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Artificial Intelligence: Positive or Negative Innovation

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ABSTRACT

Undoubtedly, innovations play a vital role in enhancing the well-being and progress of humanity. It is crucial, therefore, to acknowledge that technology and other forms of innovation should not be immediately dismissed as unfavorable. However, it is of utmost importance to exercise caution when distinguishing between beneficial innovations and those that may pose risks or dangers. Currently, the concept of Artificial Intelligence (AI) is a subject of intense debate worldwide. According to Sebastian Thrun, the Head of Google's Self-driving car initiative, AI research is expected to span a century before reaching its full potential. Thrun suggests that AI is gradually gaining control over various aspects of our world, potentially diminishing the dominance of human beings, although they may still retain some level of control in certain domains. The rapid progress and advancement of AI technology have raised concerns among experts. While some researchers argue that AI holds the potential to revolutionize numerous fields, others express apprehension regarding its negative consequences, such as job displacement and compromised privacy. This review paper aims to explore both the positive and negative aspects of AI innovation in selected sectors, while also examining the potential future trajectory of this innovation.

Key words: Artificial Intelligence, Innovation, Technology, Impact, Consequences.

1. INTRODUCTION

Throughout history, innovation has been the driving force behind improved standard of living. Nonetheless, innovation can cause significant disruptions. Some technologies like the Internet of Things (IoT), big data, data science, cloud computing, and artificial intelligence (AI), all have existed for at least 25 years but only recently gained mainstream acceptance and viability for commercial applications [1]. These technologies have broad applications in various fields, transforming human lives and society.

AI has a long history, dating back to the 1950s when the first AI programs were developed. “Artificial Intelligence” was coined by John McCarthy in 1956 as “the science and engineering of making intelligent machines”. The field experienced a period, of low interest and funding, called AI winter [2], but has continued to grow ever since as an important field of computer science. There are two broad concepts of AI namely General AI, which is focused on machines with certain human intelligence, and Normal AI which are the common type of technology used to perform specific tasks [3].

Existing literature provides ample evidence to suggest AI as an innovation that can drive significant transformations; like enhancing the accuracy and effectiveness of medical services hence improving human lives, improving transportation with autonomous cars that could reduce accidents, personalized human learning experience, etc. However, despite all of these, AI has a few negative consequences on privacy and the right to personal data, ethics and social considerations, labour displacement, and replacement, etc.

This paper explores the impacts of AI in contemporary industries with a focus on the pros and cons. Additionally, the paper examines the consequences of Al and also what the future holds. Conclusions and recommendations on the best ways to mitigate the implications and consequences as well as maximize the impact of AI conclude the research work.

1.1 History of AI and its Evolution

AI was started as a field of its own in 1956 by a group of scientists led by John McCarthy, professor emeritus of computer science at Stanford University.

In the 1950s and 1960s, researchers created machines that could solve simple mathematical problems and play chess. A programming language, Lisp, was developed by John McCarthy in 1956 and is still in use today in AI research. The General Problem Solver (GPS) was developed in 1967, allowing for the resolution of complex problems in different domains.

The 1970s marked the "AI winter," characterized by a decrease in public interest in AI and a slowdown in research progress due to reduced funding. Some hypothetical products, possible with AI, were postulated in 1973 [4]. A few of these products are a reality today:

During the 1980s, AI research shifted focus towards developing expert systems that could make decisions based on

a set of rules, but these systems had limitations in their ability to tackle complex problems and required extensive development time and effort.

Currently, AI is increasingly integrated into daily life (Table 1), from virtual assistants to self-driving cars with active use of neural networks, deep learning and machine learning algorithms.

Table 1: AI technologies predictions and their today's reality. Source: [4].

S/N	Product idea	Possible ability	Today's reality
1	Automatic language translator	"Language translating device capable of high-quality translation of text in one foreign language to another. (Both technical and commercial material)."	Google Translator, Bing Microsoft Translator
2	Automatic identification System	*"System for automatically determining a person's identity by recognizing his voice, fingerprints, face, etc"*	Apple Face ID, Mastercard Identity Check with NuData Security.
3	Automatic diagnostician	*"A system capable of interactive and/or automatic medical diagnosis based on querying the patient, an examination of biological tests, etc."*	Qualcomm tricorder, Medtronic Sugar.IQ Cognitive App in collaboration with IBM Watson.
4	Industrial robots	*"An autonomous industrial robot capable of product inspection and assembly in an automated factory, using both visual and manipulative skills."*	Kiva warehouse robots, FANUC intelligent robots, Mitsubishi Robots
5	Robot chauffeur	*"Robot cars capable of operation on standard city streets and country highways, using visual sensors"*	Google Waymo, Mercedes-Benz E-Class, Volvo C60
6	Universal game player	*"A system capable of playing Chess, Checkers, Kalah, Go, Bridge, Scrabble, Monopoly, etc., at a controllable level of proficiency, from master level to novice."*	AlphaGo, Deep Blue

