**Deep Learning**

Deep learning is a branch of machine learning which is based on artificial neural networks. It is capable of learning complex patterns and relationships within data. It has become increasingly popular in recent years due to the advances in processing power and the availability of large datasets. These neural networks are inspired by the structure and function of the human brain’s biological neurons. These networks consist of layers of interconnected nodes (neurons) that process and transform input data into meaningful output.

Neural Networks are layers of nodes. Nodes within individual layers are connected to adjacent layers. The network is said to be deeper based on the number of layers it has. In an artificial neural network, signals travel between nodes and assign corresponding weights. A heavier weighted node will exert more effect on the next layer of nodes. The final layer compiles the weighted inputs to produce an output.

**Neural Network**

Neural networks are a fundamental component of deep learning. These networks are inspired by the structure and functioning of the human brain, consisting of interconnected nodes (neurons) organized in layers. Neural networks are used to model and solve a variety of complex tasks by learning from data.

**Neurons**: Neurons are the basic units of a neural network. Each neuron receives one or more inputs, processes them using a weighted sum, and passes the result through an activation function to produce an output. The weights and biases associated with each neuron are parameters that the network learns during training.

**Layers:** Neural networks are organized into layers. The three main types of layers are: **Input Layer**- Receives the initial input data. **Hidden Layers**- Intermediate layers between the input and output layers where the neural network learns representations and features from the data. **Output Layer-** Produces the final output or prediction.

**Weights and Biases**: The connections between neurons are characterized by weights, and each neuron has an associated bias. These parameters are adjusted during training to minimize the difference between the predicted output and the actual output.

**Activation Function:** Neurons in a neural network use activation functions to introduce non-linearities into the model. Common activation functions include sigmoid, hyperbolic tangent (tanh), and rectified linear unit (ReLU). Non-linear activation functions enable the network to learn complex relationships in the data.

**Feedforward Neural Network:** In a feedforward neural network, information travels in one direction—from the input layer through the hidden layers to the output layer. This type of architecture is suitable for tasks such as classification and regression.

**Deep Neural Networks (DNNs):** Neural networks with multiple hidden layers are referred to as deep neural networks. The depth allows these networks to capture hierarchical features and representations in the data, making them well-suited for complex tasks.

**Convolutional Neural Networks (CNNs):** CNNs are specialized neural networks designed for processing grid-like data, such as images. They use convolutional layers to automatically and adaptively learn spatial hierarchies of features.

**Recurrent Neural Networks (RNNs):** RNNs are designed for sequential data, incorporating recurrent connections to capture dependencies over time. They are commonly used in natural language processing and time series analysis.

Neural networks have demonstrated remarkable success in various domains, including computer vision, natural language processing, speech recognition, and more. Their ability to automatically learn complex patterns and representations from data makes them a powerful tool in the field of artificial intelligence.