

LAB 01

Application of Neural Networks in Computer Vision

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1. 강화학습이란 무엇인가?
2. OpenAI Gym
3. Q-Learning

Machine Learning

Definition

한 컴퓨터 프로그램이 어떤 과제류(class of tasks) T 에 속하는 과제들을 수행하며 그 수행의 성과를 측정한 정도를 P 라고 할 때, 만약 어떤 경험 E 때문에 T 의 어떤 과제에 대한 성과 P 가 개선되었다면, 그 컴퓨터 프로그램은 경험 E 로부터 학습한다고 말할 수 있다.

[Mitchell, 1997]

머신러닝은 위 정의의 ‘학습’을 진행하는 알고리즘.

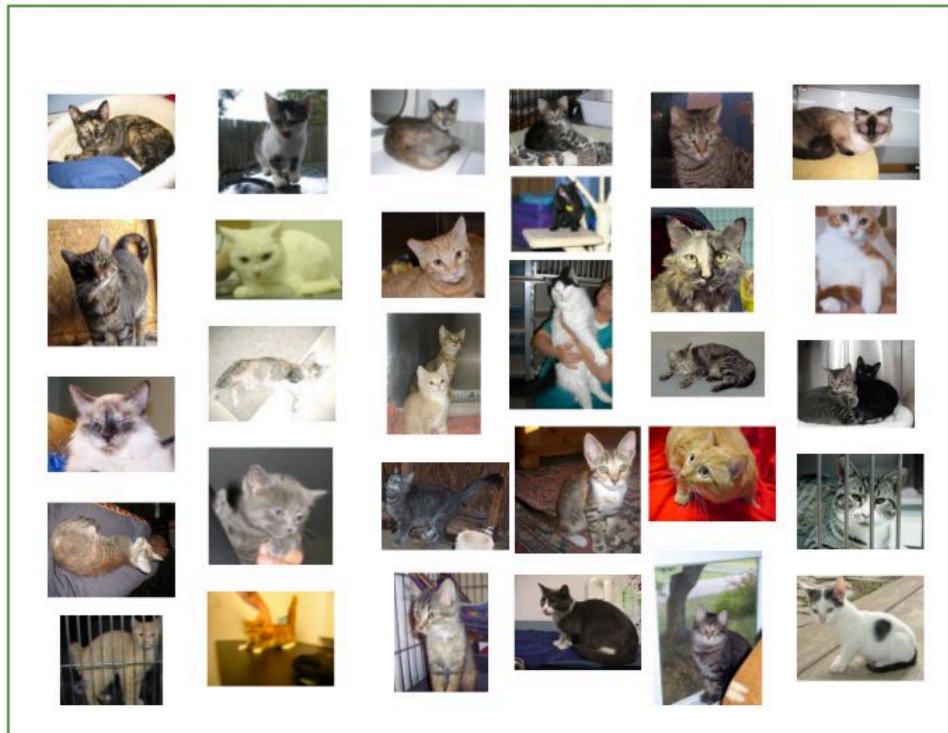
→ 경험 E 와 과제 T , 그리고 성과 측도 P 는 **해결하려는 과제마다 다르다**.

- └ What is Machine Learning?
- └ Machine Learning Tasks

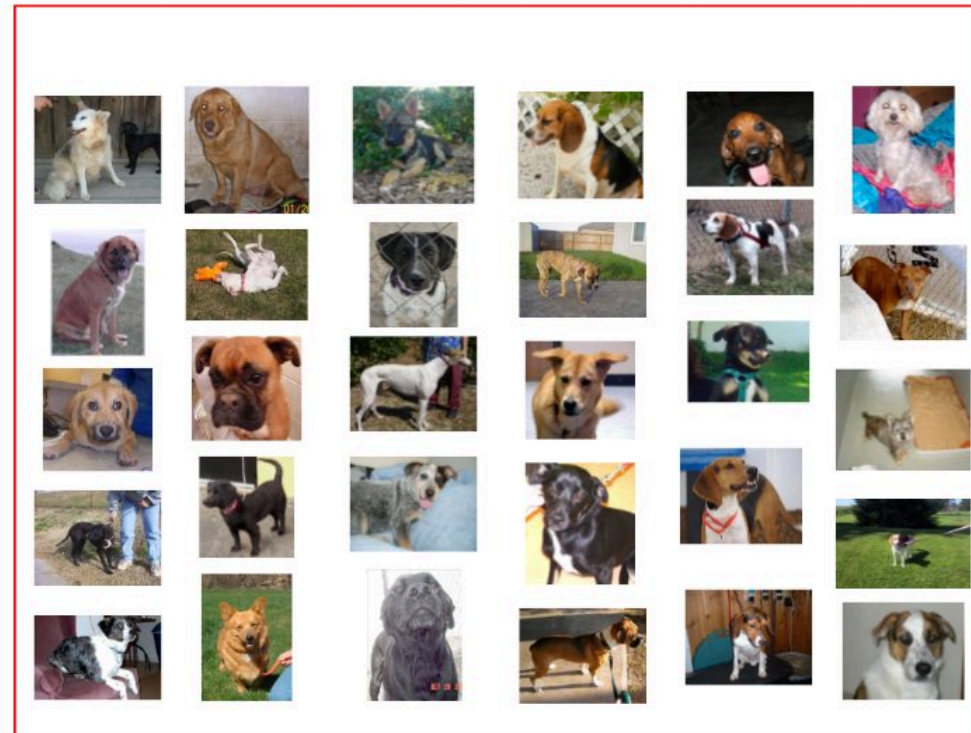
Machine Learning

머신러닝의 **과제** T | 분류(Classification)

