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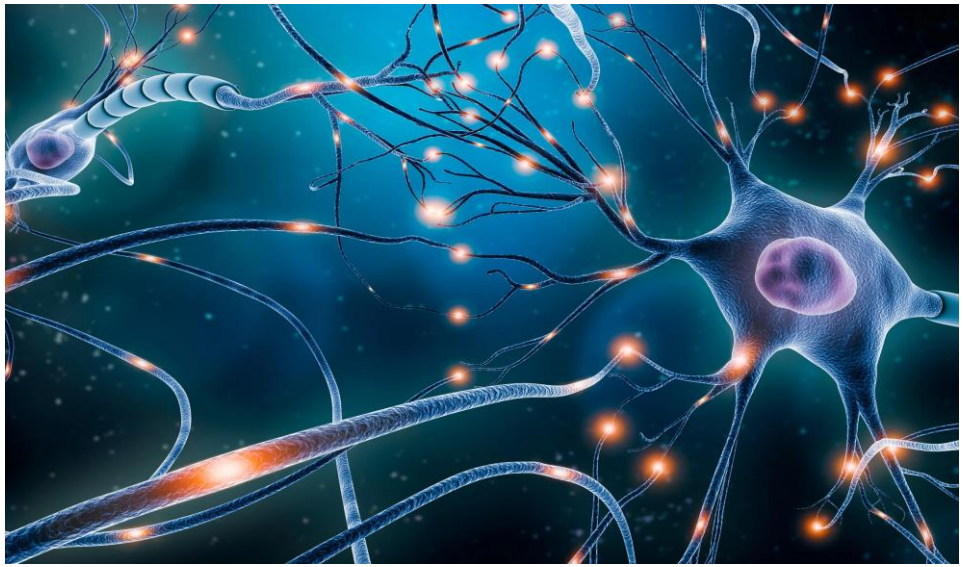
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

# ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

## UNIT - 4

## *NEURONS AND NEURAL NETWORKS*



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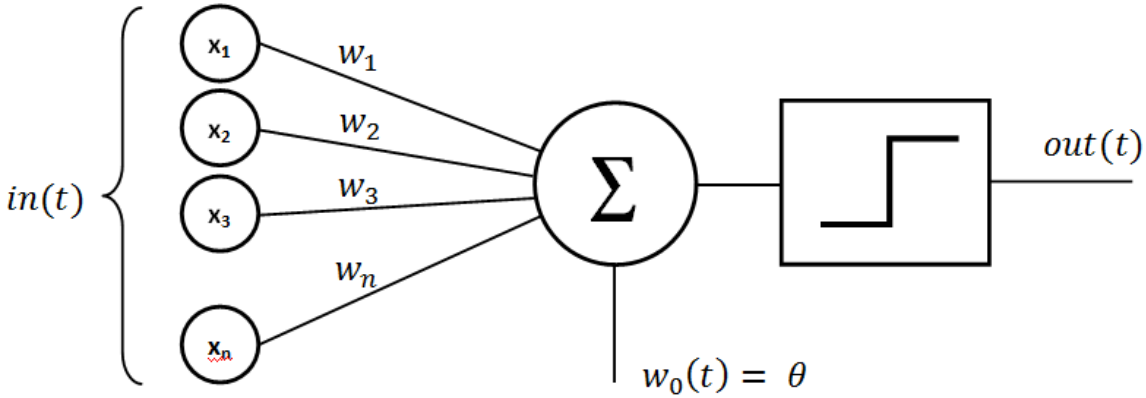
# Perceptron Learning Rule

- According to the **Perceptron Learning Rule**, the algorithm automatically learns the optimal weight coefficients.
- The characteristics of the input data are **multiplied** by these weights to determine whether a **neuron "lights up" or not.**
- The Perceptron receives **multiple** input signals. If the sum of the signals **exceeds a certain threshold**, a signal is produced or, conversely, no output is produced.
- In the context of the supervised learning method of **Machine Learning**, this is what makes it possible to predict the category of a data sample.

# Perceptron Learning Rule




**The function of the Perceptron, how to interpret the result?**

In reality, **the Perceptron is a mathematical function**. The input data (x) is multiplied by the **weight coefficients** (w). The result is a value.

