EasyChair Preprint

№ 12653

Deep Learning is the Core Method of Machine Learning

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March 21, 2024

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***Abstract*— Machine learning is a method used to devise complex models and algorithms in commercial use. Deep learning (also known as deep structured learning or hierarchical learning) is part of a broader family of learning methods based on learning data representations, as opposed to task-specific algorithms. Deep Learning can be supervised, partially supervised or unsupervised. An effective machine learning is difficult because finding patterns is hard and often not enough training data is available. If we use the Deep learning method then it will not as difficult as we think even it's much easier than other learning system. 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**

Keywords- Deep Learning, Machine Learning, Convolutional Neural Network (CNN), Supervised and Unsupervised Learning, Max pooling.

I. INTRODUCTION:

In 1959, Arthur Samuel, one of the pioneers of machine learning, defined machine learning as a "field of study that gives computers the ability to learn without being explicitly programmed." That is, machine-learning programs have not been explicitly entered into a computer, like the if-then statements above. Machine-learning programs, in a sense, adjust themselves in response to the data they're exposed to. They are, in short, an optimization algorithm. If you tune them right, they minimize their error by guessing and guessing and guessing again. In machine learning, a convolutional neural network (CNN) is a class of deep, feed-forward artificial neural networks that has successfully been applied to analyzing visual imagery. Convolutional networks were inspired by biological processes in which the connectivity pattern between neurons is inspired by the organization of the animal visual cortex. Convolutional networks may include local or global pooling layers, which combine the outputs of neuron clusters at one layer into a single neuron in the next layer. Deep learning is a subset of machine learning. Usually, when people use the term deep learning, they are referring to deep artificial neural networks, and somewhat less frequently to deep reinforcement learning. Deep artificial neural networks are a set of algorithms that have set new records in accuracy for many important problems, such as image recognition, sound recognition, recommender systems, etc. A more complete explanation of Core method of Deep learning is discussed next step.

II. RELATED WORKS AND METHODS:

In this section we will discuss about the Machine learning, the process of Machine learning with Convolutional Neural Network Working principal. Machine learning faces many unique challenges as the platforms move out of the lab and into the real world. In particular, the huge amount of variety encountered in real-world environments is extremely challenging for existing Machine learning control algorithms to handle. For these reasons, in recent years machine learning algorithms have seen widespread use for robotics applications. Rather than forcing the engineer to hand-code an entire end-to-end robotic system, machine learning allows portions of the system to be learned from some training data. This approach allows us to model concepts which might be difficult or impossible to properly hand-model. It also allows for adaptable models – as long as the form of the model is general, it can be adapted to more or different cases simply by providing training data for these new cases. While machine learning algorithms have many advantages for robotic applications, they can still be difficult to apply to new problems. If we use the deep learning process using CNN then it will reduce the problem complexity and easy to implement and the machine can learn easily by the method. In this paper we try to give a comprehensive review of Machine learning using CNN.

A. Machine learning:

The machine learning process is a bit tricky and challenging. It is very rare that we find the machine learning process easy. The reason for it being so complex is very clear, since a large amount of complex data is involved and out of which we try to find out meaningful predictive patterns and models. The Systematic Process of Machine Learning is given bellow in a step by step process.

