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Benefits of Machine Learning and Artificial Intelligence

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ABSTRACT: Today, we are at the cusp of transitioning or welcoming a new era of computer science called 'Artificial Intelligence' (AI). A plethora of cutting-edge Artificial Intelligence technologies would now help augment or replace older technologies ranging from customer service, business analytics, gain knowledge, recommend decisions and at times predict the outcome of the strategies being implemented in-house. The prediction is done by Machine learning models which use various modelling techniques unique to Artificial Intelligence to mine vast amount of data. This helps organizations focus on other important tasks like production efficiency, sales growth, customer base retention, seek out new strategies to grow the bottom line and improve their risk and safety protocols.

We are seeing a lot of Artificial Intelligence models today from CHAT-GPT, Co-Pilot, Gemini and others which are integrated into their existing services. With the advent of AI, Microsoft's Co-Pilot is a personal assistant that helps you find right information, faster than ever. So, the opportunities for a company to improve efficiency, make better business decisions to grow and expand are endless. One can see the number of automated bots ranging from car dealerships to telecom business today. These automated bots take the heavy burden of streamlining the customers to different categories and improve customer service. Some machine learning (ML) models can perform data analysis, detect anomaly, forecast cost expenditure, predict competition and dynamic pricing. In this paper, we would look in detail how ML and AI, is both an opportunity as well as a challenge for companies.

KEYWORDS: Artificial Intelligence, Knowledge, Machine Learning, Data Analysis, Dynamic Pricing.

1 INTRODUCTION

New technologies are very receptive in the computer science industry. Every year, a big number of technologies are born and brought to the market. Artificial intelligence is nothing new, it's been since 1960's. What are changed over the last few years is that computers have become smaller, efficient, powerful (able to handle vast data), store vast amount of data and are no longer cost a fortune []. This paradigm change has brought about a sea change in the Information Technology sector. Today these Business Intelligence and Machine Learning are changing the world, and one hopes for the better as there is a thought that machines can not only replace human in the work force but also can take over the world. Perhaps that day is far for now, but IT foundations are shifting already. Today, AI is pervasive, one can see them in Industrial Machines (Tool making, car industry, health and Oil and Gas, etc.). One of the most recognizable AI is the self-driving car. AI and Machine learning is applied to every field like Health (cancer cell therapy), where laser tool are augmented with AI for precision and accuracy in destroying cancerous cell. ERP is other field, where AI is used to better efficient and intelligent ERP. With the advent of powerful AI chips [], AI / ML models would continue to progress, become more stable, efficient and perhaps help humans touch the horizons he is reluctant to touch or did not know at all to begin with.

2 ARTIFICIAL INTELLIGENCE

Before we understand Artificial intelligence, one needs to understand where the AI is driven by usefulness of Business Intelligence (BI). BI collectively is a methodology of gathering huge amount of data, usually business data, analyzing it, to make some insights which then are used to make certain business decisions which are usually strategic in nature [1]. To make such

strategic decisions many technologies are used, to gather data from disparate, filter, which are then transformed into a understand business knowledge, and then this business knowledge is depicted visually in a format which is easily understood by the executives of the business, usually in a form of report [2].

With this understanding of the BI, AI is the capability of the computer to make decisions very similar to humans given a situation, there by imitating human intellect [3]. Today, AI is any software, which is tuned, developed for certain function which imitates the functions of the human brain. For example, Tesla's Car Drive AI, imitates the human driving capabilities under 90% of road conditions, and the program continuously learns from ones driving nature. The AI program can detect, sense, hear various road conditions and makes the decisions. Today, such AI programs are used from marketing, research, financial, health, car industry, manufacturing and various other fields. AI is a general nomenclature, but it encapsulates various other subcategories [4]. These subcategories include, Machine Learning (ML), Robotics / Cognitive, Deep Learning, Neural Networks, Computer Vision and natural language learning [6].

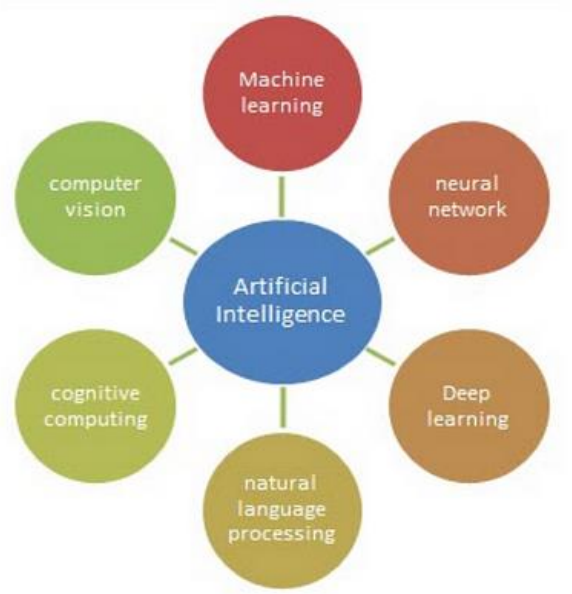

Fig. 1. Subfields of AI [5]

