

# **A review of the recent trends in the use of machine learning in business**

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## **Abstract**

A review of recently available literature on the use of machine learning in business was conducted. In order to find the relevant literature, first, a search protocol was designed. This protocol was then applied to the open source Google Scholar search engine and results were then subsequently narrowed down using a number of criteria. It is important to note that due to the relatively nascence of the field of machine learning and the relative abundance of available literature, the search was restricted to those articles published in the period of 2017-18. Five search results were selected to be further elaborated and understood. The chosen research works covered an array of aspects of the business work. These included workforce, customer engagement, scalability, operational efficiency and selection of leadership. It was observed that there was no unified or agreed upon definition of machine learning that was used by all researchers. Moreover, it was also evident that there wasn't outright agreement from all researchers whether machine learning would have a positive or negative impact on businesses, be it on business operations, efficiency or profitability.

**Keywords:** Machine Learning, Applications, Business, Review

## **Introduction**

The advent of computer and internet technology has led to numerous breakthroughs in the fields of science, medicine, law, and business, to name just a few. Moreover, the rapid acceleration of breakthroughs in the field of internet and computer technology has also shifted how the future may look in a very short period of time.

One of the most significant potential areas of future innovation is in artificial intelligence. In this arena, the latest trending topic is that of 'machine learning', whereby computers essentially begin to learn in a similar way to humans, by using experience as a teacher.

The aim of this review is to explore recent literature in the field of machine learning and its applications and trends in the field of business. In order to achieve this, a search protocol to look for relevant research was constructed. This protocol was then applied and the results generated were narrowed down to a manageable number. Care was taken to ensure that the research works chosen were very recent. The results were then analysed further and certain observations and conclusions were drawn.

## **What is Machine Learning?**

In order to move forward with the review, it is important to clarify what is meant by the phrase machine learning.

There is no unified definition as to what constitutes machine learning. As the field is still evolving, there are a few different explanations for the phrase. According to one explanation, machine learning is when machines are built such that they can learn without explicitly being programmed to do so and can be considered an approach to artificial intelligence (Dormehl,

2018). The idea is that machines can start to learn the way that humans do, that is, learn experientially. A different, yet similar explanation posits that instead of a computer or system being programmed through a step-by-step process, through a machine learning approach, the computer or system, through an algorithm, learns directly from the data, without the intervention of a programmer who can provide step-by-step instructions. (Internet Society, 2017)

As stated previously, machine learning has universal applications, and is now visible in almost every aspect of life, from education and scientific innovation, to user interfaces on e-commerce websites. As such, machine learning has enormous implications for the world of business and entrepreneurship. The aim of this paper is to specifically explore literature pertaining to the use of machine learning in the field of business.

## **Methodology**

In order to narrow down a manageable set of research works to review, a protocol to search through existing works was designed. In this section, a description of the search protocol will be provided.

First, it was decided that the search would be conducted via open sources on the internet rather than through searching dedicated digital libraries that store scholarly works. Therefore, the open source search engine Google Scholar was employed to conduct the search.

Several different compound search terms related to the topic at hand were entered into the Google Scholar search engine to generate results. These compound search terms are listed below in quotations, in no particular order.

“machine learning and business”

“trends in machine learning and business”

“impact of machine learning in business”

“use of machine learning in business”

“value of machine learning in business”

For each compound search term, the results generated were sorted in a few different ways. First, the search engine was set to only include results from the period of 2017-18. As the aim of the paper is to look into recent research works in this arena, and also due to the fact that the topic of machine learning is being subjected a significant amount of scholarly scrutiny, it was decided that only research published in the period of 2017-18 would be considered. Second, only the most relevant search results could be considered in order to fit into the narrow scope of a review paper. Therefore, only results in the first four pages of each search were considered. As each page had a total of ten search results, and five different compound search terms were used, in total, around two hundred articles were looked into. Last, of the two hundred results that were considered, only five articles in total were chosen to be reviewed and analysed further.

Details of the final five research works are provided below.

## Results

Five research works were chosen to be analysed further as part of the review.

The first paper was based on the premise of creating a model to help a firm, enterprise or business, choose directors to sit on its board, by using machine learning. The authors, Léa H. Stern, Isil Erel, Chenhao Tan and Michael S. Weisbach, through their work, developed algorithms that were specifically geared towards selecting the most useful directors for the board of a business firm. In order to create these algorithms, specific parameters, such as shareholder support for candidates and profitability of the business. The algorithms were designed to predict the efficacy or usefulness of any director. The algorithms were then implemented in order to test the predictions or outcomes. These predictions were compared to a realistic sample of rankings for potential directors. The results of the test showed that the directors that were predicted to by the authors' algorithm to fare poorly also ranked lower in the list of rankings. The authors concluded that machine learning had a great deal to offer and held promise in order to help learn how the governance structures of firms were chosen and also could, in the future, help businesses pick their leadership and improve their performance by choosing the best governance. (Stern, Erel, Tan, & Weisbach, 2017)

The second research work selected focused primarily on the usage of machine learning in business industries and its significant impact. Written by author Ashish Shrivastava, the paper on this issue, especially in regard to the potential for drawing valuable information, analysis and insight from large quantities of raw data and how this potential may be used to solve problems faced in business. The author posits that machine learning is such a fast-evolving discipline that it can aid in scalability of business, help solve complex, data-rich problems and improve operations around the world. The author also delves into the issue of business analytics and how machine learning has gained a significant foothold in this area. Shrivastava believes that easy access to mass quantities of data, affordability in accessing and maintaining records of large quantities of data and improvements in technologies associated with computers have led to a boom in the field of machine learning. In conclusion, he states that businesses now have the wherewithal to use machine learning to better understand their own processes and improve the same. (Shrivastava, 2018)

