

## Neural Networks:

A Neural Network is a type of algorithm that is inspired by the structure & function of the human brain.

It consists of a large number of interconnected nodes called Artificial Neurons or simply "neurons".

Neural Networks are designed to recognize the complex patterns & relationships b/w input & output data, by learning from examples.

They can be used for variety of tasks, such as image recognition, Natural Language processing & so on.



# 1. With Diagram explain the structure of Biological Neuron?

## Biological Neuron:

Basically ML mimics the human form of learning. On the other hand human learning or every action of human being is controlled by the Nervous system. The Nervous system is constituted of a special type of cell, called neuron or nerve cell, which has special structures allowing it to receive or send signals to other neurons. Neurons connect with each other to transmit signals to or receive signals from other neurons. This structure essentially forms a network of neurons or neural network.

A Biological Neuron is a specialized cell that processes & transmits information through electrical & chemical signals in the nervous system of animals.

Human Nervous System has 2 parts:

### 1 The Central Nervous System (CNS) :

CNS integrates all the information in the form of signals, from the diff part of the body.

### 2 Peripheral Nervous System:

It connects the CNS with limbs & organs

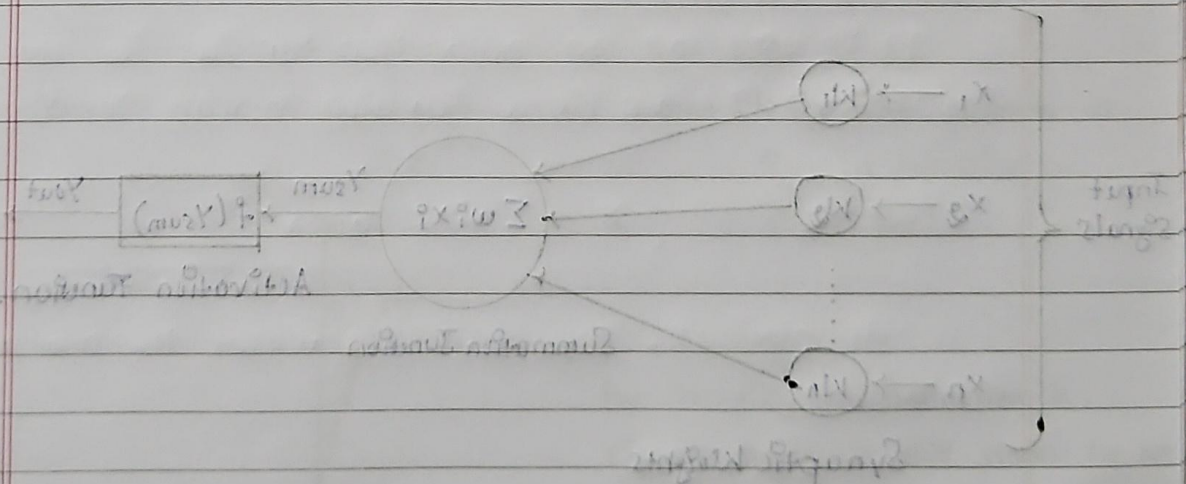
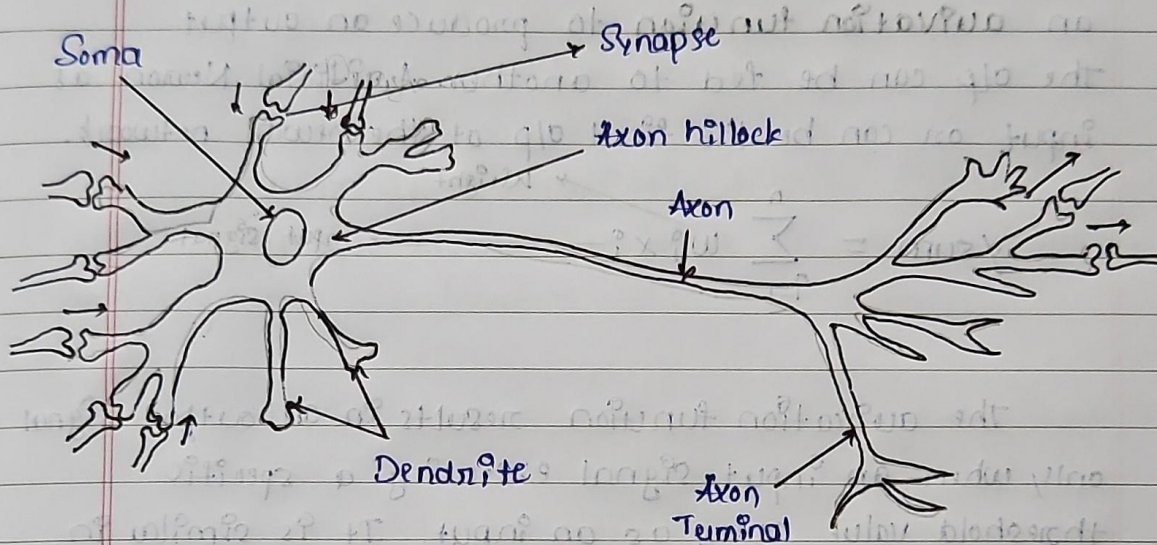
body part

