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How Artificial Intelligence and Deep Learning led to a Breakthrough in Marketing and Consumer Behaviour: A Review

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Abstract - *With the augmentation of technology around us, it is safe to assume that Artificial Intelligence will break into every field in the upcoming years. Artificial intelligence cannot be labelled as 'one' thing but is an amalgamation of several technologies namely Machine Learning, Deep Learning, Natural Language Processing et cetera. The landscape covered by AI (Artificial Intelligence) is vast and hence its uses are also varied. Intelligent systems have been for a long a subject of anticipation within the scientific community. However, recently it has been identified that it has the potential to redefine businesses and help them develop at a rate not seen before. Since it employs the use of data and and technology, it can be used in a variety of fields like Consumer behaviour, Marketing, Finance and supply chain. The objective of this paper is to first study the emergence, and uses of AI in the field of Marketing and Consumer Science, and then second to review the various research models/ work conducted in the field. This paper will include a detailed report of the past work as well as some future insights or suggestions germane to the scope of this paper.*

Key Words: **Marketing, Technology Management, Artificial Intelligence, Consumer Psychology, Consumer Behaviour**

I. INTRODUCTION

Integrating technology with business is not a new notion, it has been happening since a really long time, possibly centuries. In fact, due to these technologies businesses are able to come up with new strategies to help them achieve their growth objectives. For instance, marketing takes the advantage of various technological advancements to come up with more reliable strategies of brand promotion. The ecosystem provided by artificial intelligence to the field of marketing and advertisements has till now proved to be the most helpful in terms of customer outreach and customer feedback analysis. With time it has been observed that technology is getting more decentralised and hence is accessible by more and more people (Bijker, Hughes, & Pinch, 1987). Keeping this in mind it can be safely concluded that technology plays a big role in appeasing the problems faced by companies on day to day basis.

The purpose behind choosing go forward with the research was pretty simple. We wanted to highlight the advantages of integrating Artificial Intelligence with business and to review other works pertinent to the field to provide a concise yet compelling analysis of all the intelligent systems that have been integrated with businesses in the past. Since the use of data all over the world has augmented at an exponential level, companies are adopting artificial intelligence at a faster level. If done the right way, Artificial Intelligence can be very fruitful for the businesses. One major advantage of the technology is that employees are able to save 70% of their time [1]. Adding to this companies have also observed that they are able to scale 3 times the investment they had directed towards Artificial Intelligence. Adding on to its efficiency, the accuracy of its results has also garnered appreciation from the scientific and social communities. Since it uses data which has been procured from near past, it is able to deliver results which are precise and worthy of being worked with without second guessing.

Though Artificial Intelligence has taken over the world in a very short time, it is still appalling to know that some businesses, which can make great use of this technique and boost their profits by at least 3 times, have meagre understanding of this concept. A research report published by Accenture on November 14th, 2019 [1]

States that even though 84% of the c-suite executes believe that they should employ artificial intelligence in their company's working 76% of them still struggle with how to use the technique. In fact, 75% of the executives are scared that if they don't start working with Articifcial Intelligence in the next five years, it might drive their company to obscurity.

II. BACKGROUND

Delving deep into the concept, artificial intelligence consists of various technologies that allow the computer to sense, understand and then accordingly act. It encompasses of many techniques like machine learning, computational intelligence and natural language processing to name a few. Since it has such a variety within it, we can't really label any one particular technology as artificial intelligence.

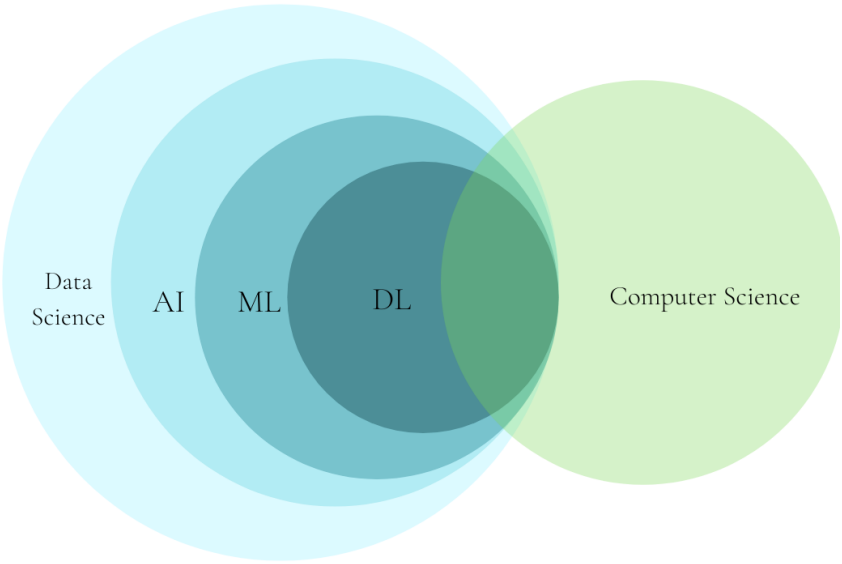

Fig 1. Basics constituents of Artificial Intelligence

From the above image one can conclude that artificial intelligence is an extremely complicated field. Artificial intelligence in the most layman terms can be explained as any system trying to replicate human intelligence. Machine learning can be described as making machines learn large and analyse large amount of datasets. Further diving deep, Deep learning is that aspect of machine learning that uses neural networks. Data science does require the use computer science and Artificial Intelligence but we cannot count it as a subset of Computer Science because it requires expertise from the field of Statistics, Business and law.

