A survey concept on Deep Learning

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Abstract

Artifical intelligence is an area of computer science that emphasize the creation of Intelligence machines that work and react like human . ie, machine can learn and think .The team machine learning , deep learning and AI are interconnected with each other. Deep Learning is a subset of machine learning and machine learning is a subset of AI, which is an umbrella term for any computer program that does something smart. Machine learning is set of algorithms that parse data, learn have learning to make intelligent decision.

Keywords:CNN,RNN,DBN

What is deep learning?

Deep learning is a subset of that achieve great power and flexibility by learning to represent the world nested hierarchy of concept , with each concept defined in related to simples concepts , in term of less abstract ones. Deep learning is a technique that teaches computer to do what comes naturally to human .ie, team by eg: Deep learning is a key technique behind delivered cars , enabling them to recognize a stop sign or to distinguish a pedestrian from a lamppost. It is the phones tablet , tvs ,hands free speaker. In deep learning a computer model from images , text and sound . Deep learning model can achieve accuracy something exceeding the human level performance.

While deep learning war first theorized in 1980 , there are 2 main reason it has only recently become useful.

(1) Deep learning required large amount of labeled data. Eg, driverless car development required million of image and thousand of videos
(2) Deep learning required substantial computing power. High performance GPU (graphical processing unit) have a Parallel architecture that is efficient for deep learning . when combining this with other computing like cluster , cloud, this enable development team to reduce training time for a deep learning network from weeks to hours or less.

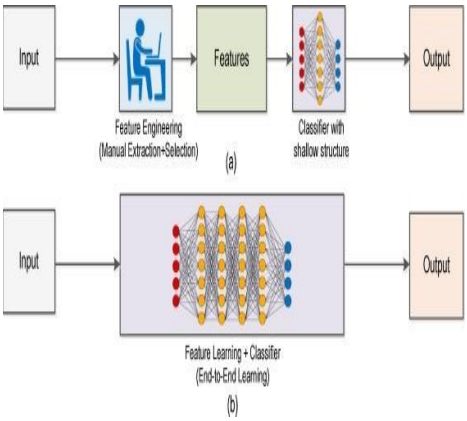
Deep learning also known as deep structured learning or hierarchical learning which is under family of machine learning and is based on learning data representation, an opposed to task specific algorithm. learning can be supervised, semi supervised or unsupervised .

- Use of cascade of multiple larger of non processing unit for feature extraction and transformation each layer uses the output from its previous larger as input.
- Learning in supervised (eg: classification)and unsupervised (eg: pattern analysis)manner.
- Learn multiple level of representation that correspond to different level of attraction.

How it works?

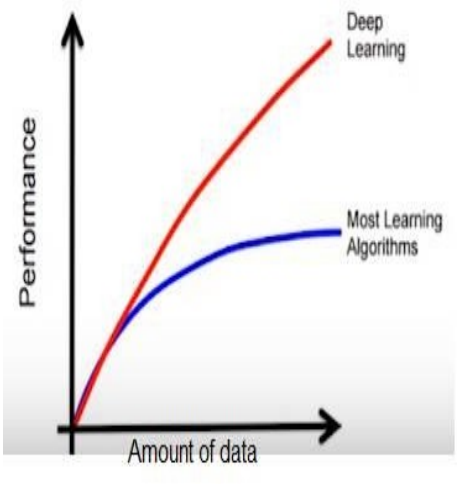
Most of the deep learning methods use neural network architectures, which is why deep learning models are often referred to as deep neural network.

The term “deep” usually refers to the number of hidden layers in neural network. traditional neural network contains 2-3 layers, while deep learning can have as many as 150.

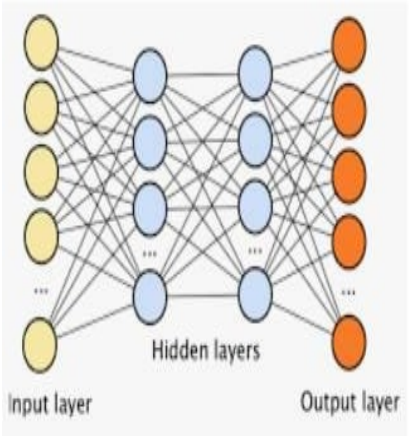


The above figure shows processes followed to identify the object in both machine learning and deep learning. Deep learning does not require feature extraction manually and takes images

directly as input. It requires high performance GPUs and lots of data. Feature extraction and classification are carried out by deep learning algorithms known as CNN. Performance of deep learning algorithms increases when amount of data increases. The same has been shown in below figure.



Deep learning models are trained by using large set of labeled data and neural network architectures that learn features directly from data without need for manual feature extraction. Ie, in deep learning we do not need to extract features from images. The network learn to extract features while traing.ie, input image >>neural network>>result.