Neurons are basic structural units of the CNS. A Neuron is able to receive, process, & transmit information in the form of chemical & electrical signals. The fig shows the structure of a neuron. It has 3 main parts to carry out its primary functionality of receiving & transmitting information.

- 1 Dendrites
- 2 Cell Body or Soma
- 3 Axon



1. Dendrites - To Receive signals from neighbouring Neurons.
2. Soma - Main body of the Neuron which collects the signals coming from the diff dendrites. It fires when the sufficient amount of signal is <sup>Collected</sup>.
3. Axon - Last part of the neuron which receives signal from Soma, once the neuron 'fires' & passes it on to the neighbouring neurons through the axon terminals.





2. With diagram explain the structure of Artificial Neuron?

Artificial Neuron: (ANN)

In ML, Artificial Neural Networks are inspired by biological Neurons in the human brain.

An Artificial Neuron is a computational unit that mimic or simulates the functioning of a biological neuron. It is the building block of an ANN.

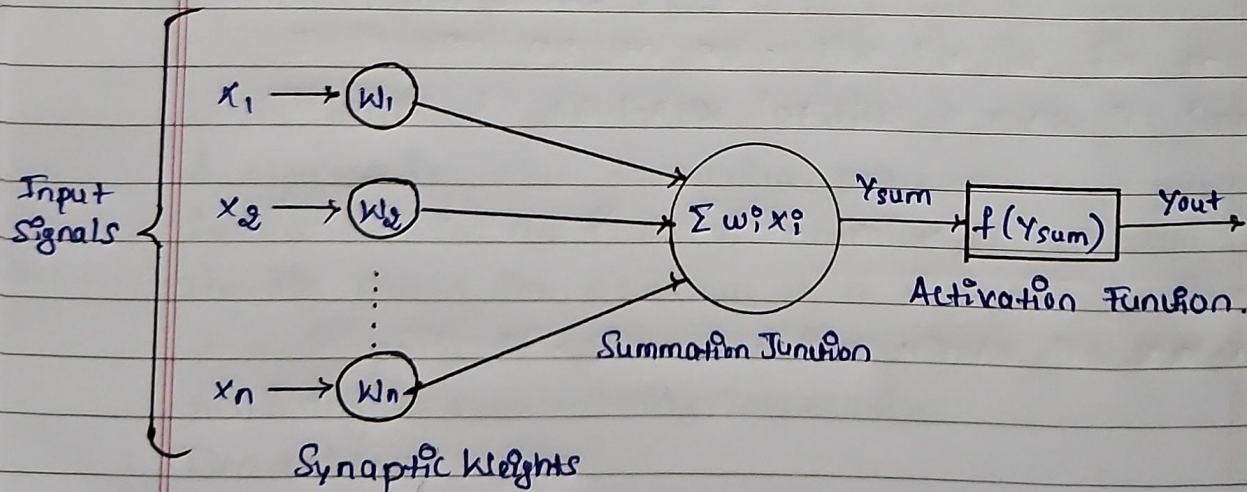
It receives one or more inputs, applies a weight to each input, sums them up, & applies an activation function to produce an output.

The o/p can be fed to another Artificial Neuron as input or can be the final o/p of the neural network.

$$y_{\text{sum}} = \sum_{i=1}^n w_i x_i$$

$\nearrow$  weight       $\longrightarrow$  input signal

The activation function results in an output signal only when an input signal exceeding a specific threshold value comes as an input. It is similar in behaviour to the biological neuron which transmits the signal only when the total input signal meets the firing threshold.



