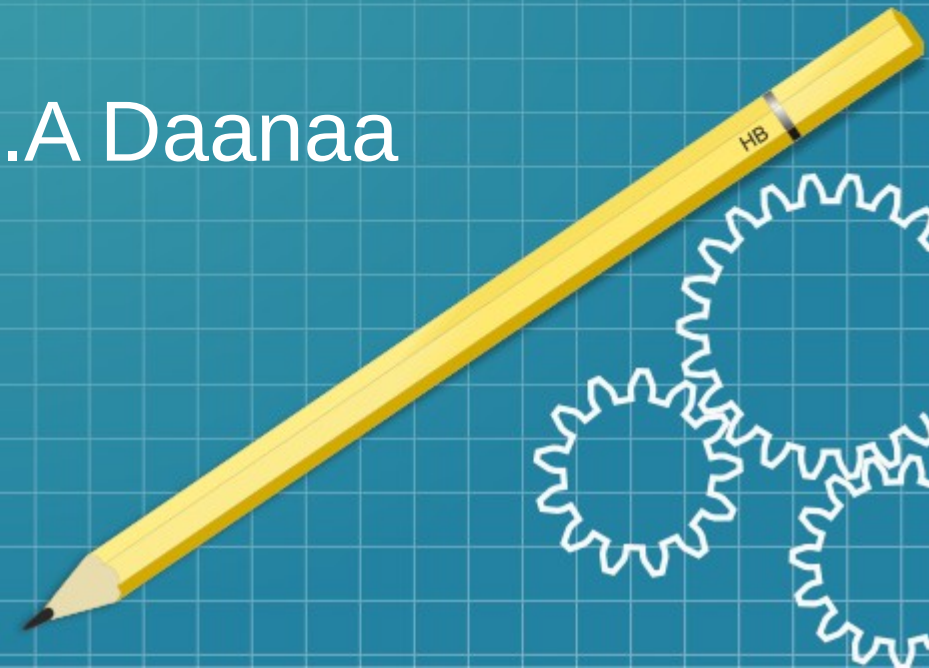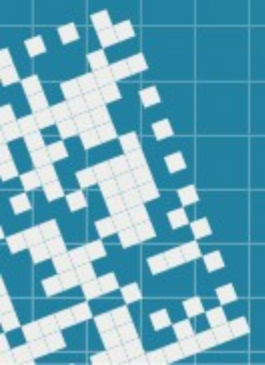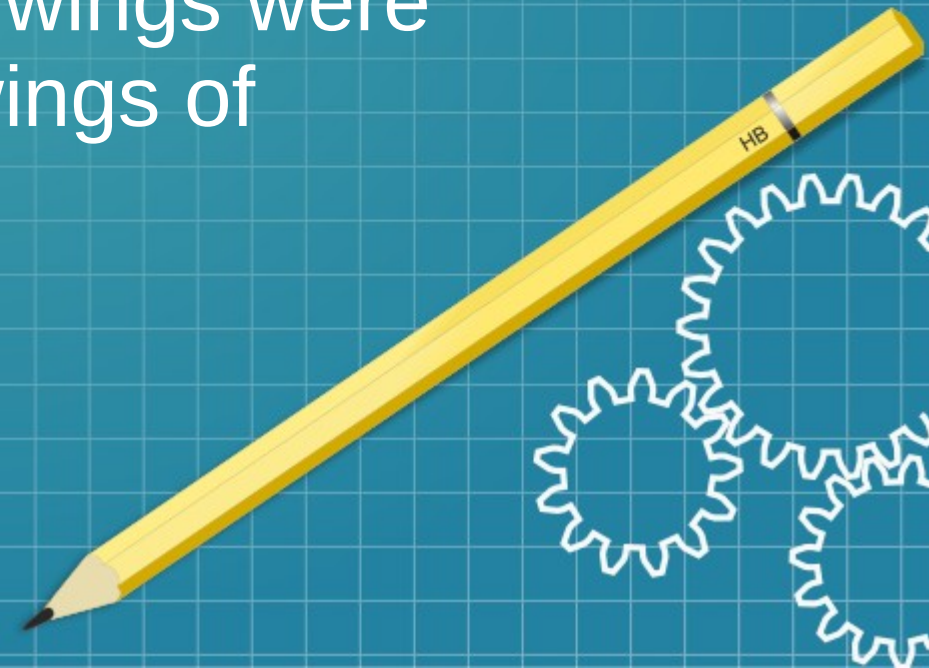# Perceptron

By Mohammed N.A Daanaa

What is a Perceptron ?

