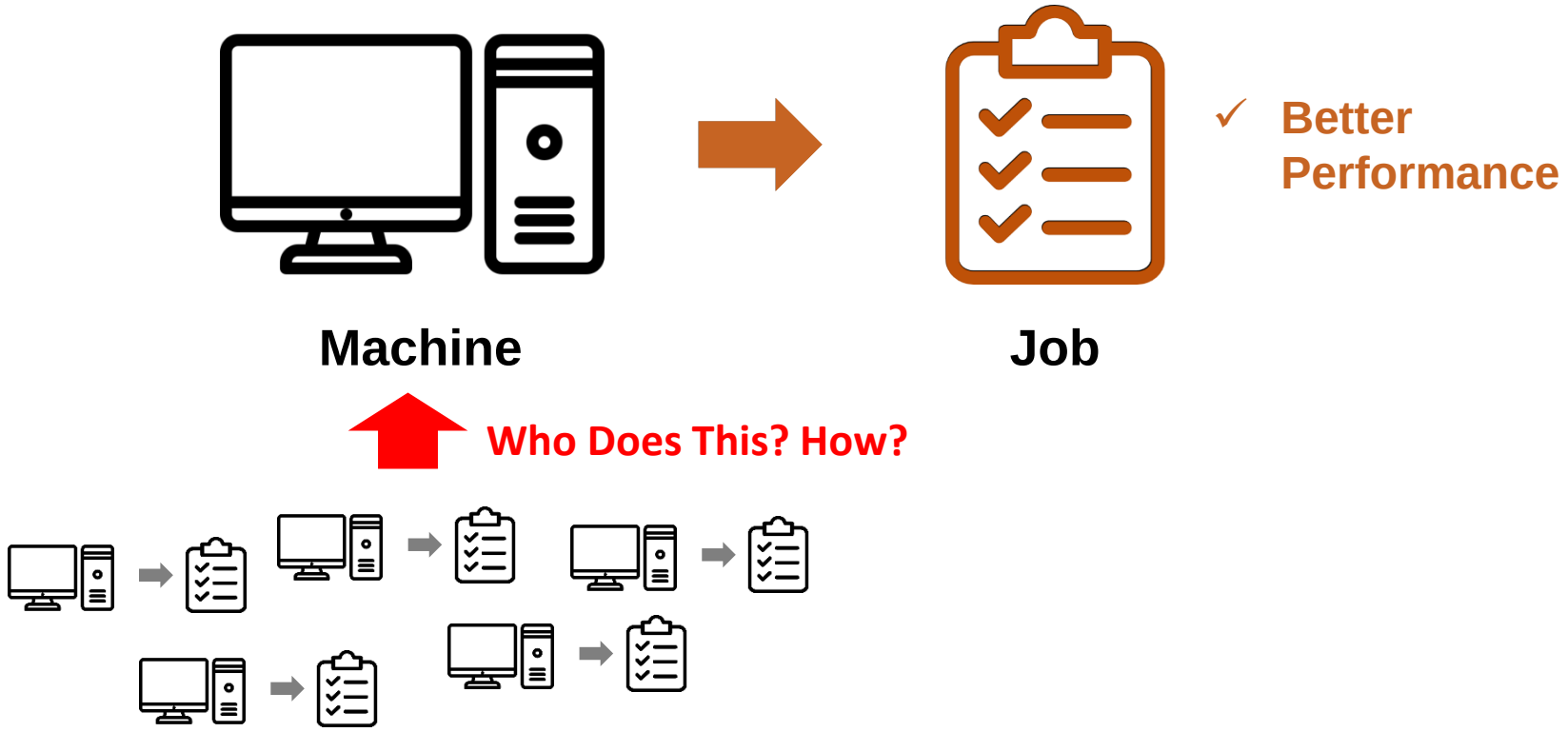
What is Machine Learning?

- According to Tom M. Mitchell,

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***



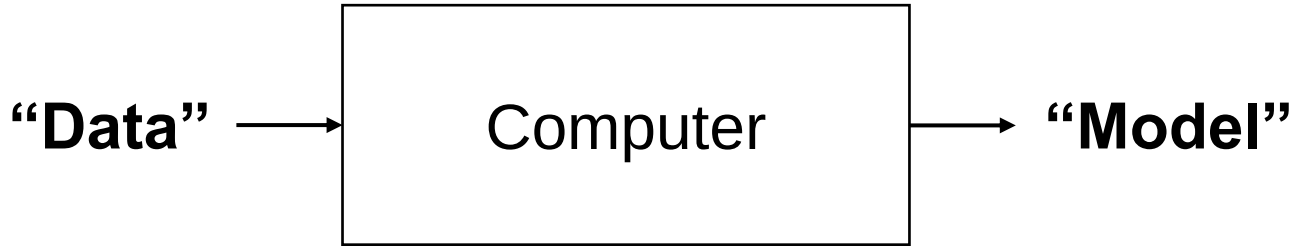
What is Machine Learning?