Cats



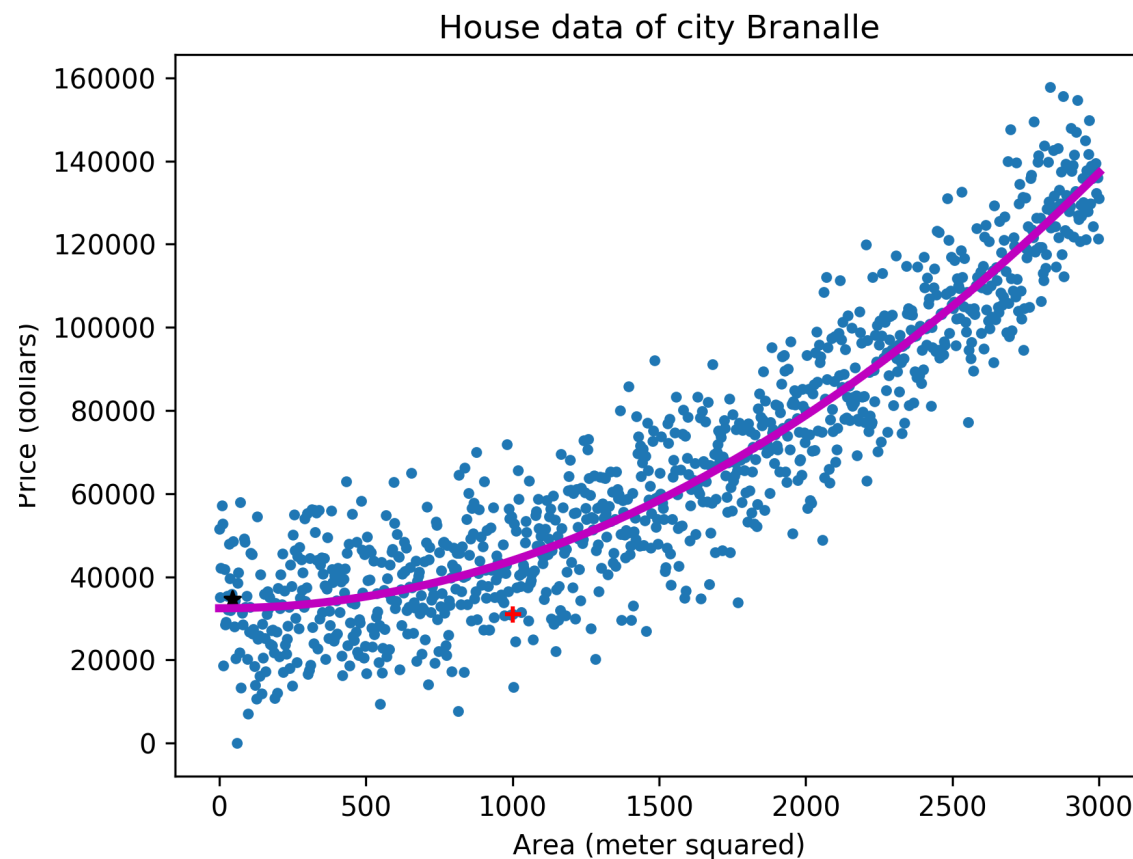
Dogs



Sample of cats & dogs images from Kaggle Dataset

Machine Learning

머신러닝의 과제 T | 회귀(Regression)



Machine Learning

머신러닝의 과제 T | 전사(Transcription)

Google
VOICE
TYPING



Machine Learning

머신러닝의 과제 T | 번역(Translation)



Machine Learning

머신러닝의 **과제** T | 합성(Synthesis)



Machine Learning

머신러닝의 **과제 T** | 잡음 제거(Denoising)

Original



Noisy image



Denoised image



Machine Learning

머신러닝의 성과 P | 정확도 (Accuracy)

ACCURACY

$$A_{cc} = \frac{1}{n} \sum 1(\hat{y}_i = y_i)$$

Diagram illustrating the formula for Accuracy (A_{cc}):

- n : number of observations (indicated by a red arrow pointing to the denominator).
- \sum : Summation over all observations.
- $1(\hat{y}_i = y_i)$: Indicator function (indicated by a green bracket below the term).
- \hat{y}_i : Predicted y (indicated by an orange arrow pointing to the predicted value).
- y_i : True y (indicated by a blue arrow pointing to the true value).

A common metric in classification. Fails when we have highly imbalanced classes. In those cases F1 is more appropriate.

