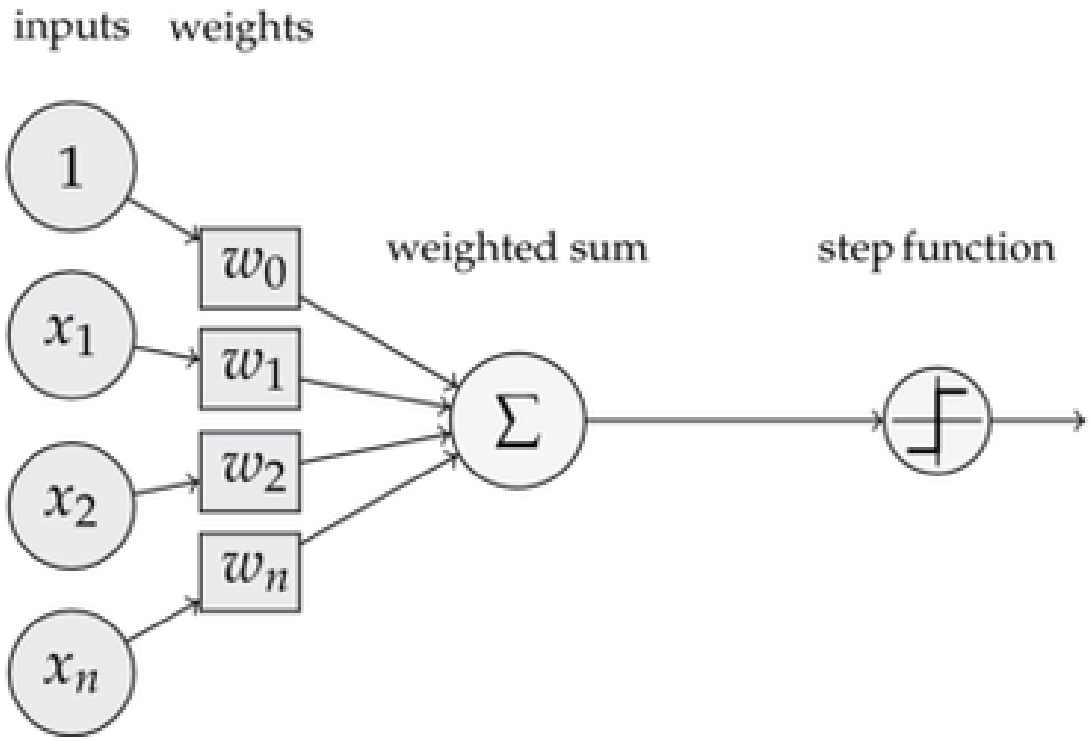


Perceptron Lab

Jin Hyun Kim

Perceptron

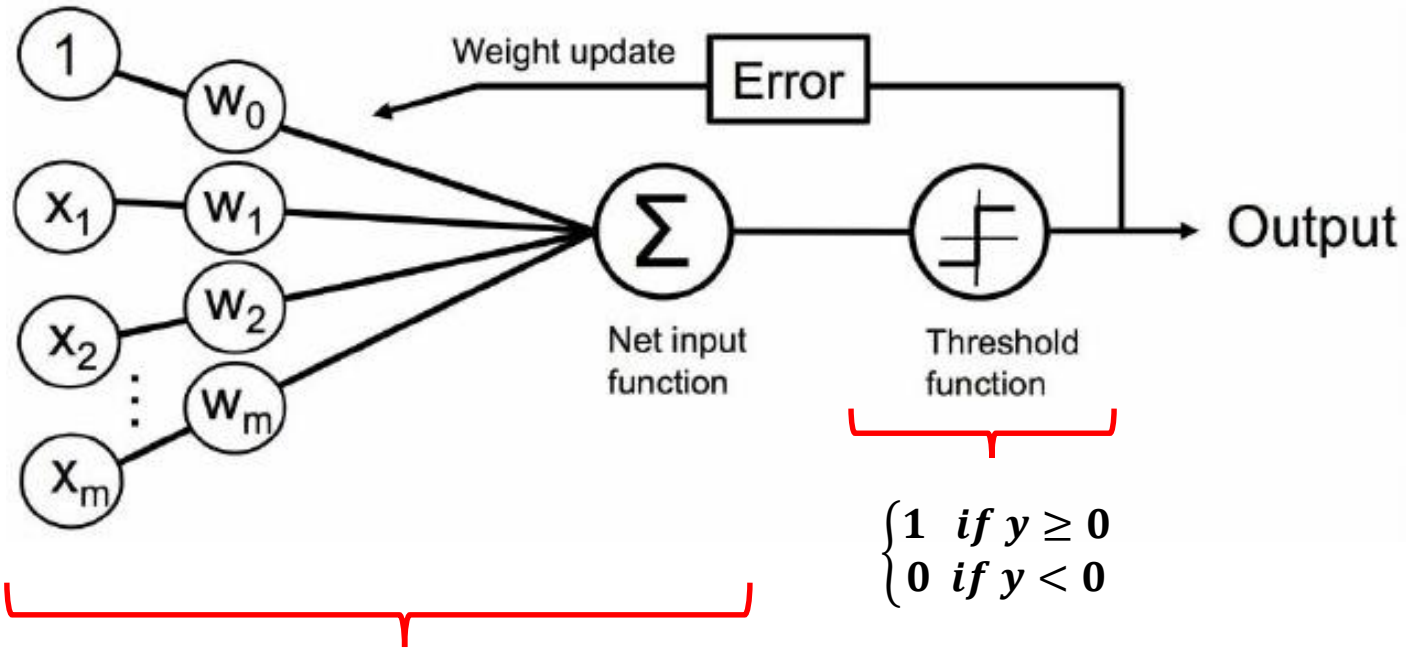
AND gate function

x1	x2	y
0	0	0
0	1	0
1	0	0
1	1	1

$$y = \begin{cases} 0 & \text{if } b + w_1 \cdot x_1 + w_2 \cdot x_2 <= 0 \\ 1 & \text{if } b + w_1 \cdot x_1 + w_2 \cdot x_2 > 0 \end{cases}$$

