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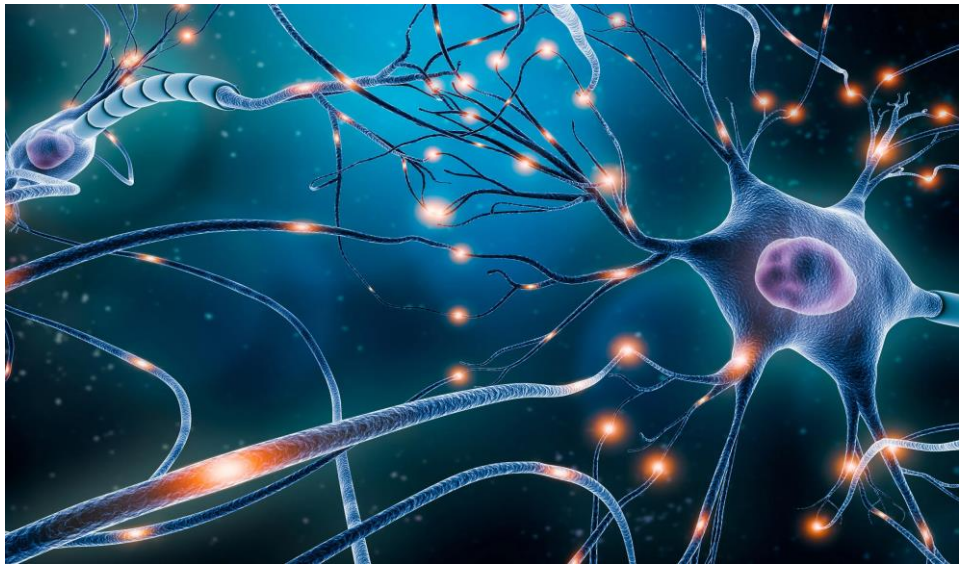
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

UNIT - 4

NEURONS AND NEURAL NETWORKS



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Perceptron

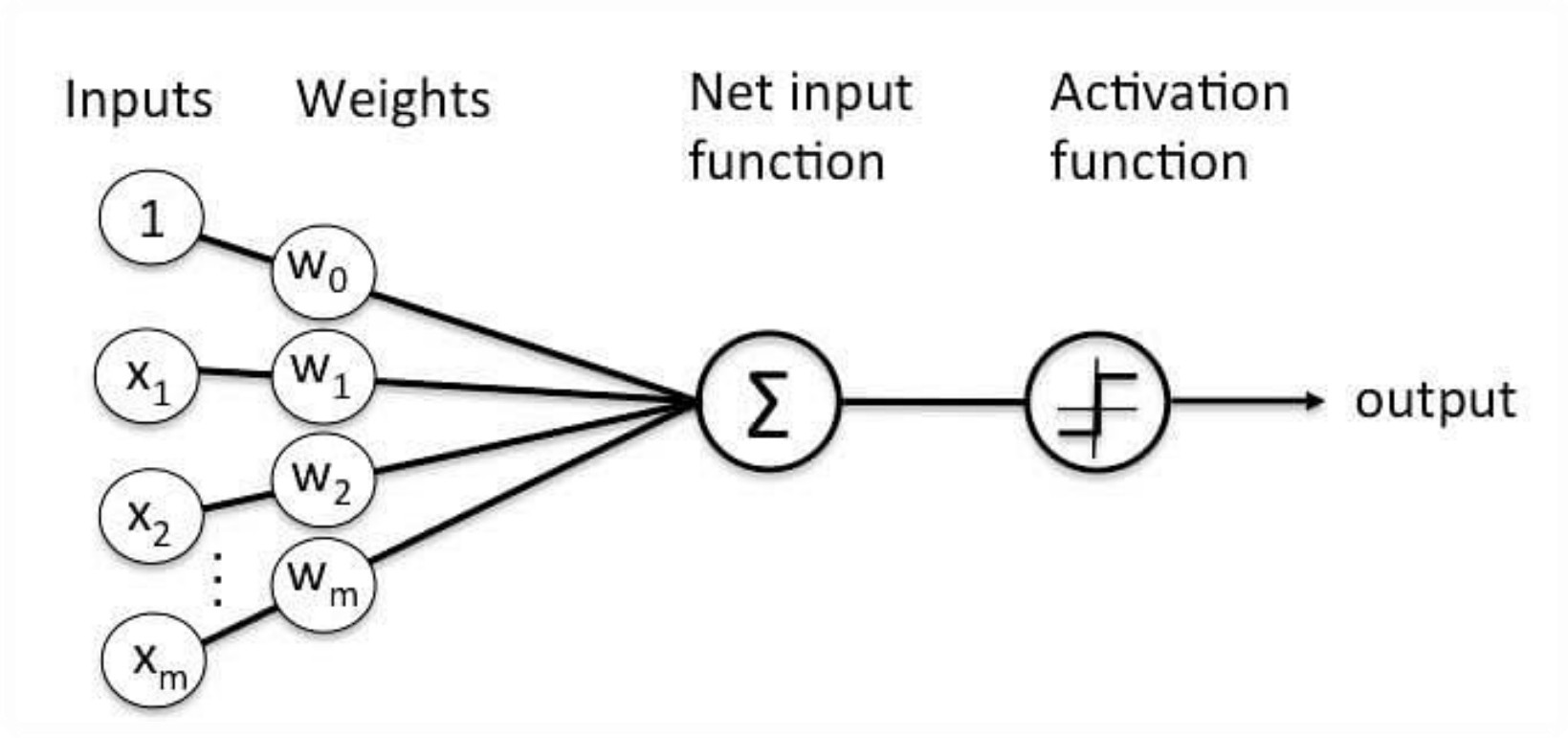
- A Perceptron is an **artificial neuron**, and thus a neural network unit.
- It **performs computations** to detect features or patterns in the input data.
- It is an algorithm for supervised learning of **binary classifiers.**
- It is this algorithm that **allows artificial neurons to learn** and **process features in a data set**.
- It was introduced by **Frank Rosenblatt in 1957s**.
- It is the simplest type of **feedforward neural network**, consisting of a single layer of input nodes that are fully connected to a layer of output nodes.
- It can learn the linearly separable patterns. it uses slightly different types of artificial neurons known as **threshold logic units** (TLU).