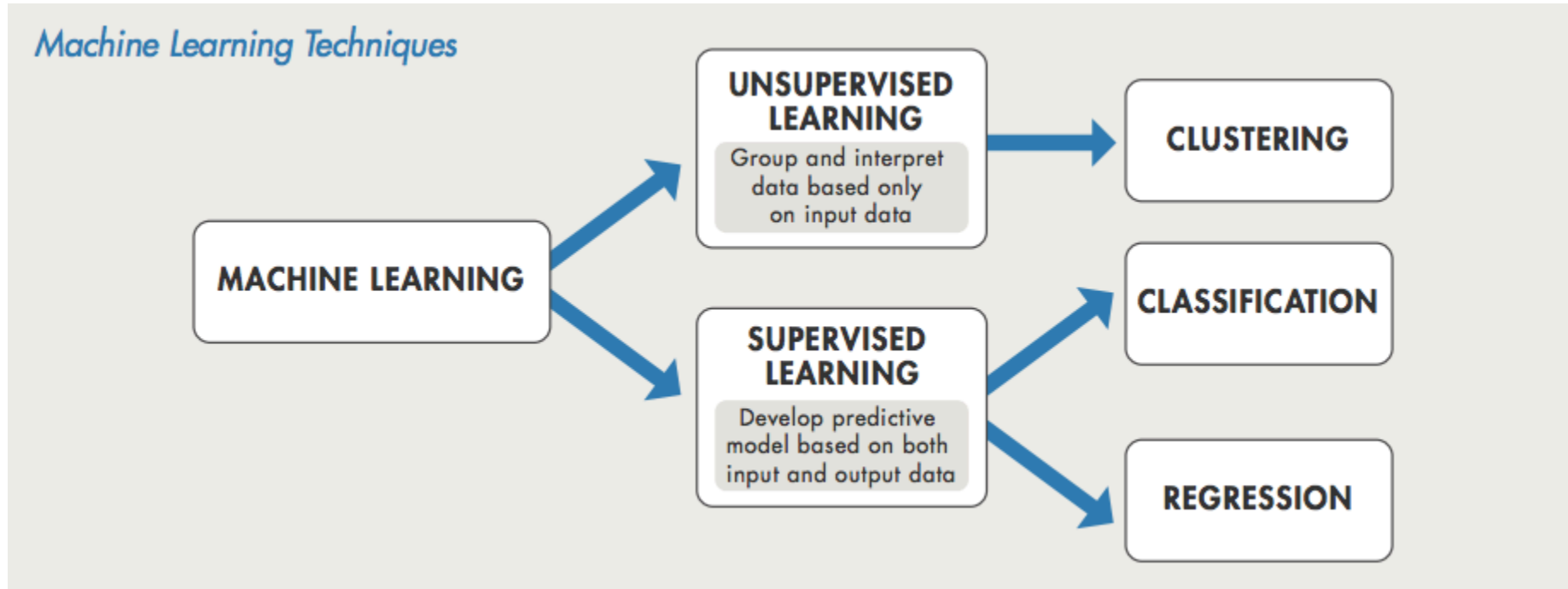
ChrisAlbon

Machine Learning

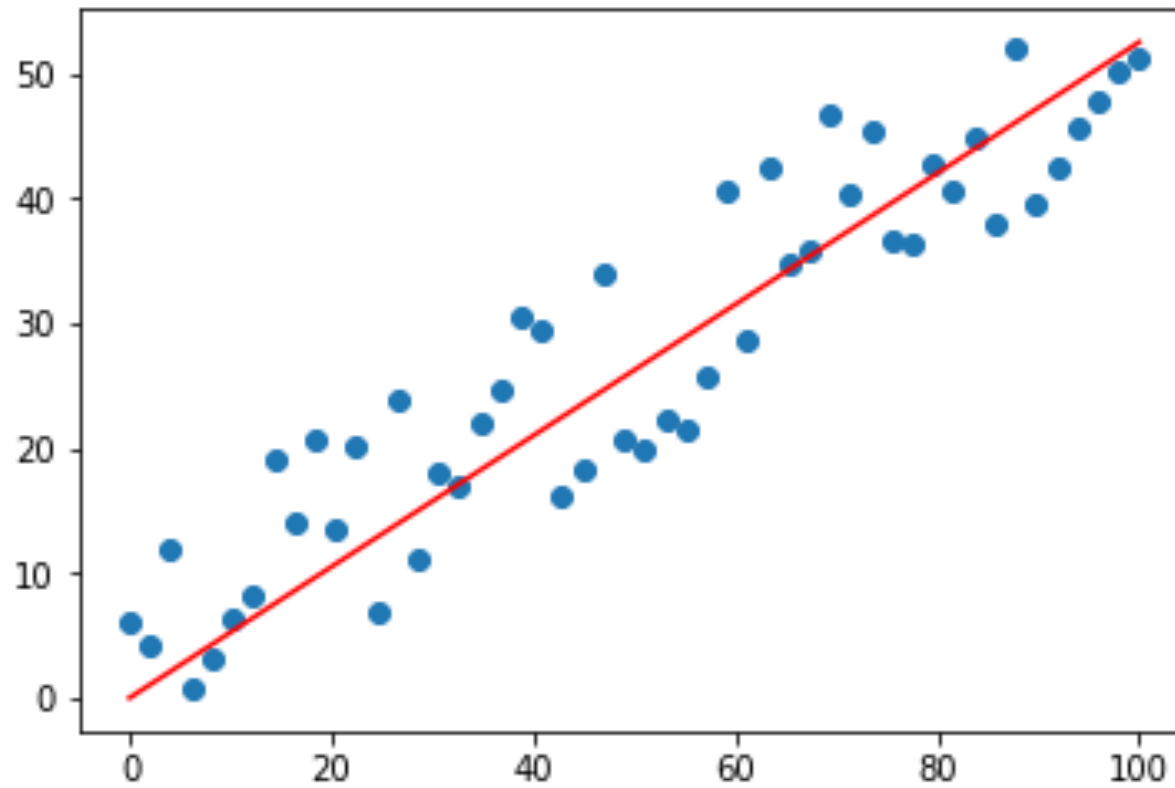
머신러닝의 경험 E | Dataset

Transaction	Time stamp	ID	Age group	Fresh fruit	Seafood
1	April	1	Senior	Orange	Tuna
2	April	2	Teenager	Banana	Tuna
3	April	4	Teenager	Banana	Tuna
4	June	1	Senior	Orange	Anchovy
5	June	3	Adult	Banana	Tuna
6	July	1	Senior	Orange	Anchovy
7	July	2	Teenager	Banana	Tuna
8	July	2	Teenager	Orange	Tuna
9	July	4	Teenager	Banana	Tuna
10	December	2	Teenager	Banana	Tuna
11	December	3	Adult	Orange	Anchovy
12	December	1	Senior	Orange	Anchovy

Machine Learning



Linear Regression

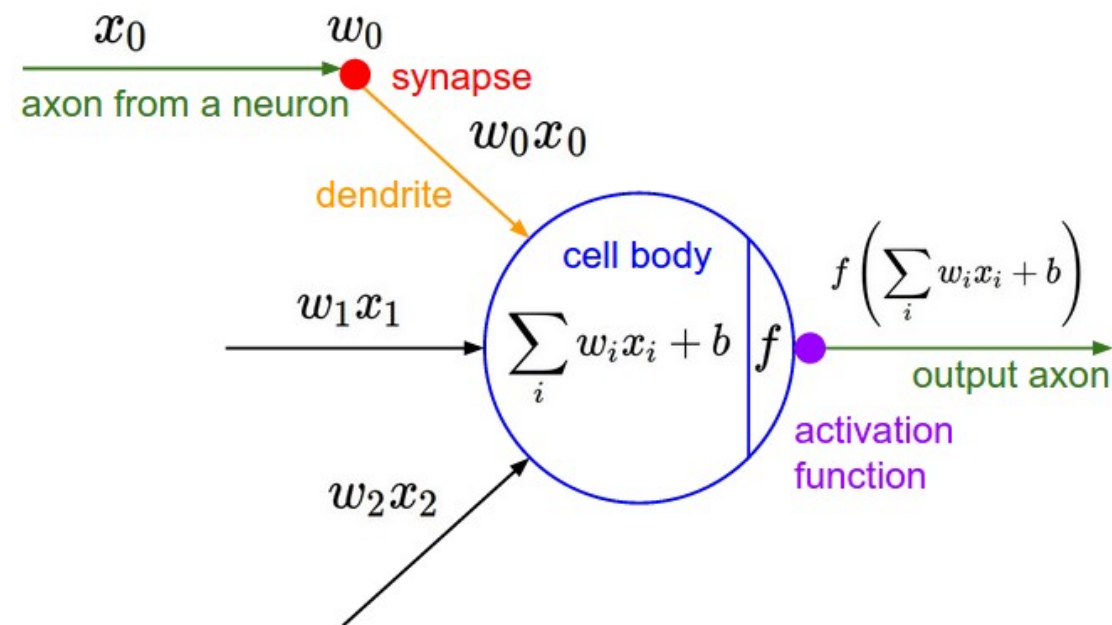
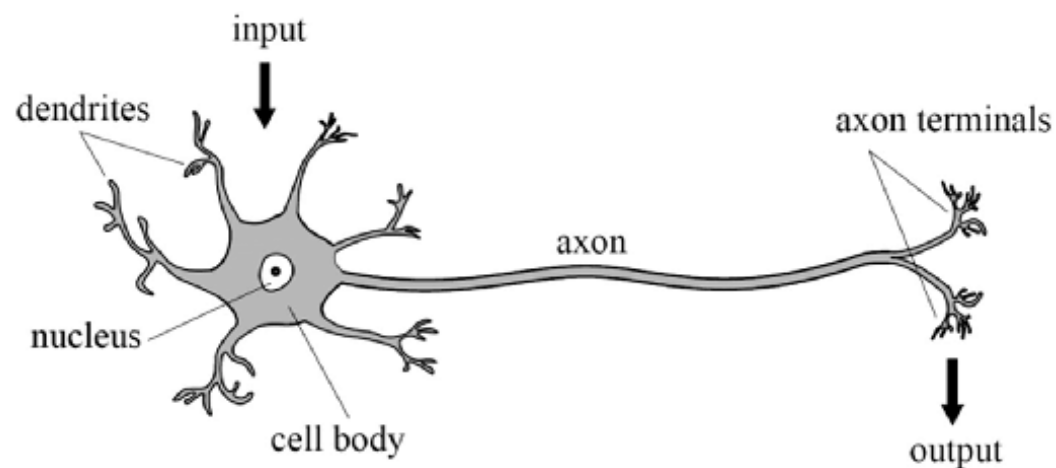


