International Journal of Research (IJR)

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 07
July 2022

IMPACT OF MACHINE LEARNING IN DECISION MAKING OF BUSINESS: A CONCEPTUAL STUDY

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Abstract

In this article we specify the integration of machine learning with artificial intelligence, deep learning, big data and data mining. we also discuss how efficiently machine learning is implemented in satisfying the needs of customers by the companies. Companies have managed to fully automate the process of monitoring employees and their progress to track the overall productivity and morale of the company. Along with this, ML applications have made it easier than ever to be able to predict emerging trends and potential investments in the respective industries. This helps to accurately guide the process of business analytics and business decision making for the betterment of the company. Multiple jobs have been created for the automation and accurate maintenance of this feature including data engineers, business analysts, etc. Machine learning has proven to be extremely effective from a decision-making of business model

Keywords- Artificial intelligence; Data mining; Deep learning; Natural language processing

INTRODUCTION

The name machine learning was coined in 1959 by Arthur Samuel. Tom M. Mitchell provided a widely quoted, more formal definition of the algorithms studied in the machine learning field: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E. "This definition of the tasks in which machine learning is concerned offers a fundamentally operational definition rather than defining the field in cognitive terms. This follows Alan Turing's proposal in his paper "Computing Machinery and Intelligence", in which the question "Can machines think?" is replaced with the question "Can machines do what we (as thinking entities) can do?". In Turing's proposal the various characteristics that could be possessed by a thinking machine and the various implications in constructing one are exposed.

The process involves building a large, all-encompassing mathematical model of the problem at hand and its correlated solutions generated by sample data, known as training data. Machine learning has paved the way for various emerging technologies in various fields from engineering to business. The first question we must ask ourselves is “what exactly is machine learning?” The scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead is called machine learning. It is essentially seen as a sub-set of artificial intelligence.

As of today, machine learning (ML) has seen an emergence in all fields imaginable. Repetitive jobs are slowly being replaced by machines in a process called automation, thereby reducing the workload for upper management as well as boosting the efficiency of the firm at large. More advanced jobs are slowly incorporating elements of machine learning to help aid their respective employees in terms of efficiency and workload. These machines get better at their jobs as time goes on due to the inherent nature of ML algorithms. The more data these machines are exposed to, the more accurate their results get. These ideas have wide-scope applications in various fields such as engineering, computer science, data analytics, and decision-making management in business. What is clear from the advantages of using AI within business is that a majority of companies are actively working on a roadmap for handling data (68 percent), yet only 11 percent of these companies have completed this task. The models which are the most successful today are those which allow certain tasks to be taken over by AI whereby machine learning can acquire more information from and predict consumer behaviour. Current ML models allow for rapid iterations of data and they deliver quick, reliable data sets which impact directly on the culture of work for businesses involved in any sort of real-time analytics, data integration and management, sales/revenue forecasting, and personal security and data processing.

As machine learning has provoked worries in many quarters that our jobs will be replaced by AI, the reality is that machine learning is already merely allowing humans to get on with the more interesting facets of their jobs as AI slogs away at the more mundane aspects of operations such as data mining. It’s time for us to embrace machine learning for what it offers us instead of worrying what it might take away. In the end, we can look to ML as a time-saving device that allows humans to explore their more creative ambitions while ML is in the background crunching numbers and generally taking on the more mundane tasks.

Machine learning also poses a host of ethical questions. Systems which are trained on datasets collected with biases may exhibit these biases upon use (algorithmic bias), thus digitizing cultural prejudices. For example, using job hiring data from a firm with racist hiring policies may lead to a machine learning system duplicating the bias by scoring job applicants against similarity to previous successful applicants. Responsible collection of data and documentation of algorithmic rules used by a system thus is a critical part of machine learning. Because human languages contain biases, machines trained on language corpora will necessarily also learn these biases. Other forms of ethical challenges, not related to personal biases, are more seen in health care. There are concerns among health care professionals that these systems might not be designed in the public's interest but as income-generating machines. This is especially true in the United States where there is a long-standing ethical dilemma of improving health care, but also increase profits. For example, the algorithms could be designed to provide patients with unnecessary tests or medication in which the algorithm's proprietary owners hold stakes in.

