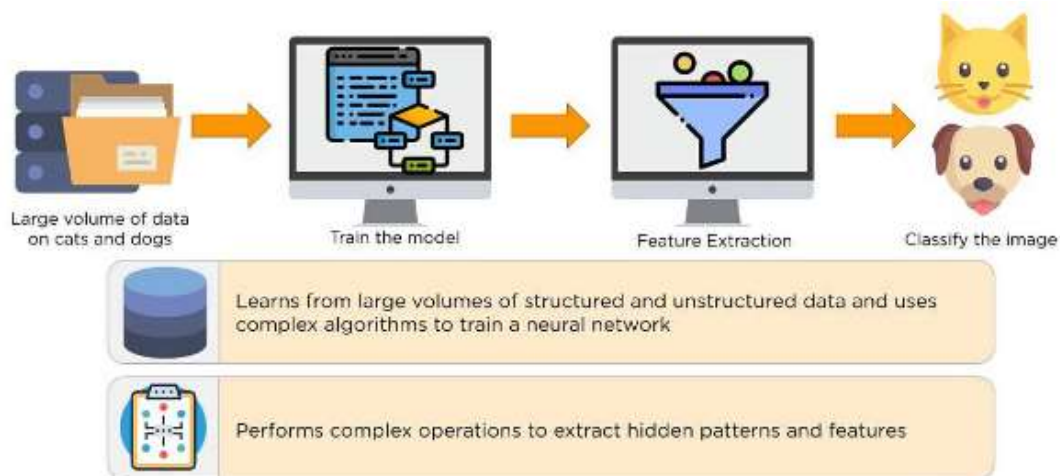


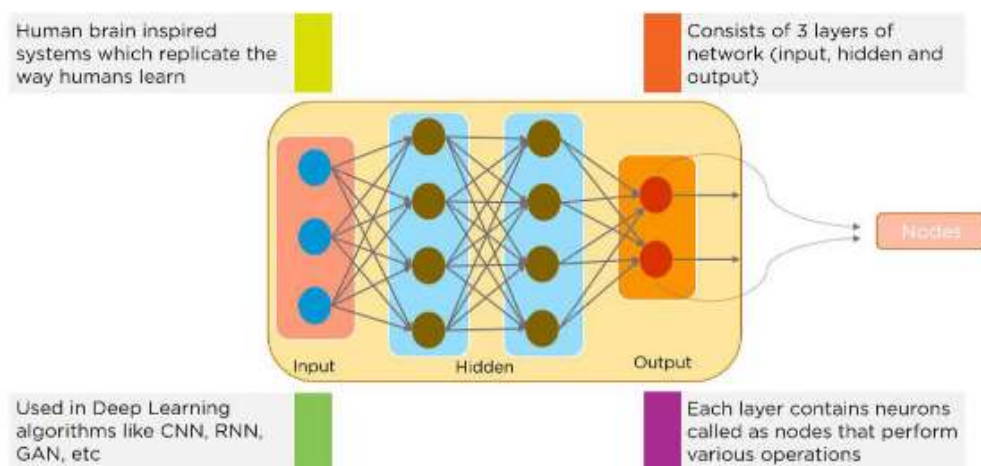
What is Deep Learning?

Deep Learning involves taking large volumes of structured or unstructured data and using complex algorithms to train neural networks. It performs complex operations to extract hidden patterns and features (for instance, distinguishing the image of a cat from that of a dog).



What is a Neural Network?

Neural Networks replicate the way humans learn, inspired by how the neurons in our brains fire, only much simpler.



The most common Neural Networks consist of three network layers:

1. An input layer
2. A hidden layer (this is the most important layer where feature extraction takes place, and adjustments are made to train faster and function better)
3. An output layer

Each sheet contains neurons called “nodes,” performing various operations. Neural Networks are used in deep learning algorithms like CNN, RNN, GAN, etc.

What Is a Multi-layer Perceptron (MLP)?

As in Neural Networks, MLPs have an input layer, a hidden layer, and an output layer. It has the same structure as a single layer perceptron with one or more hidden layers. A single layer perceptron can classify only linear separable classes with binary output (0,1), but MLP can classify nonlinear classes.

Except for the input layer, each node in the other layers uses a nonlinear activation function. This means the input layers, the data coming in, and the activation function is based upon all nodes and weights being added together, producing the output. MLP uses a supervised learning method called “backpropagation.” In backpropagation, the neural network calculates the error with the help of cost function. It propagates this error backward from where it came (adjusts the weights to train the model more accurately).

What Is Data Normalization, and Why Do We Need It?