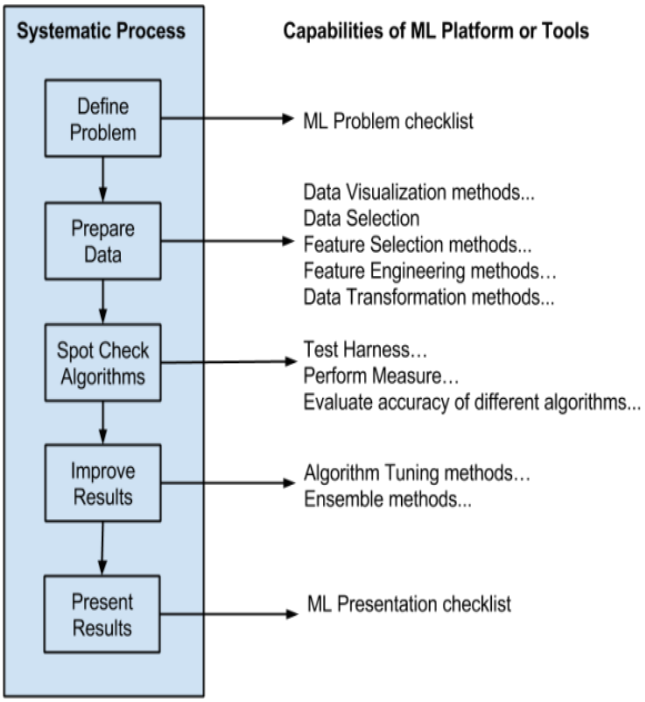

Fig.1. Systematic Process of Machine Learning

We need to repeat the entire process again and again and re-create the model at regular intervals. The reason again for this process is very simple, it's because the scenarios and factors change and we need to have our model up to date and real all the time. This could eventually also mean to process new data or applying new algorithms altogether. Two popular methods of machine learning are supervised learning and unsupervised learning. It is estimated that about 70 percent of machine learning is supervised learning, while unsupervised learning ranges from 10 – 20 percent. Other methods that are less-often used are semi-supervised and reinforcement learning. So supervised learning is the most effective method for Machine learning. Supervised Learning, This kind of learning is possible when inputs and the outputs are clearly identified, and algorithms are trained using labelled examples. Unsupervised Learning, unlike supervised learning, unsupervised learning is used with data sets without historical data. Unsupervised learning algorithm explores surpassed data to find the structure. Semi-Supervised Learning, as the name suggests, semi-supervised learning is a bit of both supervised and unsupervised learning and uses both labelled and unlabelled data for training. Deep learning is also a supervised learning it will be discussed in bellow with details method.

B. Deep learning and Convolutional Neural Network:

Convolutional Neural Network (CNN) is a deep learning architecture which is inspired by the structure of visual system. In 1962, Hubel and Wiesel in their classic work on cat's primary visual cortex found that cells in the visual Cortex are sensitive to small sub-regions of the visual field called as receptive field. These cells are responsible for Detecting light in the receptive fields. Neocognitron proposed by Fukushima was the first model which was simulated on a computer and was inspired from the works of Hubel and Wiesel. This network is widely considered as a predecessor of CNN and it was based on the hierarchical Organization between neurons for the transformation of image. We have mentioned many CNN architectures in the literature but their basic components are very similar. Let us consider the typical convolutional network architecture for recognizing characters in Fig.2 and the working process of CNN in fig. 3.

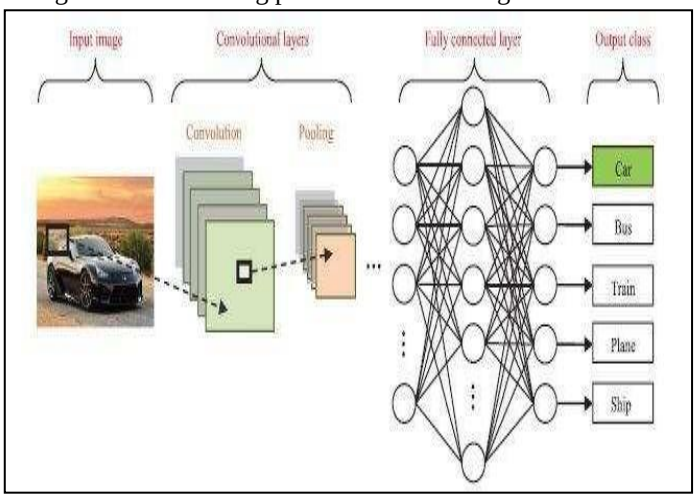

Fig. 2. Schematic diagram of CNN

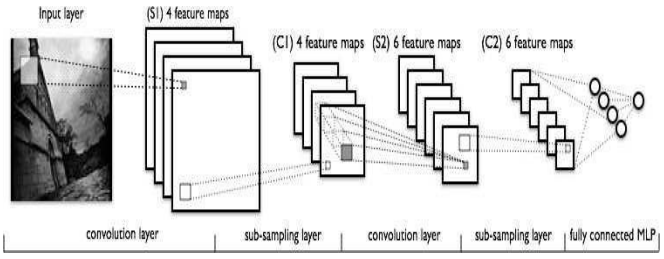

Fig. 3. Working process of CNN

Convolutional networks may include local or global pooling layers, which combine the outputs of neuron clusters at one layer into a single neuron in the next layer. For example,
Max pooling uses the maximum value from each of a cluster of neurons at the prior layer. Another example is average pooling, which uses the average value from each of a cluster of neurons at the prior layer. A typical convolutional layer doing all of this consists one Layer.

a) Pooling and normalization is optional.
b) Stack them up and train just like multilayer neural nets.

