Deep Learning 101

The Basics

Schedule

week	Date	Topic
9	10.27	The Setup, Python & TensorFlow overview
10	11.03	Training and testing
11	11.11	CNN
12	11.18	RNN
13	11.24	Autoencoder & GAN

Today's Agenda

- Goals
- Concepts:
  - AI, Machine Learning, Deep Learning
  - Supervised, Unsupervised, and Reinforcement
  - Structured vs. Unstructured
  - Deep Learning vocabulary
- Setup
- Lab time

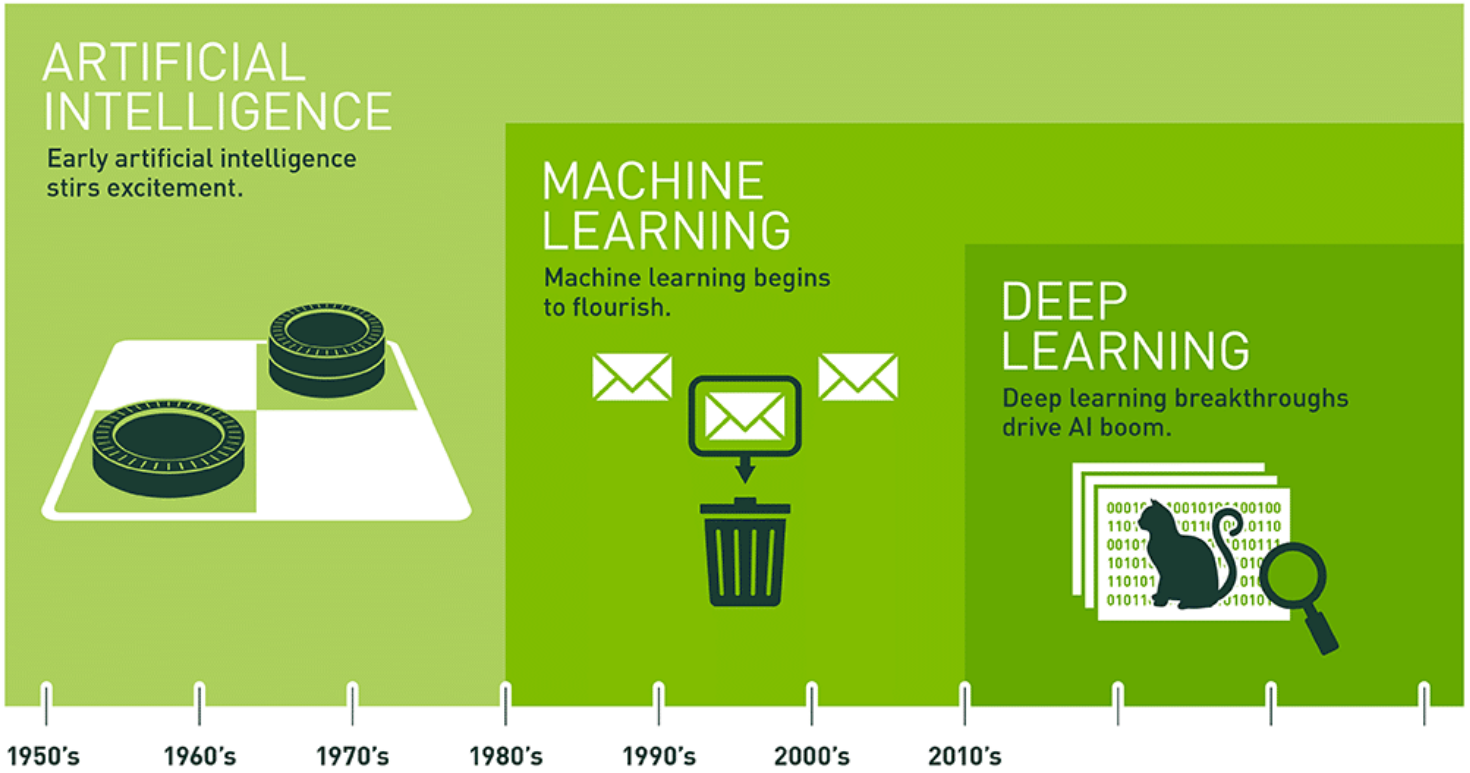
Goals

- Conceptual understanding of Deep Learning: to understand how an AI system works ‘under the hood’
  - Model, training, inference, etc.
- Knowledge about various Deep Learning algorithms
  - Regression, Artificial Neural Networks, CNN, RNN, GAN, etc.
- Basic technical skills for developing AI models
  - Python, Jupyter notebooks, TensorFlow

What is AI?

