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An Overview Studying of Deep Learning

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ABSTRACT

Deep learning is a subfield of machine learning however both drop under the broad category of artificial intelligence. Deep learning is what powers the most human-like artificial intelligence that consents computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. Deep learning is making major advances in solving problems hence categorized in wider section of artificial intelligence. The main advantage of Deep Learning is to create an artificial neural network that can learn and make intelligent decisions on its own and to process large numbers of features makes deep learning very powerful when dealing with unstructured data.
Keywords: Deep Learning, Machine Learning

I. INTRODUCTION

Deep Learning, one of the subfields of Machine Learning and Statistical Learning has been advancing in impressive levels in the past years. Deep learning (also known as deep structured learning or differential programming) is part of a broader family of machine learning methods based on artificial neural networks with representation learning. [16] Deep learning (DL) and Machine learning (ML) are two concepts related to Artificial Intelligence(AI). The two combined to improve the future of AI. They are different in many terms which must consider for creating the AI which is even better than the human brain. Machine learning the outlook to get Artificial Intelligence and the implementation of it is known as Deep learning. It is the difference which everyone must know at the time of using these terms. Modern technologies like AI, machine learning, deep learning, data science have become the buzzwords that everybody talks about to meet the current market opportunities. There is a misconception related to the words as most people think these things are the same as they directly relate to, Machine Learning or Artificial Intelligence. Artificial Intelligence (AI), machine learning and deep learning are three terms often used interchangeably to describe software that behaves intelligently. However, it is useful to understand the key distinctions among them.

Artificial intelligence (AI) as an intelligence exhibited by machines has been an effective approach to human learning and reasoning. AI is imparting a cognitive ability to a machine. The benchmark for AI is the human intelligence regarding reasoning, speech, and vision. This benchmark is far off in the future. Artificial Intelligence, as the name, suggests that it is the intelligence created by humans. It constructed as complex machines using computer properties and performing various actions just like we the humans. These machines have senses similar to humans, or if we say that they show and sense more than humans, then we are not wrong. In a nutshell, it is incorporated human intelligence into machines. These technology is the future of humanity and making their lives better than before. The

functionality of these technologies is similar to humans, so they preferred as the best solution for the tasks which can't be performed by us. If we try to define this term, then there are no such words or definition which suits its properties. We can say that it is a computer operated the machine which can function similar to the human brain. [12]

Machine learning is the best tool so far to analyze, understand and identify a pattern in the data. One of the main ideas behind machine learning is that the computer can be trained to automate tasks that would be exhaustive or impossible for a human being. The clear breach from the traditional analysis is that machine learning can take decisions with minimal human intervention. Machine learning uses data to feed an algorithm that can understand the relationship between the input and the output. When the machine finished learning, it can predict the value or the class of new data point. Machine learning is a part of Artificial Intelligence. The machines can learn. The robots learn themselves from the data provided to them. It makes more like to be a technique which makes us realize the presence of Artificial Intelligence. This technique uses algorithms to get data, learn, and then analyze the data. The results came in the form of predictions. We may have noticed when getting recommendation on shopping sites, Google, or Facebook. We get suggestions according to your interests. It is done with machine learning algorithms which are developed in the way to analyzing the recent searches, history, and other information. This technique also influences the marketing and banking sectors.

Machine learning came directly from minds of the early AI crowd, and the algorithmic approaches over the years included decision tree learning, inductive logic programming. clustering, reinforcement learning, and Bayesian networks among others. As we know, none achieved the ultimate goal of General AI, and even Narrow AI was mostly out of reach with early machine learning approaches. [13]

II. METHODS AND MATERIAL

Deep Learning (DL)