The main element of a deep learning neural network is a layer of computational nodes called “neurons”. Every neuron connect to all of the neuron in the underlying layer. The “deep learning” means the neural network is leveraging atleast two hidden layers. By adding more hidden layers, the researchers enable more in depth calculations, yet deploying such network demands immense amounts of computational power.

Deep learning in matlab

The mat lab(matrix laboratory) is a multi paradigm numerical computing environment and proprietary programming language developed by mathworks. Mat lab allows matrix manipulations, plotting of functions and data, implementations of algorithms, creation of user interfaces and interfacing with programs written in other languages including c ,c++,c#, java,python. Mat lab makes deep learning easy. with tools and functions for managing large datasets, matlab also offers specialized toolboxes for working with other learning techniques.

With just a few lines of code mat lab lets you do deep learning without being an expert. Teams are successful using mat lab for deep learning because,

1) Create and visualize models with just a few lines of code.
2) Perform deep learning without being an expert.
3) Integrate deep learning in a single workflow.
   Eg. Try deep learning in ten lines of matlab code
   This example shows how to use deep learning to identify objects on a live webcam using only 10 lines of code.
   Camera=webcam;
   Net= alexnet;
   Alexnet is used to classify images.ie,classify images into thousands of objects categories(eg:keyboard,mouse,coffee mug,pencil etc).

```
While true
        im=snapshot(camera);
        image(im);
        im=imresize(im,[227,227]);
        label=classify(net,im);
        title(char(label));
        drawnow;
    end
```

Deep learning in politics

Politics is important because making decisions is important, and politics is how a group makes decisions. If we didn’t have politics, that would mean no one was trying to have power or control over people. There are various corruptions also occur in this field. Here I introduce a technique that a machine can predict the outcome of election based on human emotions. Politicians and political organizations routinely interact with voters and the

public at large using images, yet until recently, computational limitations have precluded experts to gain systematic knowledge about how images function as a medium of political communication. Here what i am interested to say is that "consider peoples in a particular area and identify there emotions about the particular political party or the particular candidate". This is done with the help of social media platforms. The goal of this model is to predict the percentage of voters who are interested to vote for a certain candidate, the independent variable. It is easy for the politicians to know exactly what to say to make us love themand hate their enemies.

The deep learning algorithms built a mathematical model of sample data, known as "training data" in order to make predictions or decisions without being explicitly programmed to perform the task. Here training data can be considered as various images, text, videos etc of politics that is found in the social media platforms like face book, you tube, twitter etc.

We know that in this present generation, most of the peoples use social medias. Based on various information's such as videos, text, images related to political parties, peoples in the world can react with them through likes, shares, comments etc. so by using this learning technique the system can understand the emotions of peoples through there feedbacks and response. This will help the system to predict the political image of various parties or members.

At the time of election this will help to predict the outcome of election. In the modern history, most of the political parties have had a limited number oftools to monitor their electoral campaign. Based on various information's provided in the social media network, peoples in the whole world can reach it and they provide there emotions through likes, share etc. through sharing it will be reached by more number of people. Therefore this method is also used as a powerful tool for electoral campaigns.

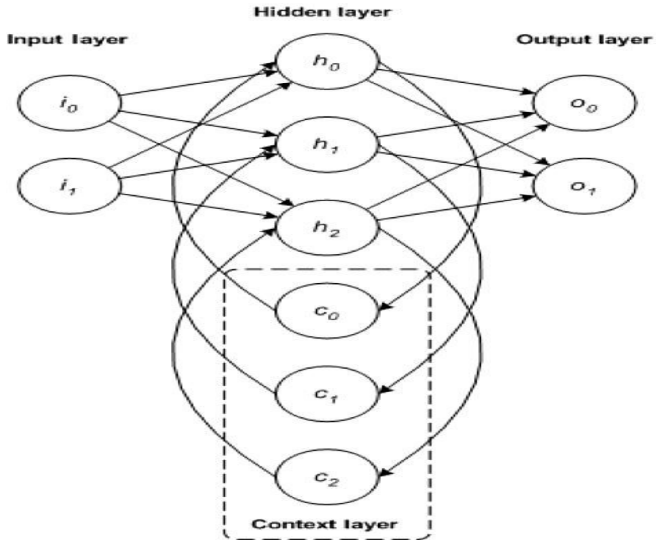
Deep learning architecture

There are number of architectures and algorithms that are used in deep learning. Some of the architectures are,

1) Recurrent Neural Network(RNN)
2) Convolutional Neural Network(CNN)
3) Deep Belief Network(DBN)

Recurrent Neural Network(RNN)

The RNN is one of the foundational network architectures from which other deep learning architectures are built. The primary difference between a typical multilayer network and a RNN is that rather than completely forward connections, a recurrent network might have connections that feed back into prior layer(or into same layer).this allows RNN to maintain memory memory of past input and model problems in time.