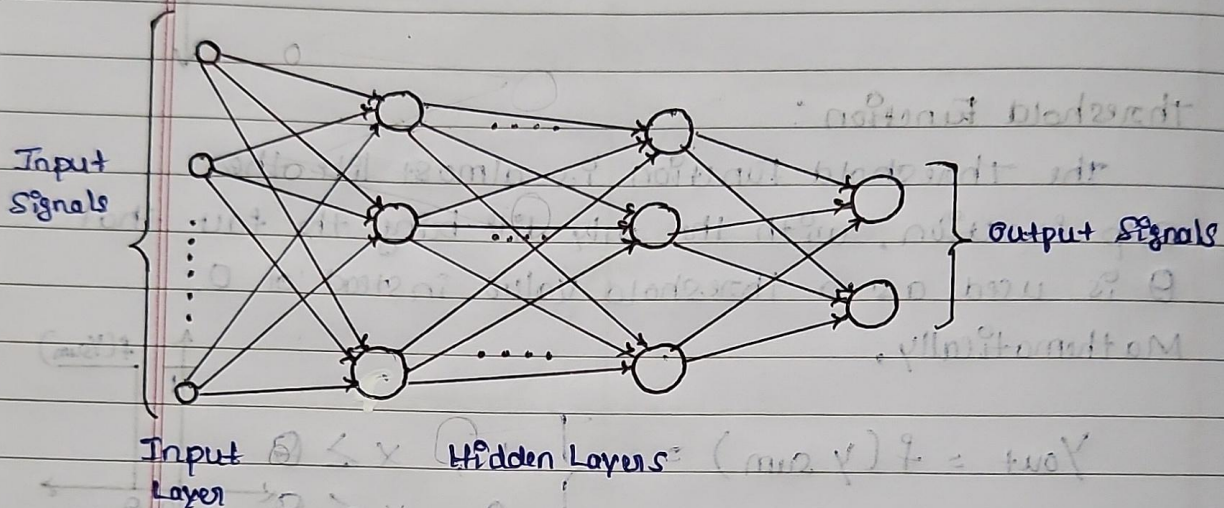


## 8 Explain the Concept of Multi-Layer Perception?

**Multi-Layer Perception: (MLP)**

A Multi-Layer Perception is a type of Artificial Neural Network (ANN) or the implementation of ANN which is commonly used in ML for both classification & regression tasks.

MLPs are composed of multiple layers of interconnected nodes, where each node receives the input from the previous layer & produces an output for the next layer.



The 1<sup>st</sup> Layer of MLP is the input layer, which takes <sup>in</sup> the input data. The next layer is one or more hidden layers, <sup>which are hidden from I/P & O/P layers</sup> which processes the input data & transform it into a set of features. The final layer is the output layer, which produces the final output of the MLP. Each layer is composed of multiple nodes or neurons, which are connected by weights.

The MLP is trained using a labeled data set, where the inputs & outputs are known, & the weights are updated iteratively until the model can accurately predict the output for unseen inputs.

The MLP can model complex, & non-linear relationships b/w inputs & outputs making it a powerful tool for solving many machine learning problems like, image recognition, speech recognition, & Natural Language Processing.



### 3. What is Deep Learning? Explain the <sup>Architecture</sup> concept of DNN

#### Deep Learning:

Deep Learning is a branch of Machine Learning which is completely based on Artificial Neural Networks (ANN), as Neural Network is going to mimic the human brain, So Deep Learning is also a kind of mimic of human brain.

In Deep Learning Neural Networks with many layers often referred to as "Deep" Neural Network DNN are used to extract features from the input data, which are then used to make predictions or decisions about new data.

The main Advantages of Deep learning is that it can learn to extract & represent complex features from raw data without requiring explicit feature engineering, which can be time consuming & labour intensive.

Draw MLP diagram.

#### Architecture of DNN:

Deep Neural Network is a type of Artificial Neural Network (ANN) that has multiple layers b/w the input & output layers.

#### 1 Deep Neural Network: (DNN)

It is a neural Network with a certain level of complexity having multiple hidden layers in b/w the input & output layers.

#### 2 Deep Belief Network (DBN)

DBN is a type of DNN that is composed of multiple layers of Restricted Boltzmann Machine (RBM). In a DBN multiple RBMs are stacked on top of each other.

#### 3. Recurrent:

Perform same task for every element of a sequence.  
Neural Network - Allows for parallel & sequential computation.  
Similar to human brain



Working :

First we need to identify the actual problem in order to get the right solution & it should be understood, the feasibility of Deep Learning should also be checked i.e. whether it should fit DL or not.

Second we need to identify relevant data which should correspond to the actual problem & should be prepared accordingly.

Third choose the Deep Learning Algorithm appropriately.

Fourth, Algorithm should be used while training the data set.

Fifth, Final testing should be done on the data set.

Understand the problem &  
check feasibility for DL

Identify relevant  
data & prepare it

Choose Deep Learning  
Algorithm

Training  
Algorithm

Test model's  
Performance