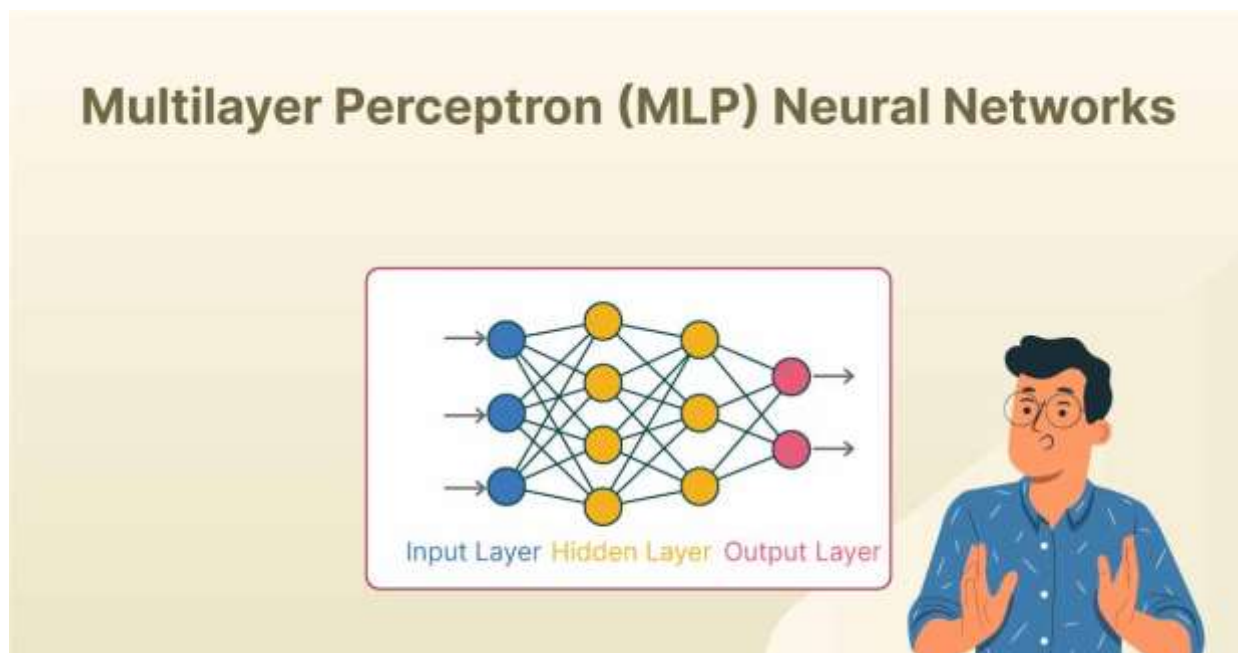# Module 1

Multilayer Perceptron:

An MLP is a type of feedforward artificial neural network with multiple layers, including an input layer, one or more hidden layers, and an output layer. Each layer is fully connected to the next. In this article, we will understand MultiLayer Perceptron Neural Network, an important concept of deep learning and neural networks.

MultiLayer Perceptron Neural Network is a Neural Network with multiple layers, and all its layers are connected. It uses a BackPropagation algorithm for training the model. Multilayer Perceptron is a class of Deep Learning, also known as MLP.

What is a Multilayer Perceptron Neural Network?

A multilayer perceptron (MLP) Neural network belongs to the feedforward neural network. It is an Artificial Neural Network in which all nodes are interconnected with nodes of different layers.

Frank Rosenblatt first defined the word Perceptron in his perceptron program. Perceptron is a basic unit of an artificial neural network that defines the artificial neuron in the neural network. It is a supervised learning algorithm containing nodes' values, activation functions, inputs, and weights to calculate the output.

