

## Experiment 02 : Implementation of Simple Neural Network.

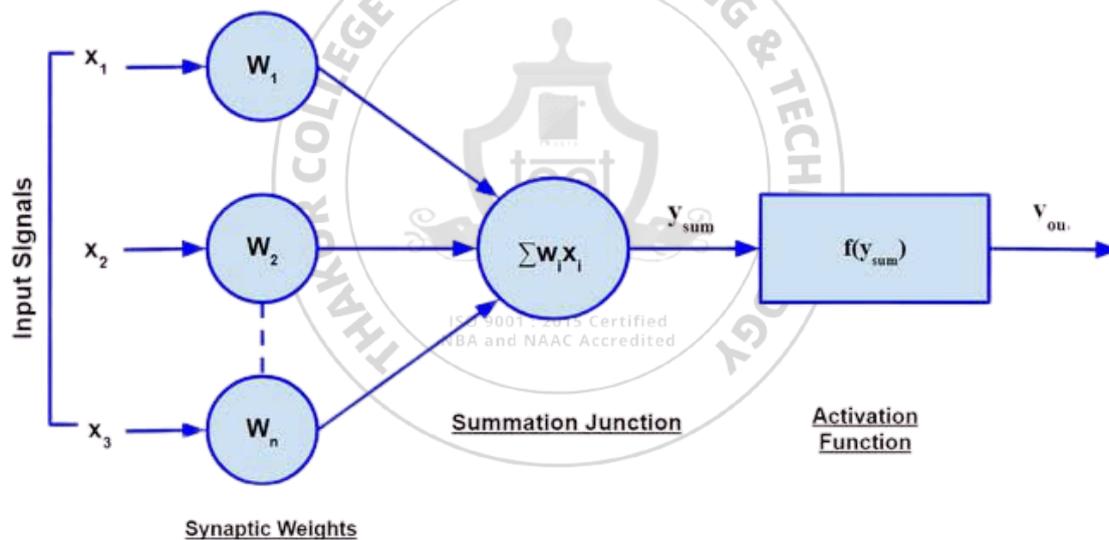
**Learning Objective :** Implementation of Simple Neural Network. (McCulloch-Pitts Model)

**Tools :** Python

### Theory :

The McCulloch-Pitts model is a simple model of a neuron, proposed by Warren McCulloch and Walter Pitts in 1943. It is a simplified model of a biological neuron and is based on the idea that a neuron receives inputs from other neurons or sensory organs and produces an output based on these inputs.

The McCulloch-Pitts model consists of a set of binary inputs, a set of weights associated with each input, and a threshold. The neuron computes the weighted sum of the inputs and compares it to the threshold. If the weighted sum is greater than or equal to the threshold, the neuron produces an output of 1. Otherwise, it produces an output of 0.



Formally, let  $x_1, x_2, \dots, x_n$  be the binary inputs  $w_1, w_2, \dots, w_n$  be the weights associated with each input, and  $\theta$  be the threshold. Then the output  $y$  of the neuron is given by:

$$y = 1 \text{ if } \sum(x_i * w_i) \geq \theta$$

0 otherwise

Where  $\sum(x_i * w_i)$  represents the weighted sum of the inputs.

The McCulloch-Pitts model is a building block for more complex neural networks and has been used in various applications such as pattern recognition, signal processing, and control systems. It is a simple yet powerful model that can capture complex nonlinear relationships between inputs and outputs.

**Implementation :**

```
[ ]: def calculate_threshold(weights, inputs):  
  
    if len(weights) != len(inputs):  
        raise ValueError("The lengths of weights and inputs must be the same")  
  
    threshold = sum(w * x for w, x in zip(weights, inputs))  
    return threshold  
  
weights = [1, 1]  
inputs = [1, 0]  
threshold = calculate_threshold(weights, inputs)  
print(f"The threshold for the given weights {weights} and inputs {inputs} is:␣  
↵{threshold}")
```

The threshold for the given weights [1, 1] and inputs [1, 0] is: 1

**Result and Discussion :**

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**Learning Outcomes :** Students should have the ability to

LO 2.1: Ability to obtain the fundamentals and different architecture of neural networks

LO 2.2: Ability to implement McCulloch-Pitts model.

**Course Outcomes :**

CO : Understand and apply simple neural network.

**Conclusion :**

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**Viva Questions :**

Q1. What are Neural Networks? What are the types of neural networks?

Q2. How are Artificial Neural Networks different from Normal Computers?

**For Faculty Use**

<b>Correction Parameters</b>	<b>Formative Assessment [40%]</b>	<b>Timely completion of Practical [ 40%]</b>	<b>Attendance / Learning Attitude [20%]</b>	<b>Total</b>
<b>Marks Obtained</b>				

