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Research Article

A Study to Analyze and Explain the Impacts that Machine Learning has on Business Management to Speed Up Research & Development

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A B S T R A C T

Machine learning is a subfield of computer science that focuses on the development of artificially intelligent systems and tools. These systems and tools may automatically learn from their environment and build on their existing knowledge without being explicitly programmed to do so. It is well acknowledged that Machine Learning is one of the most dynamic disciplines in the present age and it is anticipated that it will blossom to an exalted degree in the next era of Digitalization. It is common knowledge that machine learning is being put to extensive use in many different industries, such as automobiles, genetics, medicine, finance, agriculture and education, amongst others, in order to automate procedures, reduce processing time, eliminate the possibility of human errors and analyze data on a massive scale, thereby assisting in the process of making decisions that are both quicker and more accurate without the need for human intervention.

The purpose of present research paper is to investigate and provide explanations for the multiplicity of impacts that Machine Learning has had and is having on our society in order to speed up the processes of research and development in convergence with refined and solid commercial acumen. As a game-changing technology, machine learning paves the way for social innovation by assisting users in making effective decisions, load sharing, sales prediction, weather forecasting, opinion mining and other similar activities. These activities are necessary in order to construct a society that is not only economically viable, but also eco-friendly and sustainable.

Keywords: Artificial Intelligence, Machine Learning, SWOT Approach, Global Warming, STEM Career

Introduction

These days, the phrase “Machine Learning” is used rather often. When you type “What is Machine Learning?” into the search box on Google, a massive list of results including a wide variety of topics, such as research papers, self-developed definitions, applications, blogs and forums, among other things, appears. The science of teaching computer systems to learn and behave like humans and to improve their learning over time in an autonomous manner, by providing them with data and information in the form of observations and real-world interactions is referred to as Machine Learning (ML), which is a component of, or

subset of, artificial intelligence (AI) (Patel M, 2019). The creation of programming languages and algorithms that can access the concepts of statistics, algebra and probability in order to solve real-world issues is the primary objective of ML. Figure 1 presents a taxonomy of several machine learning methodologies together with a list of machine learning algorithms.

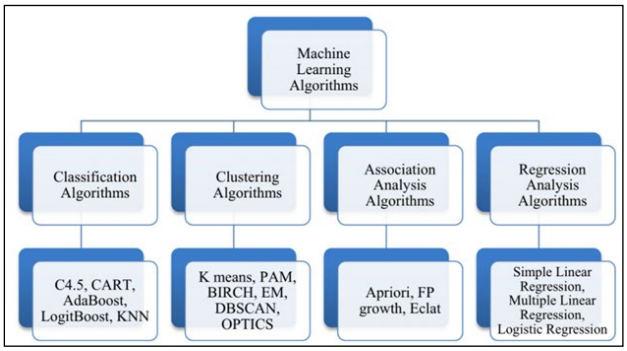

Figure 1. Taxonomy of Machine Learning Algorithms (Mittal et al., 2019)

The several well-known machine learning algorithms are now being used in a variety of domains to bring advantages to each and everyone. Online education, smart healthcare, smart farming and agricultural practices, climate change monitoring and weather forecasting, enhanced gaming systems via Augmented Reality/Virtual Reality (AR/VR), automated and driverless automobile technology, improvements in banking for safe and secure transactions, personalized digital media, tailored news and media report production, smart home and city planning are some notable impacts of Machine Learning that are projected to drive (Lampix, 2018). The digitalization of workflows by using machine learning and sophisticated analytics is the new approach that companies in a variety of sectors are turning to in order to increase their business value. In this article, a comprehensive discussion on the myriad impacts of machine learning have been presented in order to comprehend how ML can act as a harbinger in solving real-world challenges for the purpose of making our society a better place to live in.