The Multilayer Perceptron (MLP) Neural Network works only in the forward direction. All nodes are fully connected to the network. Each node passes its value to the coming node only in the forward direction. The MLP neural network uses a Backpropagation algorithm to increase the accuracy of the training model.
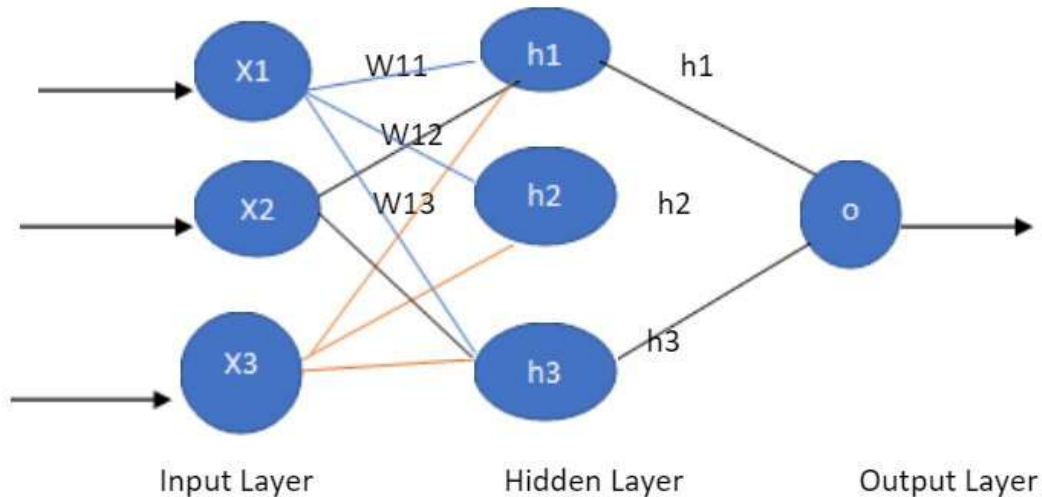
Module 1

Diagram Of MultiLayer Perceptron Neural Network

Structure of MultiLayer Perceptron Neural Network

This network has three main layers that combine to form a complete Artificial Neural Network. These layers are as follows:

Input Layer

It is the initial or starting layer of the Multilayer perceptron. It takes input from the training data set and forwards it to the hidden layer. There are n input nodes in the input layer. The number of input nodes depends on the number of dataset features. Each input vector variable is distributed to each of the nodes of the hidden layer.

Hidden Layer

It is the heart of all Artificial neural networks. This layer comprises all computations of the neural network. The edges of the hidden layer have weights multiplied by the node values. This layer uses the activation function.

There can be one or two hidden layers in the model.

Several hidden layer nodes should be accurate as few nodes in the hidden layer make the model unable to work efficiently with complex data. More nodes will result in an overfitting problem.

Output Layer

This layer gives the estimated output of the Neural Network. The number of nodes in the output layer depends on the type of problem. For a single targeted variable, use one node. N classification problem, ANN uses N nodes in the output layer.

Module 1

Working of MultiLayer Perceptron Neural Network

- The input node represents the feature of the dataset.

- Each input node passes the vector input value to the hidden layer.

- In the hidden layer, each edge has some weight multiplied by the input variable. All the production values from the hidden nodes are summed together. To generate the output

- The activation function is used in the hidden layer to identify the active nodes.

- The output is passed to the output layer.

- Calculate the difference between predicted and actual output at the output layer.

- The model uses backpropagation after calculating the predicted output.

BackPropagation Algorithm

The backpropagation algorithm is used in a Multilayer perceptron neural network to increase the accuracy of the output by reducing the error in predicted output and actual output.

According to this algorithm,

- Calculate the error after calculating the output from the Multilayer perceptron neural network.

- This error is the difference between the output generated by the neural network and the actual output. The calculated error is fed back to the network, from the output layer to the hidden layer.

- Now, the output becomes the input to the network.

- The model reduces error by adjusting the weights in the hidden layer.

- Calculate the predicted output with adjusted weight and check the error. The process is recursively used till there is minimum or no error.

- This algorithm helps in increasing the accuracy of the neural network.

Difference Between Multilayer Perceptron Neural Network and Conventional Neural Network

Module 1

	MultiLayer Perceptron Neural Network	Convolutional Neural Network
Types of Input	It takes vector inputs.	It takes both vectors and matrices as input.
Network Type	It is a fully connected Neural network	It is a spatially connected neural network.
Focus Problem	It can deal with non-linear problems.	Can only deal with linear problems.
Application	It is good for simple image classification.	It is mostly used for complex image classification.

Advantages of MultiLayer Perceptron Neural Network

- MultiLayer Perceptron Neural Networks can easily work with non-linear problems.

- It can handle complex problems while dealing with large datasets.

- Developers use this model to deal with the fitness problem of Neural Networks.

- It has a higher accuracy rate and reduces prediction error by using backpropagation.

- After training the model, the Multilayer Perceptron Neural Network quickly predicts the output.

Disadvantages of MultiLayer Perceptron Neural Network

- This Neural Network consists of large computation, which sometimes increases the overall cost of the model.

- The model will perform well only when it is trained perfectly.

- Due to this model's tight connections, the number of parameters and node redundancy increases.

Conclusion

The conclusion is Multilayer Perceptron Neural Network is the most used deep learning concept. We can make use of it in various applications, like image classification, regression prediction problems, and the handling of non-linear problems. It has several nodes in its layer that increase computation complexity, resulting in more parameters.

Module 1

The use of MLP, CNN, and RNN depends on the type of problem and the dataset.