

#Perceptron - Single Neuron

what it is

a Perceptron is the simplest neural network:

one neuron that makes a binary decision.

- core components

1. Weighted Sum

Input features are multiplied by weights and summed.

$$z = w_1 x_1 + w_2 x_2 + \dots + w_n x_n + b$$

• $w \rightarrow$ learnable parameters

• $b \rightarrow$ bias (shifts decision boundary)

2. Activation Function

Turns the weighted sum into an output.

Step function (classic perceptron):

$$\hat{y} = \begin{cases} 1 & \text{if } z \geq 0 \\ 0 & \text{if } z < 0 \end{cases}$$

Purpose:

- introduces decision
- makes classification possible

3. Learning Rule (Update)

If Prediction is wrong, update weights.

$$w = w + \eta (y - \hat{y}) x$$

$$b = b + \eta (y - \hat{y})$$

• $\eta \rightarrow$ learning rate

• move decision boundary toward correct class.