In science and technology, some of the greatest innovations have been mimicked from nature.
Like the way the aircraft wings were inspired by that of bird wings of different species

Neuron

Neurons are interconnected nerve cells in the brain that are involved in the processing and transmitting of chemical and electrical signals.

Nerve cell as a simple logic gate with binary outputs; multiple signals arrive at the dendrites, are then integrated into the cell body, and, if the accumulated signal exceeds a certain threshold, an output signal is generated that will be passed on by the axon.

- They are usually found in many multi-cellular biological entities like humans

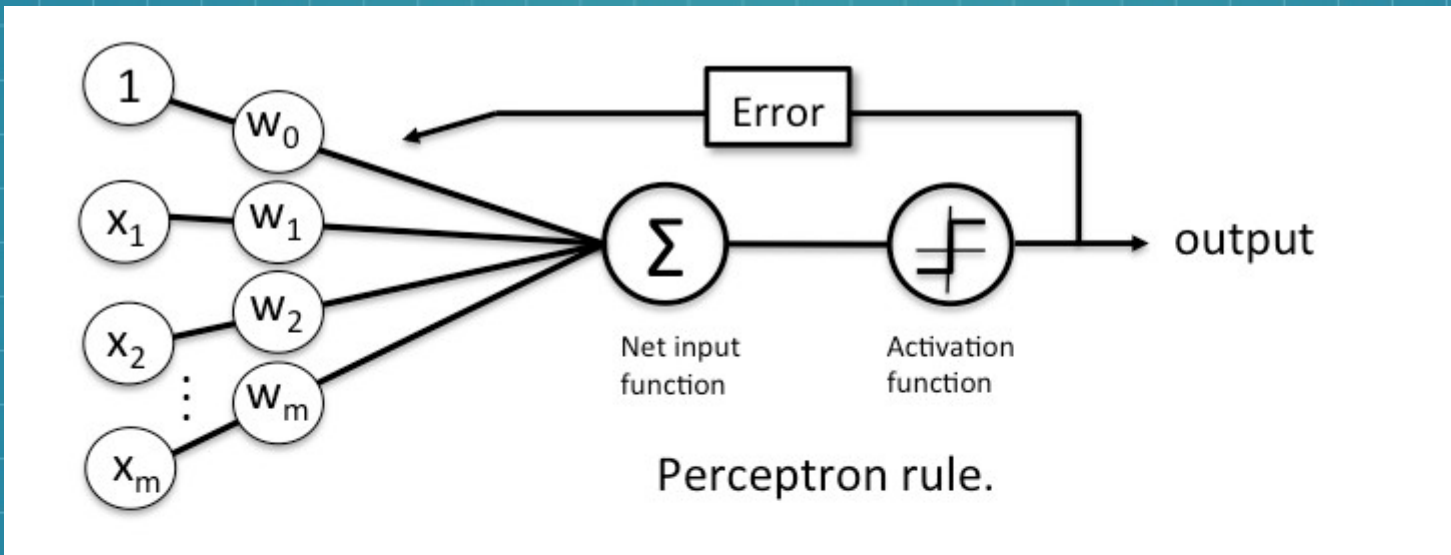# Neuron
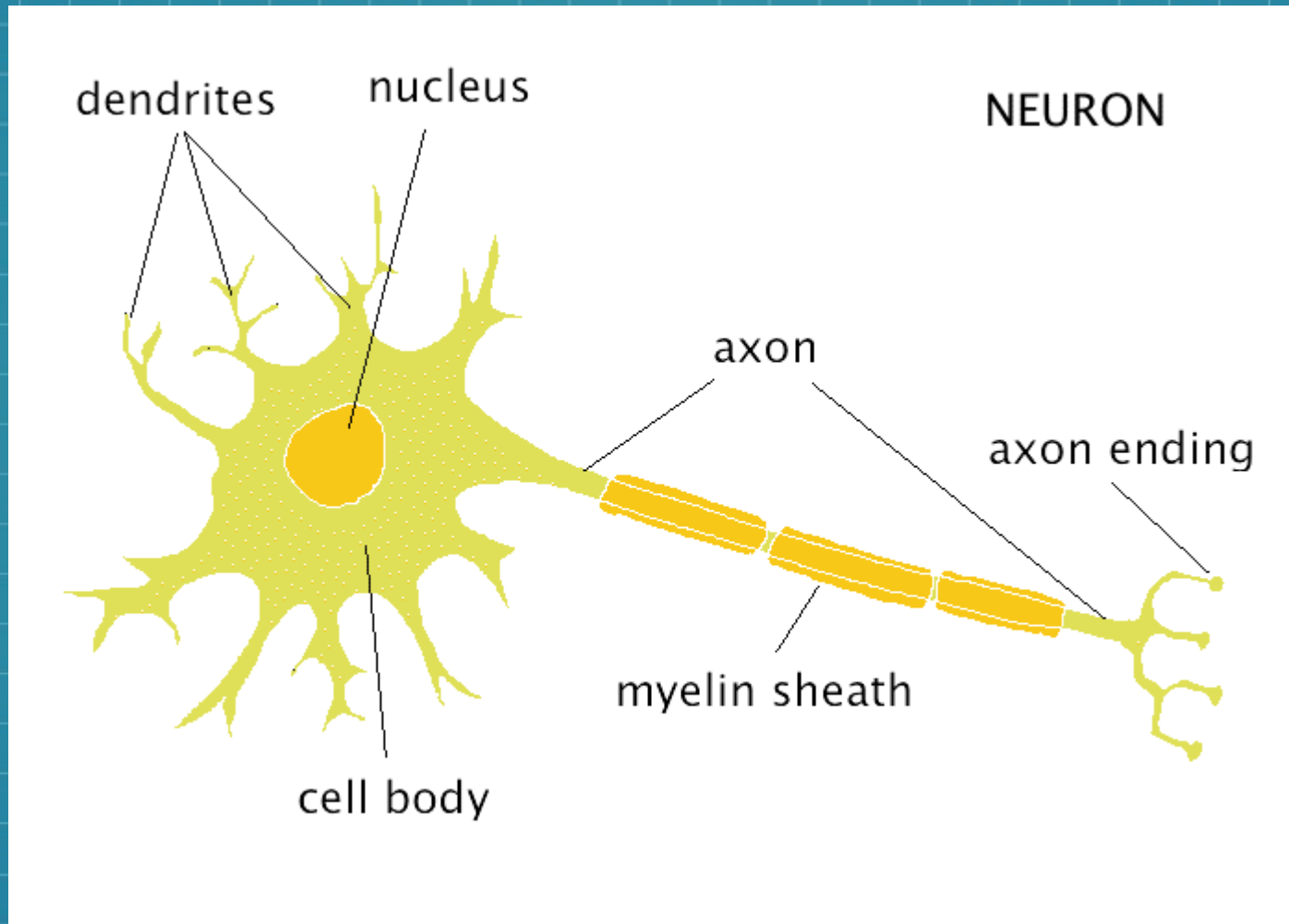
So Whats a Perceptron !!!