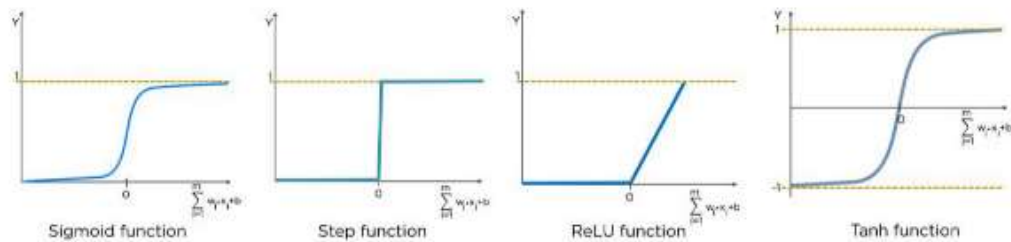
The process of standardizing and reforming data is called “Data Normalization.” It’s a pre-processing step to eliminate data redundancy. Often, data comes in, and you get the same information in different formats. In these cases, you should rescale values to fit into a particular range, achieving better convergence.

What is the Boltzmann Machine?

One of the most basic Deep Learning models is a Boltzmann Machine, resembling a simplified version of the Multi-Layer Perceptron. This model features a visible input layer and a hidden layer -- just a two-layer neural net that makes stochastic decisions as to whether a neuron should be on or off. Nodes are connected across layers, but no two nodes of the same layer are connected.

What Is the Role of Activation Functions in a Neural Network?

At the most basic level, an activation function decides whether a neuron should be fired or not. It accepts the weighted sum of the inputs and bias as input to any activation function. Step function, Sigmoid, ReLU, Tanh, and Softmax are examples of activation functions.



What Is the Cost Function?

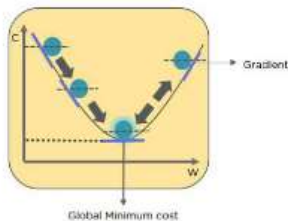
Also referred to as “loss” or “error,” cost function is a measure to evaluate how good your model’s performance is. It’s used to compute the error of the output layer during backpropagation. We push that error backward through the neural network and use that during the different training functions.

Cost Function: $C = \frac{1}{2} \sum (Y - \hat{Y})^2$

Y -----> Original Output
 \hat{Y} -----> Predicted Output

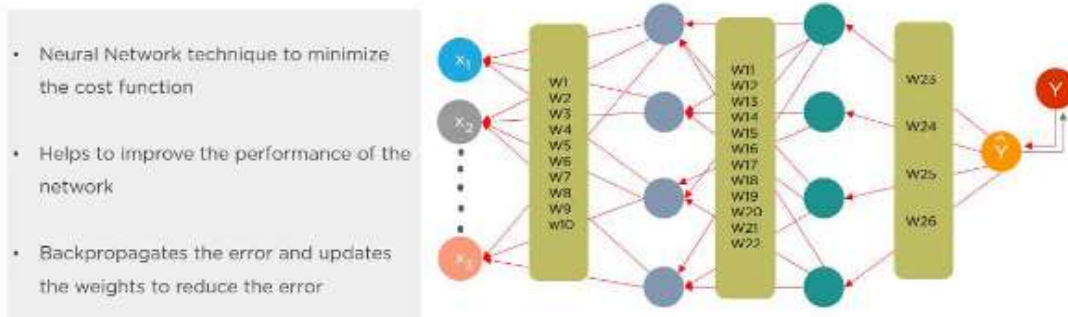
What Is Gradient Descent?

Gradient Descent is an optimal algorithm to minimize the cost function or to minimize an error. The aim is to find the local-global minima of a function. This determines the direction the model should take to reduce the error.



What Do You Understand by Backpropagation?

This is one of the most frequently asked deep learning interview questions. Backpropagation is a technique to improve the performance of the network. It backpropagates the error and updates the weights to reduce the error.



What Is the Difference Between a Feedforward Neural Network and Recurrent Neural Network?

In this deep learning interview question, the interviewee expects you to give a detailed answer.

A Feedforward Neural Network signals travel in one direction from input to output. There are no feedback loops; the network considers only the current input. It cannot memorize previous inputs (e.g., CNN).

A Recurrent Neural Network's signals travel in both directions, creating a looped network. It considers the current input with the previously received inputs for generating the output of a layer and can memorize past data due to its internal memory.

What Are the Applications of a Recurrent Neural Network (RNN)?

The RNN can be used for sentiment analysis, text mining, and image captioning. Recurrent Neural Networks can also address time series problems such as predicting the prices of stocks in a month or quarter.

What Are the Softmax and ReLU Functions?

Softmax is an activation function that generates the output between zero and one. It divides each output, such that the total sum of the outputs is equal to one. Softmax is often used for output layers.

ReLU (or Rectified Linear Unit) is the most widely used activation function. It gives an output of X if X is positive and zeros otherwise. ReLU is often used for hidden layers.

What Is Dropout and Batch Normalization?

Dropout is a technique of dropping out hidden and visible units of a network randomly to prevent overfitting of data (typically dropping 20 percent of the nodes). It doubles the number of iterations needed to converge the network.

Batch normalization is the technique to improve the performance and stability of neural networks by normalizing the inputs in every layer so that they have mean output activation of zero and standard deviation of one.

What is Overfitting and Underfitting, and How to Combat Them?