- **AI (인공지능): 기계로 하여금 사람 같은 지능으로 인지하고 행동**
- **Machine Learning (기계 학습): 경험을 통해 자동으로 학습**
- **Deep Learning (심층 학습): Artificial Neural Network 기반 학습**

AI, Machine Learning, & Deep Learning



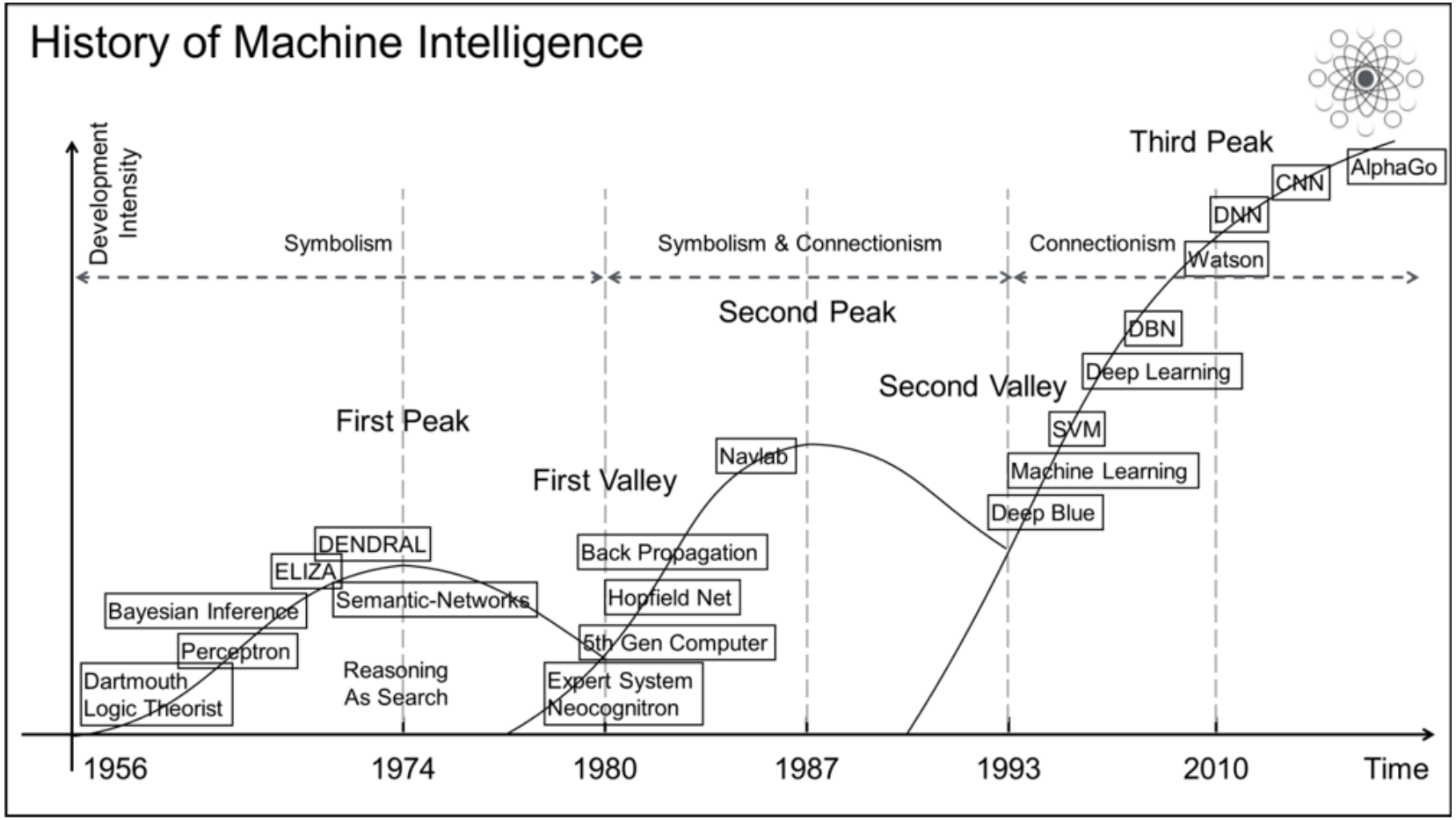
Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

https://blogs.nvidia.com.tw/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

