DEEP LEARNING

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**Abstract:**

Deep learning, the current hot trend in data science which got popularity in the year 2015 is grabbing the research interests of many researchers. The basic concept of deep learning is to replicate the human neural system to make computers do tasks with equal expertise or sometimes more better than that of humans. The main reasons for this popularity being its efficiency, accuracy and flexibility. This paper discusses about the concept of deep learning in detailed, including its evolution, how it is useful to solve the real world problems as well as the demerits using it.

**Introduction:**

Artificial intelligence which was long coined in 1900’s, was first traced in Dartmouth’s research project exploring on the topics like problem solving and symbolic methods. The concept of artificial intelligence is to program the computer to ‘behave’, ‘think’ like humans to understand requests and draw conclusions based on the data provided on its own.AI lead the way for automation and formal reasoning that we see on our devices today.

Machine learning derived as a subset of AI where the computers are made to learn by themselves without any human interventions, i.e, feeding data and algorithms to ‘learn’ and make conclusions instead of being programmed. The basis of machine learning is simply to compare the inputs and output of any data or any real word problem and to draw a relation between them.

With several advances in the computer engineering, with high speed and high performance computers machine learning took an other step. Deep learning raised as a part of machine learning as an answer to the questions rose in the AI. The expression of deep learning was first coined by Igor Aizenberg and team around 2000, when talking about the artificial neural networks in the context of Boolean threshold neurons. The field got reignited in 2012 with the papers published by Krizhevsky, Sutskever and Hinton’s and many. ‘Deep’ is a technical term that refers to the number of layers in a neural network.

**Concept of Deep Learning:**

Deep learning is a statistical method where computers learn to classify patterns. Similar to the machine learning techniques deep learning also need input and output data to find patterns on the given data. It uses neural networks with multiple layers to do the above. The networks possess inputs and outputs, a little like the neurons in our own brains. The inputs given to the models can be in the form of words or pixels. The network consists of multiple hidden layers with multiple hidden nodes or neurons. More the number of layers deeper the network is considered and more the accuracy, as the conclusions are drawn on basis of more training set. The network consists of output nodes. The data is used to train the machine to learn on its own and perform complex feature selection. On a typical network the data used to train will be handwritten in with the inputs are called the training set or feature attributes and the outputs are called the labels. The connection between the nodes or neurons is also called as mapping.

The process called gradient decent is used to adjust the mapping between the nodes. The algorithm used for the above is called as the back propagation or backprop, in which the mathematical weights between the nodes are adjusted so that the input leads to a right output. Deep learning can be used for supervised, semi-supervised and unsupervised learning. But mostly used as a classification system where the system is asked to differentiate, categorize the data and recognize the patterns. The neural network memorized the pattern of data it found using the fed data and uses that memory to do prediction.

We might assume that more number of layers and feeding more data could make the system do anything and everything which isn’t true. According to Gary Marcus, a professor of cognitive psychology at NYU “Deep learning is not a universal solvent, but one tool among many.”

Deep learning architectures such as [deep neural networks](https://en.wikipedia.org/wiki/Deep_learning#Deep_neural_networks), [deep belief networks](https://en.wikipedia.org/wiki/Deep_belief_network) and [recurrent neural networks](https://en.wikipedia.org/wiki/Recurrent_neural_networks) have been applied to fields including [computer vision](https://en.wikipedia.org/wiki/Computer_vision), [speech recognition](https://en.wikipedia.org/wiki/Automatic_speech_recognition), [natural language processing](https://en.wikipedia.org/wiki/Natural_language_processing), audio recognition, social network filtering, [machine translation](https://en.wikipedia.org/wiki/Machine_translation), [bioinformatics](https://en.wikipedia.org/wiki/Bioinformatics) and [drug design](https://en.wikipedia.org/wiki/Drug_design), where they have produced results comparable to and in some cases superior to human experts.

Use of deep learning can increase the accuracy of the pattern recognition and the conclusions drawn, as the conclusions are based on large amount of data. It can reduce the need of feature engineering which is the laborious part of data analysis. Deep learning provides more advantage over machine learning when dealing with unstructured data, as it doesn’t need the data to be labeled. It is useful for large companies to reduce unnecessary costs by detecting subjective defects which are difficult to train. In a business perspective deep leaning can provide the advantages of quality and accurate results, cost and time reduction and job growth. Deep learning has accomplished great achievements in these 5 years in areas like speech recognition, face recognition which we can experience this with our own mobile phones the improvements in face recognition, the finger locks. Different deep learning architectures like deep neural networks, recurrent neural networks and deep belief networks are being used in several real-world applications. Deep learning stands behind numerous other innovations like self-driving cars, both voice and image recognition, etc. The well known social medias like Facebook uses deep learning in automatic recognition of faces to tag the person.

Despite several advantages and challenges solved by deep learning including the improved methods of unstructured big data analytics there are few disadvantages to it. Deep learning being a quite resource demanding technology requires large amount of storage, high performance and powerful GPU’s etc. compared to the traditional machine learning algorithms. An other major challenge is to feed the computers with numerous amounts of data that took programmers to laboriously write software that is familiar with the attributes. There are other challenges to deal with -management of the continuous input data. The conclusions drawn by the network has no reasoning and is not transparent, to correct any error in the result the whole algorithm has to be reversed which is a hectic process. More data could sometimes lead to the problem of over fitting.

**Conclusion:**

In the era of exponentially growing data deep learning can be one of the best tools to deal with data. There are few disadvantages there are many challenges to face acquiring abstract concepts sibling etc. where logical interference doesn’t work. The future scope of deep learning is wide it can extend to different applications. Also extending to differentiation and pattern recognition in moving objects. On the other hand there are clear advantages of cost reduction, accuracy in results, less time consumption and several advances in speech recognition, image recognition. The intensive researches and the advances in this field shows that everyone would come across deep learning in some form in the coming era.

**References:**

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