- According to Alpaydin,

  Programming computers to optimize performance criterion using example data or past experience

- Machine learning is about developing predictive models from uncertain data.

General Flow of Machine Learning

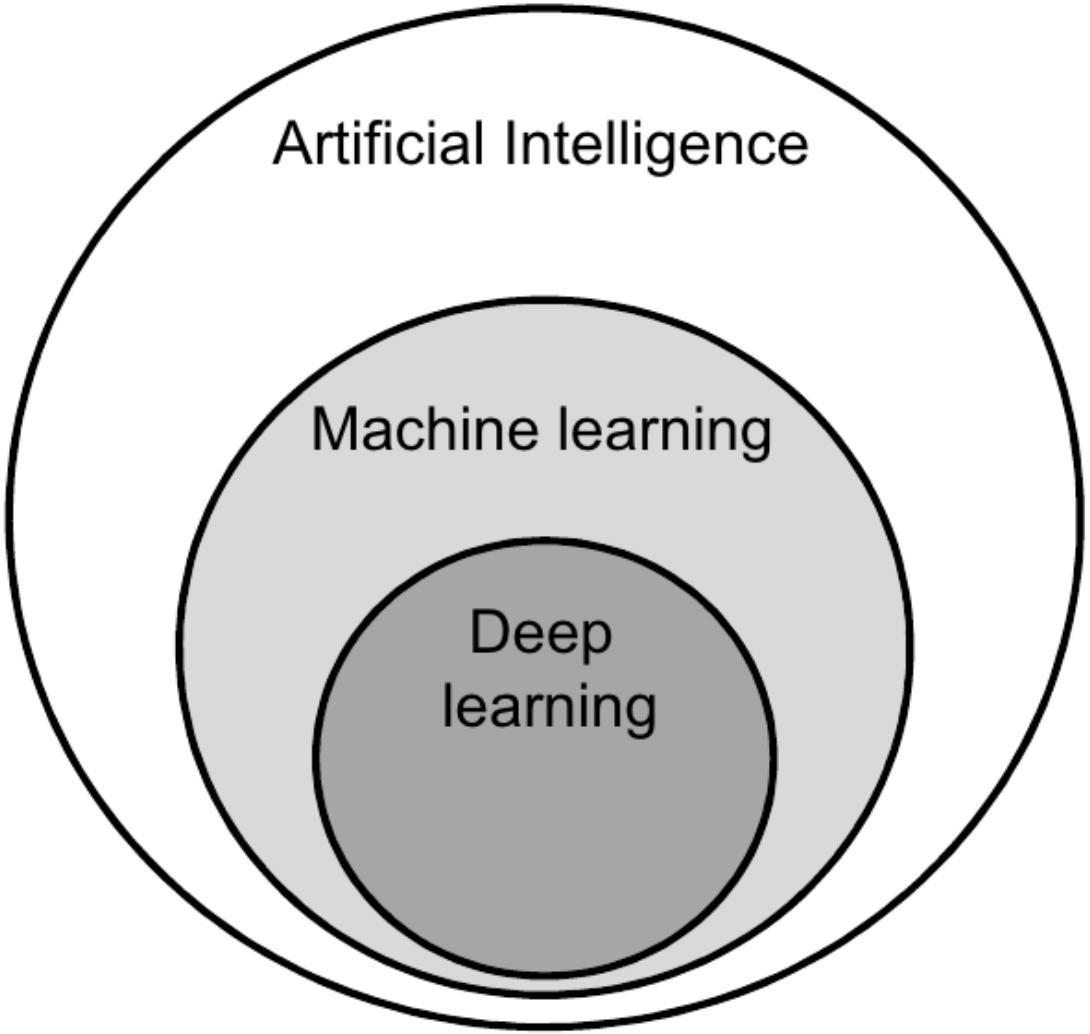


Examples of Machine Learning

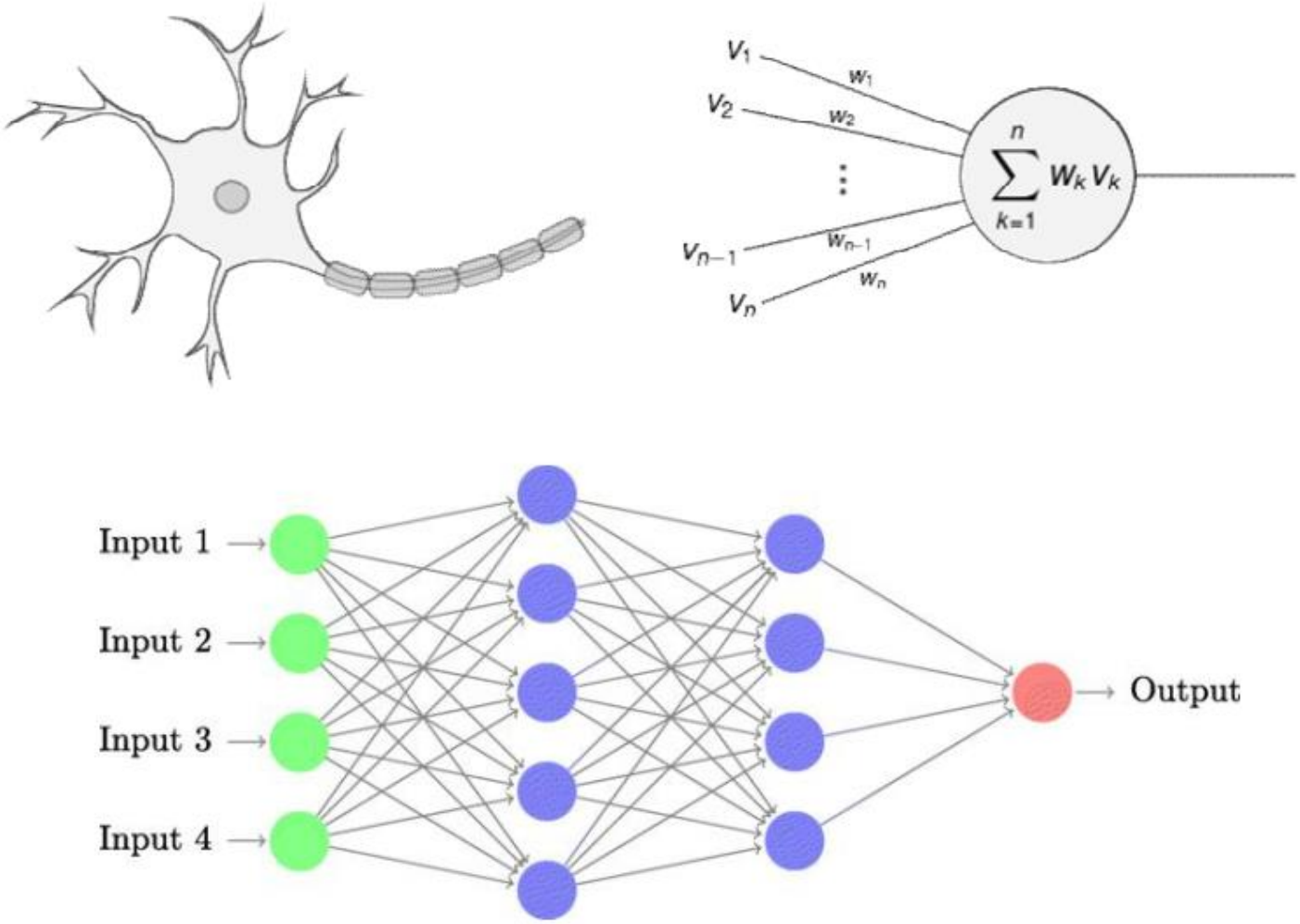
- Spam Filtering, Image Processing, Classifying Flowers
- Temperature prediction, Stock market
- User clustering in E-commerce
- Alphago



AI vs. ML vs. DL



Artificial Neural Network



Types of Machine Learning

- Supervised vs. Unsupervised learning
- Parametric vs. non-parametric method
- Batch vs. online learning
- Discriminative vs. Generative method