Linear Regression



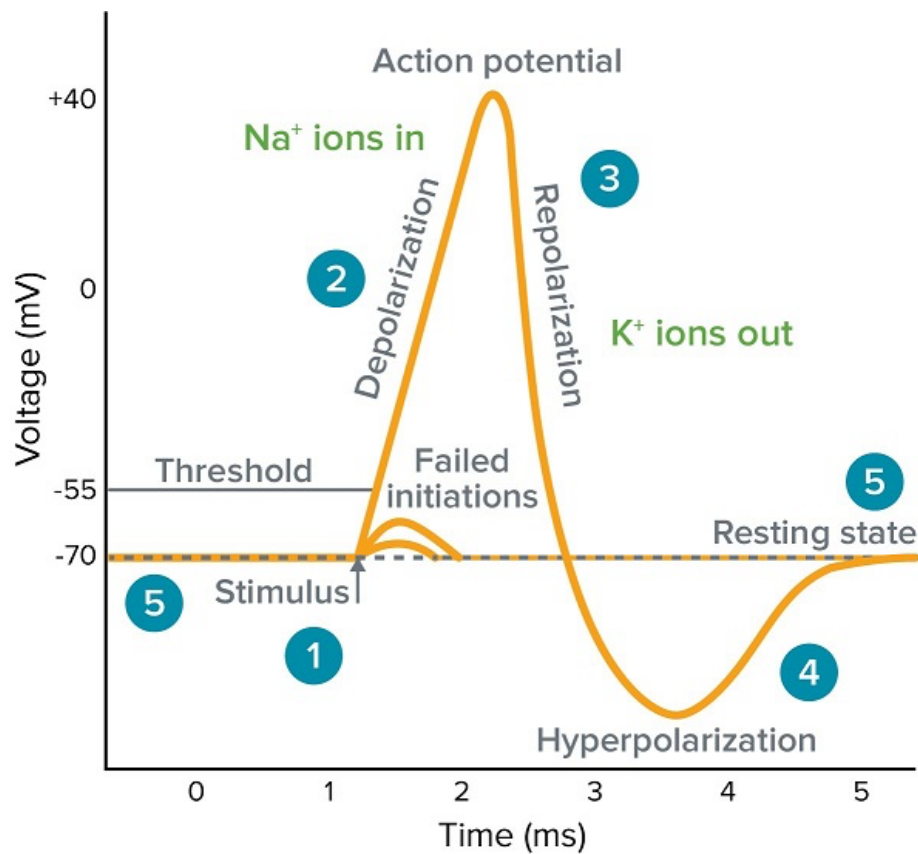
Neural Networks

인간의 뇌를 구성하는 신경세포에서 영감을 받아 만든 **수학적 모델**



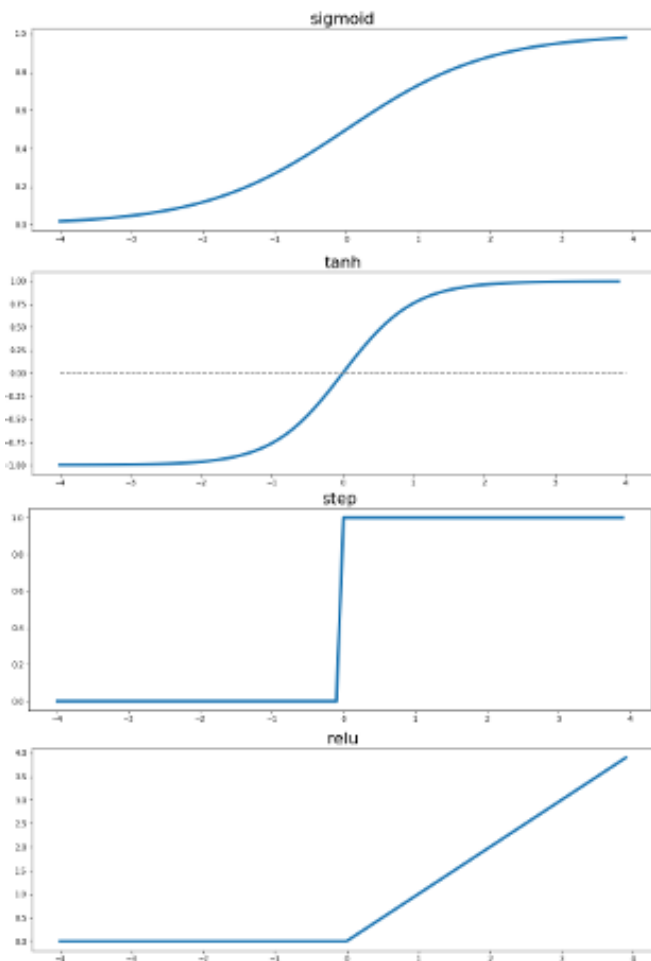
Neural Networks

생물학적 뉴런의 활성화



Neural Networks

수학적 뉴런의 활성화



Neural Networks

선형성(Linearity)