Machine Learning on Monitoring the Impact of the Economic Crisis on Crime in India

In the recent past, there has been a meteoric rise in the number of crimes committed in India. A detrimental act of any type committed against the public is considered a crime and those found guilty may be sentenced to the death penalty, imprisonment, or a fine by the state. As a result of crimes committed against children, women and other vulnerable members of society, the situation has become intolerable not only for the general populace but also for the government. When a nation's economy sees a sharp decline for no apparent reason, it is considered to be in the midst of an economic crisis. This decline is often the result of a financial crisis. Indicators of the economy, such as the unemployment rate, have a direct influence on the composition of the Indian population and, as a result, on the levels of economic crime. This is true regardless of whether or not there is an ongoing economic crisis. Because there has been a significant rise in the rate of unemployment and because there have been fewer opportunities for people to find jobs, a significant portion of the country's population is unable to make ends meet and this is either directly or indirectly inciting and forcing them to commit an act of crime out of frustration, despair, anger and other such vices. Records from the past state that analysts have been employing a variety of Data Mining and Machine Learning approaches for the analysis of data linked to crimes that have been committed in the past in order to uncover the crime patterns and forecast the odds of its happening in the future. For the purpose of evaluating crime statistics on economic indicators such as the unemployment rate and GDDP (Gross District Domestic Product), several machine learning algorithms such as Decision Trees, Random Forest, Linear Regression and Neural networks have been used (Mittal et al., 2019).

Tracking Climate Change with Machine Learning

The most significant repercussion of the greenhouse effect, sometimes known as "global warming," has had a negative impact on the weather patterns that prevail across the planet. According to projections made in the Intergovernmental Panel on Climate Change's (IPCC) 2018 report, the planet will be put in jeopardy of experiencing catastrophic effects if the global rate of greenhouse gas emissions is not reversed within the next thirty years. Machine learning allows autonomous monitoring to be carried out by remote sensing. This may be accomplished, for instance, by locating areas of deforestation, collecting data on structures and determining the extent of damage caused by natural catastrophes. It has the potential to speed up the process of scientific discovery by pointing researchers in the direction of novel materials that might be used in carbon capture, batteries and building. Machine learning has the potential to optimize systems, which may enhance efficiency and reduce waste by, for example, consolidating freight, establishing carbon markets and cutting food waste. Additionally, it helps speed up physically demanding simulations that need a lot of computer power by using hybrid climate models and energy scheduling models. It is common knowledge that the combustion of fossil fuels for the generation of power, heat, transportation and other purposes is one of the main sources of Green House Gas emissions (GHG) that are caused by human activity everywhere in the world. The use of the Machine Learning idea is shown in Figure 2, which presents a number

of different opportunities for lowering GHG emissions. It is important to keep in mind that machine learning is only one component of the solution to this problem. In order to effectively address such complex issues, it is necessary to design and develop an integrated and embedded model that is either ML-based or Internet of Things (IoT)-based and that makes use of a combination of hardware and software. The use of machine learning in the fight against climate change has the potential to be beneficial to society as a whole and it also has the potential to create advancements in the area of machine learning via exploratory research approaches (Rolnick et al., 2019).

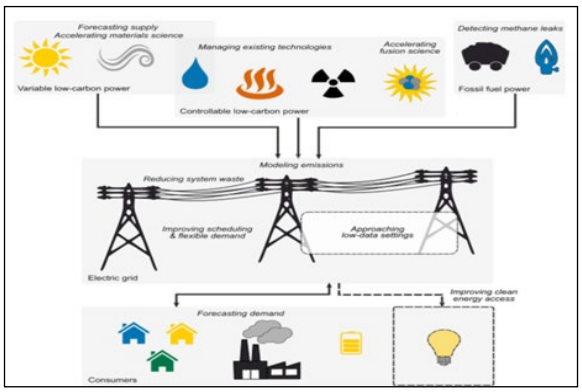

Figure 2.Opportunities for Machine Learning to Cut Greenhouse Gas Emissions in Electricity Systems (Rolnick et al., 2019)