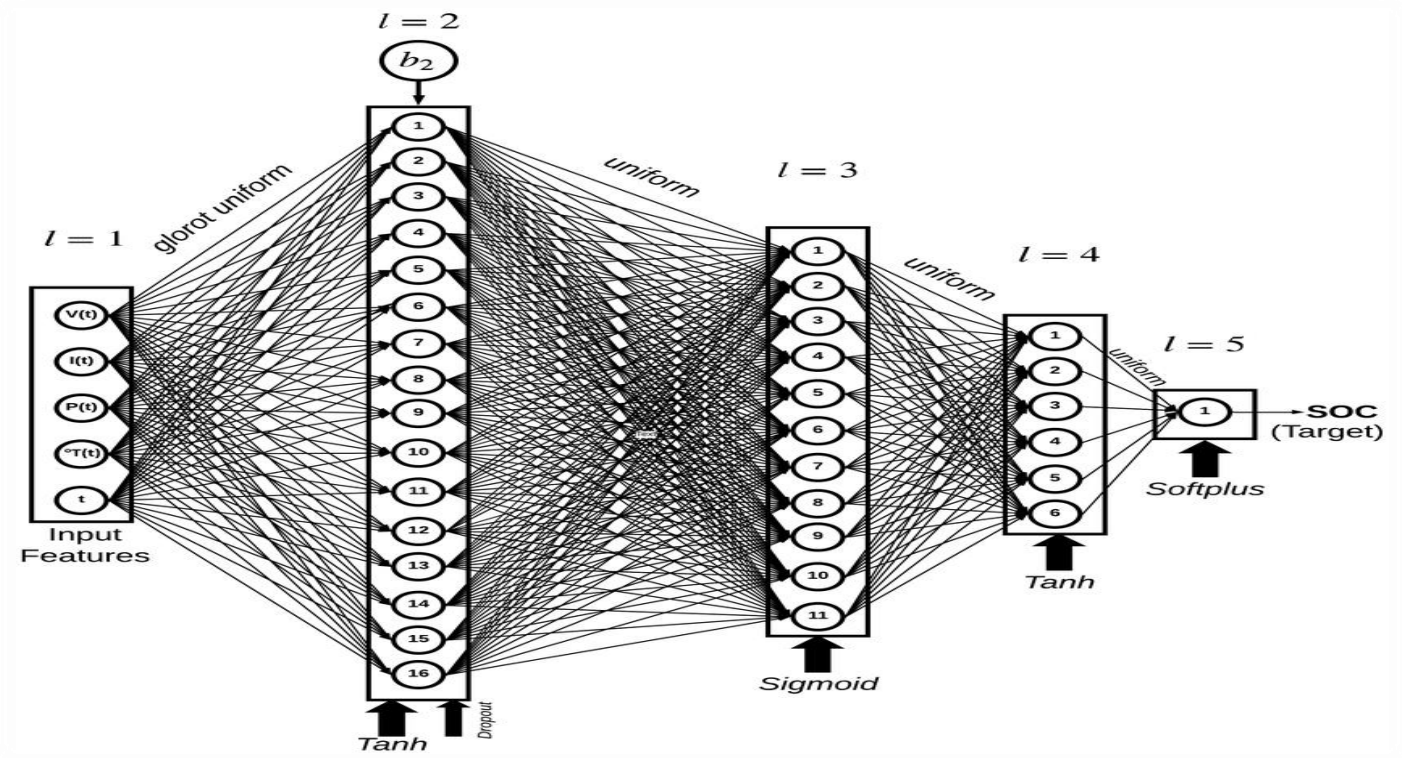
**Perceptron and Neural Networks**

In short, a neural network is a set of **interconnected Perceptrons**. Its operation is based on multiplication operations between two important components: **the input** and **the weight**.

The **sum of this multiplication** is passed to an **activation function**, determining a binary value of 0 or 1. This is what allows the data to be **classified**.

# Multi-layer Perceptron

- Multilayer perceptron's (MLPs) are ANNs with **multiple layers of neurons.** They are more powerful than perceptron's and can learn complex patterns. MLPs use backpropagation to train their weights.



# Limitations of Perceptron

- The perceptron was an important development in the **history of neural networks**, as it demonstrated that simple neural networks could learn to **classify patterns**. However, its capabilities are limited:
- The perceptron model has some limitations that can make it unsuitable **for certain types of problems**:
- Limited to **linearly separable** problems.
- **Convergence issues** with non-separable data
- Requires **labeled data**
- Sensitivity to **input scaling**
- Lack of **hidden layers**


Thank You