**NEURAL NETWROKS – Deep Learning**

Every action we take is controlled by neurons, i.e., our Nervous System. The actions depend on how the neurons are connected within the system and how strong is the connection between them. This is the main concept of Deep Learning.

These networks consist of layers such as the input layer, hidden layer(s) and the output layer. Some basic terminology regarding neural networks is as follows:

**Perceptron:**

A perceptron can be defined as the simplest artificial neuron that only contains an input layer and an output layer. The input layer is processed by an activation function and the output is attained. A diagram depicting a simple perceptron is as follows:

Input Layer Neuron Output Layer

W

**Activation Function:**

The activation function is responsible for converting the sum of weighted inputs into outputs. The output of one layer is fed as an input to the next layer. Following are some types of activation functions used in neural networks:

1. Sigmoid: The range of sigmoid function is from 0 to 1. It is generally used for binary classification. Also known as Logistic Function.

2. Tanh: The range varies from -1 to 1. This activation function is generally used in hidden layers.

3. Relu: It stands for Rectified Linear unit. This ranges from 0 to maximum of inputs. It is the default activation function in hidden layers.

4. Softmax: This function is used in the output layer of a neural network which is required to predict multiple class labels.

**Layers in a simple Artificial Neural Network (ANN):**

A simple neural network consists of three layers:

1. Input Layer: This layer is responsible for perceiving the input features of a problem. The number of nodes given in this layer is usually equal to the number of input features. The data doesn’t get changed when it passes through the input layer.

2. Hidden Layer: The Hidden layer is responsible for making the transformation in data. The processing in Hidden layer is actually done by ‘weighted connections. The hidden layers increase the predictive power of a neural network.

3. The output layer finally receives the connections from the hidden layer or the input layer directly and is responsible for predicting the output. In classification problems, we give the number of nodes in an output layer as 1.

Input Layer Hidden Layer Output Layer

Output

The neural network learns to adjust the weights and also the threshold value(formula associated with the weights) in order to predict the correct outputs.

Complex problems cannot be solved simply by using these three layers. Hence, more hidden layers are added to the neural network.

Therefore, when we have more than three layers including the input and the output layer, the network is called **Deep Neural network**. Also, training such complex networks is referred to as **Deep Learning**. The limitation which one comes across using neural networks is that neural networks need a large diversity of data in order to train themselves and give the correct predictions.

Common applications of Neural networks are financial forecasting (e.g., predicting the house prices, etc.), Voice recognition, character recognition, signature verification etc.