OBJECTIVES

1) To explore the possibilities of linking machine learning with business analytics/business decision making.
2) To Examine the impact machine learning has had on the industry.
3) Examine how exactly machine learning plays its part in business intelligence.

LITERATURE REVIEW

Singh and Singh (2013) analysed the relation between machine learning and effective business communication. They acknowledge that in the modern world, business intelligence standards can have effective contribution to make a business sustainable and productive. They stated that machine learning has provided a valuable support system for helping organizations analyse business data as well as processes. Machine learning helps make these processes more streamlined, error-free, and fast. The focus of business intelligence is to determine key business performance measurements, integrate data from disparate systems into an enterprise-wide data warehouse and to plan, budget, forecast with historical, current and future view of business operations. After conducting various surveys and analysing the related data, they concluded that most business intelligence solutions are extremely powerful and must require at least a base knowledge of the underlying data in order to leverage them effectively. With real-time business intelligence, an enterprise establishes long-term strategies to optimize its operations while at the same time reacting with intelligence to events as they occur. They also found that: Machine learning and business intelligence enables businesses to be pro-active in their decision making. Business intelligence gives decision makers access to current, relevant, updated information. Machine learning in business intelligence enhanced organization's ability to up-sell and effectively manage the entire business with intelligent analytics.

Bose and Mahapatra (2001) analysed the concepts of data mining in businesses using machine learning technologies. The objectives of their paper were to inform Information Systems (IS) managers about the role of machine learning techniques in business data mining. Machine learning may be used for data analysis and pattern-matching and hence may thus play a key role in the development of data mining applications. Data mining and machine learning has evolved to play a major role in the facets of business/industry decision making. Their findings confirmed the fact that artificial intelligence can help data-mining applications to produce useful analytical details for all facets of a business. These findings gave way to the discovery of a wide range of data mining techniques that would regularly be used in public spheres in the years to come. For 2001, this was a revolutionary ground-breaking research paper that opened people's eyes to a new kind of technology that would go on to make their lives easier.

Ahmad Khan (2014) analysed the improvement of business decision making technologies with the advent of machine learning techniques. He explained the following findings: Growing technological progressions have given rise to many issues concerning the contemporary decision making in business, which is a difficult phenomenon without Business Intelligence/ Machine Learning. Companies have understood the brilliance of enforcing achievements of the goals defined by their business strategies through business intelligence concepts and with the help of machine learning. It describes the insights on the role and requirement of real time BI by examining the business needs. Abstract Growing technological progressions have given rise to many issues concerning the contemporary decision making in business, which is a difficult phenomenon without Business Intelligence/ Machine Learning. The linking of machine learning with business intelligence is not only pivotal for business decision making but also for the business intelligence in totality, owing to the reason that in absence of machine learning, decision making couldn't take place

efficaciously. Machines need to learn, re-learn, and then only they can help your learning process.

Chid Apte (2010) analysed the role of machine learning in business optimization. He found that there are several trends that show up regarding the applications of data mining in a business environment. His paper highlights these trends and describes the many ways in which leading edge machine learning concepts are being utilized in business applications developed by IBM for its internal use and for clients. His paper also highlights the different methods of data analysis which mainly includes descriptive analytics as well as predictive analytics, he describes Descriptive analytics of data as allowing a user to get a retrospective view on the business, getting answers to questions like "what happened", "how many times", and "where", and predictive analytics as allowing a user to get a prospective view on the business, getting answers to questions like "what could happen", "what if these trends continue", and "what might happen next if..". Prescriptive analytics allows a user to obtain an actionable solution, getting an answer to the question, "what is the set of required actions" to take to achieve a business objective, under a given set of predictions and business constraints. He goes on to describe several case studies that have overwhelmingly demonstrated that businesses dramatically improve their competitive presence by embracing predictive and prescriptive applications to optimize their business decision making. He also states that the ongoing rapid growth of online data due to the widespread use of database technology has driven a new appetite for Machine Learning and Data Mining. The challenge of extracting useful insights from data draws upon research in statistics, data management, pattern recognition, and machine learning. Key advances in robust and scalable data mining techniques, methods for fast pattern detection from very large databases, and innovative applications of machine learning for business applications have come from various worldwide research laboratories.