Supervised vs. Unsupervised Learning

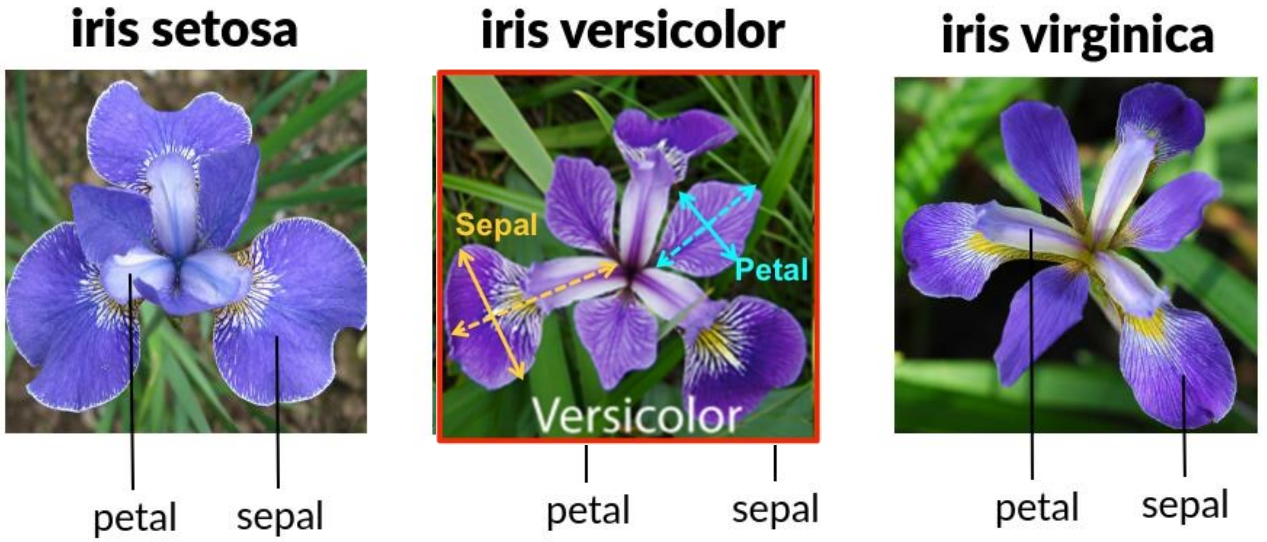
- Supervised learning / “Predictive”
  - Training set : $\mathcal{D} = \{(\mathbf{x}_i, y_i)\}_{i=1}^{N}$
    - ✓ Input x_i : D-dimensional vectors called features or attributes
    - ✓ Output y_i : **response variable**
  - Classification, Regression, Neural Network ..
- Unsupervised
  - Only given inputs, $\mathcal{D} = \{\mathbf{x}_i\}_{i=1}^{N}$
  - Clustering, Association rule, Density estimation, Dimension control

Semi-supervised or Reinforcement Learning

- Semisupervised learning
- Reinforcement learning : reward and punishment

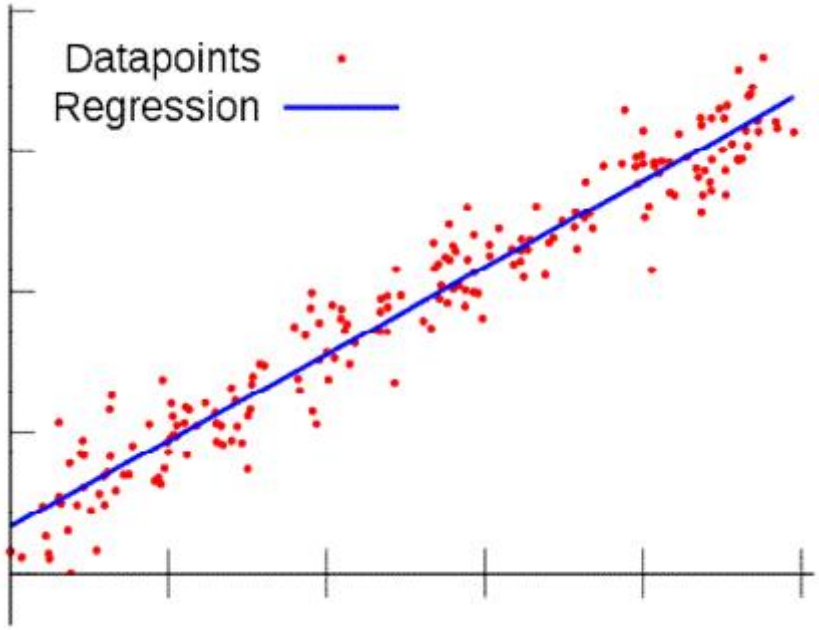
Simple Classification; Iris Flower

- Can you specify $\mathbf{x}_i$ and y_i?



Simple Regression

- Can you specify $\mathbf{x}_i$ and y_i?



Are You Familiar With …?

- Linear algebra
- Calculus or algorithm based optimization
- Probability and statistics
- Computer programming

➔ No worry! You will learn from this course!

Why We Need Probability & Statistics

- Basically, we want “the machine” can perform delicate jobs.
- Real world data is “uncertain” and “ambigous”
- Handling exception case (or outliers)

Machine Learning in Electronic Engineering

- Lithography
  - Compact Lithographic Process Model
  - Mask Synthesis – correction techniques in mask designs
- Manufacturing, Yield and Reliability
  - Wafer level correlation
  - Yield enhancement during manufacturing
  - Virtual probe for chip characterization
  - Aging analysis
- Failure Modeling
  - Extreme yield memory design
  - Fast yield estimation tool

Machine Learning in Electronic Engineering

- Analog circuit design
  - Classification of analog circuit design with limited simulation runs
  - Establishing circuit model considering large number of scenario
  - Circuit optimization
- System Design optimization
  - Auto tuning system for high performance computing
  - Workload decision for power/thermal management
  - Hardware for machine learning