Machine Learning, Virtual Reality, and How They Are Impacting Operating Systems For the Future

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Abstract

In this paper, we strive to examine the implications and applications of various machine learning and virtual reality technologies that have arisen across the past century and how they could potentially impact the near future of operating systems. Machine learning, sometimes better referred to as Artificial Intelligence or deep learning, is becoming more and more relevant in workplace settings and has recently been known to outperform professionals in both analysis and operation. The outstanding potential for machine algorithms to utilize supervised, unsupervised, and reinforcement learning is both amazing and inspiring. We touch on the abilities of machine algorithms to consistently exceed the capabilities of human observation and the potential it holds to positively impact a multitude of areas in our society. Virtual reality is beginning to show a popularity curve reminiscent of technological advances of the near past like the introduction of the iPhone and the first in-home personal computer. Modern operating systems are picking up steam with advancements in hardware and software that many only dreamed of until recently. Processing power, memory capabilities, and new graphical advancements are paving the way for the world's next big technological leap. We have researched these areas and consider both machine learning and virtual reality as the two stalwarts of the future and the new horizon of technology.

Introduction

Virtual reality and machine learning are technologies that have been rapidly improving and changing over the recent years. These technologies push the boundaries of what can be done with computers and will continue to improve and augment our human experience as we know it. With the rise in technological advancements, naturally, operating systems are pushed to their limits. They are given new tasks, new features, and new abilities to parallel the rise in demand for fast and efficient systems.

Definitions

Let us first establish a definition and understanding of these two concepts. Machine learning at a basic level is an algorithm. This algorithm is able to use statistics and data sets to identify patterns and anomalies. These patterns and anomalies can span extraordinary systems and massive amounts of data. These algorithms are scalable, having the potential to span several nodes in a process, communicating and working together in a technique that is called "deep learning" using deep neural networks [8]. The potential of machine learning to have benefits in real world applications is remarkable. Industries such as healthcare, automobiles, networking, and many others have begun utilizing machine learning to improve efficiency and accuracy when accomplishing critical tasks.

Virtual reality, or more specifically a virtual reality experience, is any experience in which a user is thrust effectively into an immersive and responsive virtual environment [9]. This includes simulations that may have controllers such as a flight simulator as well as head mounted displays. Virtual reality is not a new concept, in fact it has been around for over a century. However, in recent years, the demand and usefulness of these systems has become apparent. To mirror this demand, the technologies that implement virtual reality systems have become more powerful, more efficient, and more accessible to the public. Similar to machine learning, the benefits are already being seen in common industries. Healthcare, flight, and entertainment industries have been able to utilize virtual reality systems to improve their fields.

Operating Systems' Relevance

The world as we know it already has some implementations of deep machine learning without most of us being aware of it. The largest example of this is with social media. Social media sites use machine learning algorithms to proctor information and selectively display content for their users. Many

of us who have used social media have experienced this. We have all seen ads that cater to our interests or seen an Instagram feed that shows posts similar to what we seem to be interested in. Social media sites like Instagram, Facebook, Twitter, and many others have incredible amounts of data that these algorithms sort through endlessly and effortlessly all hours of the day. In order for these sites to maintain that effortless guise, they have to have intense data centers and systems. Most social media sites utilize the Linux operating system. One of the big benefits of utilizing this operating system is the open source aspect of it. Because the development stack for most social media sites is open source, it allows for massive scalability, especially when integrating APIs into other applications [18] [14].

Deep neural networks are beginning to play a huge role in cybersecurity. Each operating system and the device it is controlling has a fingerprint that it leaves behind upon connection or reception with another system. Researchers and cybersecurity experts are beginning to implement a machine learning algorithm that can detect malicious fingerprints immediately upon connection to a device [3]. Fortunately for researchers today, algorithms are becoming more and more scalable and are finding ways to traverse node paths and models that have previously been unimplemented. Node classifying, clustering, and model embedding are becoming more proficient and are beginning to outperform previous algorithms [6]. One specific example of these improvements is a study done on ImageNet image libraries that implemented a machine learning algorithm to classify 1.2 million images into 1000 categories. Utilizing over 650,000 neurons across 60 million parameters, the algorithm was effectively able to classify the images with a top-5 error rate of 17% [12]. Also impressively, recent advancements in the automobile industry have proven that autopilot cars with machine learning algorithms to recognize street signs, stoplights, pedestrians, and other vehicles are viable options on the road and can eventually be safer and more efficient than standard gas-powered cars [16].

Virtual reality has been on the forefront of research and development recently. Many people believe that virtual reality holds capabilities of rehabilitation, training, development, and many other things. For example, in recent years, developers have been working on creating virtual reality operating systems independent from traditional operating systems such as windows or linux. One of the early examples of this is from 2001. A system aptly titled “VR Juggler” was developed and implemented as an “operating system independent system” used for development of applications. The notable thing about these systems is their portability. As noted in this article describing the VR Juggler the development that is done in the system is portable to nearly any architecture [4] [11].

Another recent development in the virtual reality field specifically is the development of a Robot Operating System. This operating system is one that interacts directly with robots to accomplish tasks as simple as folding a tee shirt to as complex as assembling a car. Recently with the introduction of consumer-grade virtual reality systems, the integration between the two has been incredible. Since consumers can interact with a three dimensional virtual environment, linking with the ROS (Robot Operating System) has created an outlet for companies and individuals to teleoperate from remote locations [19].

Virtual reality and machine learning have their biggest current impact on the healthcare field. When looking at the processes and procedures used by healthcare professionals, developers have been able to create algorithms and applications to aid these professionals in diagnosis and treatment for many patients. One such virtual reality application has been developed as recently as 2018. A depth perception training application was developed and detailed in an article. It details the decision making when developing such an application. Interestingly, the first decision they tried to make was regarding the platform. They initially entertained the idea of the Windows operating system. Their reasoning for this was it was the most widely used at the time. They also noted that the Windows operating system had .NET capabilities which worked well with the kinect (as they were both microsoft products). The Kinect idea was considered due to the nature of the project being depth perception. However, they eventually reached the conclusion that Android, a mobile operating system, would be the best option because they wanted the application to be accessible in peoples’ homes [7].

When looking at the interaction between machine learning and virtual reality, it is easy to see a cause and effect relationship between the two. Machine learning provides quick, accurate, and efficient

diagnostics, and virtual reality provides accessible, effective treatment and solutions to problems in different fields. Given the quantity of studies recently, it seems that operating systems will need to be improved upon and step up when it comes to these technologies. These technologies need scalability to thrive, and they need to span the world. This means that networking frameworks integrated into operating systems will need to have higher capabilities in the future.

Conclusion

It is apparent in today's society that the technological advancements in operating systems, virtual reality, and machine learning have huge implications for the future. Machine learning and virtual reality can work together to bring significantly more innovation and efficiency to many imperative industries. In order for these systems to work, the operating system behind it all needs to provide a diverse set of functionality and massive scalability. As noted before, operating systems like Linux that provide open source capabilities may be the future of scalable and portable applications. While some of these recent advancements in technology may seem amazing, the trajectory of these innovations in technology is only going up. Because of this, we believe that the future of technology lies in the hands of machine learning, virtual reality, and the operating systems behind it all.

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