The third reviewed work was based on the idea of using machine learning in one specific industry, i.e. that of hospitality and hospitality management. The work, by authors Ajay Aluri, Bradley S. Price and Nancy H. McIntyre, is based on the premise of "using machine learning to co-create value through dynamic customer engagement in a brand loyalty program". According to authors' research, hospitality programs have, until now, relied on historical data that has been provided by the customers themselves, to manage the relationship between the provider and customer. In order to test the merits of machine learning intervention in this process, the authors selected a hospitality venue that was considered a major one. The authors then compared results from machine learning and from traditionally used methods to check the customers' preferences in loyalty programmes implemented by the venue. The authors' results revealed that machine learning provided improved systems and processes in finding the customers who valued specific promotions or rewards provided by the hospitality venue, when directly compared to the results obtained through traditional means. (Aluri, Price, & McIntyre, 2018)

The fourth research work selected for analysis focused specifically on the issue of scaling machine learning a service that businesses can then use. According to the authors, Li Erran Li,

Eric Chen, Jeremy Hermann, Pusheng Zhang and Luming Wang, machine learning has the potential to deliver success to business enterprises by providing them with business intelligence gained through the mining of big data. In particular, the authors discussed Machine Learning as a Service or MLaaS. The focus of the work is scaling machine learning as a service, with an additional challenge of helping this answer important questions in real time. The authors built a scalable MLaaS that they had built for the global transportation company Uber. According to the authors, they focused on several challenges that came with scalability, including, building accurate models given the wide variance in the data (such as individual city or regional characteristics as the company operates in multiple geographies), deploying the scalable model and having to answer to real time problems across the globe in multiple settings. The authors designed a scalable solution with these challenges in mind, with the aim of providing a framework that can manage and train a hierarchy of model as a single logical entity. (Li, Chen, Hermann, Zhang, & Wang, 2017)

The final article that was analysed was focused on the workforce implications of machine learning. This avenue of research was chosen by authors Erik Brynjolfsson and Tom Mitchell as due to the enormous leaps in machine learning, the pace of automation may increase, affecting the workforce. According to the authors, machine learning is a ‘general purpose technology’ whose advent will likely lead to numerous innovations, much like the advent of electricity did. As there is no agreed upon list of tasks that will benefit from the use of machine learning, the authors believe that the potential impact on the workforce from increased usage of machine learning is as yet uncalculated. Through their paper, the authors argue that the overall accepted wisdom that machine learning will result in the substitution of automation for human jobs, leading to a negative implication for the workforce, is too simplistic. In fact, the authors argue that the situation may be more complex as while some aspects of certain tasks could use machine learning, other aspects of those same tasks may not benefit from machine learning. However, the authors believe that while in the present day the effect of machine learning on the workforce may not yet be evident, in the future, this is not likely to be the case and in fact, machine learning may have a major impact. (Brynjolfsson & Mitchell, 2017)

## **Discussion and Conclusion**

The systematic review produced interesting results as well as certain observations that are listed below in this section, in no particular order.

It is clear that from the diversity of research topics that machine learning has the potential to impact numerous aspects of business, including some of the areas covered here, such as workforce, customer engagement, scalability, operational efficiency and selection of leadership. It is likely that other research works focused on still other aspects of business that may be impacted by machine learning and its growth in the business sector.

Another aspect that was brought out clearly through the systematic review is the fact that there does not yet seem to exist a unified definition for machine learning that all scientists can use. It is likely that the nascence of the subject matter and its ever-evolving nature have proven to be an obstacle in the acceptance of any single definition of the core subject.

Possibly the most significant observation is that there is no blanket agreement that machine learning will improve business practices and profitability. This is likely an area of widespread conversation in the coming years in the business world as conventional wisdom states that

increased reliance on computer technology and automation is not only inevitable but also likely to increase efficiency, reduce overheads and ultimately be more profitable.

All of the researchers seemed to agree that machine learning had great potential and more research needed to be done in order to determine the impacts of machine learning on the specific aspect of business they had focused on. They also seemed to imply that the increased use to machine learning was inevitable and likely to continue to grow in the business sector.

All of the researchers also had to contend with the rapid evolution of the field of machine learning, meaning that practices that they were studying could become outdated very quickly. This is something that future researchers may also have to contend with. Due to the almost daily changes in the field of machine learning and also in the field of big data, the rapidity and speed of changes not only lend themselves to study, but the impact of this rapid change on machine learning practices in business may also be an avenue for study.

It is also important to list the limitations of this review. Given the scope of a short review article, only a certain number of articles were considered, as detailed in previous sections. Moreover, as explained previously, only articles from the period of 2017-18 were considered, leaving out any valuable insights that may have been present in research published previously. This step was taken to look into the most recent scholarly works published in this area. Moreover, since no further specifications were sought to narrow down the research results, this review presents an overview of the general research conducted in this area, rather than on one specific aspect or geographic or regional specialization.

Given these observations and limitations, it is imperative at the end of this review to also state that there is an abundance of areas for future research to be conducted. It may not be possible to determine outright through research means whether machine learning will improve or decline business practices and profitability. However, it may be possible for the effects of machine learning on specific aspects of business, or in specific geographies, or, for that matter, even in specific tasks. This is where a lot of research may concentrate.

It is also important that research concentrate on the impact of machine learning on not only businesses, but on the overall impact of the increased use of machine learning on the overall global economy.

However, it is also important that research be focused on finding common definitions for all aspects of machine learning so that future research can be more focused. This is an area where more work may be done.

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