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Applications of Data Science and AI in Business

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Abstract: Just like natural human intelligence, Artificial Intelligence (AI) can be explained as the intelligence demonstrated by machines, or rather how the machines and models are trained to predict outcomes and give answers in a way that mimic human intelligence. The goal of artificial intelligence is to provide software that can reason on input and explain the output through its various methods. Artificial Intelligence has found its applications in almost every sector in every industry – ranging from finance to marketing to general business management. Similarly, Data Science deals with decision making based on the insights gathered from data analysis rather than merely replying upon the decision maker's intuition and experience. This paper explores with how Data Science and Artificial Intelligence has transformed the way businesses operate and hence changing the strategic decision making and operations landscape in medium scale as well as large sized businesses.

Keywords: Data Science, Artificial Intelligence, Business Analytics, Neural Networks, Recommender Systems.

I. INTRODUCTION

Artificial Intelligence (AI) is the endeavour to simulate human intelligence in machines. AI is a wide branch which encompasses various other domains in computer science, such as Artificial Neural Networks, Machine Learning, Natural Language Processing, Image and Speech Recognition, Robotics, Smart Sensor Technology and many more. Data Science is the study of various trends in data in order to gain useful information for the purpose of making key decisions in business.

Artificial Intelligence is a significant advancement in the technology that helps not only to reduce costs, but also increase revenues. In today's modern businesses, many business applications ranging from applications used in legal departments to marketing, have been built using AI. The predictive models could be integrated into real estate prices estimations, stock exchange prices, financial and accounting models, market prediction models and to some extent sentimental analysis which gives how consumers react to a given product. It is used by marketing agencies for market research analysis, in medicine to detect cancer and malign tumours and by entertainment companies to build recommender systems. The telecommunication industry has also found several AI use cases to improve customer experiences.

II. AI IN FINANCE AND BANKING

Other than the technology sector, the financial services industry is one of the largest spender [1] on AI services and is growing very fast. Up until recently, Hedge Funds and HFT firms were the main users of AI in financial services, but its applications have now spread to other related areas including banks, regulators, insurance firms, Fintech and many others. Within the financial services industry, AI applications include fraud detection and compliance, algorithmic trading, portfolio composition and optimization, virtual customer assistants, algorithmic trading, market impact analysis, regulatory compliance and stress testing. AI is particularly helpful in Corporate Finance, as it helps to predict and reduce loan risks. AI is used to identify fraud, detect anti-money laundering (AML) patterns and make customer recommendations [2]. One of the major applications of AI is stock market prediction. In 2016, $16 billion dollars was stolen due to fraud and identity theft, which is why it's one of the biggest applications in AI. Insurance companies use it to create policies and predict insurance fraud. With e-commerce becoming more widespread, online fraud has also increased. A number of banks have had hefty fines imposed upon them as they failed to stop illegal financing, and in turn, a lot of these banks have adopted AI techniques in order to improve their operations. One of the simplest ways to detect fraud is "Benford's Law". It involves running an analysis on the first digits in a given dataset. A predictable distribution of first digits will be in a set of real data. AI is helpful here as Machine Learning (ML) algorithms have the capability to analyse millions of data points for detecting fraudulent transactions that may tend to go unnoticed by humans. At the same time, machine learning helps to improve the accuracy of real-time approvals and also reduces the count of false rejections. With the help of ML techniques, fraud detection systems can actively learn and regulate their response to new potential or real security threats. Using various machine learning methods, banks can detect unique activities or behaviours that are very uncommon (a.k.a. anomalies) and flag them for investigation. One of the most common applications of machine learning algorithms is credit card fraud detection. Banks have historical payments data that the ML models are trained upon. Algorithm training, back testing and validation are based upon massive datasets of credit card transactions. Classification algorithms label events as "fraud" or "non-fraud", taking into account factors and fraudulent transactions can then be put to an end in real time.

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A. Case Study: JP Morgan Bank

JP Morgan implemented a program called COiN – Contract Intelligence that uses unsupervised machine learning to automate mundane and typical tasks done by lawyers and loan officers at the firm such as interpreting commercial loan agreements [3]. The main technique used for this purpose is image recognition where the software compares and differentiates between different agreements. The algorithm can identify patterns based on wording and locations in the contract. COiN runs on an ML system which is powered by a new private cloud network that the bank uses to automate the document review process for a particular class of contracts. It is estimated that lawyers and loan officers at JP Morgan Chase spent 360,000 hours each year doing these tasks which is now done in seconds by the COiN algorithm. Hence, besides saving thousands of person-hours, the AI software is also more cost-efficient and less prone to errors.

