The Future of Artificial Intelligence and Machine Learning

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Introduction

Machine learning is an exponentially growing field within computer science that focuses on trying to teach computer programs to "learn". This goal is achieved through the repetition of specific tasks while collecting data throughout its process. Machine learning is the groundwork that allows artificial intelligence applications to function and improve over time. There are two main types that machine learning falls under. The first type is called supervised learning in which programs are given example inputs (such as pictures of houses, cars and boats) with their desired output (only identify the pictures of boats). The goal of the program is to learn how the inputs lead to the desired output and to derive a general rule or procedure they can follow and apply to other inputs. The other type, which is significantly harder to successfully achieve, is unsupervised learning. In this type of machine learning, the program is only given the desired output and it's up to the program to properly identify the input(s) and achieve the desired output with no direction. Unsupervised learning is only able to be achieved in a small amount of cases and as such does not have wide spread use. It's future is still largely unknown and it's uncertain the extend it will be able to be implemented in the future. As such it will not be touched upon in this paper.

Finally there is a much newer subset of machine learning called deep learning. Deep learning programs have multiple layers each with a different purpose and which take a different form of input. Originally designed to resemble the nervous system in humans, deep learning has lead to many breakthroughs in processing images, videos, audio and speech (LeCun 2015). The first and very significant use of deep learning was automatic speech recognition. This has led to many breakthroughs in allowing people to communicate verbally with machines. Some industries already focusing on integrating deep learning are the financial industry, the medical industry, and the transportation industry. With many

industries now focusing heavily, if not solely, on artificial intelligence, this paper will go through the basis and future of machine learning as well as deep learning.

Discussion

Historically, machine learning innovation and artificial intelligence innovation have gone hand in hand. As computers continue to collect more data, they continue to see improvements in their ability to interact with humans. Advanced artificial intelligence would be very hard for most people to interact with even ten years ago but it is outfitted in all smartphones now along with stand alone applications for people's homes like Google "Home" or Amazon's "Alexa". These devices show the evaluations of artificial intelligence as people are able to interact with them on a daily basis with their ever improving ability to keep up in conversation. As people interact with these artificial intelligence devices, the devices are able to collect data to continue to improve themselves. One way they can self improve is if you ask the same question multiple times in a short span of time; the program would know you may not have been satisfied with the first answer and try to answer differently in subsequent attempts.

As previously mentioned the most common form of machine learning and deep learning is called supervised learning. The most basic and one of the first uses of machine learning is image recognition (LeCun 2015). This was one of the first uses of machine learning because image recognition as been a long sought goal in computer science. A lot of work had already been done around the subject with moderate success making the implemption of machine learning much easier. Under supervised learning, first you would collect a large set of pictures of the object you want to identify. The program would then produce an output that could be as simple as two vectors on a 0-100 scale representing "object" and "not object". The program would then be told how far off it was in identifying the object. Now comes the part where the machine "learns"; it would adjust values within itself to try and get closer in its next attempt. After hundreds, thousands or millions of attempts depending on how complex the program is, it would

eventually come with values that are able to correctly identify the object with a low failure rate. This is the basis behind how machine learning works. As machine learning programs get more complex, more variables are added that the program needs to tune in order to get the correct result.

In recent years deep learning has lead to breakthroughs in things such as imagine classification. Through crowdsourcing data collection techniques like image captcha's, where users are asked to identify all images with a sign for instance, deep learning algorithms are now extremely efficient at identifying the contents of images (LeCun 2015). Another significant breakthrough in recent time is the ability to translate words and sentences in real time. This has been achieved by improved text recognition that is more properly abled to correctly identify text in images. These innovations have all been able to happen because of the advanced "learning" techniques of deep learning.

One industry starting to experiment in using deep learning as an additional resource is the finance industry. Unlike other uses of deep learning where humans are already inherently good at the task, such as identifying images which is a very simple task for any person, using deep learning to manage a stock portfolio is not something that people are inherently able to do. Where deep learning does succeed in the finance industry is finding the relationship in massive datasets regardless of its complexity or non-linear relationship (Sokolov 2017). Well financial models have been used for a long time with large datasets, through deep learning they are able to go through much more data, in much fewer time and while being able to find more complex relationships between variables. This information from the deep learning algorithms is then used to assist people in managing portfolios. As things such as stocks do not follow strict patterns, current fully automated portfolios on average do not always beat out portfolios made by financial experts (Sokolov 2017). This is an area where deep learning can still improve on by incorporating and interpreting other factors such as news stories.

A more impactful field exploring the use of deep learning is the medical field. Deep learning algorithms are able to interpret information from a patient and then deliver a diagnoses. While deep

learning has a bright future in medical analysis, it is not without current challenges. One major obstacle facing the task right now is that deep learning programs need massive sources of data which is not easily accessible for medical information. Ideally the program would be able to look through millions of past patients and obtain their test results, their diagnoses, and any other relevant information to learn off of. The first problem with getting this information is that most of it would be confidential information that can not be released. Even if the information was properly anonymized and able to be used, obtaining it would be a rather daunting task as a large amount of medical facilities do not have the most up to date record keeping (Litjens 2017). This leaves the deep learning algorithms to only be able to access information from things such as past medical research. While there is still a large amount of data, deep learning program only get more accurate with even more information. Despite this, research has already shown it is possible to outperform medical experts in certain tasks (Litjens 2017). With already much success within the field, deep learning programs will only improve in making a big impact within the medical field.

Deep learning algorithms can also affect people in their day to day lives. Using deep learning, models can be created to more precious predicate traffic flow (Zhang and Kabuka 2018). Incorporating factors such as the weather, past accidents, popular events and others, these models can determine with great accuracy the traffic flow on a given day for cars, public transport and pedestrians. Through deep learning these models are able to go through more data and are quicker to adjust their algorithms as it continues to learn. This can be incredibly useful in city designs as you are able to more accurately predict how traffic will flow in a specific part of the city before it's built. It can also be used to determine when construction could commence to interrupt traffic flow the least. This would enhance the everyday life of people as they are less impeded by traffic and can more quickly get to their destination. This information can also go on to help build a "smart city" with maximum efficiency in transportation.

Conclusion

In conclusion, machine learning and specifically deep learning have the ability to significantly change how things are done with a sharp shift towards more tasks completed by artificial intelligence. Industries such as finance, medical, and transportation are already greatly improving by incorporating deep learning and its ability to efficiently read massive amounts of data. These are surely the first of many industries to incorporate deep learning into their work. While the technology is still relatively new and the extent of its future applications is still widely unknown, it is clear deep learning will be used in many industries. As computers themselves get faster and more efficient, deep learning program will also be able to run faster and with more data. If breakthroughs are made in computer processors, such as breakthroughs in quantum computing, then the future of deep learning will only be more advanced. Powered by deep learning, advancements in artificial intelligence will also be made on technology such as self driving cars, trucks and aviation. The future is wide open for advancements in machine learning, deep learning and artificial intelligence.

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