Overfitting occurs when the model learns the details and noise in the training data to the degree that it adversely impacts the execution of the model on new

information. It is more likely to occur with nonlinear models that have more flexibility when learning a target function. An example would be if a model is looking at cars and trucks, but only recognizes trucks that have a specific box shape. It might not be able to notice a flatbed truck because there's only a particular kind of truck it saw in training. The model performs well on training data, but not in the real world.

Underfitting alludes to a **model that is neither well-trained on data nor can generalize to new information.** This usually **happens when there is less and incorrect data to train a model.** Underfitting has both **poor performance and accuracy.**

To **combat overfitting and underfitting**, you can **resample the data to estimate the model accuracy** (k-fold cross-validation) and **by having a validation dataset to evaluate the model.**

18. How Are Weights Initialized in a Network?

There are two methods here: we can either

1. **initialize the weights to zero** or
2. **assign them randomly.**

Initializing all weights to 0: This makes your **model similar to a linear model.** **All the neurons and every layer perform the same operation, giving the same output and making the deep net useless.**

Initializing all weights randomly: Here, the **weights are assigned randomly by initializing them very close to 0.** It gives better accuracy to the model since every neuron performs different computations. This is the most commonly used method.

What Are the Different Layers on CNN?

1. Convolutional Layer - the layer that performs a convolutional operation, creating several smaller picture windows to go over the data.
2. ReLU Layer - it brings non-linearity to the network and converts all the negative pixels to zero. The output is a rectified feature map.
3. Pooling Layer - pooling is a down-sampling operation that reduces the dimensionality of the feature map.
4. Fully Connected Layer - this layer recognizes and classifies the objects in the image.

What is Pooling on CNN, and How Does It Work?

Pooling is used to reduce the spatial dimensions of a CNN. It performs down-sampling operations to reduce the dimensionality and creates a pooled feature map by sliding a filter matrix over the input matrix.

How Does an LSTM Network Work?

Long-Short-Term Memory (LSTM) is a special kind of recurrent neural network capable of learning long-term dependencies, remembering information for long periods as its default behavior. There are three steps in an LSTM network:

- Step 1: The network decides what to forget and what to remember.
- Step 2: It selectively updates cell state values.
- Step 3: The network decides what part of the current state makes it to the output.

Why is Tensorflow the Most Preferred Library in Deep Learning?

Tensorflow provides both C++ and Python APIs, making it easier to work on and has a faster compilation time compared to other Deep Learning libraries like Keras and Torch. Tensorflow supports both CPU and GPU computing devices.

What Do You Mean by Tensor in Tensorflow?

This is another most frequently asked deep learning interview question. A tensor is a mathematical object represented as arrays of higher dimensions. These arrays of data with different dimensions and ranks fed as input to the neural network are called "Tensors."

What Is an Auto-encoder?

This Neural Network has three layers in which the input neurons are equal to the output neurons. The network's target outside is the same as the input. It uses dimensionality reduction to restructure the input. It works by compressing the image input to a latent space representation then reconstructing the output from this representation.

What Is Bagging and Boosting?

Bagging and Boosting are ensemble techniques to train multiple models using the same learning algorithm and then taking a call.

With Bagging, we take a dataset and split it into training data and test data. Then we randomly select data to place into the bags and train the model separately.

With Boosting, the emphasis is on selecting data points which give wrong output to improve the accuracy.

The following are some of the most important advanced deep learning interview questions that you should know!

What is the significance of using the Fourier transform in Deep Learning tasks?

The Fourier transform function efficiently analyzes, maintains, and manages large datasets. You can use it to generate real-time array data that is helpful for processing multiple signals.

Explain two ways to deal with the vanishing gradient problem in a deep neural network.

- Use the ReLU activation function instead of the sigmoid function
- Initialize neural networks using Xavier initialization that works with tanh activation.

What is the need to add randomness in the weight initialization process?

If you set the weights to zero, then every neuron at each layer will produce the same result and the same gradient value during backpropagation. So, the neural network won't be able to learn the function as there is no asymmetry between the neurons. Hence, randomness to the weight initialization process is crucial.

What is a perceptron?

A perceptron is similar to the actual neuron in the human brain. It receives inputs from various entities and applies functions to these inputs, which transform them to be the output.

A perceptron is mainly used to perform binary classification where it sees an input, computes functions based on the weights of the input, and outputs the required transformation.

What are some of the most used applications of Deep Learning?

Deep Learning is used in a variety of fields today. The most used ones are as follows:

- Sentiment Analysis
- Computer Vision
- Automatic Text Generation
- Object Detection
- Natural Language Processing, Image Recognition

What is an RNN in Deep Learning?

RNNs stand for [recurrent neural networks](#), which form to be a popular type of artificial neural network. They are used to process sequences of data, text, genomes, handwriting, and more. RNNs make use of backpropagation for the training requirements.

Where are autoencoders used?

[Autoencoders](#) have a wide variety of usage in the real world. The following are some of the popular ones:

- Adding color to black–white images
- Removing noise from images
- Dimensionality reduction
- Feature removal and variation