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SURVEY ON DEEP LEARNING ALGORITHMS

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ABSTRACT

In recent past years, deep learning algorithms are becoming more significant in object recognition, Segmentation of image, speech recognition. Deep learning also provides flexible tools for analyze and processing big data. The objective of the article is to make a survey of many deep learning algorithms which are used in emerging research. Hence, the paper focuses on three mostly used and widely applied algorithms knows as deep neural networks, convolutional neural networks, recurrent neural networks. The aim is to provide better understanding of these algorithms, their efficiency, application and highlighting features.

KEYWORDS

deep learning, neural networks, deep neural networks, convolutional neural networks, recurrent neural networks

1. INTRODUCTION

Deep learning is a subset of machine learning dealing with algorithms inspired by the structure and function of human brain called artificial neural networks. [2-3]In other way, It exactly shows, the functioning of our brains. Deep learning algorithms are similar to how nervous system is designed where every neuron connected each other and passing information. Deep learning models functions in layers and a significant model having not less than three layers. [1]Every layer accepts the information and data from previous and send it on to the next one.[5,6,7] Deep learning models tend to perform well with large amount of data in which traditional machine learning models stops improving after a doused point. [4]Fig 1.1 shows the exact function of machine learning and deep learning.

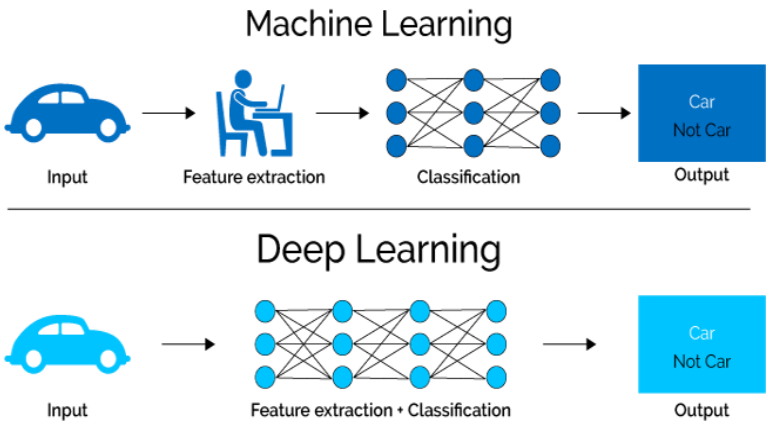


Fig 1.1 Machine Learning Vs Deep Learning

2. DEEP NEURAL NETWORKS

The fundamental building block of Deep Learning is the Perceptron which is a single neuron in a Neural Network. Provided a finite set of m inputs (e.g. m words or m pixels), we multiply each input by a weight (theta 1 to theta m) then we sum up the weighted combination of inputs, add a bias and finally pass them through a non-linear activation function. That produces the output Yhat. Fig 2.2 shows the exact working model of neural networks. [8-16]