TESTWORKS

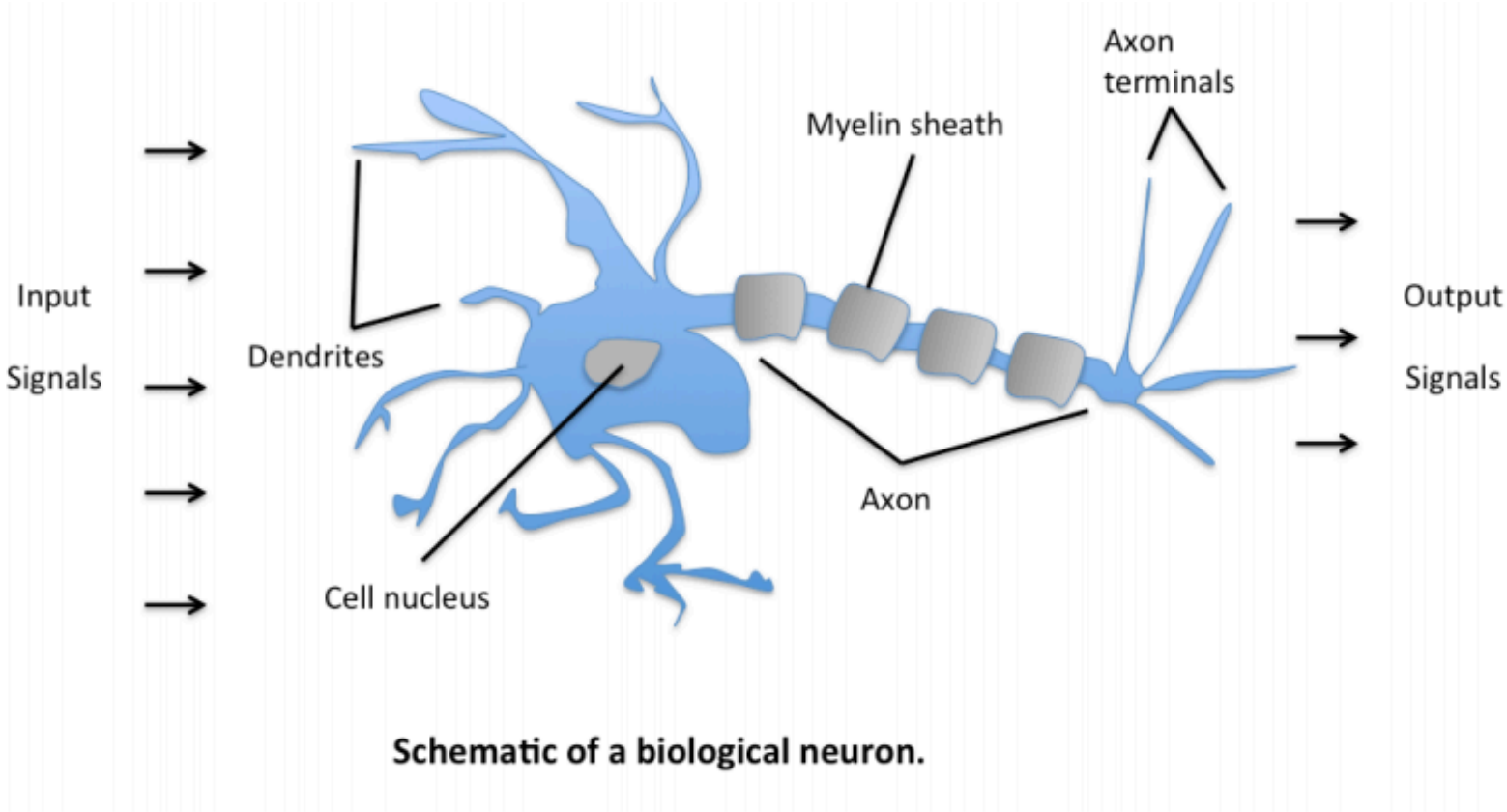
AI in the wild

A Brief History of Machine Intelligence



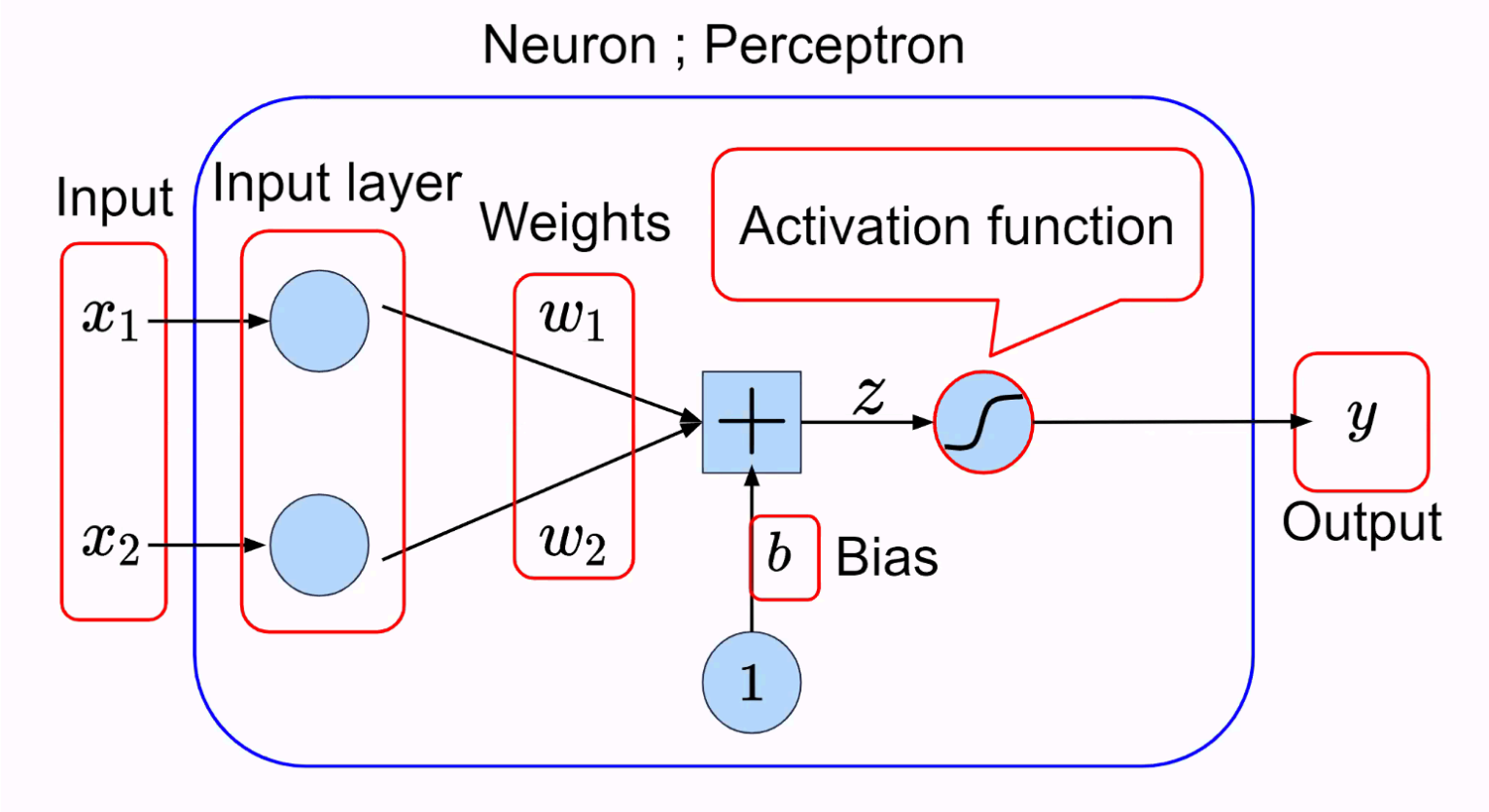
https://www.alibabacloud.com/blog/looking-forward-will-machine-intelligence-be-able-to-outsmart-hackeers_595907

Neural Network



Schematic of a biological neuron.