- Frank Rosenblatt proposed in his paper (The Perceptron: A Perceiving and Recognizing Automaton, F. Rosenblatt, Cornell Aeronautical Laboratory, 1957) an algorithm that would automatically learn the optimal weight coefficients that are then multiplied with the input features in order to make the decision of whether a neuron fires or not.

- In the context of supervised learning and classification, such an algorithm could then be used to predict if a sample belongs to one class or the other.
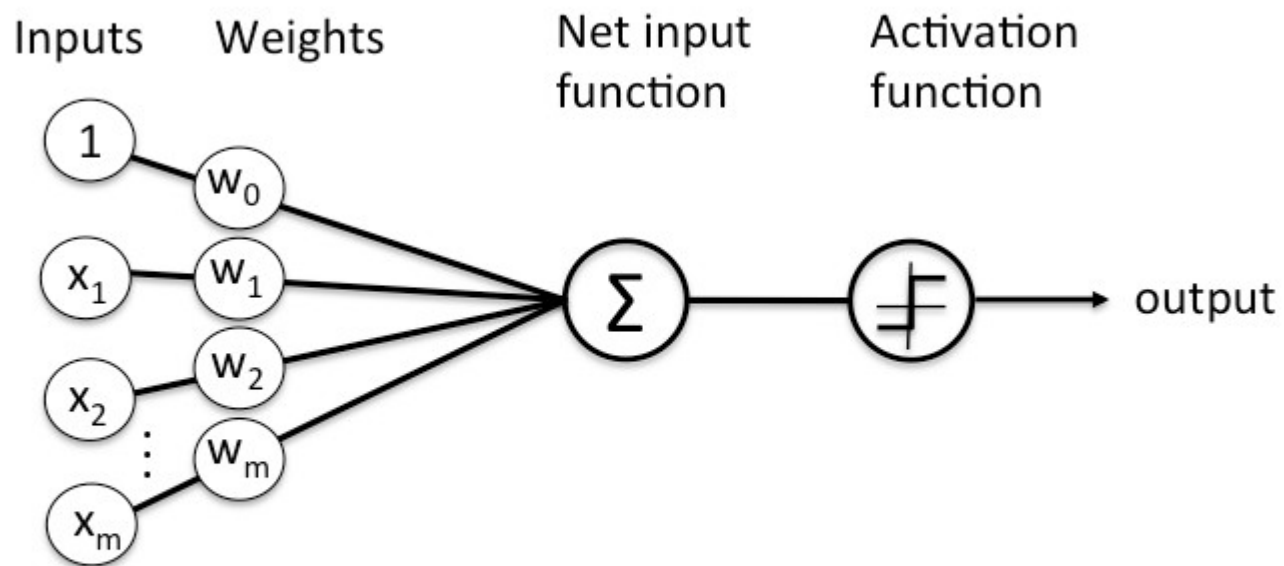
Schematic of Rosenblatt's perceptron.

Modern Perceptron

Perceptron rule.

Activation functions

- Step input

- Linear activation

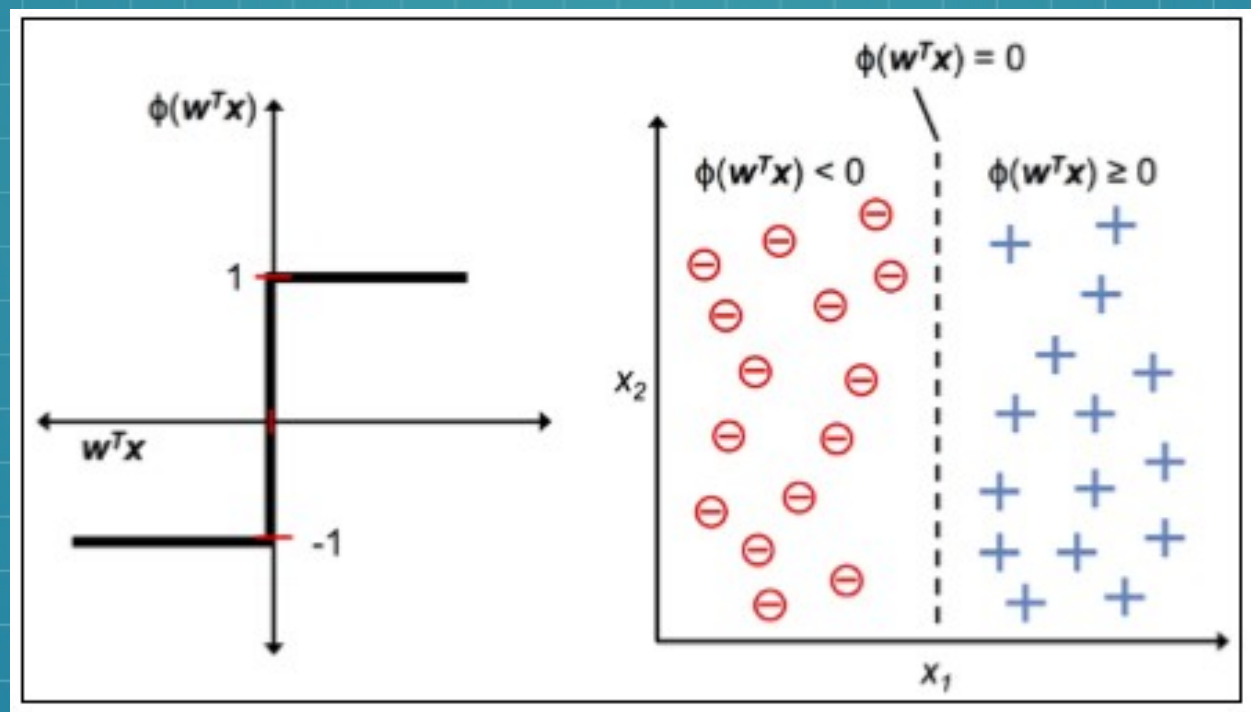- Sigmoid(Logistic)