III. AI IN MARKETING

AI is often used in marketing where speed and precision are important. Various AI tools such as automated chatbots, and personalized emails are leveraged to send current consumers and prospective customers tailored messages at the right time without intervention from the marketing team members of an organization, ensuring maximum efficiency [4]. It is also used to analyse the history of purchases and anticipate the next move of the customer. AI is used to craft special personalized advertisements and offers by gaining insights from data and spotting behavioural trends. Market Research is the branch of marketing which heavily relies on manual customer inputs for various aspects of the product or service to later analyze it and create marketing budget as well as new offers based on the answers. It also includes surveys, feedback forms and sample of products. Data Science and AI in Market Research is a major game changer as, unlike traditional market research methodologies, it accounts for the entire customer journey, right from the ad view, to the first click to the satisfaction survey.

A. Tools Used

Google Ads and Google Analytics are one of the single biggest tools utilized in the marketing industry. It provides consumer insights which can not only be analyzed by Google Analytics' built-in Data Studio, but also supports the creation of interactive dashboards and reports which can be exported to various formats. Various software that assists in dashboard creation such as Tableau and Microsoft's Power BI are used by market researchers to analyze and plot trends on graphs. Free datasets for specific industries are found on websites such as Kaggle, FRED and the University of California's ML repository which are used to get patterns. From Marketing perspective, neural networks are effective in gathering and extracting information from large data lakes [5].

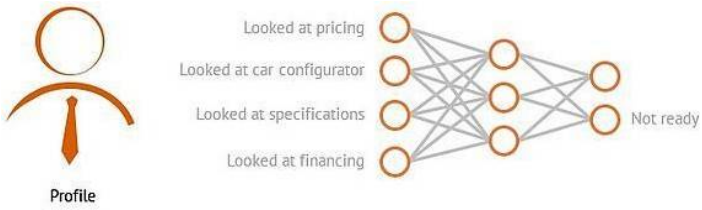


Fig. 1: Neural Networks in Marketing [6]

IV. AI IN ENTERTAINMENT INDUSTRY

Artificial Intelligence is used in entertainment industry, especially on online TV streaming services and OTT (over- the-top) platforms such as Netflix, Amazon Prime Video, Disney Plus, Hulu, etc. AI tools such as Recommender systems, software for Process Improvement, Cognitive AI for increasing customer engagement, retention and satisfaction are used. AI in this domain also helps in digital rights, IP and royalty management [7]. AI based models and analysis helps bots to digitize, automate and analyse the meta-data attributed content. New developments in AR/VR are also due to the advancements in Artificial Intelligence. From e-commerce (suggest to buyer's products or articles that could interest them) to online advertisement (suggest to users the right contents, matching their preferences), recommender systems are today unavoidable in our daily online journeys. Machine Learning can recommend personalized content based on the user data preferences [8]. These "recommendation engines" or "recommender systems" are specialized piece of software or code written in a modern programming language, popularly Python or R, which does the task of taking user data input such as movies or TV series or product browsed and then recommends those similar products to the user. Amazon reports success of more than 60% due to the use of recommendation engines. There are three main types of recommender systems:

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1) Content-Based Filtering
2) Collaborative Filtering
3) Hybrid Recommendation Systems

A. Content-Based Filtering

Content-based methods for recommender systems are methods that are based purely on the past interactions between the user and items in order to produce new recommendations. The main idea here is that past interactions of the user with the items is enough to predict future preferences and produce new recommendations. The main advantage of this method is that they require no information about users or items so they can be sued in many situations. However, since it only considers past interactions, it is impossible to recommend anything to new users or to recommend a new item to any user. Sometimes, there are too little interactions between users and items in order for them to be efficiently handled.

B. Collaborative Filtering

Unlike content-based filtering methods, Collaborative filtering approach uses additional information about users and items. It creates a user-item matrix, which takes into account all the users with similar preferences and their interactions with various items, then run the obtained results through an algorithm. Based on the algorithm's efficiency, relevant suggestions are made. As compared to content-based filtering method, this is a much better system to implement for a recommender system.

C. Hybrid Recommendation Systems

Hybrid filtering methods use both the above-mentioned approaches and can take mainly two forms: we can either train two models independently (one collaborative filtering model and one content-based model) and combine their suggestions or directly build a single model (often a neural network) that unify both approaches by using as inputs priorinformation (about user and/or item) as well as “collaborative” interactions information. Hybrid approach isused by many large- scale recommender systems.

V. AI IN HUMAN RESOURCE MANAGEMENT

The role of the HR Department is to ensure that every employee is getting the required help and provide them space for creativity, intelligence, and empathy to increase productivity. Artificial intelligence has helped a lot in improving the processes of HR. It automates and completes the low-value tasks so that attention may be focused on the strategic scope of work. Artificial Intelligence as a technology has an emerging role in the different HR practices involving talent acquisition and assessing the performance of the people at the work place. It begins with automated process in recruitment and extends to performance appraisal of employees. Many human resource executives and organizational leaders have a firm belief that merging artificial intelligence (AI) into HR functions like sorting CVs of candidates, automated screening of these CVs, on-boarding of selected candidates and administration of benefits will improve the overall employee experience [9]. AI is seen facilitating in recruitment process with least interference by humans by sending automated messages and helping in conducting reference checks. Above all, machines were observed to have a better performance then HR team members by reducing the attrition rate and improving talent retention. AI has been successful in carrying out simple activities of HR but how far it can take up complex issues of HR is yet to see.