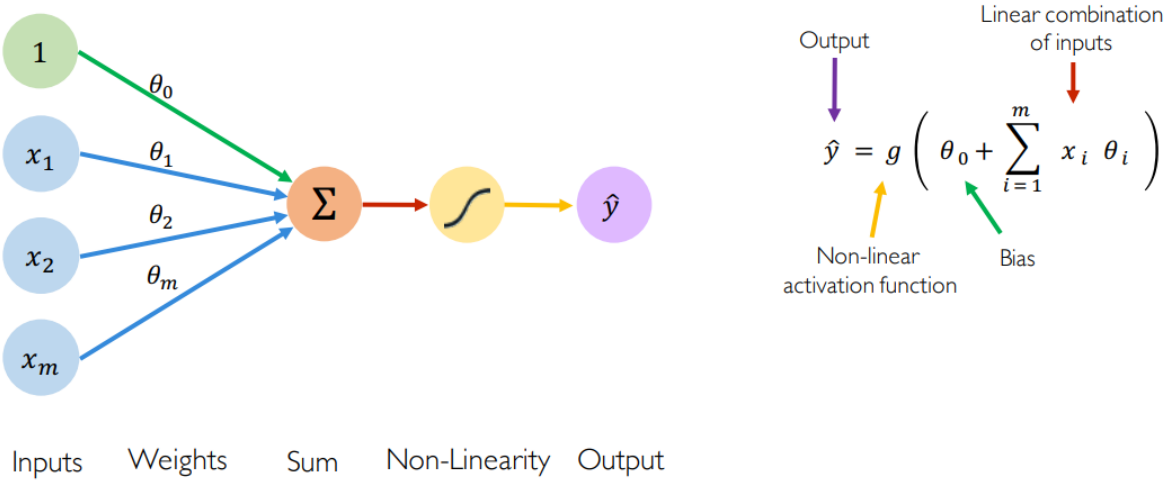


Fig 2.2 neural network architecture

Deep Neural Networks are no more than a piling of multiple perceptron (hidden layers) to produce an output.A deep neural network (DNN) is an ANN with numerous hidden layers between the input and output layers. Training the data sets forms a vital part of Deep Learning models. [16-20]In addition, Backpropagation is the major algorithm in training the deep learning models. It works with training large neural networks with difficult input output conversions.

3. CONVOLUTIONAL NEURAL NETWORKS

Convolutional Neural Networks are very alike usual Neural Networks , they are made up of neurons that have learnable weights and biases. Each neuron receives some inputs, achieves a dot product and optionally follows it with a non-linearity. The entire network still expresses a single differentiable score function: from the raw image pixels on one end to class scores at the other. They still have a loss function on the last (fully-connected) layer and all the tips/tricks we developed for learning regular Neural Networks still apply. Convolutional Neural Networks take advantage of the fact that the input consists of images and they constrain the architecture in a more sensible way. In particular, unlike a regular Neural Network, the layers of a ConvNet have neurons arranged in 3 dimensions: width, height, depth. [21-28]

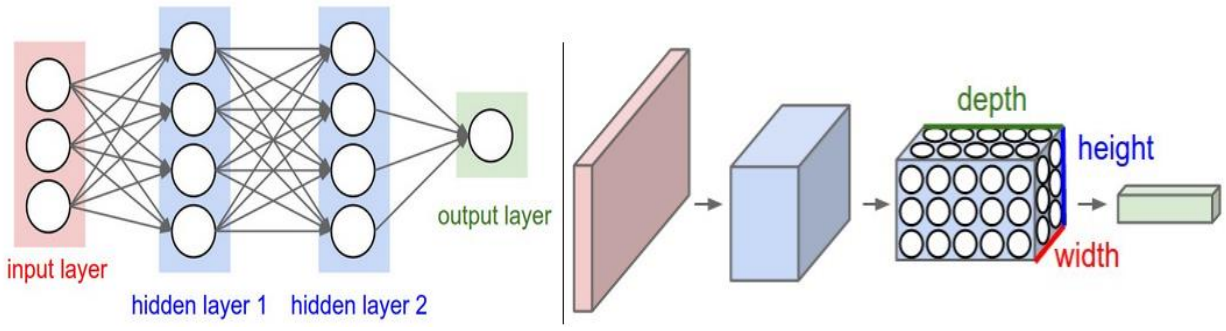
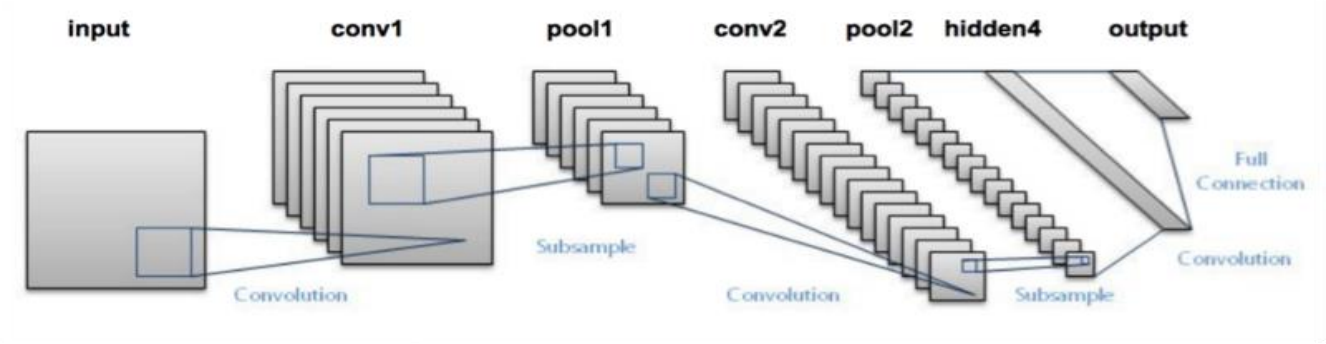


