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Unraveling Information about Deep Learning

Simardeep Singh Mehta

Amity University Noida, Amity Road, Sector 125,Noida, Uttar Pradesh 201301

Abstract - *A new field of machine learning (ML) study is deep learning. There are numerous concealed artificial neural network layers in it. The deep learning methodology uses high level model abstractions and transformations in massive databases. Deep learning architectures have recently made major strides in a variety of domains, and these developments have already had a big impact on artificial intelligence. Additionally, the advantages of the layer-based hierarchy and nonlinear operations of deep learning methodology are discussed and contrasted with those of more traditional techniques in widely used applications. It also has a significant impact on face recognition methods, as demonstrated by Facebook's highly effective Deep Face technology, which enables users to tag photos.*

1. INTRODUCTION

Artificial neural systems are the foundation of deep learning, which is a branch of AI that mimics the human brain in a similar way to how neural systems function. We don't have to explicitly programme everything in deep learning. Deep learning is not a brand-new concept. At this point, it has been around for two or three years. Because we didn't have as much planning power and information in the past, it's on hype these days. Deep learning and AI entered the scene as the preparing power increased tremendously over the last 20 years.

1.1 A formal defining of deep learning is-

Deep learning is a particular kind of machine learning that achieves great power and flexibility by learning to represent the world as a nested hierarchy of concepts, with each concept defined in relation to simpler concepts, and more abstract representations computed in terms of less abstract ones.

In human brain approximately 100 billion neurons all together this is a picture of an individual neuron, and each neuron is connected through thousands of their neighbors. The question here is how we recreate these neurons in a computer. So, we create an artificial structure called an artificial neural net where we have nodes or neurons. We have some neurons for input value and some for-output value and in between, there may be lots of neurons interconnected in the hidden layer. [1]

AI empowered computers benefited from genuine crude information or models, and it attempts to extricate designs from it and settle on better choices without anyone else. A portion of the AI calculations are strategic relapse, SVM and so forth.

The presentation of these AI calculations relies vigorously upon the portrayal of the information that are given. Each snippet of data remembered for the portrayal is known as highlights and these calculations figures out how to utilize these highlights to extricate designs or to get information.

Nevertheless, sometimes it might be challenging to discern which details should be deleted. For instance, if we were trying to identify cars from a photograph, we may enjoy the opportunity to use the proximity of the wheel as a cue. However, in terms of pixel values, it is challenging to depict what a wheel looks like. Using AI to extract value from those traits (representation) but not the highlights themselves is one way to solve this problem. This approach is called portrayal learning. Once more, if the calculation learns without the assistance of anyone else and with very little human

2. HISTORY

Long time back in 1943, deep learning was introduced by Warren McCulloch and Walter Pitts, when they created a computer based on neural networks in the brain Warren McColluch and Walter Pitts made a combination of algorithms and mathematical evolutions which is known as threshold magic in order to replicate the thought process. And thus, after that deep learning has evolved a lot and there have been two major breakthrough moments. [6] One of these was in 1960 by Henry J Kelly which was the development of basics of continuous beam propagation model Later on in 1962 Stuart Drefyus found a simple version based on the chain rule One of the earliest roles to develop deep learning algorithms was in 1965 where two people Alexey Grigoryevich Ivakhnenko and Valentin Grigor'evich Lapa used models of polynomial functions which were analyzed statistically

There were various hurdles too in the development of it which is one of the most important and interesting topics in today's world. A major setback was when in 1970 due to lack of funding the research about artificial intelligence and deep learning had to restricted. But even after such impossible conditions certain individuals researched about it even after lack of financial help

The term convolutional neural networks which we hear the most in today's time whenever we talk about deep learning was used the first time by Kunihiko Fukushima. [6] He himself designed the neural networks using convolutional layers He created a multilayer and hierarchical design in1979 which was termed as neocognitron. It helped the computer to learn visual patterns. The networks resembled modern versions and were trained to activate multiple recurring layers.

Later then the world was introduced with the FORTAN CODE for Back Propagation. This was developed in the 1970's and it used numerous errors to train the deep learning models.

This became popular later on when a thesis written by Seppo Linnainmaa including The FORTAN CODE became available and known. [5] Even though the fact that it was developed in 1970 it wasn't under action in neural networks until the year 1985.