VI. CONCLUSION

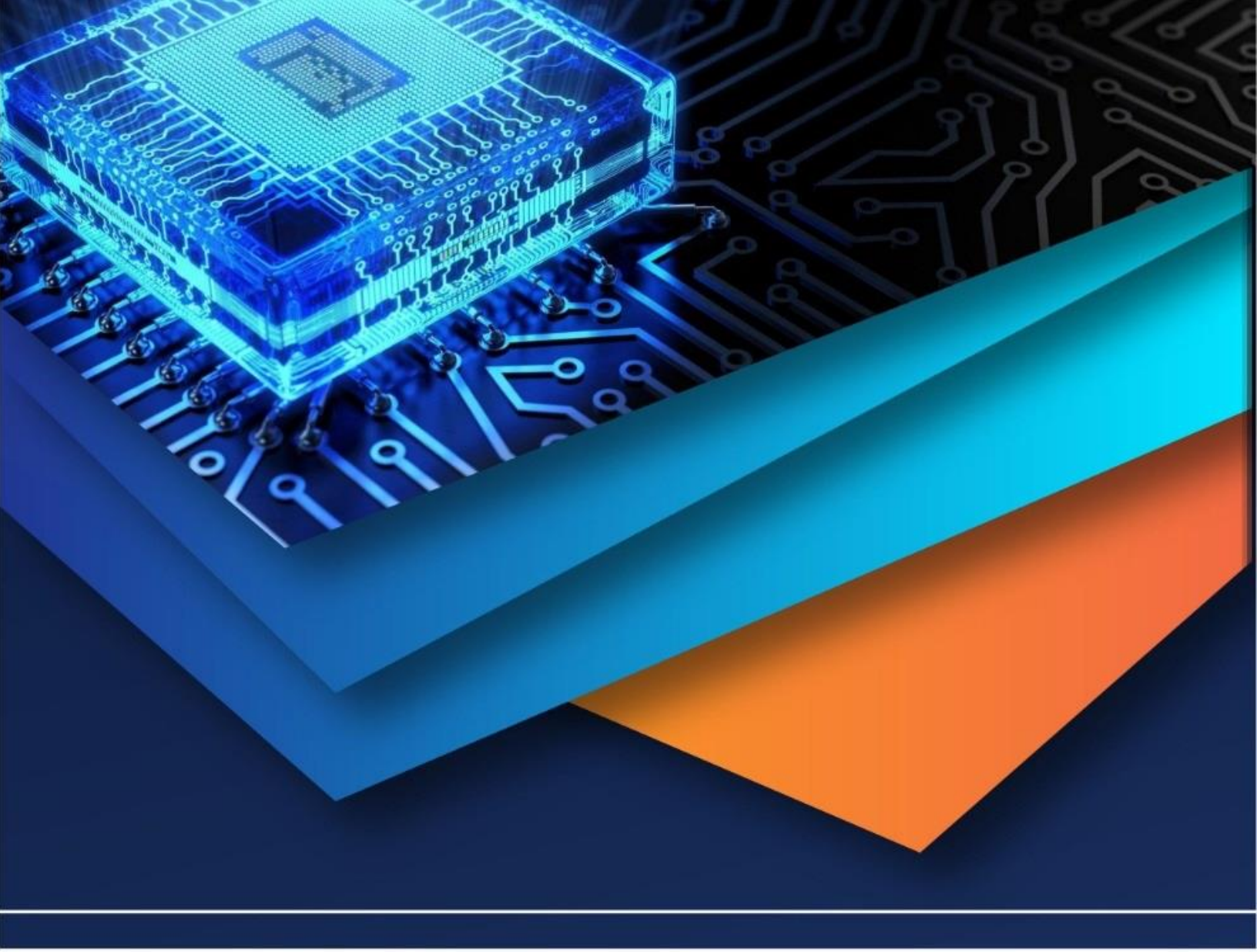
Traditional processes at various medium and large-scale businesses included relying on the manager, their previous experience, leadership skills and management capabilities. Whilst these managerial skills are still important today, what is more important is the way how Data Science and Artificial Intelligence can revolutionize how businesses takes critical decisions, by taking into account actual data and general trends in the population. Firms are relying more on data, the pattern that is visible amongst consumer studies and craft the best policies keeping these results in mind. Companies are investing in AI tools, in order to gain valuable insights and automate a large part of the manual labor work that was needed in the past.

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