Machine Learning in the field of Education

Not only has machine learning shown its usefulness in finding solutions to issues that really occur in the real world, but it has also made its presence known by radically altering the educational education and the employment opportunities that it leads to. We are fully aware of the fact that machine learning is a paradigm shifter in the industry. The number of job opportunities expected to become available in the near future is expected to expand as a direct result of the growing competition for the position of data analyst. Since quite some time ago, artificial intelligence has been dominating a significant portion of society as well as the educational education. Career opportunities in the area of artificial intelligence (AI) are rapidly expanding and as a result, there is a growing demand for workers who are knowledgeable about AI. This will lead to an increase in the number of students who are interested in STEM (science, technology, engineering and mathematics) fields of study, which will provide a solid foundation for higher education and result in improved future prospects and job openings. Machine learning is used to power a vast array of applications, including voice recognition systems, intelligent assistants, self-driving vehicles, healthcare and many more. The findings suggest that teaching students to ML in the classroom might not only improve their comprehension and enthusiasm in this field of study, but also contextualize ML concepts by illustrating how their application affects society. According to the findings, there have already been 30 instructional units in 2019 alone that have begun teaching the concepts and theories of state learning in schools and it is quite likely that this number will continue to climb in the near future. Figure 3 illustrates how, from 2011 to 2019, a growing number of instructional units (IUs) in school-level education have begun using ML. Several Instructional Units (IUs) cover simply the most accessible procedures, such as data management, or address model learning and testing on an abstract level. With this in mind, it is important to note that the complexity of ML concepts is taken into consideration (by black-boxing some of the underlying ML processes). In order to teach machine learning at the educational level, the IUs provide a variety of instructional resources accessible at no cost as well as specialized frameworks and tools. These may include block-based programming environments as well as Python and generic ML frameworks (Marques et al., 2020).

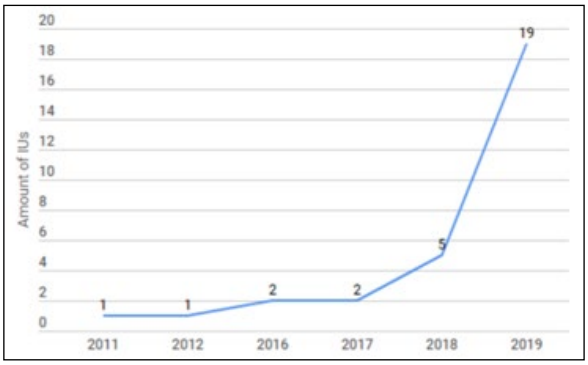

Figure 3.An annual count of the number of ML-specific IUs produced by academic institutions (Marques et al., 2020)

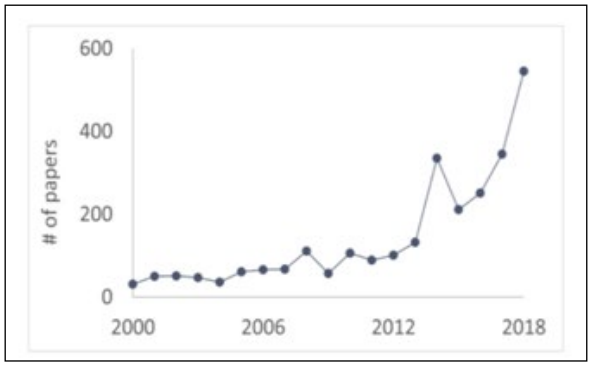

Figure 4.The total number of papers published per year on the topic of machine learning in a single discipline (Hajizadeh, Y., 2019)

Machine Learning in the Gas and Oil Industry

Experimentation and operationalization are the two stages that may be used to broadly classify machine learning's development. In business contexts, there have been many

unsuccessful efforts to execute a machine learning project that goes beyond what is presented in research publications and white papers. Figure 4 shows the average number of research articles and white papers pertaining to machine learning that have been published in OnePetro during the course of the previous 18 years.

An analysis employing the Strengths, Weaknesses, Opportunities and Threats (SWOT) technique is required if one want to correctly analyze the influence that Machine Learning will have on the Oil and Gas business. The following is an in-depth discussion of the SWOT technique.

Strengths

Data is the cornerstone of every machine learning pipeline and fortunately for the oil and gas business, there is a plenty of raw data to draw from. The measurements that are taken by downhole sensors are recorded every few seconds and a single seismic survey may create more than 6 terabytes of data in a single day. The majority of businesses also have access to sizable computing resources, either on-site or hosted in the cloud, which may be put to use in the execution of large-scale experimental projects.

Weaknesses

The industry world is widely known for its risk-averse mentality and the glacial pace at which it adopts new technology. In addition, the industry has weak innovation management techniques, which is like rubbing salt in an open sore. This is a difficult subject and the analyst's coverage may even have an effect on the innovation strategy that a company chooses to implement. It needs carefully developed systems and strategies, yet a significant number of oil and gas businesses do not have an innovation management system in place for their machine learning and analytics initiatives.