3 ARTIFICIAL INTELLIGENCE LITERATURE

AI has been known to man for a long time than what it is credited for according to [7], it was first conceptualized in Greece, but it made its first modern appearance Alan Turing [8] and made famous by Dartmouth College in 1956 [9], where the 'Artificial Intelligence' are first defined and coined by Jon McCarthy. Later in 2020, Russel and Norvig [10], first gave the credit to this conference as the birth of Artificial Intelligence. At the time of AI birth, its initial capabilities surrounded high-level cognition and the ability of recognizing patterns, vision, and execute complex motor skills which was associated with man at the time. It involved multi step processing of reasoning, understanding natural language and interpreting the natural language to achieve a final goal. For example, lifting a fork based on whether it is upside and normal position [11], [21].

Artificial intelligence then progressed to achieve reason about their own reasoning. This propelled a system to intelligence like humans and was now referred to as strong AI [12]. For strong AI, the primary approach has centered on this reasoning, and not by mere calculations. Newell and Simon 1976 [13], in their hypothesis noted that intelligent behavior appears to require the ability to interpret and manipulate symbolic structures. This approach showed great promised coming into the 21st century, but it has not gathered the momentum due to its difficult approach and its future remain uncertain.

There is a certain attempt made to define 'weak AI' and 'strong AI', the distinction is all about rule adherence, meaning, the way the machines follows the rules and what it makes of those rules. Authors in [14], distinguishes the machines which follow the rules set initially by the programmer, and make certain decisions based of the rules as 'Weak AI'. While a Strong AI, is a rule following decision system in Neural Networks (NN), which allow the program to learn constantly, making new rules to the existing rules and build on them. AI has gone many cycles where it gathered momentum and then fell off a cliff for certain period. 2010's brought a new leash of life to AI, mainly because the computing power, storage capacity of the chips, and the access to huge amount of data [15], Authors in [16], [17] and [15], attest this new resurgence in AI in the main IT domain, to

the following three reasons, 1: The evolution of complex sophisticated algorithms, 2: Access to powerful GPUs, where a dedicated processing unit can do calculations in milliseconds, 3: The availability of cheap storage units coupled with the availability of large databases which can store information to make these sophisticated AI systems.

There has been a lot of effort to officially define the concept of AI, and yet we are as close to it as we were in 1950's as it is mainly because AI never caught the sustained research and its applications coming to the market as it has been lately [18, 19]. With no clear definition of the term, it has become difficult for policymakers to wrap what constitutes an AI system and what it can do soon. With no globally accepted framework to assess what characters are desirable and what are not, it has been a difficult task to gauge what AI stands today. This is again expressed of [20], where they determine that AI has been a bit of confusion and the general public has not quite grasped the idea of machine learning and making decisions yet.

4 USEFULNESS OF BUSINESS INTELLIGENCE

In this paper, we would be looking at AI and ML role in improving the business decision making and how these AI programs lead to better efficiency, capital gain and what are the challenges that AI and Businesses face in implementing them. AI today has enabled organizations see through vast amount of data it generates, translating these insights to valuable knowledge to made accurate predictions for the future. Machine Learning (ML), which is a subset of AI, are designed to use and learn upon these vast data and discover patterns which are otherwise lost when performed manually, which are then translated to knowledge. It is one of the most widely used AI Subsystem today.

AI is also used through natural language processing, sound and computer vision, where information from unstructured sources like text, images, videos are extracted, and AI programs can process this vast amount of data and make decisions [22], [34]. Self-driving car is a perfect example. As the self-driving car learns every day, it gains insights and new information from a wide range of data and sources and further trains itself for efficiency. Merging AI and ML into business intelligence are brought many advantages for the companies across the field. The organizations are now able to automate repetitive and time-consuming tasks like data cleaning, data integration and report generation [6].

It now allows the resources to concentrate of other activities which need more focus and energy [6]. AI and ML can improve data analysis by discovering hidden patterns and translate them to knowledge base (KB). This KB is then used to made future predictions, forecasting, and strategic business decision to improve profits and gain more market share. AI is also used for context-based decision-making tasks like price strategy in many vendors, from garments to tourism [6]. Today AI / ML help organizations with valuable insights from vast data they collect from the consumers, automate some of their processes like shipping, behave their decision making, drive up their innovation and become part of their differentiating factors amongst their competition [6], [23].