Deep learning is a computer software that mimics the network of neurons in a brain. It is a subset of machine learning and is called deep learning because it makes use of deep neural networks. The machine uses different layers to learn from the data. The depth of the model is represented by the number of layers in the model. Deep learning is the new state of the art in term of AI. In deep learning, the learning phase is done through a neural network. A neural network is an architecture where the layers are stacked on top of each other. Deep learning is a subfield of Machine Learning, and Machine Learning is a subfield of Artificial Intelligence. Deep Learning is a sub-branch of Machine Learning in that it also has a set of learning algorithms that can train on and learn from data, and more specifically DL is powered by neural networks. Deep learning is based on a set of algorithms that attempt to model high-level abstractions in data by using multiple processing layers with complex structures, or otherwise composed of multiple non-linear transformations [1]. The deep learning methodology applies nonlinear transformations and model abstractions of high level in large databases. Furthermore, the superior and beneficial of the deep learning methodology and its hierarchy in layers and nonlinear operations are presented and compared with the more conventional algorithms in the common applications. Studies in this area attempts to make better representations and create models to learn these representations from large-scale unlabeled data. Learn multiple levels of representations that correspond to different levels of abstraction; the levels form a hierarchy of concepts [1].

Deep learning exploits this idea of hierarchical explanatory factors where higher level, more abstract concepts are learned from the lower level ones. These architectures are often constructed with a greedy layer-by-layer method. Deep learning helps to

disentangle these abstractions and pick out which features are useful for learning [3]. For supervised learning tasks, deep learning methods obviate feature engineering, by translating the data into compact intermediate representations akin to principal components, and derive layered structures which remove redundancy in representation [1]. Many deep learning algorithms are applied to unsupervised learning tasks. This is an important benefit because unlabeled data is usually more abundant than labeled data. An example of a deep structure that can be trained in an unsupervised manner is a deep belief network [3].

Deep Learning algorithm

Deep learning algorithms are based on distributed representations. The underlying assumption behind distributed representations is that observed data is generated by the interactions of factors organized in layers. Deep learning adds the assumption that these layers of factors correspond to levels of abstraction or composition. Varying numbers of layers and layer sizes can be used to provide different amounts of abstraction [3]. Deep learning algorithms are contrasted with shallow learning algorithms by the number of parameterized transformations a signal encounters as it propagates from the input layer to the output layer, where a parameterized transformation is a processing unit that has trainable parameters, such as weights and thresholds [4]. A chain of transformations from input to output is a credit assignment path (CAP). CAPs describe potentially causal connections between input and output and may vary in length. For a feedforward neural network, the depth of the CAPs, and thus the depth of the network, is the number of hidden layers plus one (the output layer is also parameterized). For recurrent neural networks, in which a signal may propagate through a layer more than once, the CAP is potentially unlimited in length. There is no universally agreed upon threshold of depth dividing shallow learning from deep learning, but most researchers in the field agree that deep learning has multiple nonlinear layers (CAP > 2) and [4] considers CAP > 10 to be very deep learning.

Deep Learning Application

Here have been several studies demonstrating the effectiveness of deep learning methods in a variety of application domains. The reality of data proliferation and abundance of multimodal sensory information is admittedly a challenge and a recurring theme in many military as well as civilian applications, such as sophisticated surveillance systems. Deep learning implies an abstract layer analysis and hierarchical methods. However, it can be utilized in numerous real life applications. As an example, within digital image processing; grayscale image coloring from a picture used to be done manually by users who had to choose each color based on their own judgment. Applying a deep learning algorithm, coloring can be performed automatically by a computer [14. The applications of deep learning are categorized in pure digital image processing, medicine and biometrics.