Final layer is usually fully connected neural net with output size == number of classes CNNs share weights in convolutional layers, which means that the same filter weights bank is used for each receptive field in the layer; this reduces memory footprint and improves performance. Max-pooling is

useful in vision for two reasons- One: By eliminating non-maximal values, it reduces computation for upper layers. Two: It provides a form of translation invariance. Imagine cascading a max-pooling layer with a convolutional layer. There are 8 directions in which one can translate the input image by a single pixel. If max-pooling is done over a 2x2 region, 3 out of these 8 possible configurations will produce exactly the same output at the convolutional layer. For max-pooling over a 3x3 window, this jumps to 5/8. Since it provides additional robustness to position, max-pooling is a "smart" way of reducing the dimensionality of intermediate representations. The steps of implementation in CNN is figured bellow-

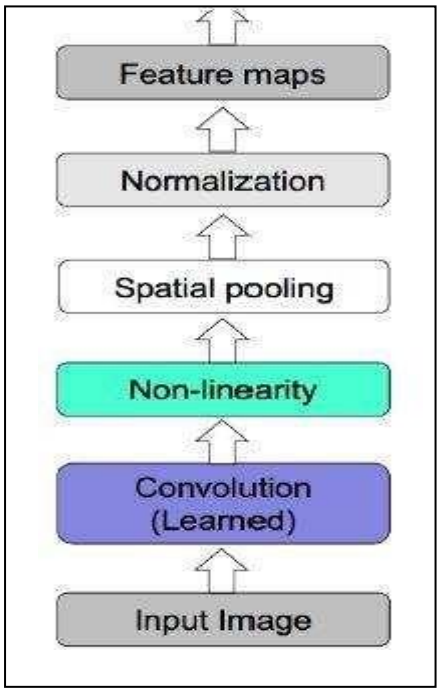

Fig. 4. Steps of CNN implimentation

C. Main Applications of CNN:

1. CNNs are often used in image recognition systems
2. Object Classification in Photographs.
3. Automatic Handwriting Generation.
4. Classification: normal, pneumonia and tuberculosis in the chest X-ray.
5. Object detection: lung nodules in lung CT-Scan.
6. Image segmentation: gastric cancer pathology.
7. Implementation of large Matrix Multiplication

III. RESULTS & DISCUSSIONS:

The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multi-layered neural networks to vast amounts of data. Deep learning, in that vision, could transform almost any industry. From above there comes a result that using Deep learning method of CNN we can easily Train a machine. By this process the machine learning will be more easy and appropriate but it needs more practice, for a machine to learn properly. The more we practice a machine in the deep learning process the machine will get much neural weight to work properly.

TABLE I: Deep learning-based applications grouped by learning algorithms and application fields.

Learning Type	Algorithm	Task	Field of applications
Supervised	CNN	Outdoor Navigation Indoor Navigation	Navigation
		Object Recognition	Generic
		Object recognition	Agriculture
		Scene classification	Generic
		Scene classification	Agriculture
		Path Planning	Search & Rescue
		Image registration	Location Navigation

From the above table we say that using CNN algorithm we can easily train a machine and improve the process of machine learning. That's why we can say that it's completely true that Deep Learning is the Core method of Machine Learning.

IV. CONCLUSIONS:

Think of machine learning like this. As a human, and as a user of technology, you complete certain tasks that require you to make a decision or classify something. For instance, when you read your inbox in the morning, you decide to mark that 'Win a Free Cruise if you click here' email as spam. How would a computer know to do the same thing? Machine learning is comprised of algorithms that teach computers to perform tasks that human beings do naturally on a daily basis. The first attempts at Machine learning involved teaching a computer by writing a rule. In this paper we describe the core method of Machine learning. Now it is easy to understand the whole process. Here we discussed about the machine learning process using Convolutional Neural Network algorithm. CNN is a Deep learning process indeed. With this work, we show that Deep Learning is the Core method of Machine Learning.

ACKNOWLEDGMENTS:

The Research work was done to get more clear view of Machine learning. The Author would like to thank the numerous researchers upon whose work these design patterns are based. Also acknowledged, herein, a couple online picture illustrations used in this paper for clarifying the established ideas and technologies.

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