Fig 3.1 Architecture of Convolutional Neural Networks

In fig 3.1 Left: A regular 3-layer Neural Network. Right: A ConvNet arranges its neurons in three dimensions (width, height, depth), as pictured in one of the layers. Each layer of a ConvNet transmutes the 3D input volume to a 3D output volume of neuron activations. In this sample, the red input layer holds the image, so its width and height would be the dimensions of the image, and the depth would be 3 (Red, Green, Blue channels).[29][30]



Now pass an input image to the first convolutional layer. The convoluted output is gained as an activation map. The filters applied in the convolution layer extract pertinent features from the input image to pass further. Each filter shall give a different feature to aid the correct class prediction. In case we need to retain the size of the image, we use same padding(zero padding), other wise valid padding is used since it helps to decrease the number of features. Pooling layers are then added to further reduce the number of parameters. Numerous convolution and pooling layers are added before the prediction is made. Convolutional layer assistance in extracting features. Getting deeper in the network more specific structures are extracted as compared to a shallow network where the features extracted are more generic. The output layer in a CNN as stated previously is a fully connected layer, where the input from the other layers is flattened and sent so as the transform the output into the number of classes as anticipated by the network. The output is then generated through the output layer and is compared to the output layer for error generation. A loss function is defined in the fully connected output layer to compute the mean square loss. The gradient of error is then calculated. The fault is then backpropagated to inform the filter(weights) and bias values. One training cycle is completed in a single forward and backward pass.[30-35]

4. RECURRENT NEURAL NETWORKS

RNN are standard algorithm mainly for sequential data which more prominent and Robust. Even Apples Siri are using deep leaning RNN for voice processing. RNN have good memory which remembers its input in internal memory. This part consists of the concepts of RNN and its work Process.RNN are more popular due its super memory which reminds all input data and forecast the future events and happenings. RNN are widely applied in time series data, speech data and other major sphere of applications. They are used more signifyingly due its deep interpretably feature. The names are formed by channel information for FFNN and RNN. The flow of information is unidirectional in FFNN from input to output layer through hidden layers. But there is no memory in FFNN and their predictions are very poor comparing to RNN. While RNN has two nodes information such as current information and previously learnt information which makes prediction accurate and higher.

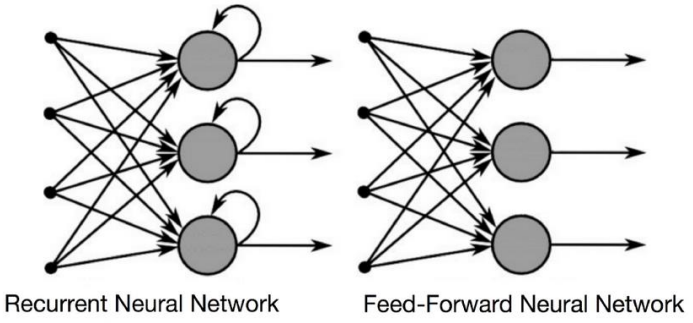


Fig 4.1 RNN VS FNN

RNN has another fantastic property which can map one node as input to many nodes as a output or many nodes as a input to many as output and one node to many nodes but FFNN map only one node as a input to one nodes as output. The extended version of RNN is called LSTM. LSTM has longer memory and RNN has short and temporary memory. LSTM is used in long duration experiments which gives good results. The LSTM units are deployed in RNN. The limitations and issues of RNN are overcome by LSTM.

5. CONCLUSION

The deep learning algorithms stated above can be applied on speech, image and object recognition where it produces more accurate results than available machine learning models. Hence it can be extended in fraud detection , thief detection using images, number plate detection and many other image detection models where blurred images are captured in case of object in motion can be clearly studied, analyzed and can be predicted.

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