

Perceptron - The Building Block of Deep Learning (4)

— x — x —

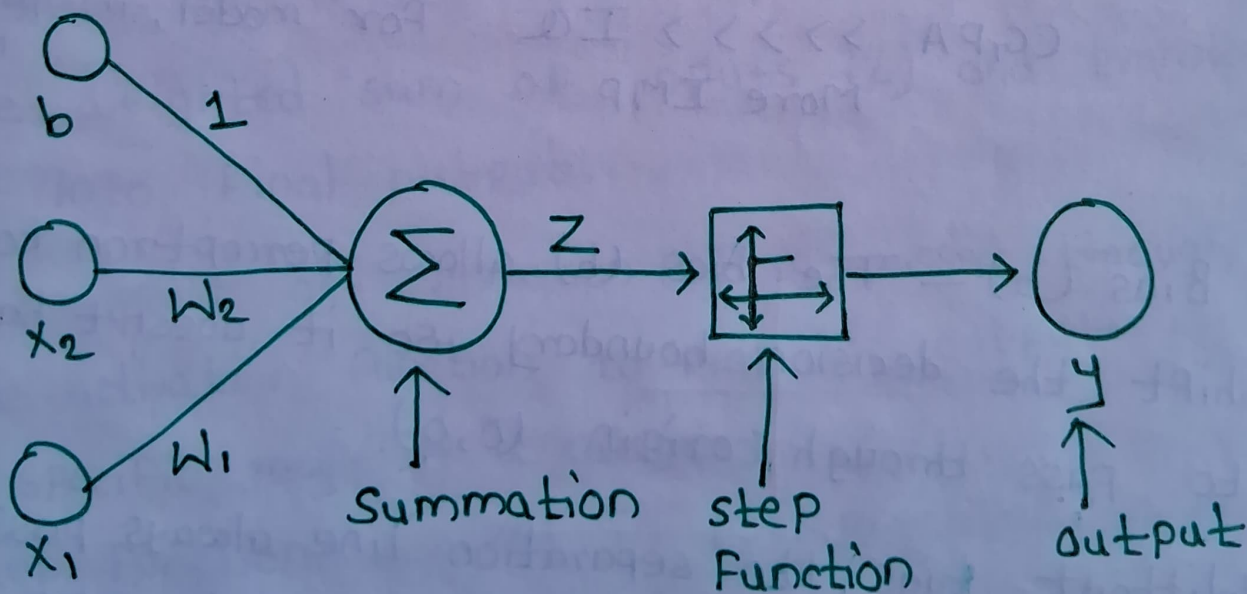
* Perceptron :-

The Perceptron is the fundamental Building Block of ANN.

It operates as an 'Supervised Machine Learning' algorithm.

It is defined as a Mathematical Model designed to perform binary classification.

* Architecture of Perceptron :-



$$y = f(z) \quad ; \quad z = x_1 w_1 + x_2 w_2 + b$$

A Perceptron consist of several distinct components that process data in specific flow.

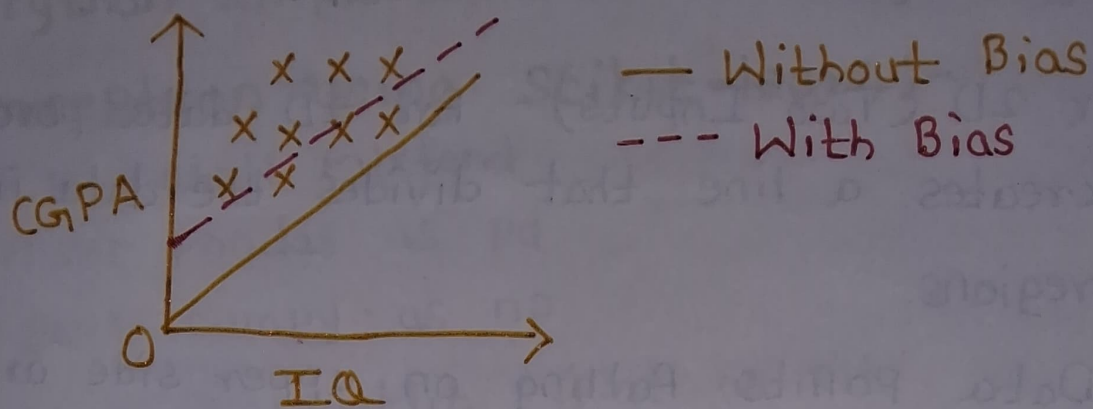
- ① Input - The model receives input features (eg: stud. IQ, CGPA). If there are multiple columns in data, there will be multiple inputs.
- ② Weights (W) - Each input is connected to the core processing unit via "Weights"