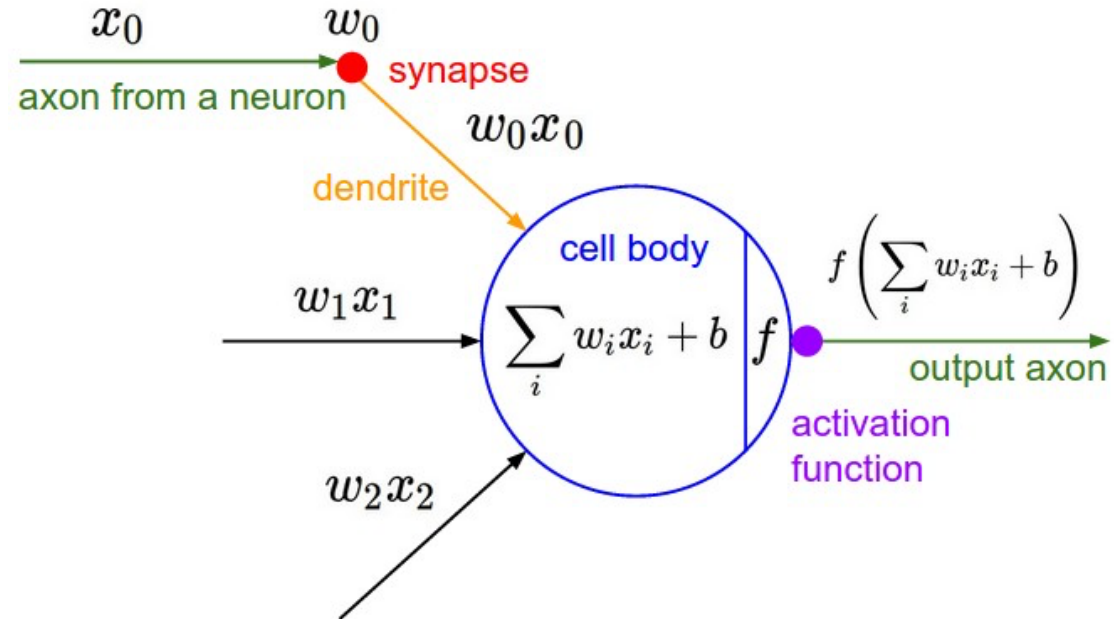
Definition

함수 f 에 대해, 가산성(Additivity: $f(x + y) = f(x) + f(y)$)와, 동차성(Homogeneity: $f(\alpha x) = \alpha f(x)$)가 항상 성립할 때 함수 f 는 '선형'이라고 한다.

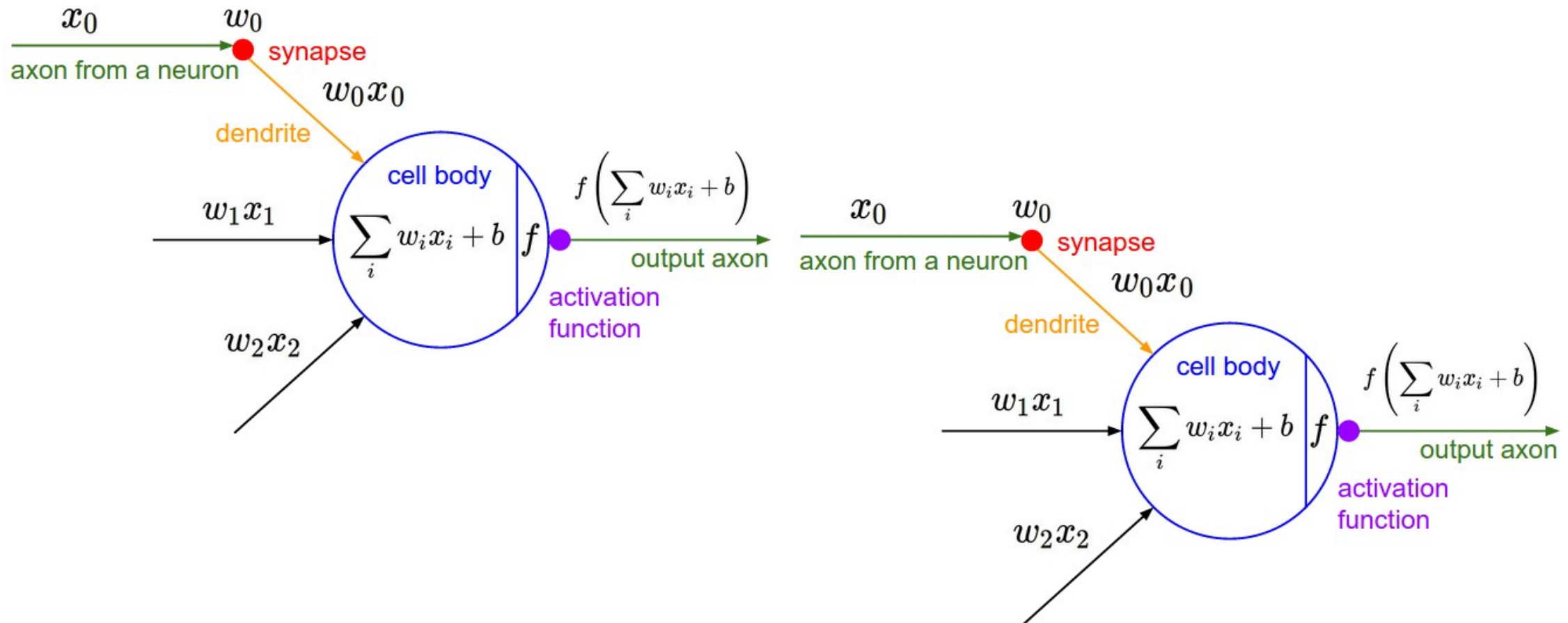
Linear Regression에서는 선형인 모델을 학습하기 위해 회귀를 진행했다.

Neural Network에서 역시 각각의 뉴런 자체들은 하나의 선형인 모델을 학습하는 것과 마찬가지이다.