Yann LeCunn was the first one to explain the and provide a practical demonstration in 1989.Something that he did was that he combined convolutional networks with back propagation in order to scan handwritten digits

As the next decade kicked in artificial intelligence and deep learning did not make a lot of progress. in 1995 Vladimir Vapnik and Dana Cortes developed the support vector machine which is a system for mapping and recognizing similar data. Long short-term memory or LSTM was developed in 1997 by Juergen Schmidhuber and Sepp Hochreiter for recurrent neural networks.

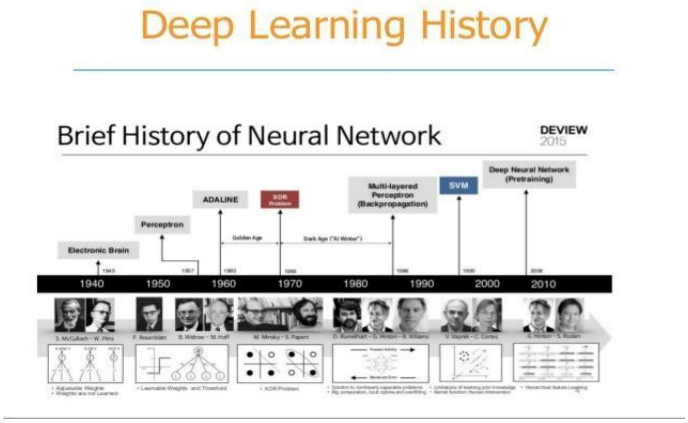

Chart -1: History

Going into the next century The Vanishing Gradient downside came into the year

2000 once "features" (lessons) fashioned in lower layers weren't being learned by the higher layers since no learning signal reached these layers were discovered. This wasn't an elementary downside for all neural networks however it was restricted to solely gradient-based learning ways.

In 2001, a quest report compiled by the META cluster (now known as Gartner) came up with the challenges and opportunities of the three-dimensional knowledge growth. This report marked the onslaught of massive knowledge and represented the increasing volume and speed of information as increasing the vary of information sources and kinds.

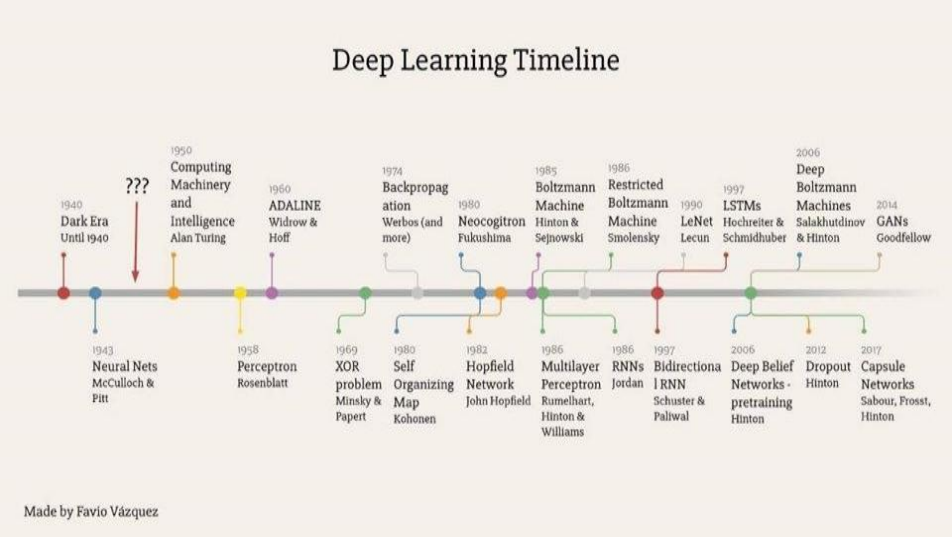

Fig -1: Timeline

3. NEED OF DEEP LEARNING

Now the question that would pop in in everyone's mind is that why it matters and why do we need deep learning.in just a word, deep learning can be defined using accuracy and precise work Deep learning has achieved higher accuracy in recognition department than anyone ever before this has numerous benefits, one of which is meeting customer expectations and important for the operation of self-learning devices such as driverless cars

Recent research shows and scientists believe that there are certain tasks at which deep learning is even better than humans mainly being image recognition

Deep learning was firstly introduced in 1980s properly, since then it has been evolving and there are two main reasons for its existence-

1. One of the major needs of deep learning is labelled data. For example, millions of images and hours of video are required for development of driverless cars

2. Deep learning requires substantial computing power. High-performance GPUs have a parallel architecture that is efficient for deep learning. When combined with cloud computing, this enables development of teams to reduce training time for a deep learning network from weeks to hours or less.