III. RESULTS AND DISCUSSION

Practical Examples of Deep Learning

Deep learning allows machines to solve complex problems even when using a data set that is very diverse, unstructured and inter-connected. The deeper learning algorithms learn, the better they perform. Now that we're in a time when machines can learn to solve complex problems without human intervention, what exactly are the problems they are tackling? Here are just a few of the tasks that deep learning supports today and the list will just continue to grow as the algorithms continue to learn via the infusion of data. The virtual assistants of online service providers use deep learning to help understand your speech and the language humans use when they interact with them. Translations, in a similar way, deep learning algorithms can automatically translate between languages. This can be powerful for travelers, business people and those in government. Vision for driverless delivery trucks,

drones and autonomous cars is the way an autonomous vehicle understands the realities of the road and how to respond to them whether it's a stop sign, a ball in the street or another vehicle is through deep learning algorithms. The more data the algorithms receive, the better they are able to act human-like in their information processing knowing a stop sign covered with snow is still a stop sign. Chatbots and service bots that provide customer service for a lot of companies are able to respond in an intelligent and helpful way to an increasing amount of auditory and text questions thanks to deep learning. Image colorization, the transforming black-and-white images into color was formerly a task done meticulously by human hand. Today, deep learning algorithms are able to use the context and objects in the images to color them to basically recreate the black-and-white image in color. The results are impressive and accurate. Facial recognition of deep learning is being used for facial recognition not only for security purposes but for tagging people on Facebook posts and we might be able to pay for items in a store just by using our faces in the near future. The challenges for deep-learning algorithms for facial recognition is knowing it's the same person even when they have changed hairstyles, grown or shaved off a beard or if the image taken is poor due to bad lighting or an obstruction.

Medicine and pharmaceuticals, disease and tumor diagnoses to personalized medicines created specifically for an individual's genome, deep learning in the medical field has the attention of many of the largest pharmaceutical and medical companies. [15]

Benefits of Deep Learning

The deep learning architecture is flexible to be adapted to new problems in the future One of deep learning's main advantages over other machine learning algorithms is its capacity to execute feature engineering on its own. A deep learning algorithm will scan the data to search for features that correlate and combine them to enable faster learning without being explicitly told to do so. This ability means that data scientists can sometimes save months of work. Besides, the neural networks that a deep learning algorithm is made of can uncover new, more complex features that human can miss. The following are the benefits of Deep Learning, features are automatically deduced and optimally tuned for desired outcome and are not required to be extracted ahead of time, avoids time consuming machine learning techniques, robustness to natural variations in the data is automatically learned same as neural network based approach can be applied to many different applications and data types and the 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 is huge. [7]

Drawbacks of Deep Learning

In order to solve a problem, deep learning enables machines to mirror the human brain by making use of artificial neural networks. These networks are known to run a variety of applications such as speech recognition devices like Siri and Neuro-Linguistic Programming. Deep learning has hence been recognized as one of the major research areas required to advance AI. Although the importance of deep learning is increasing and several advances in its research are touching great heights, there are a few downsides or challenges that have to be tackled to develop it. To exemplify, for a speech recognition program, data formulating multiple dialects, demographics and time scales is required to obtain desired results [8]. Moving on, though deep learning models are very efficient and are able to formulate an adequate solution to a particular problem once trained with data, they are unable to do so for a similar problem and require retraining [10]. To elaborate, these neural network architectures are highly specialized to a specific domain and reassessment is needed to solve issues that do not pertain to that identical domain. Another challenge of deep learning is it requires large amounts of processing power. This

high-performance hardware is mostly the multi-core high performing graphics processing unit or a similar processing system [8]. These processing units require and consume a lot of power and are therefore a costly affair. Computing Hardware: As you mentioned, the GCPUs and alike processors have limitations. Our speaker from IBM in class 3 had touched the subject of quantum computation. That solution looks very promising for reducing computation time and complexity. That is a better future to reduce computation complexity needed by DL. [9][11]

IV.CONCLUSION

Deep learning is powerful technique in current generation and will have many more successes in the near future because it requires very little engineering by hand, so it can easily take advantage of increases in the amount of available computation and data. Artificial intelligence in recent times, coupled with the recognition that deep learning is evolving as one of its most powerful techniques. Though this paper has tried to present an overview of Artificial Intelligence, Machine Learning, deep learning and how its advantages and drawback of regarding deep learning algorithms and its applications, there still remains a great deal of work to be done in improving the learning process.

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