In this paper we follow the definition following definition (Arnaud De Bruyn, Vijay Viswanathan, Yean Shan Beh, Jürgen Kai-Uwe Brock, Florian von Wangenheim, 2020) "machines that mimic human intelligence in tasks such as learning, planning, and problem-solving through higher-level, autonomous knowledge creation". We do so because we believe that the definition has the following advantages: a) It indicates the three specific tasks

Artificial Intelligence in capable of doing, b) It explicitly states that the system doesn't contain any intelligence of its own and rather mimics humans, and c) it circumscribes artificial intelligence to independently generated knowledge constructs.

However, we believe that much attention should be paid towards what Artificial Intelligence enables us to do. Artificial Intelligence provides its users with end-to-end efficiency by removing friction in the data has significantly reducing the cost. Furthermore, it is capable of working autonomously and has almost negligible maintenance needs. It has also been known to assist humans with decision making. One thing that caught our attention was that these intelligent systems are able to tackle quotidian tasks, giving more time to the employees to focus on tasks which require their direct attention.

We identified several fields where intelligent systems have been used namely: Supply chain management, Organisational behaviour, Pricing strategies, Product management, Ecommerce, and B2B communication strategies.

On the basis of our extensive research we were able to draw the following conclusions:

- The last two decade saw a spur of research papers published on the application of Artificial Intelligence in industries. (Francisco J. Martínez-López ,Jorge Casillas, 2013)

- The life real application of this technology in management is still scarce.

III. LITERATURE REVIEW

III. A) ***Li, S. (2000). Development of a hybrid intelligent system for developing marketing strategy. Decision Support Systems.***

The researchers proposed an ad-hoc intelligent system comprising of artificial neural networks, fuzzy logic and decision support system which will work towards developing marketing strategies. It includes providing a coherent strategy development process, help employees deal with the uncertainty and erratic nature of marketing. Adding to this it also provides support group to assess marketing strategies. The Artificial Neural Network predicted the growth of the market and fuzzy-rule based system was responsible for managing the uncertainty of the field. This model was put into real time use with marketing managers and the results produced were of great use. The system was able to aid the process of marketing strategy development. The performance of this system was surprisingly accurate and very credible and reflected managerial acuteness.

III. B) ***Metaxiotis, K. S., Psarras, J. E., & Askounis, D. T. (2002). GENESYS: An expert system for production scheduling. Industrial Management & Data Systems.***

This research put forward a rule based system called 'GENESYS' fine tuned with optimisation algorithms. It was developed with the purpose of helping the production of SME taking the following criterions into account: production characteristics, constraints, performance criteria. The result was increased automation which increased the efficiency of the employees. It also helped in improving the production quality and decision making process.

III. C) ***Li, S. (2007). AgentStra: An Internet-based multi-agent intelligent system for strategic decision making. Expert Systems with Applications.***

This ad-hoc intelligent system has proved to decrease the cognitive load and help the managers come up with better marketing strategies. The parameters used to judge this system was efficiency, accuracy and complexity. It resulted to be more effective than the survey method employing paper-based questionnaire. The multi-agent internet enabled prototype system was named AgentStra and was built with the aim of developing marketing strategies, consumer feedback analysis, and e-commerce upliftment strategies.

III. D) ***Lin, P. -C., Wang, J., & Chin, S. -S. (2009). Dynamic optimization of price, warranty length and production rate. International Journal of Systems Science.***

The authors of this paper proposed a model-driven Decision making system. It helped in making decisions for optimising production rate, warranty rate, and product pricing. The aim was t gain the maximum profit over the entire lifecycle of the product. This paper employed an AI based system to helps the users gain new insights on the complex codependencies of the decision making process. Decision making support system has been employed to determine the paths for price, product warranty length and production rate. To optimise the process the paper has made use of dynamic programming.

III. E) ***Chan, S. L., & Ip, W. H. (2011). A dynamic decision support system to predict the value of customer for new product development. Decision Support Systems***

The project was aimed with the objective to study the customer purchasing pattern given a certain product. It also proposed a model to study the marketing influences and the behaviour of a customer towards purchasing a particular product. The model proposed in the paper enables a more efficient decision support system. It provides accurate solutions and companies, which develop products that are competitive, can make use of the proposed model. The system showed to be useful in various ways - It was able to accurately compare competitive alternatives of the product for which the system in being used. It was able to properly understand consumer psychology and sentiments, which will enhance the profits generated by the selling of the product. Idea generation saw improvement.

IV. CONCLUSION

One of the biggest strengths of artificial intelligence is to identify the relationship between complex data and generate constructs of higher degree from raw data. There has been identified a lack of common sense in such systems (Arnaud De Bruy & Vijay Viswanathan & Yean Shan Beh & Jürgen Kai-Uwe Brock & Florian von Wangenheim, 2020). The systems only adhere to a set of rules for which the model has been trained. Thy don't obey any rules that are perhaps considered as 'given' or are 'unsaid'(A. De Bruyn, V. Viswanathan, Y.S. Beh, et al.

2020). Most of the challenges have risen due to the inability of the information system to transfer knowledge efficiently between the expert user and the model. However, where artificial intelligence does have weaknesses, it also has its strengths.

Artificial Intelligence has made way for new technology to emerge (Li, B.H., Zhang, L., Chai, X.D., 2014).

Important areas of intelligent systems have made groundbreaking. High end machine tools, intelligent instruments, computerised industrial robots (Miao, 2016). AI has given way to digital audio which has enabled it to track campaigns on digital media to create better user experience (Cramer, 2017). All thanks to such advancements, the marketing domain if also flourishing.

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