4. WORKING

Well what do you do when you get to know about a problem the first thing that you do is that you identify it and then find a solution for the problem, the feasibility of the Deep Learning should also be checked. Second, we need to identify the relevant data which corresponds to the actual problem and should be prepared accordingly. Third, picking the appropriate deep learning algorithm. Fourth, Algorithm should be used while training the dataset. Fifth, Final testing should be done on the dataset.

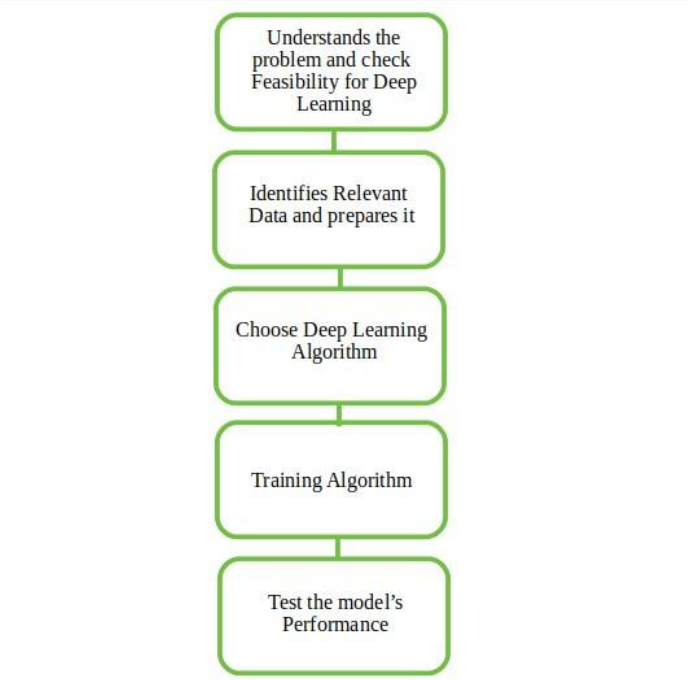

Fig -1: Flow Graph

Most deep learning methods use neural network architectures, which is why deep learning models are often mentioned as deep neural networks.

The term "deep" usually refers to the number of hidden layers within the neural network. [1] Generally, neural networks just contain 2-3 hidden layers, while deep networks can have as many as 150.

Deep learning models are trained by using large sets of labelled data and neural network architectures that learn features automatically from the data without the need for manual feature extraction.

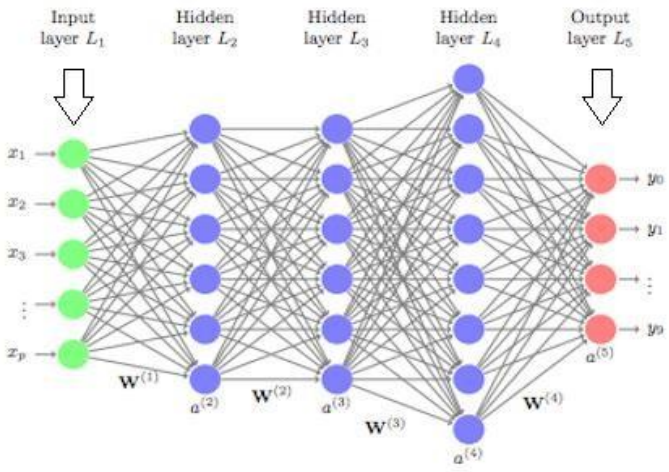

Fig -1: Model

One of the foremost popular sorts of deep neural networks is understood as convolutional neural networks (CNN or ConvNet). A CNN convolves learned features with input file, and uses 2D convolutional layers, making this architecture compatible to processing 2D data, like images.

CNNs eliminate the necessity for manual feature extraction, so you are doing not got to identify features wont to classify images.[1] The CNN works by extracting features directly from images. The relevant features aren't pre-trained; they're learned while the network trains on a set of images. This automated feature extraction makes deep learning models highly accurate for computer vision tasks like object classification.