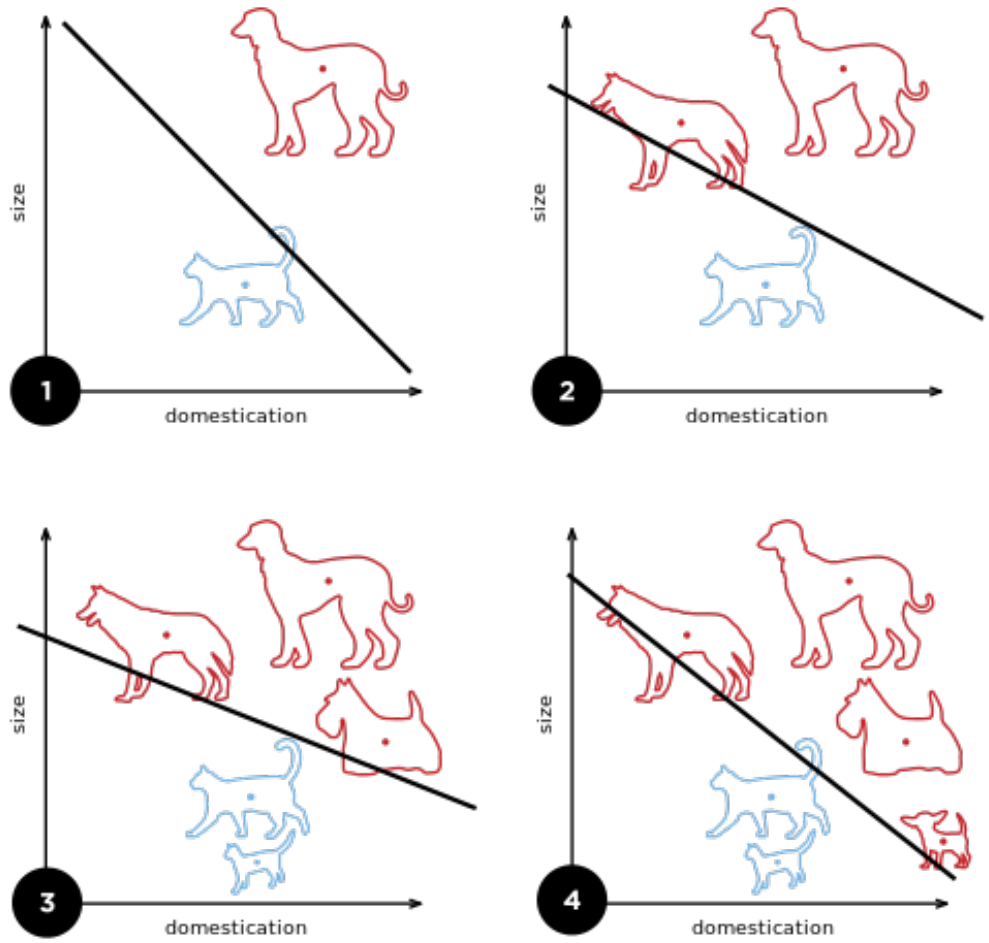
Perceptron



Developed by Frank Rosenblatt at the Cornell Aeronautical Laboratory in 1958 (https://en.wikipedia.org/wiki/Perceptron)

Perceptron for classification problems

$$f(\mathbf{x}) = \begin{cases} 1 & \text{if } \mathbf{w} \cdot \mathbf{x} + b > 0, \\ 0 & \text{otherwise} \end{cases}$$