- Hyperbolic Tangent

-

Step input

- A binary step function is a threshold-based activation function. If the input value is above or below a certain threshold, the neuron is activated and sends exactly the same signal to the next layer.
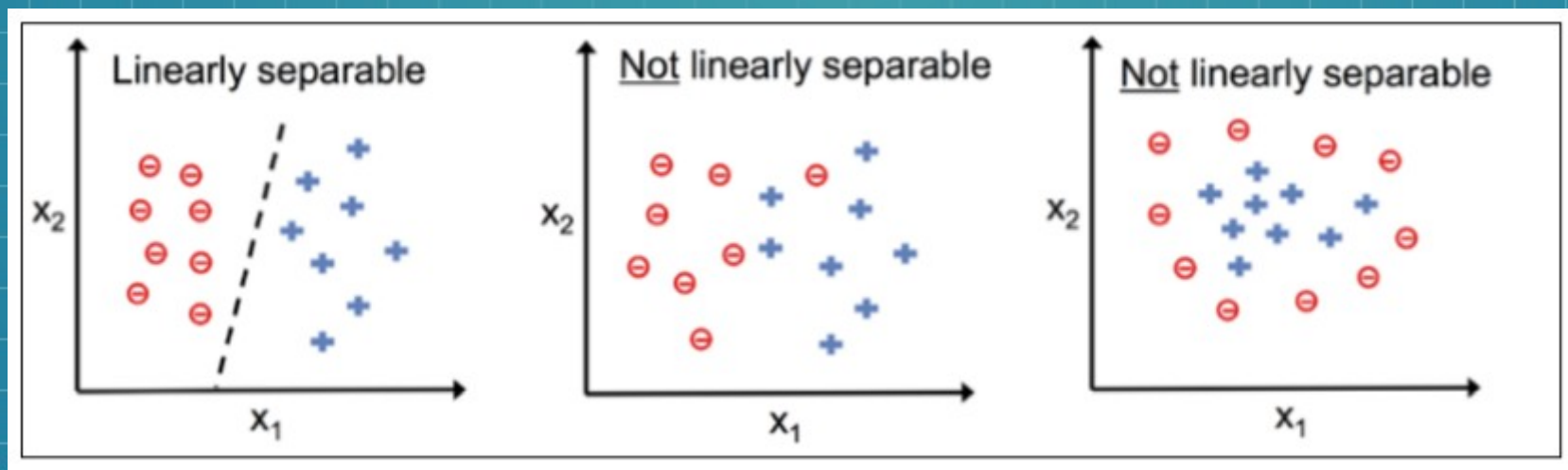
Step input

So What can it do?

- The perceptron is a classifier classifies data that are linearly separable

Perceptron's equation

$$z = w_0 x_0 + w_1 x_1 + \cdots + w_m x_m = \sum_{j=0}^{m} x_j w_j = \boldsymbol{w}^T \boldsymbol{x}$$

Weight Update equation

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

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

Where
η is the learning rate
w(j) the weight vector
y(i) is the true class label of the ith training sample
yhat(i) is the predicted class label
x(i) training sample

Terminology

- The learning rate: in machine learning is a which determines to what extent newly acquired information overrides old information.

- Epoch: Refers to the number of times an entire dataset is passed forward and backward through a neural Network

- Batch Size: The Total number of training example present in a single batch(an entire data set cant be passed through a neural net at once, so they are divided is to batches)

- Iterations: Refers to the number of batches needed to complete 1 epoch

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Thank you