Transformative applications of Artificial Intelligence in diverse areas of Medicine, Smart Mobility and Business

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Abstract- AI has emerged as a transformative technology with applications in a variety of fields, including healthcare, smart mobility, and business. This article provides a historical overview of AI developments, highlighting advances in machine learning and deep learning transforming AI. The article then delves into the applications of artificial intelligence in medicine, such as diagnostics and image analysis, precision medicine, health monitoring, and medical education. The impact of artificial intelligence (AI) in smart mobility, particularly in autonomous vehicles, is discussed, with an emphasis on improved road safety and transportation efficiency. Finally, the advantages of AI in business are examined, including pattern recognition, analytics, and product design. It concludes by emphasising the importance of interdisciplinary research in order to develop AI systems that are transparent, fair, and accountable.

Keywords -Artificial Intelligence (AI), Machine learning, Deep learning, Neural networks, smart mobility.

INTRODUCTION

The field of artificial intelligence (AI) has become an increasingly important one in computer science, with extensive research leading to the development of applications in a wide variety of industries. Despite the fact that there is no universal agreement on the definition of artificial intelligence, AI has become an increasingly important field. AI refers to machines' ability to perform tasks requiring human-like intelligence, such as visual perception, speech recognition, decision making, and natural language processing. (McCarthy, 2007) Artificial intelligence (AI) systems should have the following capabilities:

- natural language processing, which allows them to communicate in a natural language;
- knowledge representation, which allows them to store information;
- automated reasoning, which is the use of the stored information to answer questions and draw new conclusions; and
- machine learning, which allows them to adapt to new circumstances and detect and extrapolate patterns.

AI software allows machines to process massive amounts of data, learn from previous experiences, and improve over time. Russell and Norvig (2010) AI has been around for decades, but recent advances in machine learning, deep learning, and neural networks have enabled machines to more accurately mimic human cognitive abilities. (Goodfellow, Bengio & Courville, 2016; Jordan & Mitchell, 2015; LeCun, Bengio & Hinton, 2015).

As a result of technological advancements, artificial intelligence has become an integral part of contemporary society, with numerous applications in fields such as healthcare, finance, manufacturing, transportation, and education. AI is a rapidly evolving field with enormous innovation and impact potential. AI has vast and varied applications, with the potential to revolutionize various industries and create new job opportunities.

HISTORICAL DEVELOPMENTS OF AI

Since its inception in the 1950s, artificial intelligence (AI) has been a field with rapid growth. Early AI was characterised by rule-based systems that relied on human problem-solving experts to frame rules. (McCarthy et al., 1955). Major drawback for these systems is that they had limited capabilities and were difficult to scale to large-scale problems.

Expert AI systems that used rule-based systems to solve specific problems, such as diagnosing diseases or predicting stock prices, were on the rise in the 1980s (Feigenbaum & McCorduck, 1983). Expert systems were effective in certain domains, but they were rigid and difficult to maintain.

In the 1990s, machine learning emerged, which involves training algorithms on massive datasets to recognise patterns and make predictions (Jordan & Mitchell, 2015). Machine learning represented a major advancement in artificial intelligence because it enabled computers to learn from data and improve over time. In the 1990s, neural networks, which are algorithms based on the structure of the human brain, gained popularity (Rumelhart et al., 1986). The development of neural networks made it possible to accomplish more difficult tasks, such as image and speech recognition.

The 2000s witnessed the rise of big data and the implementation of deep learning, which involves training neural networks with multiple layers to execute more complex tasks (LeCun, Bengio, & Hinton, 2015). Computer vision, natural language processing, and robotics have all benefited from deep learning. Deep learning has also enabled the creation of self-driving cars and enhanced medical diagnosis.

Reinforcement learning, involving training algorithms through the method of trial and error, became popular in the 2000s which led to advances in areas such as gaming and robotics. (Sutton & Barto, 2018

The second decade of the 21st century saw the rise of personal assistants powered by artificial intelligence, such as Siri and Alexa. These personal assistants use natural language processing to comprehend user requests and respond. (Rohrbach & Tappen, 2019). Improvements have also been made in customer service and support as a direct result of the development of chatbots and virtual assistants powered by AI.