$$\boldsymbol{w_1 = 0.5, w_2 = 0.5, b = -0.7}$$

Perceptron



$$\begin{cases} 1 & if\ y \geq 0 \\ 0 & if\ y < 0 \end{cases}$$

$$y = w_1 \cdot x_1 + \ldots + w_m \cdot x_m = \sum_{i=1}^{m} w_i \cdot x_i,$$

Perceptron Learning

1. Initialize the weights to 0 or small random numbers.
2. For each training sample $x^{(i)}$:
   a. Compute the output value $\hat{y} = \sum_{i=1}^{m} w_i \cdot x_i$
   b. Update the weights.

$$w_j := w_j + \Delta w_j$$

$$\Delta w_j = \eta \left(y^{(i)} - \hat{y}^{(i)} \right) x_j^{(i)}$$

Perceptron Learning

- Update the weights

$$\Delta w_0 = \eta\left(y^{(i)} - output^{(i)}\right)$$

$$\Delta w_1 = \eta\left(y^{(i)} - output^{(i)}\right)x_1^{(i)}$$

$$\Delta w_2 = \eta\left(y^{(i)} - output^{(i)}\right)x_2^{(i)}$$

Perceptron Learning

- Update the weights

Guess True

$$\Delta w_j = \eta\left(-1--1\right)x_j^{(i)} = 0$$

$$\Delta w_j = \eta\left(1-1\right)x_j^{(i)} = 0$$

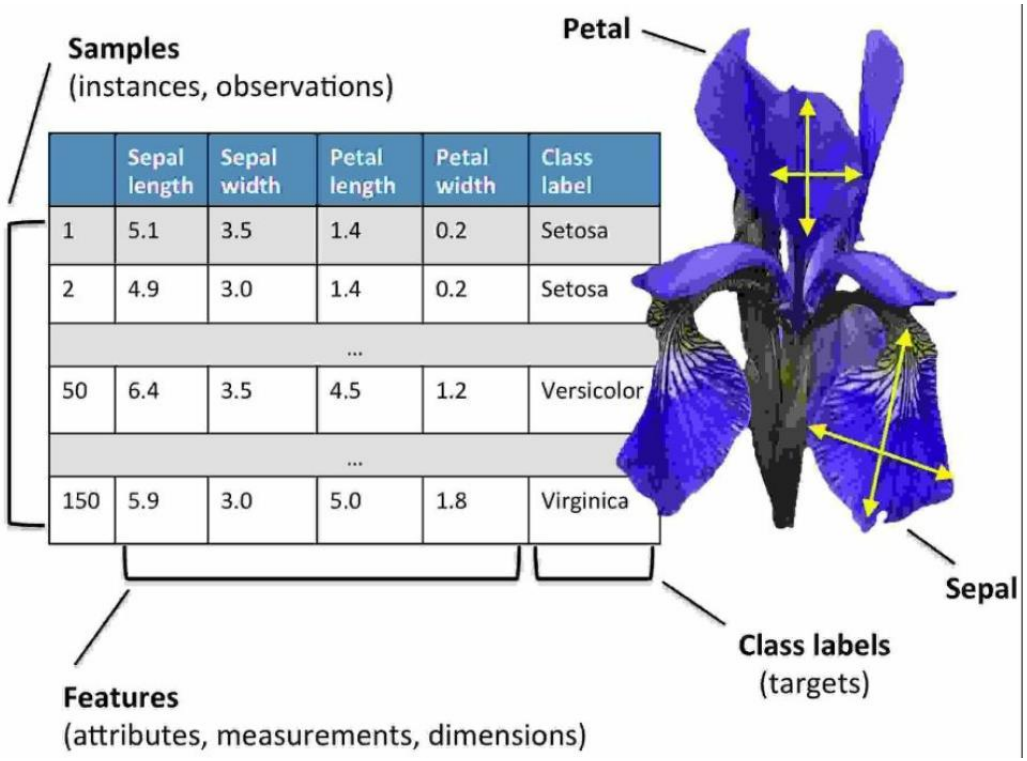
Guess False

$$\Delta w_j = \eta\left(1--1\right)x_j^{(i)} = \eta\left(2\right)x_j^{(i)}$$

$$\Delta w_j = \eta\left(-1-1\right)x_j^{(i)} = \eta\left(-2\right)x_j^{(i)}$$

Lab

- Guess the class of Iris for given an instance of features



	Sepal length	Sepal width	Petal length	Petal width	Class label
1	5.1	3.5	1.4	0.2	Setosa
2	4.9	3.0	1.4	0.2	Setosa
...					
50	6.4	3.5	4.5	1.2	Versicolor
...					
150	5.9	3.0	5.0	1.8	Virginica