Types of Perceptron

- **Single-Layer Perceptron:**
- A **single layer Perceptron** can learn only separable linear functions.
- This type of perceptron is limited to **learning linearly separable patterns**. effective for tasks where the data can be divided into **distinct categories through a straight line.**
- **Multilayer Perceptron**:
- A **multi-layer Perceptron**, also known as a feed-forward neural network, overcomes this limitation and offers superior computational power. It is also possible to **combine several Perceptrons** to create a **powerful mechanism**.
- Multilayer perceptrons possess enhanced processing capabilities as they consist of **two or more layers,** adopt at handling more complex patterns and relationships within the data.

Single layer Perceptron

- The perceptron learning algorithm **updates the weights of the connections.**



Basic Components of Perceptron

- A perceptron, the basic unit of a neural network, comprises essential components that collaborate in information processing.
- **Input Features:** The perceptron takes **multiple input features**, each input feature represents a characteristic or attribute of the input data.
- **Weights**: Each input feature is associated with **a weight**, determining the significance of each input feature in influencing the perceptron's output. During training, **these weights are adjusted** to learn the optimal values.
- **Summation Function**: The perceptron calculates the **weighted sum of its inputs using the summation function**. The summation function combines the inputs with their respective weights to produce a weighted sum.
- **Activation Function**: The weighted sum is then passed through an activation function. Perceptron uses Heaviside **step function,** which take the summed values as input and compare with the threshold and **provide the output as 0 or 1**.

Basic Components of Perceptron

- **Output**: The final output of the perceptron, is determined by the activation function's result. For example, in binary classification problems, the output might represent a **predicted class (0 or 1).**
- **Bias**: A bias term is often included in the perceptron model. The bias allows the model **to make adjustments** that are **independent of the input.** It is an additional parameter that is learned during training.
- **Learning Algorithm (Weight Update Rule)**: During training, the perceptron learns by adjusting its weights and **bias based on a learning algorithm**.
- A common approach is the perceptron learning algorithm, which updates **weights based** on the difference between the **predicted output and the true output.**


Thank You