1. What is the function of a summation junction of a neuron? What is threshold activation function?

ANS:

The linear combiner or the summing junction adds all the products of the synapses and parameters.

A threshold value determines whether a neuron should be activated or not activated in a binary step activation function. The activation function compares the input value to a threshold value. If the input value is greater than the threshold value, the neuron is activated.

1. What is a step function? What is the difference of step function with threshold function?

ANS:

A step function is a function like that used by the original Perceptron. The output is a certain value, A1, if the input sum is above a certain threshold and A0 if the input sum is below a certain threshold. The values used by the Perceptron were A1 = 1 and A0 = 0.

1. Explain the McCulloch–Pitts model of neuron.

ANS:

Model Architecture

The motivation behind the McCulloh Pitt's Model is a biological neuron. A biological neuron takes an input signal from the dendrites and after processing it passes onto other connected neurons as the output if the signal is received positively, through axons and synapses.

1. Explain the ADALINE network model.

ANS:

MADALINE (Many ADALINE) is a three-layer (input, hidden, output), fully connected, feed-forward artificial neural network architecture for classification that uses ADALINE units in its hidden and output layers, i.e. its activation function is the sign function. The three-layer network uses memistors.

1. What is the constraint of a simple perceptron? Why it may fail with a real-world data set?

ANS:

A perceptron model has limitations as follows:

The output of a perceptron can only be a binary number (0 or 1) due to the hard limit transfer function. Perceptron can only be used to classify the linearly separable sets of input vectors. If input vectors are non-linear, it is not easy to classify them properly.

1. What is linearly inseparable problem? What is the role of the hidden layer?

ANS:

Hidden layers allow for the function of a neural network to be broken down into specific transformations of the data. Each hidden layer function is specialized to produce a defined output.

Linear inseparability  
  
Clearly not all decision problems are linearly separable: they cannot be solved using a linear decision boundary. Problems like these are termed linearly inseparable. XOR is a linearly inseparable problem.

1. Explain XOR problem in case of a simple perceptron.

ANS:

The XOr problem is that we need to build a Neural Network (a perceptron in our case) to produce the truth table related to the XOr logical operator. This is a binary classification problem. Hence, supervised learning is a better way to solve it. In this case, we will be using perceptrons.

1. Design a multi-layer perceptron to implement A XOR B.

ANS:

The XOR problem with neural networks can be solved by using Multi-Layer Perceptrons or a neural network architecture with an input layer, hidden layer, and output layer. So during the forward propagation through the neural networks, the weights get updated to the corresponding layers and the XOR logic gets executed

1. Explain the single-layer feed forward architecture of ANN.

ANS:

Single layer feedforward network − The concept is of feedforward ANN having only one weighted layer. In other words, we can say the input layer is fully connected to the output layer.

1. Explain the competitive network architecture of ANN.

ANS:

Architecture of ANN

A neural network consists of three layers. The first layer is the input layer. It contains the input neurons that send information to the hidden layer. The hidden layer performs the computations on input data and transfers the output to the output layer.

1. Consider a multi-layer feed forward neural network. Enumerate and explain steps in the backpropagation algorithm used to train the network.

ANS:

The backpropagation algorithm performs learning on a multilayer feed-forward neural network. It iteratively learns a set of weights for prediction of the class label of tuples. A multilayer feed-forward neural network consists of an input layer, one or more hidden layers, and an output layer.

Below are the steps involved in Backpropagation:

1. Step – 1: Forward Propagation.
2. Step – 2: Backward Propagation.
3. Step – 3: Putting all the values together and calculating the updated weight value.
4. What are the advantages and disadvantages of neural networks?

ANS:

Conclusion Neural networks are a powerful tool for machine learning and artificial intelligence. They offer many advantages, such as the ability to learn from data and generalize. However, they also have some drawbacks, such as the cost and the difficulty of interpreting the results.

Advantages of Artificial Neural Network  
  
A neural network can implement tasks that a linear program cannot. When an item of the neural network declines, it can continue without some issues by its parallel features. A neural network determines and does not require to be reprogrammed.

4 Disadvantages of Neural Networks & Deep Learning

* Black box.
* Duration of development.
* Amount of data.
* Computationally expensive.

1. Write short notes on any two of the following:
   * 1. Biological neuron

ANS:

In the biological systems, a neuron is a cell just like any other cell of the body, which has a DNA code and is generated in the same way as the other cells. Though it might have different DNA, the function is similar in all the organisms.

* + 1. ReLU function

ANS:

The rectified linear activation function or ReLU for short is a piecewise linear function that will output the input directly if it is positive, otherwise, it will output zero

* + 1. Single-layer feed forward ANN

ANS:

A single-layer neural network represents the most simple form of neural network, in which there is only one layer of input nodes that send weighted inputs to a subsequent layer of receiving nodes, or in some cases, one receiving node

* + 1. Gradient descent

ANS:

Gradient descent is an optimization algorithm which is commonly-used to train machine learning models and neural networks. Training data helps these models learn over time, and the cost function within gradient descent specifically acts as a barometer, gauging its accuracy with each iteration of parameter updates.

* + 1. Recurrent networks

ANS:

A recurrent neural network is a type of artificial neural network commonly used in speech recognition and natural language processing. Recurrent neural networks recognize data's sequential characteristics and use patterns to predict the next likely scenario.

Recurrent Neural Networks are used in several domains. For instance, in Natural Language Processing (NLP), they've been used to generate handwritten text, perform machine translation and speech recognition. But their applications are not restricted to processing language