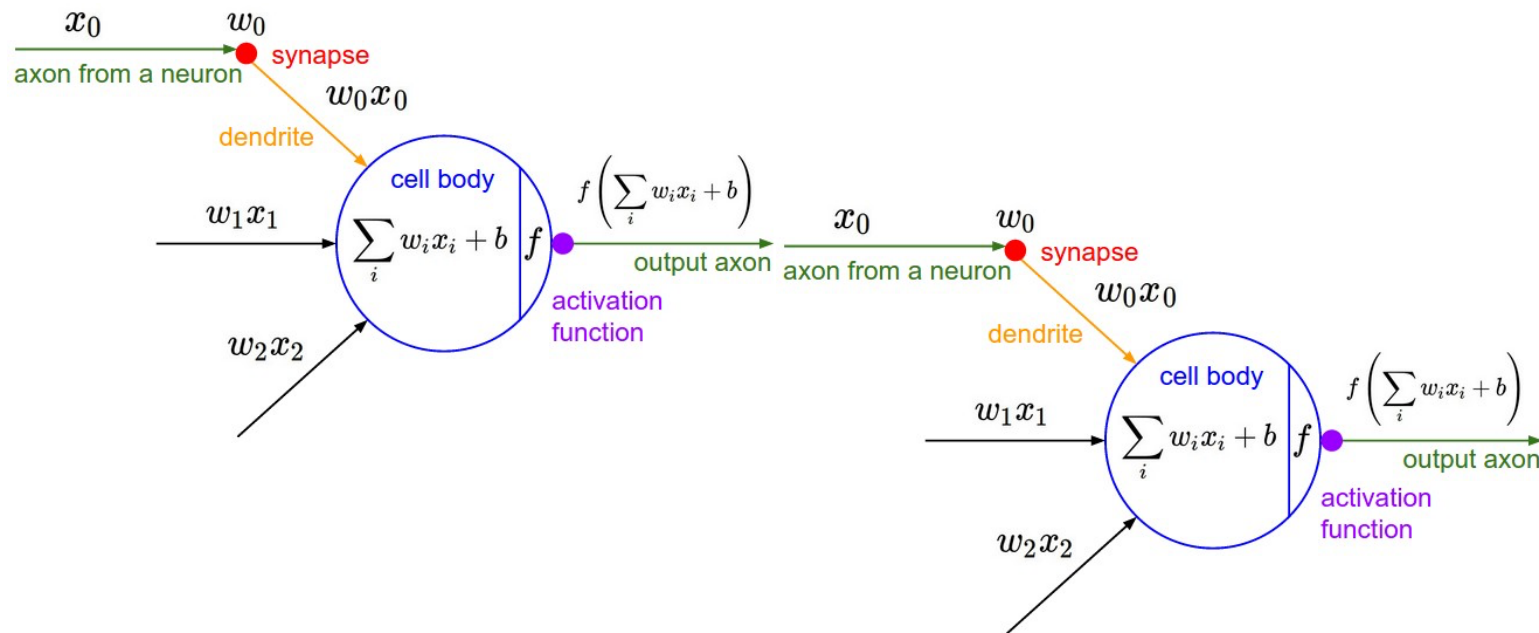
Neural Networks



Neural Networks



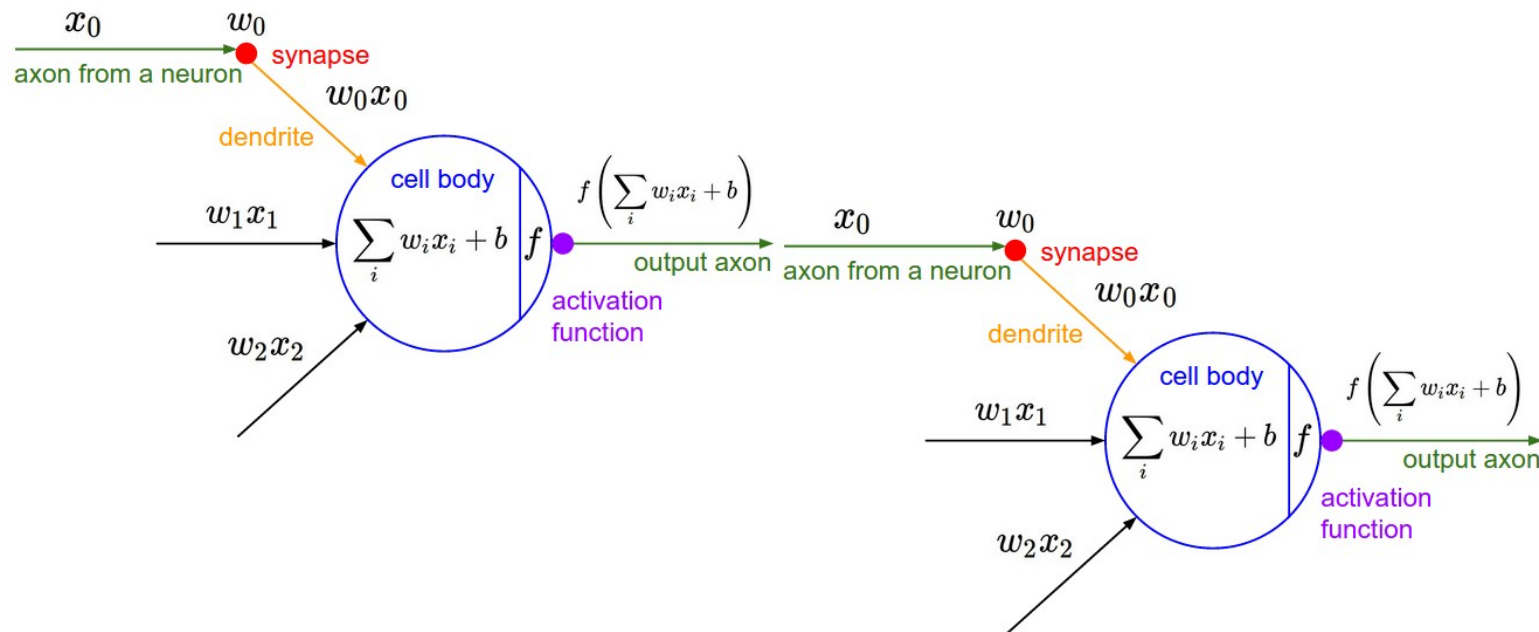
Neural Networks



$$out1 = W_1 x$$

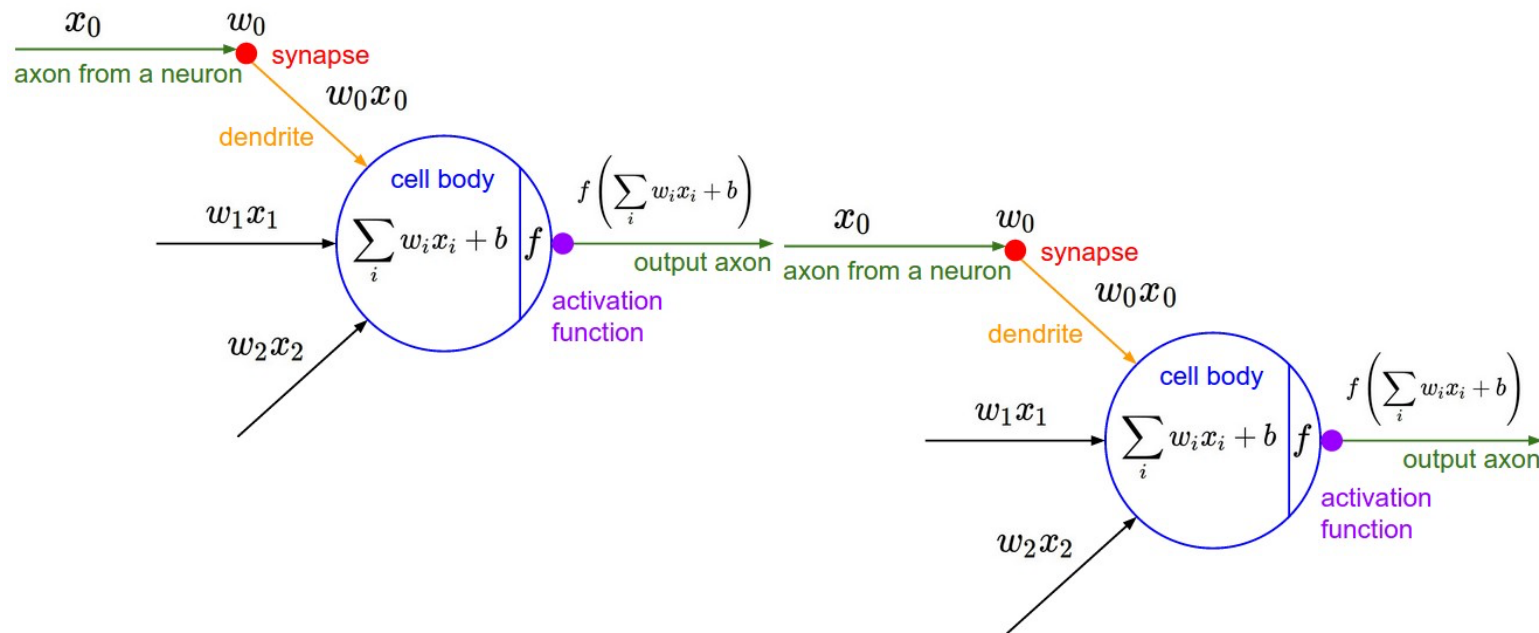
$$out2 = W_2 out1$$