Niladri Syam and Arun Sharma (2018) analysed the role of machine learning and artificial intelligence in sales research. They suggested that the next few decades will herald the fourth industrial revolution. The fourth industrial revolution will be powered by digitization, information and communications technology, machine learning, robotics and artificial intelligence; and will shift more decision-making from humans to machines. They postulated that the ensuing societal changes will have a profound impact on both personal selling and sales management research and practices. They concluded that in the future, technology will act as an active decision-facilitator and maybe even a decision maker in some cases, that can act in close collaboration with the salesperson to enhance the latter's effectiveness. Predictive technologies will be able to detect patterns in customer behaviour are development of consideration sets, development of preferences and utilities from consumption, social influence, and buying patterns. Companies will be able to use this information to further strengthen their marketing and business strategies. They also describe the potential efficiency machine learning will be able to provide when it comes to designing complex buying centers. Presently, the complexity of buying centers, which includes the size and the variety of stakeholders in it, continues to increase and is very difficult for salespeople to interact successfully with buying centers in this complex environment. They suggest that with the advent of the Fourth Industrial Revolution and the increased use of machine learning and AI algorithms and models can simulate the buying center with all its complexities, and can inform salespeople about the data to use, allowing salespeople to anticipate roadblocks and potential pitfalls when engaging with the buying center. They suggest that the impact of

machine learning and AI on the personal selling and sales management function will be profound.

Soni, Sharma, Singh and Kapoor (2019) analysed the the fast pace of artificial intelligence (AI) and automation that is propelling strategists to reshape their business models. They stated that these technologies are fostering the integration of AI in the business processes but the consequences of this adoption are underexplored and needs attention. The paper focuses on the overall impact of AI on businesses - from research, innovation, market deployment to future shifts in business models. A three dimensional research model was constructed, based upon the Neo-Schumpeterian economics and its three forces viz. innovation, knowledge, and entrepreneurship. The first dimension deals with research and innovation in AI. In the second dimension, the influence of AI on the global market and the strategic objectives of the businesses were explored and finally the third dimension examines how AI is shaping business contexts. Additionally, the paper explores AI implications on actors and its dark sides. They were able to conclude that AI has had a drastic impact on various facets of business management such as the reshaping of the innovative process, the strategic objectives and priorities of businesses, the ease of integration for various start-ups, funding opportunities, customer interactions, and sales platforms. It is evident that AI has the capability of transforming the global economy via technological innovations, scientific knowledge and entrepreneurial activities. The progressive growth of automation and AI in the last decade is attributed to two major factors: the increasing availability of big data and hardware accelerators (GPUs and TPUs). These 26 factors are making AI the core technology responsible for extreme automation and connectivity and thus, taking the world towards the dawn of the fourth industrial revolution. This will have profound impacts on governments, communities, companies, and individuals. The extreme high capability of intelligent agents (IA) in various games, recognition and classification tasks offer opportunities for process innovation as well as product innovation. This is leading to the development of assistive technologies and products for the disable and elderly people. This is also advancing the toy and gaming industry which will enhance the entertaining experience and develop cognitive & emotional intelligence of children. Conclusively, the involvement of the autonomous technology in almost every sector and launch of a large number of AI-based machines and services would improve health, educational opportunities, security, transportation, safety, trade and every other aspect of living. However, there are some security, privacy and ethical concerns associated with the use of AI technology which needs a lot of attention.

Akella (2012) was able to provide methods and systems for knowledge extraction that involve using analytical approaches and combining the analytical approaches with one or more knowledge pro cesses. In some embodiments, these knowledge processes may be related to human-human interaction, device-human interaction, and device-device interaction. Some examples of knowledge extraction are based on combining analytical approaches, such as statistical and machine learning approaches, with business processes and sequences. The disclosed systems may include extraction modules, meta knowledge process based behaviour pattern modules, context and intent modules to characterize emergent behaviour, others to generate relevance by matching context and intent, recommenders to suggest actions or alerts based on the relevant data and potential user relevance and attribution feedback on the effectiveness of the system alerts on actions in influencing user action, updating of recommender systems actions or policies to incorporate this attribution feedback, pre-processing modules, and human input modules (e.g., a crowd-sourcing module) to extract knowledge. The knowledge may be extracted from structured or from unstructured data types. These may also be implemented in real time and may rely on in-memory approaches.