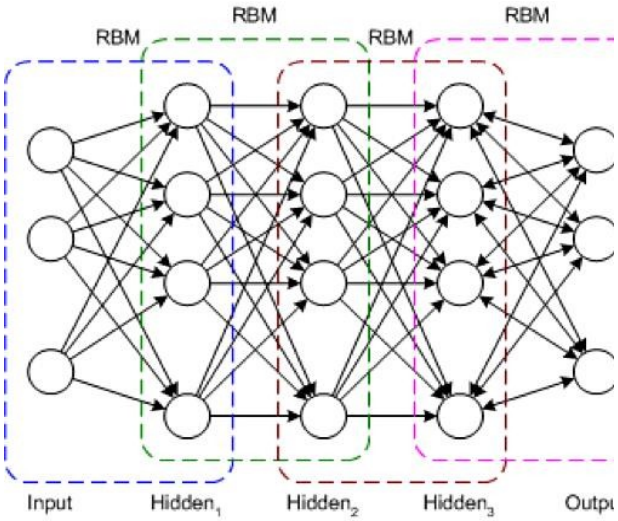
Convolutional Neural Network(CNN)

A CNN is a multilayer neural network that was biologically inspired by animal visual cortex. The CNN architecture is used in image processing applications. The first CNN was created by Yann lelan. As a deep network, early layers recognize features and later layers recombine these features into higher level attributes of the input. CNN is made up of several layers that implement feature extraction, and then classification. The image is divided into receptive fields that feed into a convolutional layer, which then extracts feature from input image. The next step is pooling which reduces the dimensionalities of extracted features while retaining most important information's. The final output layer of network is a set of nodes that identify features of image. The use of deep layers of processing, convolutions, pooling and a fully connected classification layer opened the door to various new applications of deep learning network.

Deep Belief Network (DBN)

The DBN is a typical network architecture but includes a training algorithm. The DBN is a multilayer network(many hidden layers) in which each pair of connected layers is a restricted

Boltzmann machine(RBM) in this way, a DBN is represented as a stack of RBMs.



In DBN, the input layer represents the raw sensory inputs and each hidden layer learns abstract representations of this input. The output layer, which is treated somewhat differently than the other layer, implements the network classification. Training occurs in two steps. Unsupervised pretraining and supervised fine tuning.

In unsupervised pretraining, each RBM is trained to reconstruct its input. (eg. The first RBM reconstruct the input layer to the first hidden layer). The next RBM is trained similarly, but first hidden layer is treated as input. This process continues. When pretraining is complete, fine tuning begins. In this phase, the output nodes are applied labels to give them meaning.

Advantages of deep learning

1) Features are automatically deduced and optimally tuned for desired outcome. Features are not required to be extracted ahead of time. This avoids time consuming machine learning techniques.
2) Robustness to natural variations in the data is automatically learned.
3) The same neural network based approach can be applied to many different applications and data types.
4) Massive parallel computations can be performed using GPUs and are scalable for large volumes of data. Moreover it delivers better performance results when amount of data are huge.
5) The deep learning architecture is flexible to be adapted to new problems in the future.

Disadvantages of deep learning

1) It requires very large amount of data in order to perform better than other techniques.
2) It is extremely expensive to train due to complex data models. Moreover deep learning requires expensive GPUs and hundreds of machines. This increases the cost to the users.
3) There is no standard theory to guide you in selecting right deep learning tools as it requires knowledge of topology, training methods and other parameters. As a result it is difficult to be adopted by less skilled people.
4) It is not easy to comprehend output based on mere learning and requires classifiers to do so. Convolution neural network based algorithms perform such tasks.

Some inspirational applications of deep learning

1) Colorization of black and white images

Deep learning can be used to use the objects and their context within the photograph to color the image, much like a human operator might approach the problem.

2) Automatically adding sounds to silent movies

In this task the system must synthesis sounds to match a silent video. The system is trained using 1000 example of video with sound of a drum stick striking different surfaces and creating different sounds. A deep learning model associates the video frames with a database of prerecorded sounds in order to select a sound to play that best matches what is happening in the scene.

3) Automatic machine translation

This is a task where given words, phrase or sentence in one language, automatically translate it into another language.

4) Object classification and detection in photographs

This task requires the classification of objects within a photograph as one of a set of previously known objects.

5) Automatic image caption generation

This is the task where given an image the system must generate a caption that describes the contents of the image.

Conclusion

The concept of deep learning implies that the machine creates its functionality by itself as long as it is possible at the current time. Deep learning is a quite resource demanding technology. It requires more powerful GPUs, high performance graphics processing units, large amounts of storage to train the models etc. furthermore, this technology needs more time to train in comparison with traditional machine learning. One of the main benefit of deep learning over various machine learning algorithms is its ability to generate new features from a limited series of features located in the training dataset. Therefore deep learning algorithms can create new tasks to solve current ones.If technology can help to solve problems,it will help people to save time with reduce effort.

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