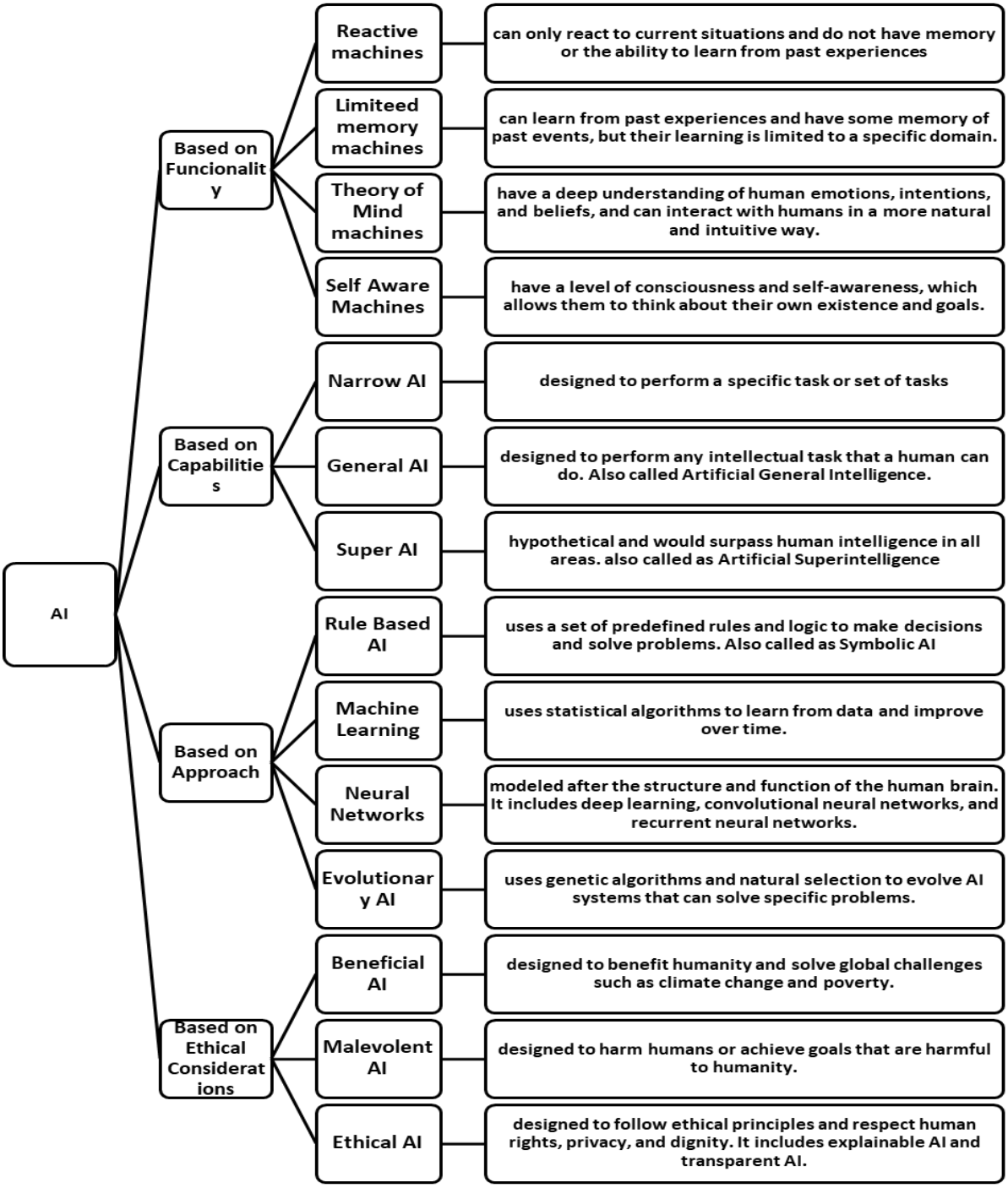
AI-powered systems can assist in the diagnosis of diseases by physicians (Esteva et al., 2017), the making of investment decisions by traders (Feldman & Regev, 2018), the navigation of roads by drivers (Bojarski et al., 2016), the optimization of production in factories (Schneider et al., 2017), and the gamers play more difficult games (Bojarski et al., 2016). (Mnih et al., 2015).

Nevertheless, the development of AI also raises a number of ethical, legal, and social concerns, including privacy, bias, accountability, transparency, and job displacement. This can result in discriminatory outcomes if AI systems are trained on biassed datasets (Suresh & Guttag, 2019). Additionally, AI systems can raise privacy concerns if they collect and use personal information without permission (Crawford & Schultz, 2014). There are also concerns regarding the impact of AI on employment, as AI systems can automate many previously human-performed tasks (Brynjolfsson & McAfee, 2014).

