Machine Learning

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*Abstract*—The goal of machine learning is to build computers that are better at learning by gaining experience. It is a rapidly growing field that lies near the intersection of computer science, statistics, and artificial intelligence. This paper focuses on necessity of Machine Learning in software industry, existing solutions, and their merits/demerits. It will also propose improvements to help overcome limitations of existing solutions.

# Introduction

The term machine learning was first coined in the 1950s when Artificial Intelligence pioneer Arthur Samuel built the first self-learning system for playing checkers. He noticed that the more the system played, the better it performed.

Fueled by advances in statistics and computer science, as well as better datasets and the growth of neural networks, machine learning has truly taken off in recent years.

The application of machine learning has become ubiquitous today, whether it is in automated self-driving, healthcare system, predictive market analysis, marketing & advertisement, gaming and so on.

# Industry Trends & Needs

## **Autonomous Self-Driving**

The development of self-driving cars is one of the most trendy and popular directions in the field of machine learning. The prospect of a future where we don’t have to drive is very appealing for many, which is why many prominent players in market are working on build autonomous solutions. The semi and fully autonomous vehicle market in North America alone was worth $1.7 billion in 2016 and is projected to grow to more than $26.2 billion by 2030.1

**Need for Autonomous Self Driving**

Globally, approximately 1.25 billion road traffic deaths occur every year.2 And according to the U.S. Department of Transportation, “The major factor in 94 percent of all fatal crashes is human error.”3 So, reassuringly, greater use of autonomous vehicles could limit those mistakes that humans are making and eliminate millions of otherwise avoidable deaths.

**Importance of Machine Learning in Achieving Autonomous Self-Driving**

Machine learning algorithms make it possible for self-driving cars to make autonomous decisions. They allow a car to collect data on its surroundings (using cameras and other sensors), interpret it, and decide what actions to take. The brains of a self-driving car can be divided into three parts: the perception system, the decision system and the motion system. The perception system is what allows the car to see the environment. Automotive cameras, radar, laser scanners and ultrasound are used to capture the environment around the car so it can see. The decision system is where most of the machine learning happens. This is where the car's computer system analyzes the information from the perception system and decides what to do next. The third part is the motion system, which is the part that makes the car move. The machine learning part of this is making sure the car is aware of its surroundings and can react to pedestrians and other cars appropriately. Bayesian regression, neural network regression and decision forest regression, among others, are types of regression algorithms used for self-driving cars.

**Critical Analysis**

**Pros:**

* Vast majority of motor vehicle crashes are due to human error - driver fatigue, inattention and distracted driving, and alcohol-related impairment. It is estimated that ML driven fully automated vehicles can reduce vehicle crashes by 90%.
* Fully automated vehicles can communicate with each other through a network of computers. This allows real-time analysis to determine best routes of travel.
* Self-driving vehicles could be a safer, more accessible alternative for persons with disabilities and the elderly.

**Cons:**

* To wider adoption of autonomous vehicles, countries will need to have appropriate infrastructure in place and needs law-making authorities to legislate and regulate the industry, both globally and locally.
* Population dependent on the automotive industry for their livelihoods would be impacted. Many of those working in trucking, public transit, and delivery services would find their roles obsolete in a fully self-driving future.
* Security issues are very real limitation of self-driving vehicles. When vehicles rely on computers to function, they are susceptible to cyber threats.

**Proposed Enhancements**

Along with autonomous self-driving, there is further scope of applying Machine Learning to enhance future of mobility. A powertrain is congregation of every component involved in delivering power to the wheels and pushing a vehicle forward. Usually, time series data points are generated by these powertrains which can be used by machine learning to enhance motor control and battery management. Instead of being restricted to factory-built boundary conditions, the system can adapt to changes in the vehicle and respond consequently. The vehicle can operate at a higher level of efficiency due to the flexibility of its boundary conditions. Machine learning can help prevent system failures that could lead to fatal outcomes. Data collected on variables such as motor temperature, battery charge, oil pressure, and coolant levels can be delivered to the system. Creating a analysis of motor performance and the vehicle’s overall health. If potential faults are detected, the system can be notifying the driver about next steps (repairing or maintenance). Additionally, ML can ensure that camera, LiDAR, and radar sensor systems are well-maintained and accordingly notify.

## **Healthcare**

Machine Learning coupled with AI is accelerating the Healthcare industry to the next level with advanced processing and understanding of life science. AI-driven diagnostics collects patient data to diagnose and suggest possible ways to treat disease with accuracy.

**Need for Machine Learning & AI in Healthcare industry**

AI doesn’t mean to elevate new methods in medication, it just projects a path with existing medication in the right way, it can detect medical problems much faster than a human sense. Artificial Neural Networks are widely used in healthcare, Kohonen’s Neural Network is one of the popular Neural Networks which is a basic type of Self-organizing network that gathers the data to provide a more sophisticated visual presentation. AI and ML accelerate reading for researchers in understanding life science, discovering the causes of the disease, and helping to develop precise diagnoses to treat the diseases.

**Importance of Machine Learning in HealthCare**

Machine learning in healthcare can be used to develop better diagnostic tools to analyze medical images. For example, a machine learning algorithm can be used in medical imaging (such as X-rays or MRI scans) using pattern recognition to look for patterns that indicate a particular disease. This could potentially help doctors make quicker, more accurate diagnoses.

**Critical Analysis**

**Pros:**

* One of the strongest suits of AI in healthcare industry is its ability to deliver data in real-time. This allows faster diagnosis based on results which ultimately contributes greatly towards recovery/treatment plans of patients4.
* AI in healthcare has immensely contributed towards streamlining tasks such as setting appointments, translating clinical information, transferring, and tracking patient’s record and medical history.
* As AI replaces tedious human tasks with advanced algorithms, it has reduced the expenses of hospitals by a great fraction.
* More than just providing real-time data, AI can also integrate other sources of information based on research that can be of great use for analysing diseases. [Software have been created](https://drexel.edu/cci/stories/artificial-intelligence-in-medicine-pros-and-cons/~/link.aspx?_id=5B042B7BCDB74ACC8FDC3333F288F2D7&_z=z) to address specific big diseases, such as childhood cancer, to aid in the necessary procedures and options per stage of development. More so, information gathered within the hospital also becomes part of the bigger pool of advanced research for further studies on the disease.

**Cons:**

* Since healthcare is very sensitive and critical field, and AI is not perfect, we require human oversight and surveillance. Robotic technologies that aid in surgeries, for example, have no sense of empathy and will operate merely on their program. Data suggested and presented by AI will still need a human doctor who still has the final decision to make whether to dismiss it or to follow through with it, depending on the case of each specific patient he/she has.
* AI functions on algorithms that may find it most convenient to the majority (i.e., nearest possible clinic or hospital for a patient). However, this doesn’t consider any socioeconomic background of a patient and whether the patient feels comfortable going to the said suggested facility produced by AI.
* AI makes use of available data to help in diagnosis. When this data isn’t available, it can create a faulty diagnosis.

**Proposed Enhancements**

While AI in healthcare has a long way to go, there is a need to create AI bots that can generate empathy with patients and can share feelings like human counterparts. This will be crucial to bridge the gap between human and machine doctor interactions. Additionally, with various smart devices recording patient health data further enhancements can be made where that data can automatically be evaluated by Machine Learning algorithms and if needed appropriate medication can be recommended to the patient for treatment.

##### References

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