**ARTIFICIAL NEURAL NETWORK: AN INTRODUCTION & EVOLUTION OF NEURAL NETWORKS**

The Artificial Neural Networks (ANN) began with Warren McCulloch and Walter Pitts (1943) who created a computational model for neural networks based on algorithms called threshold logic Computational model that mimes the functional of human brain to perform various tasks faster than traditional system. ANN is an efficient information processing system which resembles the characteristics of biological neural network

Artificial Neural Networks Model
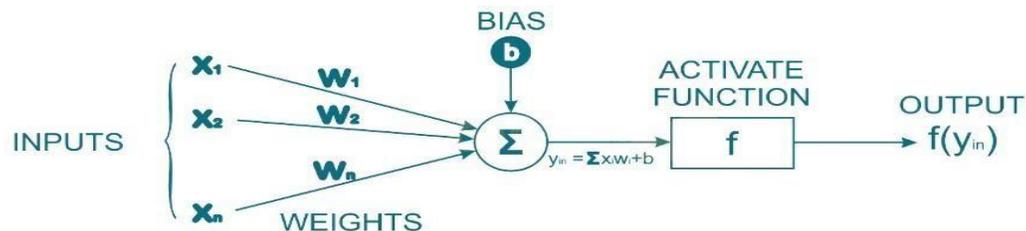
The artificial neuron model has N input, denoted as x_1, x_2, ...x_n. Each line connecting these inputs to the neuron is assigned a weight, which are denoted as w_1, w_2, .., w_n respectively. Weights in the artificial model correspond to the synaptic connections in biological neurons. The threshold in artificial neuron is usually represented by Θ and the activation corresponding to the graded potential is given by the formula:

$$y_{in} = x_1 \cdot w_1 + x_2 \cdot w_2 + x_3 \cdot w_3 \ldots x_n \cdot w_n$$

i.e., Net input

$$y_{in} = \sum_{i}^{n} x_i \cdot w_i + b$$

The output can be calculated by applying the activation function over the net input.

$$Y = F(y_{in})$$

1.1 BASIC MODELS OF ARTIFICIAL NEURAL NETWORK

The models of ANN are specified by the three basic entities namely
1. The model's synaptic interconnection.
2. The training rules or learning rules adopted for updating and adjusting the connection weights.
3. Activation functions.

Network Architectures
The manner in which the neurons of a neural network are structured is intimately linked with the learning algorithm used to train the network.
There are three fundamentally different classes of network architectures:
1. Single-Layer Feedforward Networks
2. Multilayer Feedforward Networks
3. Recurrent Networks

Single-Layer Feedforward Networks

Input layer
of source
nodes

Output layer
of neurons
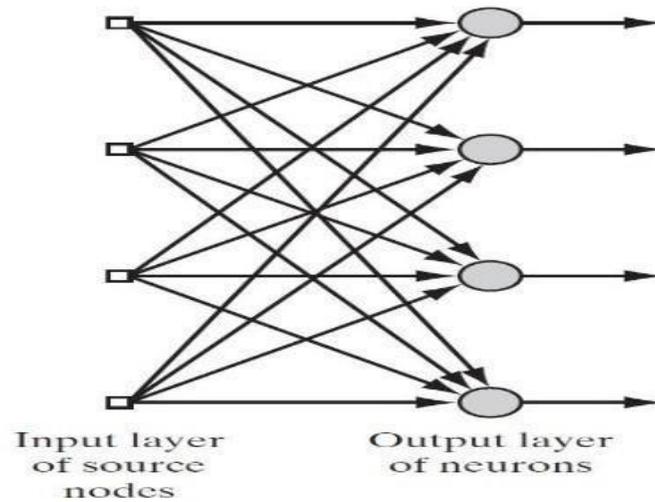
In this type of network, we have input layer and output layer but the input layer does not count
because no computation is performed in this layer.
Output Layer is formed when different weights are applied on input nodes and the cumulative
effect per node is taken.
After this, the neurons collectively give the output layer to compute the output signals.