Some examples of such data types include numerical data, geo-spatial data, Social network data, text, speech, image, video, music, and audio. Some implementation examples include product and design processes and services, user data usage pattern mining, service requests delivery, information and knowledge extraction, information and knowledge retrieval, mining of (Social and other) media including blogs for information and knowledge extraction, (online and offline) marketing based on information and knowledge extraction, other uses requiring extraction of refined knowledge in any (business or other) process. One embodiment of the present invention may include instructions executed on a processor which extracts process information from data and stores the information in a repository. On receiving or sensing a request, based on an analysis of the request, stored process information may be selected to respond to the request. Certain embodiments of the present invention allow for the creation of a repository based on the analysis of data, which may then be used to automatically respond to requests. The systems and methods may be used in various domains and industry segments and verticals including but not limited to, automotive, aerospace, business and services such as financial, marketing, support, engineering, accounting, human resources, food, social networks and other forms of social and other media, electronics, computers, semiconductors, telecommunications, networking, Smart and other mobile devices steel, web, ecommerce, e-business, social and other games, healthcare and medical, biotechnology, energy, automation, mechanical, chemical, biological, electrical, oil, gas, petroleum, transportation, mining, automation, manufacturing, equipment, machine tools, engines, and entertainment.

Najafabadi, Villanustre, Koshgoftaar, Seliya, Wald, and Muharemagic (2015) analysed the effect of deep learning in business decision making. In contrast to more conventional machine learning and feature engineering algorithms, Deep Learning has an advantage of potentially providing a solution to address the data analysis and learning problems found in massive volumes of input data. More specifically, it aids in automatically extracting complex data representations from large volumes of unsupervised data. This makes it a valuable tool for Big Data Analytics, which involves data analysis from very large collections of raw data that is generally unsupervised and un-categorized. The hierarchical learning and extraction of different levels of complex, data abstractions in Deep Learning provides a certain degree of simplification for Big Data Analytics tasks, especially for analysing massive volumes of data, semantic indexing, data tagging, information retrieval, and discriminative tasks such a classification and prediction. In the context of discussing key works in the literature and providing our insights on those specific topics, this study focused on two important areas related to Deep Learning and Big Data: (1) the application of Deep Learning algorithms and architectures for Big Data Analytics, and (2) how certain characteristics and issues of Big Data Analytics pose unique challenges towards adapting Deep Learning algorithms for those problems. A targeted survey of important literature in Deep Learning research and application to different domains is presented in the paper as a means to identify how Deep Learning can be used for different purposes in Big Data Analytics. The low-maturity of the Deep Learning field warrants extensive further research. In particular, more work is necessary on how we can adapt Deep Learning algorithms for problems associated with Big Data, including high dimensionality, streaming data analysis, scalability of Deep Learning models, improved formulation of data abstractions, distributed computing, semantic indexing, data tagging, information retrieval, criteria for extracting good data representations, and domain adaptation. Future works should focus on addressing one or

more of these problems often seen in Big Data, thus contributing to the Deep Learning and Big Data Analytics research corpus

COMPANIES THAT IMPLEMENTED MACHINE LEARNING TECHNIQUES IN THEIR CUSTOMER SATISFACTION INDICATORS:

NAME OF THE COMPANY	ML TECHNIQUE IMPLEMENTED
Amazon (E-commerce)	Combination of ANN and NLP
Zomato (Food Delivery)	Chatbots that use ANN
Microsoft (Tech Giant)	NLP over phone calls and the use of artificial chatbots.
Flipkart (E-commerce)	Automated Email Responses using ML and ANN
Swiggy (Food Delivery)	Chatbots that use ANN
Apple (Tech Giant)	NLP Chatbots
Uber (Transport)	In-app NLP Chatbot to connect to support line.
Pizza Hut (Food Delivery)	ML Algorithm to receive details of customer order
Alibaba (E-commerce)	AI-influenced algorithm to generate product descriptions to customer
Grofers.com (Food Delivery)	ANN and ML-influenced methods to generate bills/recommended items
eBay (E-commerce)	ML algorithms used to track customer history and recommend products
Facebook (Social Media)	ML and ANNs used to generate targeted ads
Instagram (Social Media)	NLP Bot used to handle ad targeting and social media
Google (Tech Giant)	ANNs, ML and AI used for targeted ads and browsing recommendations.
Ola (Travel)	In-app NLP Chatbot
PayTM (E-commerce)	NLP Chatbot for interactions
Phone Pe (E-commerce)	ML-algorithm to connect to support line

