Deep Learning Tutorial

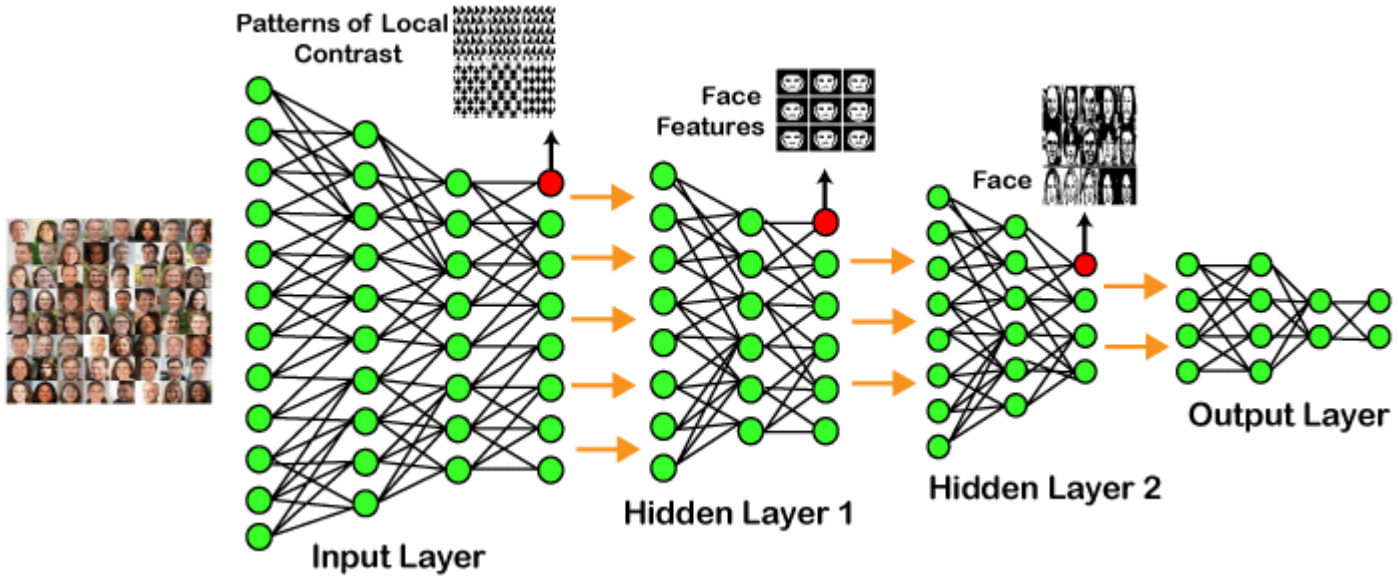
Deep learning is based on the branch of machine learning, which is a subset of artificial intelligence. Since neural networks imitate the human brain and so deep learning will do. In deep learning, nothing is programmed explicitly. Basically, it is a machine learning class that makes use of numerous nonlinear processing units so as to perform feature extraction as well as transformation. The output from each preceding layer is taken as input by each one of the successive layers.

Deep learning models are capable enough to focus on the accurate features themselves by requiring a little guidance from the programmer and are very helpful in solving out the problem of dimensionality. Deep learning algorithms are used, especially when we have a huge no of inputs and outputs.

Since deep learning has been evolved by the machine learning, which itself is a subset of artificial intelligence and as the idea behind the artificial intelligence is to mimic the human behavior, so same is "the idea of deep learning to build such algorithm that can mimic the brain".

Deep learning is implemented with the help of Neural Networks, and the idea behind the motivation of Neural Network is the biological neurons, which is nothing but a brain cell.