5 BENEFITS OF ARTIFICIAL INTELLIGENCE

5.1 PREDICTIVE ANALYSIS

Artificial Intelligence is used to analyze historical data, detect patterns and trends. This ability would help business be a step ahead of the curve as it would now be able to predict the future based of the historical data [6]. The accuracy of AI would depend on robustness of the AI program; However, the program would enable organization improve efficiency, mitigating risks, optimize the operations by forecasting demand and supply [6], improve warehousing / inventory efficiently and thereby improving the whole supply chain process [24].

AI programs which predict based of the historical data usually analyze vast amount of data, to identify the patterns, which are then converted to business knowledge. The AI programs initially work on data classification, and then would move to complex relationships between the data and their respective correlation to a value / data parameters / situation etc. When the ML / AI program train on various models / techniques, they leverage these correlations to predict accurately about the future outcomes. These predictions would now help businesses improve their operations, learn about demand and supply, and improve resource allocation. At times, the insights bring new information like risk mitigations, dynamic pricing, and supply chain risk mitigation based off an event [25], [6]. For example, a typhoon in a certain area, would help predict demand and supply for hardware, pricing on these and potential supply chain risks for the whole company in that area. So, one can see that predictive analysis is very useful to the organizations, as they help them forecast demand, identify pricing strategies, identify trends, and risk associated with an event. The predictive analyses help other departments like inventory, logistics, supply chain and reduce the costs and damage associated with an event. The predictive analysis can also analyze historical seasonal sales, trends and customer behavior to predict business future sales and revenues. Business can now take appropriate measures to enhance their sale, production, inventory, pricing, logistics, remove risks and gain on the market share over the competition.

Predictive analysis is used is almost all industry ranging from finance, insurance, sales, forecasting cost in operations, detecting anomalies in health, oil and gas, process automation, fraud, cyber security and others [26], [27], [28], [30], [31], [32], [33]. In all the fields mentioned, they are used to improve efficiency, predict trends, mitigate risks and prevent financial lose. Predictive analysis is used to personalize marketplace, offers, recommendations and create a tailor-made portfolio for the customer based of his / her historical data. E-commerce site, Netflix, YouTube and Spotify are all good examples of predictive analysis [6].

5.2 CHATBOTS

Chatbots or virtual assistance use natural language processing techniques or models to understand common user queries and advise on them appropriately. ML plays a key part in their effective responses. by leaning from customer feedback for initial queries over time. Today, we see these Chatbots everywhere from Govt to private enterprises, automating some of the customers frequently asked questions, providing them initial choices, directing them to different customer departments, and at times, even trouble shooting an issue too.

These ML based Chatbots are continuously improved to respond to new information by training them on large datasets initially but then after deployed, the Chatbots get a wealth of information from interaction with the customer, which is then used to improve their efficiency [24]. One of the main advantages of a Chatbots is that they are 24 / 7, regardless of the time zone or business hours, providing round the clock responses to customer queries. This is one step ahead of the customer service which was manually done in the past. Chatbots ability has grown over the past few years, it can now perform tasks like readout account balances, recent transactions, suggest products, recommend movies and some even provide solutions customized to an individual preferences, history and behavior patterns [6]. Today, these Chatbots are integrated across multiple channels from websites, mobile apps, banking systems, social media, health and others, providing customer support in customers preferred media or channels [35].

5.3 EXPLAINABLE AI

With growing AI models each day, there is a need for interpreting these ML based decision-making process or AI. Explainable AI or EAI aims to doing just that, to make these AI based system more transparent, understandable making common user to easily understand why certain decision or solutions were recommended by the AI system [6]. Such transparency in the AI systems would build trust and make such systems pervasive across the globe. Today, such transparent systems are not only necessary from a customer point of view but from regulatory and stakeholder point of view too. Governments and organizations are aiming at fairness, accountability and more transparency to address issues like bias, discrimination, gender preferences, regional preferences and other negative issues [36].

As AI systems become more pervasive and complex, there is a growing demand to understand how they interpret certain data and make decisions or provide solutions in others [37]. Explainable AI is the answer, which aims at developing techniques that provide explanations to AI systems. Such explainable solutions make governing bodies regulators, and auditors, along with the customers to understand the reasoning behind AI inputs / outputs and build trust in this new era of AI technology [6]. Ethical usage and development is another issue. In both the cases, interpretable AI models makes sure that there is fairness, accountability, and transparency in decision-making processes [6]. By using these explainable AI, government, policy makers and organization internally can reduce the risk associated with biases, discrimination, gender preferences, regional preferences and others which produce unwanted consequences to both society as well as organization.

5.4 DATA AUTOMATION

Tasks like data cleansing, feature extraction, file reading and data transformation can be done by ML programs today. ML programs have increasingly become more effective in data analysis task reducing the human burden. Programs can detect anomalies, in data received, stored or perceived quickly uncovering the patterns and producing invaluable insights on the data they work on both in real-time as well as working on stationary data [40].