Opportunities

The key to successfully harnessing the commercial value and seeing an actual effect is to have a greater grasp of the opportunities afforded by cutting-edge machine learning workflows. There are a large number of industry publications that apply Machine Learning algorithms to use cases in the fields of exploration, drilling, reservoir engineering, production operations and everything else in between. On the other hand, the operationalization of machine learning in the oil and gas industry has received little attention.

Threats

The management's haphazard strategy is the greatest obstacle standing in the way of an ML success story. Any machine learning endeavor that tries to get beyond the proof of concept stage will fail if it does not include carefully crafted use cases, timetables and backup positions. Because of the recent drop in oil prices, there has been very little exploration activity in the market. As an example, it is unreasonable to spend months on use cases such as seismic interpretation at this time. Before beginning a journey with machine learning, it is necessary to first clearly establish the strategic vision, direction, goals and use cases based on data-driven metrics (Hajizadeh, Y., 2019).

Figure 5 illustrates how a contemporary machine learning pipeline that utilizes a Continuous Integration and Continuous Delivery (CI/CD) methodology differs from and is superior to its conventional equivalent.

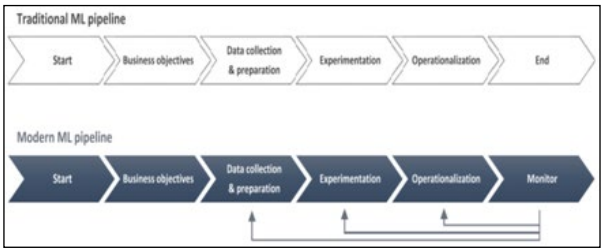

Figure 5. Compare and contrast a classic ML pipeline with one that uses continuous workflow and continuous deployment (Hajizadeh, Y., 2019)

Artificial Intelligence and Machine Learning in Medicine

Even though machine learning is extremely popular in the fields of finance and marketing, it has recently made its way into the area of patient care as well and the results thus far have been rather positive. By providing assistance to medical professionals in their assessment of a wide variety of complicated data types, artificial intelligence (AI) has the potential to bring about a fundamental shift in the practice medical care is delivered. In the event that an AI-driven system is able to effectively reproduce the practice of a harried physician, it has the potential to increase the accuracy of diagnosis, prognostication and management choices. The Arterys Algorithm, for instance, which was given the go-ahead by the Food and Drug Administration of the United States in 2017, makes use of magnetic resonance data to quantify cardiac blood flow in 15 seconds, which is an improvement over the requirement of 30 minutes that is currently in place. The goal of using machine learning algorithms, which operate on clinical data held in huge patient databases, is to discover patterns and make predictions. The data inputs might be any mix of structured and unstructured data. Data that has been structured is information that has been arranged into categories or numerical values, such as smoking status or serum hemoglobin levels. Unstructured data, such as clinical notes, may be information-dense yet lack a clear classification for the information they include. Up until quite recently, the only way to explore unstructured data was via human intelligence. There are currently very effective new

AI methods, such as Natural Language Processing (NLP), that are available. These methods are able to assess and make use of the vast amounts of information available and they may make an automated effort to anticipate illnesses and diseases (Ben-Israel, D., 2020).

Artificial Intelligence, Machine Learning and Health Systems

Globally, health systems are confronted with a myriad of challenges, including an increasing burden of illness, multimorbidity and disability brought on by an aging population and a transition in epidemiological patterns, an increased demand for health services, higher societal expectations and rising costs associated with health. Inefficiency coupled with low levels of production is still another obstacle to overcome. For the purpose of overcoming obstacles of this kind and achieving Universal Health Coverage (UHC) by the year 2030, the transformation of health care systems is of the utmost importance. The most recent and exciting development field in information technology is machine learning. It has the potential to be the driving force behind such a shift and offers the promise of doing more with less resources. For the purpose of assisting doctors in making clinical decisions, we may employ a specialized platform to perform data analysis and feed the results back to them in real time (Panch et al., 2018). While a doctor is examining a patient and entering the patient's symptoms, data and test results into an electronic medical record (EMR), there is also machine learning going on in the background, analyzing everything about the patient and providing the doctor with information that can be helpful when making a diagnosis, recommending a test, or recommending a preventive screening. As time goes on and we obtain more data that is useful and more integrated, the capabilities will, in the long run, have an influence on every facet of medical practice. We will be able to combine larger data sets that are capable of being analyzed and compared in real time, which will allow us to present the healthcare professional as well as the patient with a wide variety of information.