Neural Networks



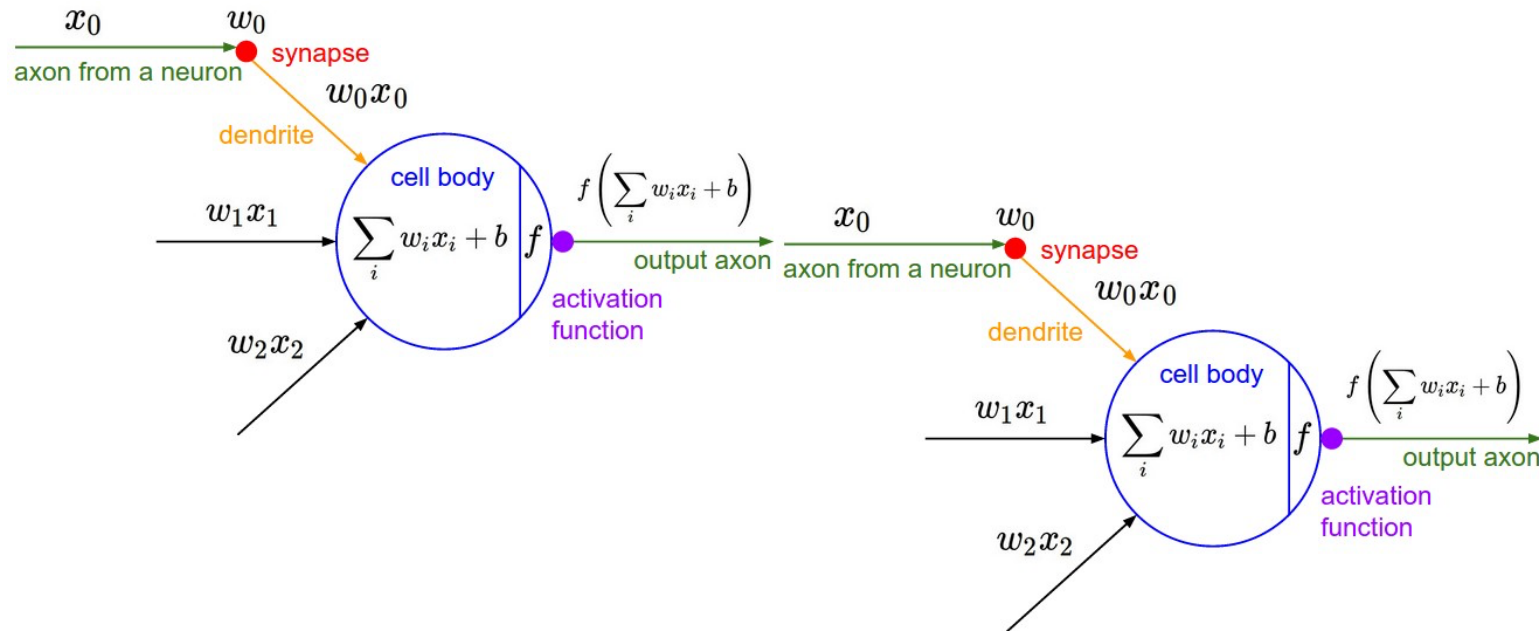
$$out = W_2(W_1x)$$

Neural Networks



$$out = Wx$$

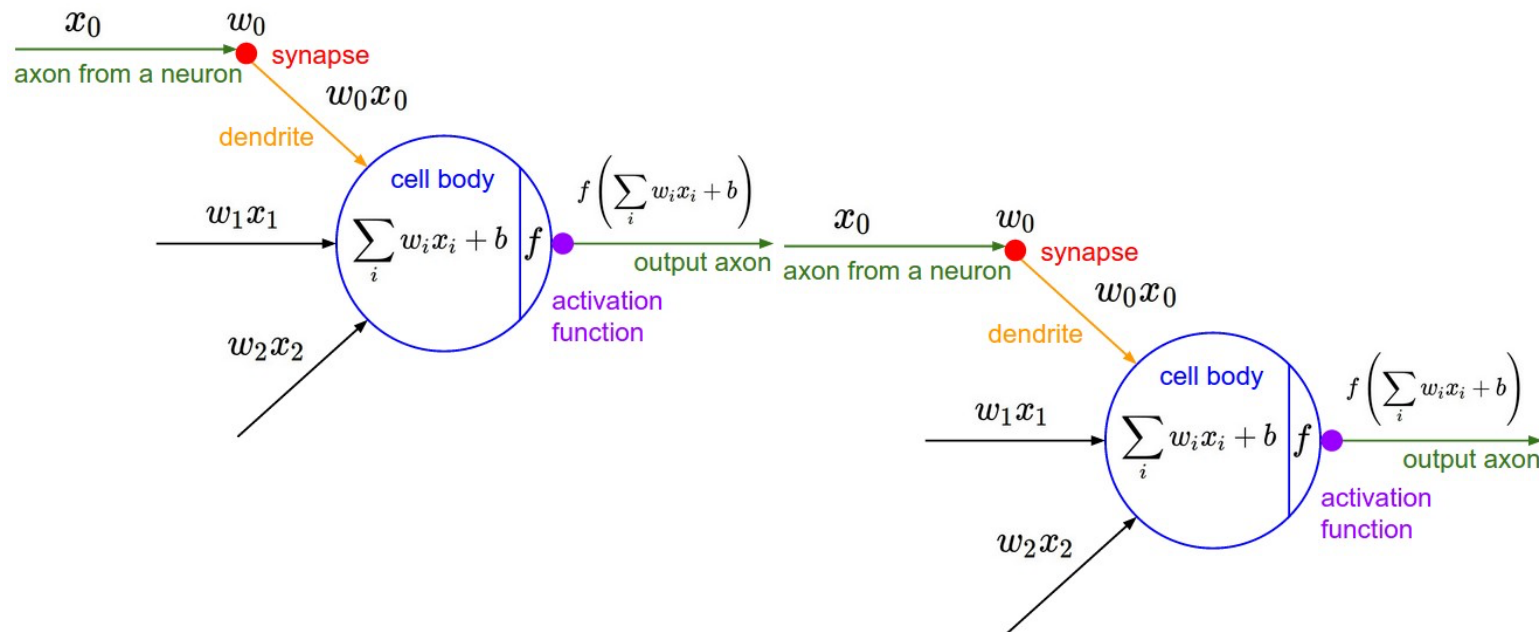
Neural Networks



$$out1 = f(W_1 x)$$

