**IT Technologies Report – Machine Learning**

**Overview**

In its most basic sense, machine learning is the application of artificial intelligence (referred to in this report as AI) which gives computer systems the capability to autonomously learn, refine and improve through experience, without the requirement of explicit instructions or programming. Machine learning is primarily employed within the field of data science, but can be found in multiple streams of mathematics, statistics and other computational fields. Algorithms written for machine learning will generally focus on giving a level of autonomy to the system in use, whether that be for collection of specific data or the completion of some other action or set of tasks. (Expert System 2017)

Machine learning is a concept that was likely first conceived over 60 years ago, but its vast application potential and variety of uses were not truly uncovered until towards the end of the 20th century. (Dataversity 2019) Even now, machine learning is applied to more fields and areas as modern technology continues to shift and change at an accelerating pace.

While the range and possibility of machine learning is far reaching and much of its potential still remains unknown, several frontrunners have emerged as recently as the last few years, revolutionising the way we look at AI, data and even robotics. Machine learning allows us to combine many of these areas in both experimental and sometimes immediately practical ways.

An area making strides in recent years is reinforcement learning (RL), an area of machine learning that involves training AI to play games at a level equal to or surpassing that of humans. George Anadiotis, a contributor for the Big on Data blog at tech news site Zdnet, points out the potential for more real-world applications of what seems to be a novelty concept. “More important than the sensationalist aspect of "AI beats humans", however, are the methods through which RL may reach such outcomes: Play driven learning, simulation and real-world combination, and curiosity-driven exploration.” (Zdnet 2019) Training AI to “play games” is another way to teach it to learn tasks or commands by trial and error, much the way a young child develops their cognitive and physical skills through play and interaction with the world around them. In contrast, Anadiotis refers to a report by Nathan Benaich, founder of the Research and Applied AI Summit (RAAIS), in which he points out the pros and cons of using games as an AI tool. While he notes that games are a great place to start due to the customisable complexity of their environments and ability to reflect real-world aspects, “…the majority of games do not accurately mimic the real world and its plentiful nuances. This means that they're a great place to start, but not an end in themselves." (Benaich 2019)

The nature of machine learning is in itself ever-changing, but much of its development also depends on contribution from and development of other fields and areas of technology. Benaich takes some time in his State of AI report to discuss the concept of “deep learning” which is another, somewhat more extensive, branch of machine learning. He goes into much detail about the potential for deep learning’s use especially in the medical field, and points out some interesting applications for this technology, such as “the potential for brain computer interfaces to restore communication for paralysed patients” through synthesised speech via monitored and recorded brain activity. (Benaich 2019) Perhaps even more revolutionary is the potential for deep learning to assist in technology for restoring limb control to those who may have suffered brain injuries resulting in paralysis.

**Impact**

It perhaps goes without saying that these medical applications would have a huge impact on the quality of life of patients who otherwise have no options within the realm of current medical treatments, or perhaps even medical research outside of related machine learning. Should these undertakings in deep learning be successful, such an impact is clear, substantial and immediate. While Anadiotis describes these feats as “science-fiction-like” (Zdnet 2019), it’s worth considering that much of our current technology, some of which we now consider as everyday conveniences, would once have been described in similar, fantastical terms.

There are other sides to the impact of machine learning that are less dramatic, but still worth discussing. Much research and discovery lies between the two extremes of reinforcement learning and teaching AI to “play games”, and the astonishing applications of deep learning to restore human limb functionality and speech capability.

Some aspects may be more obvious than others, especially those we are more inclined to associate with data, statistics and numbers in general. Fields such as finance, insurance, economics, advertising and marketing, and of course, software engineering, all rely on various types of data and numbers in general to function in some respects. Machine learning makes it easier to complete much of the work and tasks required. While there are obvious benefits to this automation of how data is mined and used, there are drawbacks that will affect our society at least to a noticeable degree.

Vinod Khosla, a renowned Silicon Valley investor, published an article a few years ago describing how medical diagnostic software, much of which relies on machine learning, will eventually replace up to 80% of medical doctors within the next two decades. (TechCrunch 2012) While this is perhaps a more extreme claim, its basis remains rooted in the fact that technology has replaced many historically human-held positions, and while it has created a huge volume of new jobs research streams and career paths, it has also made many others redundant.

As with all technology, pros and cons will always exist, but as professionals in the field, we should always be looking towards progress, new discoveries and new applications, while still acknowledging that sacrifices must be made in order to move forward.

**Personal Impact**

As someone that is studying information technology and will one day work in a field or profession that is highly likely to employ some type of machine learning, there is an undeniable impact on my future and career. My daily life is already impacted by developments in machine learning, and that of friends and family, due to the technological advancements in recent years and our geographical location in mostly developed countries. Friends and family working in statistics and finance use data mining software and programs that automate large portions of their daily work, or perhaps increase their productivity on the job. As my grandparents attend their routine medical appointments, it is likely that some type of medical diagnostic software will be used. The next time I research prices for an overseas flight, advertisements may be recommended to me based off of data collected by some type of machine learning system.

The impact of machine learning is undeniable as someone living a “typical” existence in many parts of the globe. Even so, the likelihood is that we are only seeing a small portion of its capabilities to revolutionise more than just our daily lives, and this will only be revealed with research over time and future breakthroughs.

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