Multilayer Feedforward Networks

Input layer
of source
nodes

Layer of
hidden
neurons

Layer of
output
neurons
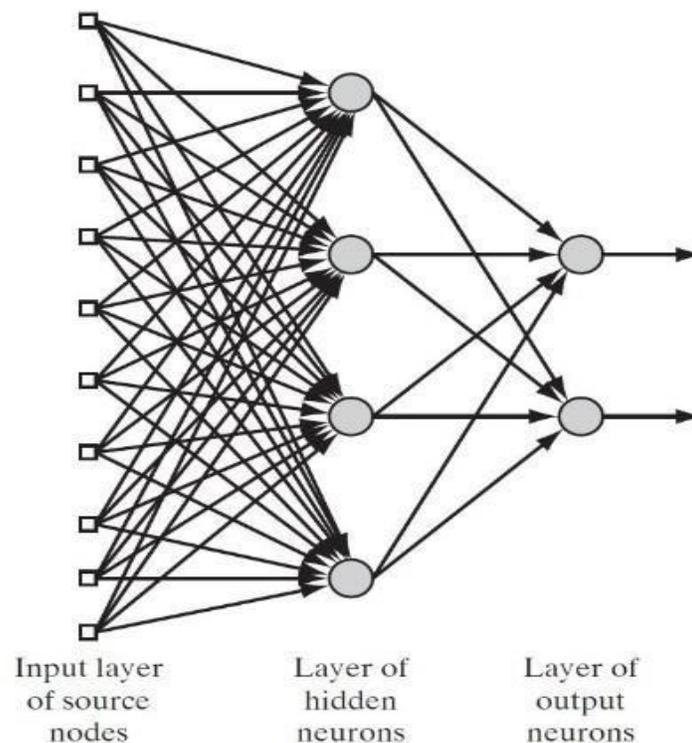
This network has one or more hidden layers, the term "hidden" refers to the fact that this part of the neural network is not seen directly from either the input or output of the network. The function of hidden neurons is to intervene between the external input and the network output in some useful manner.

The existence of one or more hidden layers enables the network to be computationally stronger.

Recurrent Networks

Are current neural network distinguishes itself from a feedforward neural network in that it has at least one feedback loop

Single Layer Recurrent Network

Unit-time delay operators
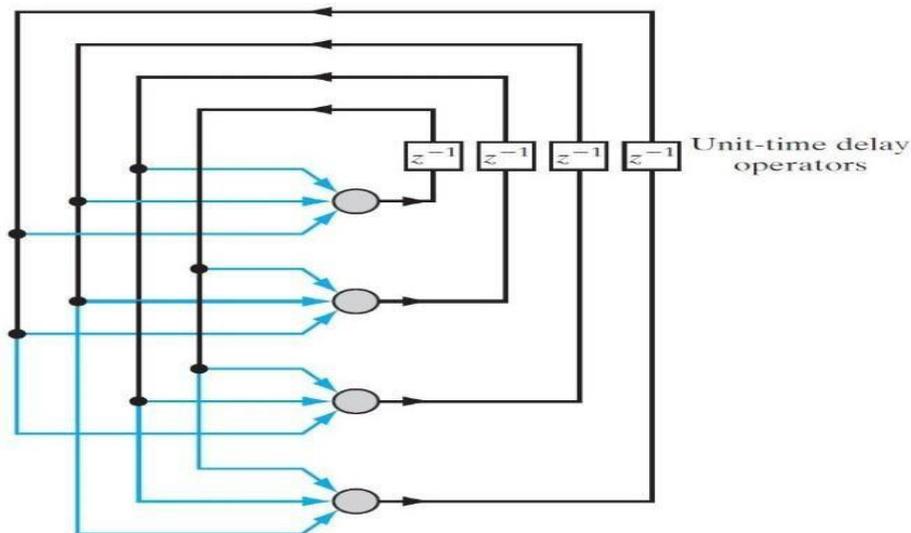
This network is a single-layer network with a feedback connection in which the processing element's output can be directed back to itself or to other processing elements or both.

A recurrent neural network is a class of artificial neural network where the connection between nodes forms a directed graph along a sequence.

This allows is it to exhibit dynamic temporal behavior for a time sequence. Unlike feedforward neural networks, RNNs can use their internal state (memory) to process sequences of inputs.

Multilayer Recurrent Network

In this type of network, processing element output can be directed to the processing element in the same layer and in the preceding layer forming a multilayer recurrent network.

They perform the same task for every element of the sequence, with the output being dependent on the previous computations. Inputs are not needed at each time step.

The main feature of a multilayer recurrent network is its hidden state, which captures information about a sequence.