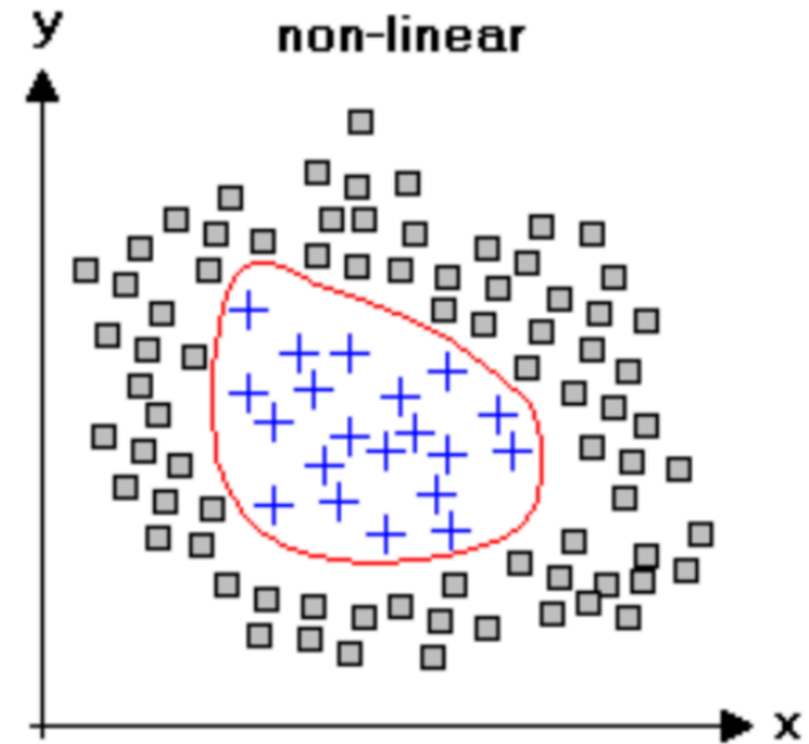
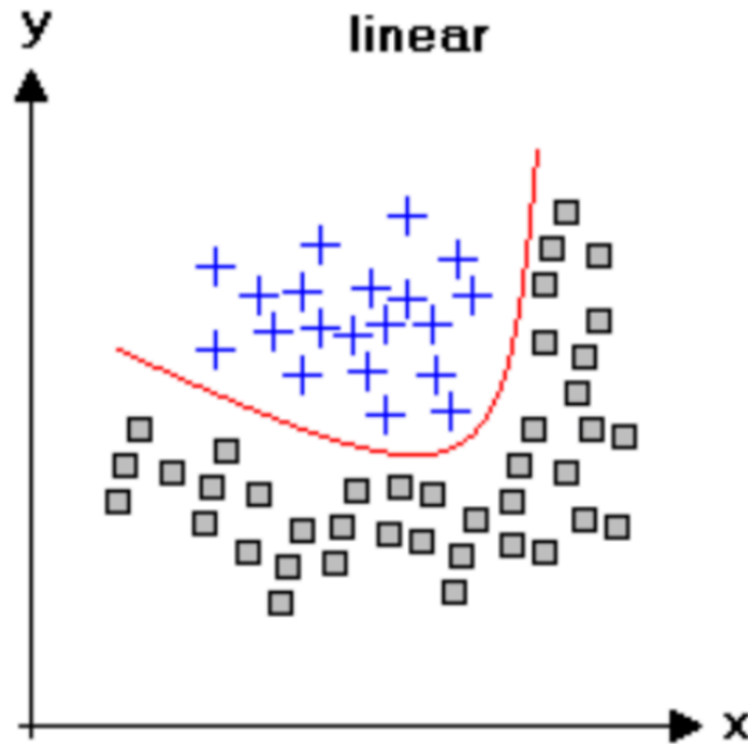
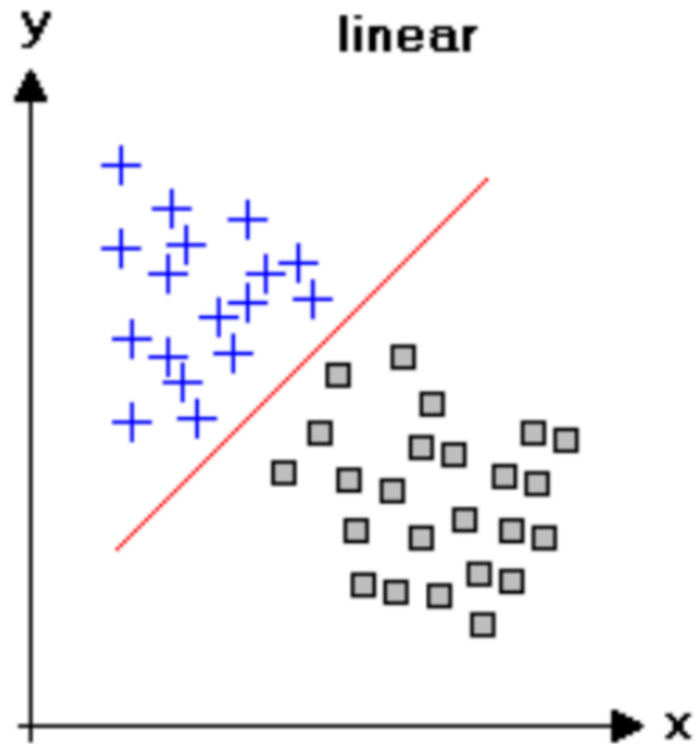
$$out2 = f(W_2 out1)$$

Neural Networks



$$out = f(W_2(f(W_1x)))$$

Neural Networks



Linear Regression