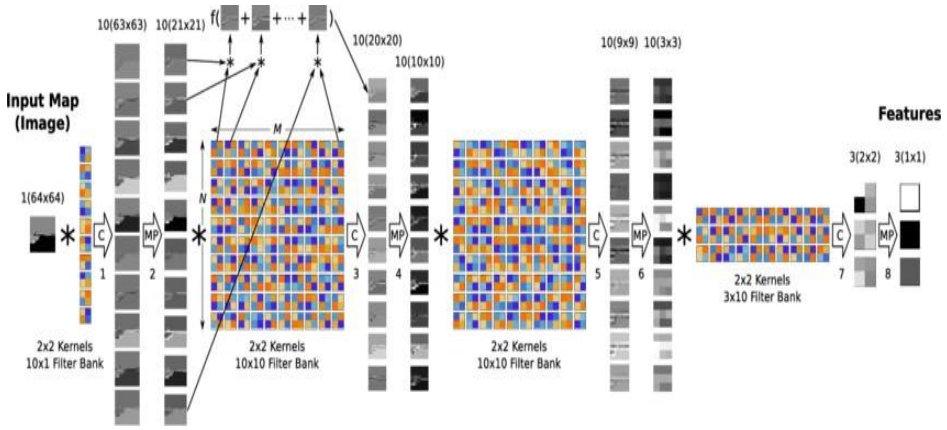

Fig -1: CNN Working

CNNs learn to detect different features of a picture using tens or many hidden layers. Every hidden layer increases the complexity of the learned image features. For example, the primary hidden layer could find out how to detect edges, and therefore the last learns the way to detect more complex shapes specifically catered to the form of the object we are trying to recognize.

5. FUTURE PROSPECTS

It is difficult to know about everything happening in the artificial intelligence world. With so many papers being released, it can be difficult to talk about the reality which is the present existence and future prospects.

1. Architecture Search

Designing neural network architectures requires more art than science. Most individuals just grab a well-liked specification off the shelf. Does anybody wonder how were these cutting-edge architectures discovered? The answer is simple- trial and error using powerful GPU computers.

The decision of when to use max-pooling, which convolution filter size to use, where to feature dropout layers is simply about random guessing.

2. **Compressing Neural Networks**

Training deep learning networks may be a good way to urge conversant in memory. A typical laptop has 16 GB of RAM memory. The latest iPhone has around 4 GB of RAM. The VGG16 image classification network, with around 144 million parameters, is around 500 MB. Due to the big size of those networks it's very difficult to create mobile AI apps and apps that use multiple networks. Having the networks loaded into RAM memory enables much faster computing time.

Research on compressing these networks like Deep Compression works very almost like JPEG image compression, Quantization and Huffman encoding. Deep Compression can reduce VGG-16 from 552 MB to 11.3 MB with no loss of accuracy.

3. **GAN-based Data Augmentation**

A major challenge while building deep learning models is the dataset. Deep learning models require a lot of data. GANs are a promising generative modelling framework that can conclude new data points from a dataset. This can be used to create humungous datasets from small ones.

6. APPLICATIONS

1.**Automatic Text Generation** – Corpus of text is learned and from this model new text is generated, word-by-word eventually this model can learn how to spell, form sentences, and use punctuations.

2.**Healthcare** – It helps in diagnosing many diseases and helps in the treatment process with the help of medical imaging [2].

3.**Automatic Machine Translation** – Certain words, sentences, or phrases in one language is transformed into another language (Deep Learning is achieving top results in the areas of text, images).

4.**Image Recognition** – Recognizing and identifying people and objects in images as well being able to understand content and context. [4] This area is already being used in Tourism and Gaming industry just to name a few

5.**Predicting Earthquakes** – Teaches a computer to perform viscoelastic computations which are used in predicting earthquakes. [6]

7. CONCLUSIONS

We are on the verge of creating or might have successfully created the most intriguing technology in the history of mankind. Thus, Artificial Intelligence (Deep Learning) is the most interesting topic in the field of Science and Technology. According to recent research there was news that certain robots were speaking an altogether different language and possibly malfunctioned, however as soon as engineers monitored the robots they concluded that machines had developed a language of their own and were communicating effectively. Later they were shut down.

So there are hundreds of possibilities in the land of artificial intelligence and specially in deep learning. Deep Learning can change our lives completely with the advancement in technology. Once we can calibrate our brain to such a level where we can unlock more capabilities of our brain, it can be breakthrough research for the mankind.

A major revolution is undertaking, and we are a part of it. Therefore, we must help in whatever way we can and contribute towards the technology. Deep Learning has a lot of potential even beyond our imagination. Huge technological giant Elon Musk's new company Neuralink is profoundly researching on deep learning and neural networks. Apple has also been doing a lot of research lately and has filed various patents related to artificial intelligence. Also, when such established companies invest billions of dollars in the technology we can very easily estimate its potential and capabilities.

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