Example of Deep Learning



Types of Deep Learning Networks

1. Feed Forward Neural Network

A feed-forward neural network is none other than an Artificial Neural Network, which ensures that the nodes do not form a cycle. In this kind of neural network, all the perceptrons are organized within layers, such that the input layer takes the input, and the output layer generates the output. Since the hidden layers do not link with the outside world, it is named as hidden layers. Each of the perceptrons contained in one single layer is associated with each node in the subsequent layer. It can be concluded that all of the nodes are fully connected. It does not contain any visible or invisible connection between the nodes in the same layer. There are no back-loops in the feed-forward network. To minimize the prediction error, the backpropagation algorithm can be used to update the weight values.

Applications:

Data Compression
Pattern Recognition
Computer Vision
Speech Recognition
Handwritten Characters Recognition

2. Recurrent Neural Network

Recurrent neural networks are yet another variation of feed-forward networks. Here each of the neurons present in the hidden layers receives an input with a specific delay in time. The Recurrent neural network mainly accesses the preceding info of existing iterations. For example, to guess the succeeding word in any sentence, one must have knowledge about the words that were previously used. It not only processes the inputs but also shares the length as well as weights crossways time. It does not let the size of the model to increase with the increase in the input size. However, the only problem with this recurrent neural network is that it has slow computational speed as well as it does not contemplate any future input for the current state. It has a problem with reminiscing prior information.

Applications:

Machine Translation
Robot Control
Time Series Prediction
Speech Recognition
Speech Synthesis
Time Series Anomaly Detection
Rhythm Learning
Music Composition

3. Convolutional Neural Network

Convolutional Neural Networks are a special kind of neural network mainly used for image classification, clustering of images and object recognition. DNNs enable unsupervised construction of hierarchical image representations. To achieve the best accuracy, deep convolutional neural networks are preferred more than any other neural network.

Applications:

Identify Faces, Street Signs, Tumors.
Image Recognition.
Video Analysis.
NLP.
Anomaly Detection.
Drug Discovery.
Checkers Game.
Time Series Forecasting.

4. Restricted Boltzmann Machine

RBMs are yet another variant of Boltzmann Machines. Here the neurons present in the input layer and the hidden layer encompasses symmetric connections amid them. However, there is no internal association within the respective layer. But in contrast to RBM, Boltzmann machines do encompass internal connections inside the hidden layer. These restrictions in BMs helps the model to train efficiently.

Applications:

Filtering.
Feature Learning.
Classification.
Risk Detection.
Business and Economic analysis.

5. Autoencoders

An autoencoder neural network is another kind of unsupervised machine learning algorithm. Here the number of hidden cells is merely small than that of the input cells. But the number of input cells is equivalent to the number of output cells. An autoencoder network is trained to display the output similar to the fed input to force AEs to find common patterns and generalize the data. The autoencoders are mainly used for the smaller representation of the input. It helps in the reconstruction of the original data from compressed data. This algorithm is comparatively simple as it only necessitates the output identical to the input.

Encoder: Convert input data in lower dimensions.
Decoder: Reconstruct the compressed data.
Applications:

Classification.
Clustering.
Feature Compression.

Deep learning applications

Self-Driving Cars

In self-driven cars, it is able to capture the images around it by processing a huge amount of data, and then it will decide which actions should be incorporated to take a left or right or should it stop. So, accordingly, it will decide what actions it should take, which will further reduce the accidents that happen every year.

Voice Controlled Assistance

When we talk about voice control assistance, then Siri is the one thing that comes into our mind. So, you can tell Siri whatever you want it to do it for you, and it will search it for you and display it for you.

Automatic Image Caption Generation

Whatever image that you upload, the algorithm will work in such a way that it will generate caption accordingly. If you say blue colored eye, it will display a blue-colored eye with a caption at the bottom of the image.

Automatic Machine Translation

With the help of automatic machine translation, we are able to convert one language into another with the help of deep learning.

Limitations

It only learns through the observations.

It comprises of biases issues.

Advantages

It lessens the need for feature engineering.

It eradicates all those costs that are needless.

It easily identifies difficult defects.

It results in the best-in-class performance on problem

Disadvantages

It requires an ample amount of data.

It is quite expensive to train.

It does not have strong theoretical groundwork.