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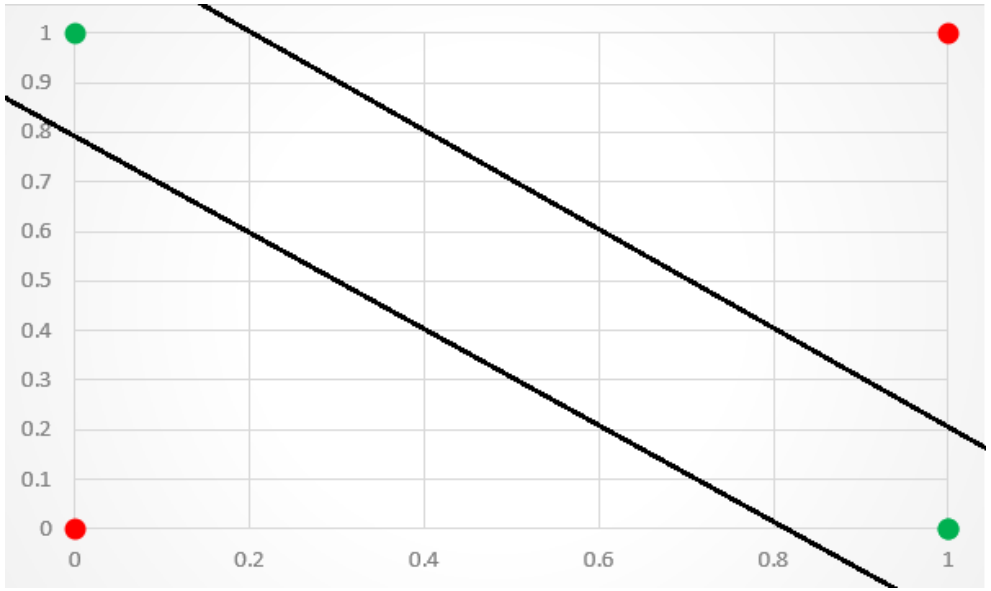
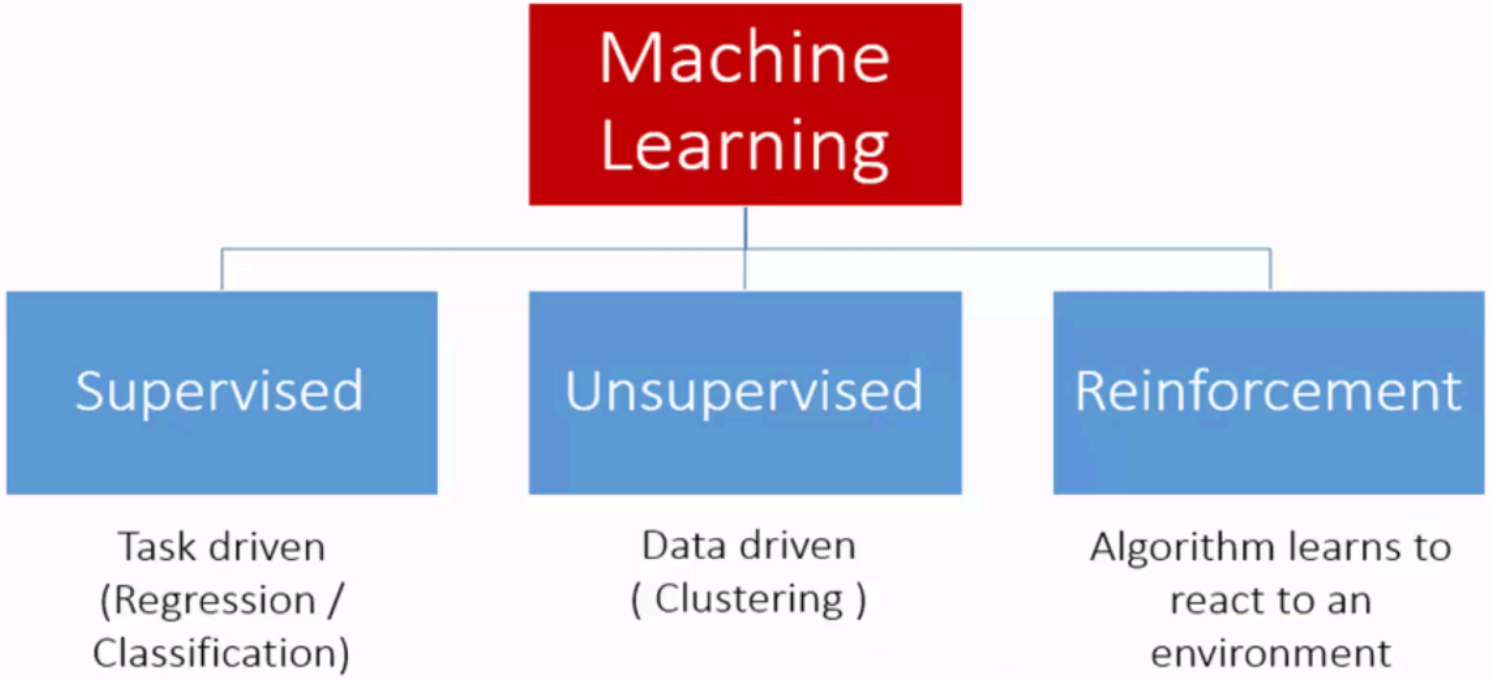
XOR problem