To address these issues, there is a growing need for interdisciplinary research that brings together experts from various fields to develop transparent, accountable, and fair artificial intelligence (AI) systems (Kleinberg et al., 2018). This includes research on algorithmic fairness, AI that protects privacy, and AI that can be explained. The objective of algorithmic fairness research is to create fair and unbiased AI systems by addressing bias and discrimination in datasets and algorithms (Barocas & Selbst, 2016). Privacy-preserving AI research focuses on the development of AI systems that can protect the privacy and confidentiality of user data (Shokri et al., 2015). Explainable AI research focuses on developing AI systems that can provide clear explanations of their decision-making processes, allowing users to comprehend and trust the output of the system (Lipton, 2016).

In this paper we shall discuss the applications of Artificial Intelligence in

1. Health care/ Medicine
2. Smart Mobility/ Transportation
3. Business



AI APPLICATIONS IN MEDICINE

Artificial intelligence (AI) has revolutionised the medical field by enabling the processing and analysis of vast quantities of medical data in real-time, thereby enhancing clinical decision-making, patient care, and drug discovery. To address the challenges of data scalability and high dimensionality in precision medicine, artificial intelligence techniques such as machine learning (ML), deep learning (DL), and natural language processing (NLP) are being used. Large amounts of data are being transformed into clinically actionable knowledge using these techniques.

APPLICATIONS OF AI IN MEDICINE

- Diagnostics and Image Analysis: AI techniques have demonstrated significant improvements in the accuracy and speed of medical image analysis. For example, AI has been used to diagnose metastatic breast cancer, melanoma, and several eye diseases (De Fauw et al. 2018; Ehteshami Bejnordi et al. 2017; Haenssle et al. 2018). AI algorithms have also been shown to outperform human experts in detecting pneumonia and lung nodules (Rajpurkar et al. 2017; Ardila et al. 2019).
- Precision Medicine: AI is increasingly being used to provide personalised care in precision medicine. Individual drug-response variability can be identified by AI systems (Kalinin et al., 2018; Lin et al., 2018), which can aid in the development of personalised medicine and cancer genomics in particular. Artificial intelligence can help predict disease progression and patient outcomes based on genetic and clinical data. (Gao et al. 2019).
- AI-powered NLP algorithms can extract and summarise patient data from Electronic Health Records (EHRs), enabling clinicians to make more informed decisions and provide better patient care (Bedi et al. 2015; Chang et al. 2016). Furthermore, AI can be used to identify patients who are at risk of rehospitalization and to provide interventions to prevent readmission (Wang et al. 2018).
- AI is being used to accelerate drug discovery by identifying novel drug candidates and predicting drug-target interactions. For instance, artificial intelligence techniques have been employed to predict the binding affinity of small molecules to target proteins (Altae-Tran et al., 2017) and to design new molecules with desirable properties (Segler et al. 2018).
- New artificial intelligence (AI)-driven services are entering the market, with a focus on health monitoring via mobile devices and the internet of things (IoT). AI can help detect early signs of diseases and monitor patients' health status in real-time (Pereira et al. 2019). AI can also help identify patients who are at risk of developing certain conditions, such as diabetes, and provide interventions to prevent the onset of the disease (Rajkomar et al. 2018).
- AI has the potential to revolutionise medical education and training by providing students with realistic and interactive simulations of real-world medical situations. One study demonstrated that simulation-based medical training, which included AI-powered virtual patients, improved student performance and knowledge retention (Aronson et al., 2019). AI can also be used to create personalised training programmes that adapt to the learner's needs and provide feedback and direction to help them improve their skills (Torous et al., 2020). Moreover, AI can aid in evaluating learner performance and identifying areas for improvement, enabling educators to develop targeted interventions to improve learning outcomes (Aronson et al., 2019). Overall, the use of AI in medical education and training has the potential to enhance the quality and efficacy of medical training, leading to improved patient outcomes.

LIMITATIONS AND CHALLENGES OF AI IN MEDICINE

Despite the many advantages of AI in medicine, there are also some limitations and challenges. One of the major challenges is the lack of transparency and interpretability of AI algorithms, which can make it difficult for clinicians to understand how decisions are made (Gianfrancesco et al. 2018). Another challenge is the need for large amounts of high-quality data to train and validate AI models, which may not always be available (Obermeyer and Emanuel, 2016). Additionally, there is a risk of bias in AI models if the data used to train the models are not representative of the population (Obermeyer et al. 2019).

AI & SMART MOBILITY

In recent years, autonomous vehicles have become a reality due to the combination of hardware and software that enables their operation. In addition to traditional technologies such as cameras, sensors, and vehicle-to-vehicle/vehicle-to-infrastructure (V2V/V2I) communication, self-driving cars heavily rely on artificial intelligence (AI) to process and analyse the vast quantities of data they collect from

their surroundings. On the basis of this data, AI algorithms are responsible for making real-time decisions, such as determining the vehicle's speed, direction, and response to any road obstacles (Alonso et al., 2021).