Facebook's Deep Learning translation model uses a neural network-based system that employs long short-term memory (LSTM) networks to analyse and translate whole sentences rather than word-for-word, with which the company's previously used phrase-based system worked. PayTM's AI-based routing engine also uses big data analytics to provide merchants with a comprehensive analysis of their sales, transactions, and success rates in an easy-to-refer dash board.

DISCUSSION

The business industry applications of machine learning has evidently made huge strides in speeding up the pace of work, automation of processes and increasing the accuracy of results.

This study has identified five main AI-related technologies that have influenced the business industry in a major way. These are:

1) Image Recognition
2) Speech Recognition
3) Chatbots and ChatOps
4) Natural Language generation
5) Sentiment analysis

Image Recognition seeks to be able to identify products/people/objects automatically and generate models/reports with analysis for the accumulation of relevant statistics. It may also be applied for security purposes in small scale shops/industries and to estimate damage costs with respect to insurance.

Speech Recognition plays a large role in tailoring the recommendations of products to various customers based on certain speech patterns and interactions with the system. Automation of closed captioning on videos has also been a major application of the advancement of speech recognition technology.

Chatbots and ChatOps help in the representation of a company's brand and also are able to serve as the first point of interaction between a new client/customer and the company. The automation of commonly asked questions/answers help save the business a lot of money/effort in the long run. It may also be used internally to help document communications between the different departments in the company.

Natural Language Generation is a useful tool in appealing to customised needs of a customer. Customised product descriptions can be generated based on the customer's needs, expertise and native language. Explanations of graphs and metrics in analytics reports can also be fully customised and generated for the purpose of internal reports.

Sentiment Analysis is useful for the building and maintenance of the relationships between customers/clients and the company. It helps to analyse how a major change in a product/service is received among the customers. The more subtle aspects of the business-client relationship is also analysed in full detail with this technology. These include the discovery of important trends in customer behaviour, identifying specific causes of a decline in sales and the identification of emotion in facial expressions and voice.

A company such as Facebook (Meta) or Amazon has applied techniques such as the five above to broaden their reach and influence beyond imagination. Advertisers using the Facebook platform have been able to reach out with their products to a huge list of customers with relevant interests/needs/hobbies. Amazon has built a product recommendation system that is accurately able to predict what a customer would need based on his past purchases and items he/she has viewed

CONCLUSION

Thanks to the relentless efforts made by researchers and scientists in the field and around the world, machine learning has seen a thorough emergence in business with the purpose of maximization of profits and efficiency. Emerging trends in the market have been accurately predicted and reported, giving a massive upper hand to companies that are looking to have one foot in the door pre-emptively. Recent literature on machine learning and its applications

have emphasized on multiple techniques of information collection and identification. This has seen widespread application with Google and its related products. The degree of accuracy with regards to recommendations of restaurants/products/services has skyrocketed over the past decade due to deep learning. The depth of personalisation and customisation available to customers and clients with regards to products and services have also reached unprecedented heights.

As a result of machine learning, some of the widespread applications have seen its use in:

1) Transport and Communication: Uber has developed several algorithms to map the shortest distance between locations. Tesla has released a fleet of self-driving cars that use ML algorithms to safely develop a route between locations.
2) Deep image recognition: Instagram has used this for the 'tagging' of different people in images of themselves.
3) Virtual Assistants: Amazon has applied tools such as voice recognition and sentiment analysis to develop Alexa, a virtual assistant used for everyday tasks relating to business and the home.
4) Online Video Streaming: Netflix has experimented with various recommendation engines in order to make sure each customer gets the best tailored content according to their likes/dislikes.

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