Fundamentals and operational requirements:

Components of Neural Network

The structure of the neural network depends on the problem's specification, and it is configured according to the application. Though, in general, a neural network has the following structure, and the components of artificial neural networks which make the fundamentals of neural networks are:

- Layers: Input, Hidden, and Output layers
- Neurons
- Activation Function
- Weights and Bias

Layers

In a neural network, there are three layers: Input Layer, Hidden Layers, and Output layer.

The input layer consists of the inputs or the independent X variable known as the predictors. These inputs are collected from external sources such as text data, images, audio, or video files. In a natural network, these Xs are the information perceived from the sense organs.

The output layer results from the neural network; it could be a numerical value in a regression problem or a binary or multi-layer class for a classification problem. The output can also be the recognition of handwriting or audio voice or classified image or text in categories.

Apart from the Input and the Output layer, there is another layer in the Neural Networks, called the Hidden Layer, which derives the features for the model. There is one hidden layer in the above image, and the below image has three hidden layers.

- Single Layer Perceptron: The neural net with one single hidden layer is called the Single Layer Perceptron.

- Multilayer Perceptron: The neural net with more than one hidden layer and where each of the layers is connected is called the Multilayer Perceptron.

Neurons

As seen above, neurons are the primary and basic processing unit in the neural network. It receives information or data, performs simple calculations, and then passes it further. The neurons are in the hidden and the output layers. The input layer doesn't have any neurons; the circles in the input layer represent the independent variables

The number of nodes in the output layer depends on the kind of the business problem:

- **Regression:** in other words when the nature of the output is continuous, then there will be one node in the output layer like the above image.

- **Classification:** In the case of a classification problem, the nodes in the output layer are equal to the number of the classes or the categories. For binary classification, we can either have one or two nodes in the output layer.

The number of neurons in the hidden layers is subject to the user. The architecture of the neural net is configured based on the problem at hand

and is determined by the user. The input layer is always predefined, and the output is the goal of the network that is also prefixed.

It is the number of hidden layers and the number of neurons that form the part of the hyperparameters. It is so because these exact parameters create the features, and a small tweak in these can significantly impact the output.