The potential for autonomous vehicles to improve road safety is one of their most compelling advantages. When it comes to automobile accidents, human error accounts for 94% of the causes, per the NHTSA (NHTSA, 2021). By removing the human element from driving, autonomous vehicles are able to eliminate the possibility of human error, thereby reducing the likelihood of road accidents.

Additionally, autonomous vehicles have the potential to lessen the effects of traffic congestion and increase the effectiveness of transportation systems. Studies have demonstrated that self-driving cars can improve traffic flow by decreasing the number of stops and starts, thereby reducing fuel consumption and emissions (Biehl et al., 2020).

Additionally, the development of autonomous vehicles has created new research opportunities. Researchers are developing better sensors and refining algorithms for real-time decision-making in an effort to improve the technology underlying autonomous vehicles. Self-driving cars have also been used in transportation planning and human-vehicle interaction research (Naujoks et al., 2019).

AI is a crucial component of self-driving cars, but it also introduces new risks. The cybersecurity of autonomous vehicles is a major concern. As more vehicles connect to the internet, they become more susceptible to cyberattacks, which could have devastating effects on the road (Rao et al., 2020). For the safe and widespread adoption of this technology, it is essential to ensure the safety of autonomous vehicles and their data.

The evolution of self-driving cars has been made possible by the rapid development of hardware and software, including AI algorithms. Possible advantages of autonomous vehicles include enhanced road safety, decreased traffic congestion, and enhanced transportation efficiency. However, there remain issues to be resolved, including cybersecurity. Future realization of self-driving cars' full potential will rely heavily on continued research and development.

AI IN BUSINESS

At the business level, AI provides several benefits, including quick pattern recognition in big data, rapid visualisation and analytics, improved product design, and the delivery of meticulous insights. These benefits are expected to result in the introduction of new levels of service, increased profit margins, business expansion, improved efficiency, and improved cost structures (Agrawal et al., 2018; Manyika et al., 2017). The authors use a novel methodology based on Neo-Schumpeterian Economics, a growth economics framework, to examine the impact of AI on businesses in this paper (Soni et al., 2019). This approach considers innovation, knowledge, and entrepreneurship to be the driving forces behind the success, commercialization, and influence of AI algorithms on investors, entrepreneurial actions, and the global market. The paper investigates AI-related entrepreneurial activities, drawing insights from two lists of the top 100 AI start-ups.

The research aims to identify the factors driving AI's exponential growth, identify academic achievements in AI that advance commercially available intelligent products, identify the top AI industries and investment trends, explore geographically strong AI locations, and demonstrate that AI is not just hype through data analysis. The findings of this study will help us better understand AI innovations and their impact on businesses and society as a whole. Furthermore, it will shed light on how AI can transform R&D practises, reshape business operations, and impact the global economy. The findings can help countries prepare for the widespread adoption of AI in the near future.

CONCLUSION

Artificial intelligence (AI) has made significant contributions to a variety of industries, transforming industries and revolutionising how tasks are completed. AI has shown remarkable capabilities in diagnostics and image analysis, precision medicine, health monitoring, and medical education. AI has improved clinical decision-making, personalised patient care, and drug discovery by leveraging machine learning, deep learning, and natural language processing. However, obstacles persist, such as the need for transparency, interpretability, and unbiased data.

AI has played a critical role in the development of autonomous vehicles in the field of smart mobility.

Self-driving cars have the potential to improve road safety, reduce traffic congestion, and improve transportation efficiency by utilising AI algorithms for real-time decision-making. However, concerns about cybersecurity must be addressed in order to ensure the safety and integrity of autonomous vehicles and their data.

AI has numerous applications in business, including pattern recognition, advanced analytics, and improved product design. Businesses can use these capabilities to gain valuable insights from big data, improve operational efficiency, and drive innovation. The increased number of AI-related entrepreneurial activities demonstrates AI's potential to transform business operations and impact the global economy.

Regardless of AI's advancements and potential benefits, ethical, legal, and social concerns must be addressed. To develop transparent, fair, and accountable AI systems, issues such as privacy, bias, accountability, and job displacement necessitate interdisciplinary research and collaboration. Algorithmic fairness, privacy-preserving AI, and explainable AI are research areas aimed at alleviating these concerns and ensuring responsible AI deployment.

To summarise, artificial intelligence (AI) has emerged as a powerful technology with numerous applications in medicine, smart mobility, and business. Its ability to process massive amounts of data, learn from experience, and make intelligent decisions has the potential to revolutionise industries and improve people's lives. However, in order to ensure AI's responsible and beneficial integration into our society, careful consideration must be given to its ethical and societal implications.

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