These weights represent the strength of connection and indicates the importance of specific feature.

For example, If weights for CGPA is higher than weight of IQ, then

CGPA >>>>> IQ For model, in prediction.
More IMP

- ③ Bias (b) - The bias (b) allows perceptron to shift the decision boundary so it doesn't have to pass through origin. (0,0).
Without bias the separation line always pass through origin leads misclassification in some cases.



④ Summation Function (Σ) - Inside perceptron a 'dot product' calculation occurs.

It multiplies inputs by their respective weights and adds the bias.

$$Z = W_1X_1 + W_2X_2 + \dots + W_nX_n + b$$

⑤ Activation Function - Activation Function in Perceptron is the Mathematical Operation that takes the weighted sum of inputs (Z) and transform it into final output.

The result of summation (Z) is passed through the activation function to map the output to a specific range or a category.

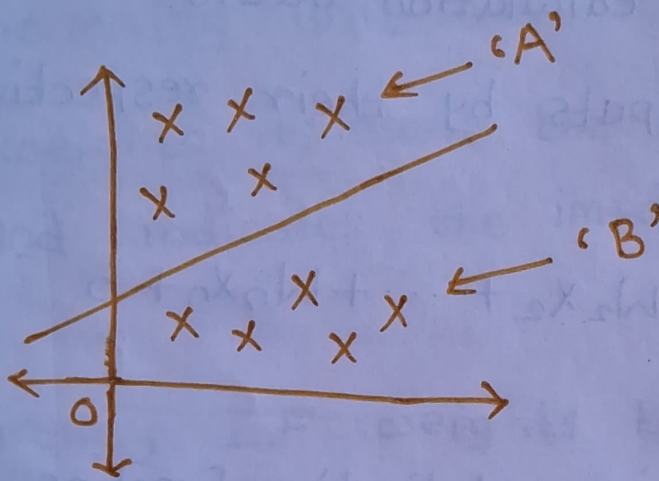
step Function is used in perceptron as an A.F.

$$\begin{cases} \text{if } Z > 0; 1 \\ \text{if } Z \leq 0; 0 \end{cases}$$

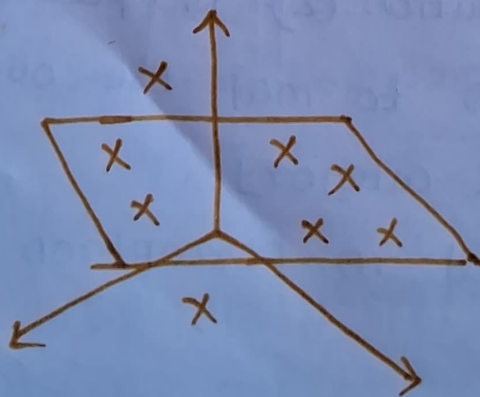
* Geometric Intuition For Perceptron :-

① For 2D (Two Inputs) - For 2D data perceptron creates a line that divides the data into two regions.

Ex! - Data points falling on upper side are classified as 'A' and points falling on lower side are classified as 'B'



② For 3D (Three Inputs) - For 3D data perceptron creates a plane that divides data into three regions.



③ In higher dimensions it works as a Hyper-plane.