Impact of Machine Learning on COVID-19 Pandemic

In the year 2020, the whole globe was engulfed in the dreadful grip of the COVID-19 pandemic, which was triggered by an unique strain of Coronavirus. The epidemic has had a significant negative impact on India due to the country's large population. The rapid propagation of this virus has resulted in the implementation of lockdown procedures in a number of cities throughout the nation and the idea of social isolation has become increasingly commonplace among the population of the country. As a direct consequence of this, there has been discovered to be an improvement in the air quality. As a result of the closure of a large number of stores and enterprises, the amount of industrial activity and vehicle usage in cities dropped greatly and there were reports of pollution levels that were far lower than the range reported under normal circumstances. The ability to identify non-linear as well as linear correlations within the data is one of the many reasons why machine learning is such a strong technology. It is interesting to note that even economists are adopting ML algorithms in tandem with other data analysis tools. According to the findings of the research that made use of concepts from machine learning, weather-normalized concentration levels have usually decreased over the course of time, notably for SO2. This drop has been driven in part by rigorous controls imposed by the government as well as a desire to limit the amount of local air pollutants. A new method called the Augmented Synthetic Control Method (Ben-Michael et al., 2018) was implemented in order to investigate how the weather-normalized concentrations of four pollutants responded to the lockdown by utilizing the data from 29 other Chinese cities that were not under lockdown as a control group. Despite the inherent difficulties in estimating the cost savings from any new emission reductions, ML-based analysis claimed that a policy as stringent as a lockdown has far-reaching implications that extend well beyond the primary purpose of disease control. This is despite the fact that there are inherent difficulties in estimating any cost savings from any new emission reductions. Policymakers need to be aware of these connections when making policy in the continuing battle against COVID-19 and future pandemics. This is because air pollution, COVID-19 and the health of the population more generally are intimately intertwined (Cole et al., 2020).

Conclusion

This article has presented a variety of Machine Learning offerings and benefits in a variety of real-life application areas so that everyone can relate to the plethora of opportunities that arise as a result of incorporating the concepts and techniques of Machine Learning in the process of tackling a wide variety of societal challenges. In the current era of "Big Data," in which a large volume of data is being generated every moment and in which the phrase "Data is the new oil" fits best, it is without a doubt that there is a dire need to apply the concept of Machine Learning and devise ML tools to solve crucial and critical large-scale real-life problems. The bitter truth, however, is that it is difficult to find top venues in the field of machine learning where the output and yield of such machine learning tools are widely accepted rather than simply acting as a test-bed result for the purpose of cross-checking. This is a challenge that has yet to be overcome. Domains such as machine learning and data mining have been widely employed and will continue to be used in many critical domains that touch people's lives on a daily basis. This is

true both now and in the future. The most significant way in which machine learning, as a potentially game-changing technology, is having an impact on the wider world is not via the development of innovative specialized algorithms or theory, but rather through its deployment in a wide variety of applications. Aspects other than algorithms and theory have the potential to be the most essential yardstick for the knowledge discovery process (Rudin and Wagstaff, 2014). As a result of this, members of the research and business communities are making consistent efforts to make a much more significant and beneficial influence on the society by using the many tools and techniques that are associated with machine learning.

Future Work

Over the course of the last two decades, there has been a practical amount of development in the field of machine learning. What was once only a curiosity in the lab has now become a technology that is widely used in business settings. Within the realm of artificial intelligence, the field of machine learning has established itself as the technique of choice for the creation of practical software for computer vision, speech recognition, natural language processing, robot control and other upcoming applications" of this kind. Many people who work on artificial intelligence systems have recently come to the realization that, for many applications, it can be a great deal simpler to train a system by showing it examples of desired input-output behavior rather than to manually program it by anticipating the desired response for all possible inputs. The impact of machine learning has been felt not only throughout the IT industry as a whole, but also across a variety of industries concerned with data-intensive issues. These industries include consumer services, the diagnosis of faults in complex systems and the control of logistics chains, to name a few (Jordan and Mitchell, 2015). The development of improved unsupervised algorithms has the potential to alter the trajectory of machine learning and its influence on society. In order to create a society that is self-sufficient, it will be necessary to solve the complex issues that are present in the actual world, which may be accomplished via the technology of the concepts of machine learning.

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