Input1	input2	Output
0	0	0
1	0	1
0	1	1
1	1	0



- Minksy and Papert (1969)
- Solution: Multilayer NN + Backpropagation

Types of Machine Learning



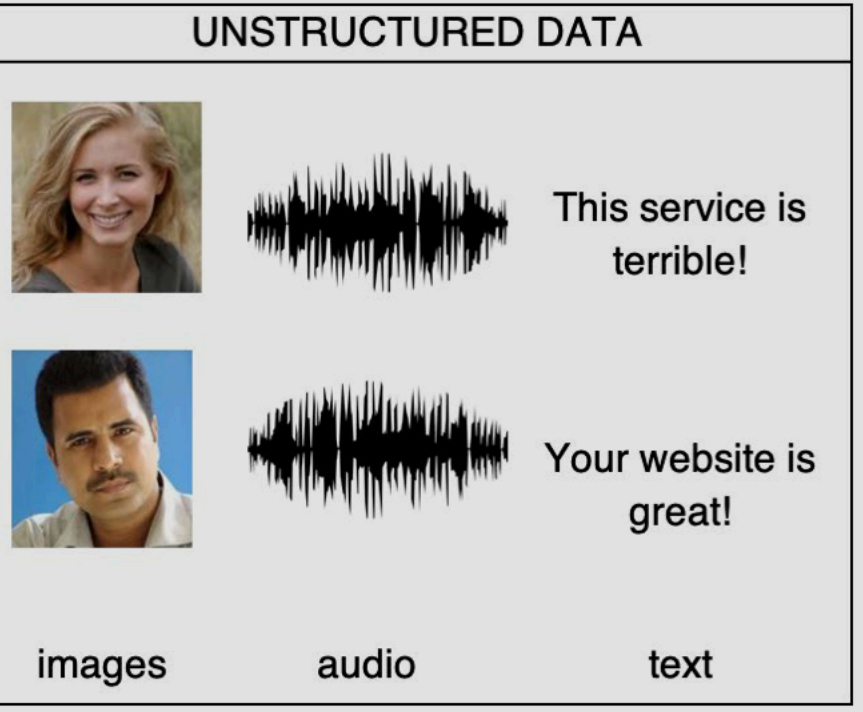
https://medium.com/deep-math-machine-learning-ai/different-types-of-machine-learning-and-their-types-34760b9128a2

Structured vs. Unstructured

- Structured: Arranged in columns of features
- Unstructured: no structure

STRUCTURED DATA

id	age	gender	height (cm)	location
0001	54	M	186	London
0002	35	F	166	New York
0003	62	F	170	Amsterdam
0004	23	M	164	London
0005	25	M	180	Cairo
0006	29	F	181	Beijing
0007	46	M	172	Chicago



What is Deep Learning?

- Layers of Neural Networks

Scalar, Vector, Matrix, & Tensor

- Scalar: a single number
  - 7, -2.4
- Vector: a list of numbers
- Matrix: a 2-dimensional array of numbers
- Tensor: an n-dimensional array of objects

* These are practical definitions.

Tensors, TensorFlow, and Keras

- Tensor: multi-dimensional arrays with a uniform type (called a dtype)
- TensorFlow: an open-source Python library for machine learning
  - Manipulates tensors
- Keras: high level API for machine learning libraries
  - Supports TensorFlow, Microsoft Cognitive Toolkit, R, Theano, and PlaidML
- Reference: https://www.tensorflow.org

Rank, dimension, axes, and shape

- Rank: number of dimensions
- Dimension: 2D, 3D, etc.
- Axes: indices of a dimension
- Shape: number of elements in each dimension
  - a scalar has a rank 0 and an empty shape ()
  - a vector has rank 1 and a shape of (D0)
  - a matrix has rank 2 and a shape of (D0, D1) and so on

What is Keras?

- Keras is an open source library that provides python interface for machine learning libraries
  - TensorFlow is one of the libraries supported by Keras
  - Easier and simpler to use than TensorFlow
  - Will learn both
- Sequential:
  - One layer follows immediately from the previous without any branching
- Functional API:
  - To create a model with multiple input and output layers

Setup

- Chrome browser
- PyCharm
- (optional) Google account: to run the code in colab

Development Environment

- Programming Language: Python

- Editor: IDE (Integrated Development Environment)
  - PyCharm Community Version
  - Jupyter notebook
- https://github.com/changsin/DeepLearning-101

Resources

- AI with Python tutorial:
  - https://www.tutorialspoint.com/artificial_intelligence_with_python/index.htm
- 모두를 위한 머신러닝 (in Korean):
  - https://hunkim.github.io/ml/
- And many more…

Lab time

- To clone: from your terminal
  - >git clone https://github.com/changsin/DeepLearning-101.git
- Or use google colab to point to the git hub repository
- Git is an open source version control system
  - Github is a host service using git.