ML machines or programs can automate data analysis on vast amount of data in a shorter time than what it was initially perceived as. Today, they can handle complex data structures, identify patterns, extract meaningful information saving both time and effort. The organizations and to some extent, governments are slowing moving into ML systems for error checking (courts), fraud (Banks), irregular data in real-time (SCADA systems) enabling organizations to take mitigation steps to avert danger or unforeseen situations. ML programs are deployed in certain areas where they are continuously analyzing data as they come in, alerting for immediate actions when it detects unusual data (Alarm systems).

ML programs or machines makes governments and organizations move their resources and efforts on other fronts which need more time, focus and effort. In mechanical jobs, ML systems can analyze historical data and recommend, potential equipment failure, replacements and maintenance work (Production industry) [38], [39]. Business and governments today are increasingly adopting ML machines to real time data analysis, monitoring and to address issues like security, and effective operational efficiency.

5.5 FORECASTING

Machine Learning can analyze data and forecast sale, market trends and other information accurately. Business would then use this information to optimize their respective operations ranging from, logistic, data warehousing, inventory management, productions plans, resource allocation, budget allocation and others. ML programs can also forecast prices based on real time market conditions, supply and demand fluctuations, and customer behavior based on the seasonal data. Again, business are now able to focus on pricing, strategies, increased revenue, inventory control and make quick changes to customer needs in real-time [6]. In certain cases, it allows organizations to maintain optimal inventory, reducing logistical costs, manpower and overall improved cost savings bringing more efficiency.

Forecasting demand combined with customer preferences, their purchase history and their willingness to pay is another aspect ML programs are affecting the organization. This information provides businesses avenues for pricing, increased revenue, better customer satisfaction and increased profits. ML analyze customer responses from their historical preferences today and determining pricing elasticity. Meaning, businesses can now understand what the price range is the customer perceives to be the right price for him/her to buy it now [36]. ML models are become so complex that they can now other organizations dynamic pricing on their websites, read the information, calculate the right price and recommend the prices to be competitive on the market. Demand forecasting and dynamic pricing models by ML give businesses and edge where the organization as an added advantage of knowing their customer demand and enabling them to optimize their pricing based off this demand. Hence, it has become more important to have a very good predicting model, which can not only predict but can optimize inventory, adjusting pricing on the website, control inventory, logistics, to increase revenue and profitability.

5.6 BETTER DECISION MAKING

AI through Machine Learning (ML) gives the organization immense capabilities to analyze tons of data, deriving insights, thereby enabling the businesses to make timely decisions. These timely alerts to the organizations help them stay alert and respond quickly to any unforeseen circumstances and be alert to any market changes, be it pricing, customer service, inventory control, supply chain or others. It empowers them to innovate, develop new products and services to stay and ward off competition or take overs in an ever-changing landscape [6].

ML systems use historical data and other ML models to forecast future results. These insights are made use of by the organizations to take proactive steps, thereby actively engaging the competition with better services and products to retain and gain more customers. These ML model-based systems today are so sophisticated that they can analyze petabytes of data in a few hours, identify patterns and extract business insights. This quick insights at the hands of the organization is invaluable, making their decision time quicker and more agile to changing data and competition [6]. Today ML programs are used for optimal resource staffing, inventory control, production schedules, deliveries, cybersecurity, and many other fields leading to increased operational efficiency, revenue, cost reductions and more importantly profits keeping the organizational shareholders happy.

6 CONCLUSION

In this paper, we have seen how AI / Ml is changing the way business is run today. It is benefiting the businesses in various ways, ranging from trend detection to decision making. The review was able to touch on range of benefits ML could provide from predictive analysis, Chatbots, explainable AI, forecasting, decision making and data automation. The advancements made in AI through ML was not possible 15 years ago. It is only in the last 15 years; we can see an explosion of AI driven systems assisting businesses in all walks of business departments. It is mainly because of the progress made in the computer chip industry, chip storage capacity and algorithms ability to harness this data to useful solutions. Today, businesses can make use of this ML machines to gather valuable insights, make optimized operations, and make timely decisions. This allows the organization to free up more resources to work on other stuff which perhaps were not in the plan. This improved efficiency coupled with near-ideal resource allocation means that the organizations are streamlined for increased revenue and profits. Importantly, AI-driven solutions help businesses understand customer behaviour, personalize experiences, and create targeted marketing campaigns, leading to higher customer satisfaction, revenue and profits. The usage of better operating systems and

their techniques further in the future [29] can unlock some of the hurdles in the AI we face today and perhaps take us to the frontiers we had only imagined a few years ago.

CONFLICT OF INTEREST

The authors have no conflicts of interest in this research.

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