2. AI AND THEIR CATEGORIES

There are different types of AI, however, categorized based on capabilities and functionalities. AI based on capabilities include Narrow AI which is the sort of AI capable of doing intelligent tasks. This type of AI is the most frequent and currently accessible. It is however programmed for one single task, and as such cannot perform outside its boundaries. Examples of narrow (or weak AI) include Apple Siri, self-driving cars, speech recognition, and picture identification. Other types are General Artificial Intelligence and Super Artificial Intelligence. General AI is capable of

doing as much intellectual work as a human and its goal is to create a system that can mimic human beings. Super AI is a futuristic idea and proposed to be a type of intelligence capable of outsmarting humans and executing tasks better than them.

Types of AI based on functionality include the most basic kinds of AI called reactive machines, limited memory, theory of mind, and self-awareness. Reactive machines do not keep track of previous experiences or memories. Limited memory on the other hand is just like reactive machines, however, they have memory capabilities that enable them to leverage past experiences in making better decisions. Real-life of examples of technologies that use this type of AI are autonomous cars, phone apps, etc. Theory of mind and Self-awareness AI are theoretical ideas for now and may take up to decades if not centuries to actualize.

2.1 AI in Contemporary Industries/Sectors

Artificial Intelligence (AI) refers to the creation of computer programs that perform tasks that typically require human intelligence, such as decision-making, problem-solving, visual perception, and language translation. This technology is rapidly evolving and transforming various industries, fundamentally changing our work and lifestyles.

The healthcare industry benefits from AI technology by employing AI algorithms to create personalized treatment plans, diagnose diseases, and predict patients' health. Similarly, in finance, AI powers the decision-making of traders and investors through real-time data analysis. Fraud detection systems and chatbots for banking customers are also developed using AI. Self-driving cars and trucks improve traffic flow and reduce accidents. AI is also used in manufacturing to develop smart factories and predictive maintenance systems that reduce downtime and waste. Personalized learning systems and virtual tutoring can be developed with AI, to adapt to individual student needs in education. In customer service, AI-powered chatbots handle customer queries and complaints. AI algorithms analyze customer data to develop targeted marketing strategies, increasing sales and customer satisfaction [5].

2.2 AI in the Job Market and Economy

According to AIDA (Artificial Intelligence Development Agency), more than 50% of children starting school now will hold jobs that never existed by the time they graduate high school or college. Also, the future of work requires that workers be creative, critical thinkers, and great decisions makers as majority of jobs and roles will become replaced by AI. McKinsey [6] add that by 2030, AI could boost the GDP of the world by 26% while potentially adding 16% to the global economy.

"Will robots really steal our jobs?". A report by PwC [7] categorized the introduction of AI technologies in the job market and workforce into three phases; algorithm, augmentation and autonomy. Algorithm involve basic tasks that do not significantly affect the job market and the autonomy is also not an immediate threat to people's jobs as it may take decades to develop. However, augmentation is already in effect and requires workers to adapt to new skill sets.

Based on reports [8], [9], AI will affect a broad range of professions, with some jobs disappearing, others adapting to new circumstances, and new AI-related jobs emerging. About 133 million jobs are expected to be created by AI by 2025 and while many jobs will be replaced, especially repetitive and mundane tasks like data entry and processing, jobs that require human skills such as empathy cannot be easily replaced by AI. Also, there will be massive demand for workers with sufficient skills for technology-rich environments which according to AIDA, are currently just about 31%.

2.3 The Role of AI in Healthcare and Medical Diagnosis

AI has been in use in medicine since the 1950s, in form of computer-aided programs, to detect symptoms and enhance diagnoses. Recent advancements and increased computing power have spurred interest and progress in medical AI with disease diagnosis being the focus. Other areas of applications of AI in medicine include clinical, diagnostic, rehabilitative, surgical, and predictive practices.

By analyzing massive amounts of data across various modalities, AI technologies can detect diseases and guide clinical decisions [12]–[14]. AI can also identify new drugs for health services management and patient care treatments, and reveal new information that would otherwise remain hidden in medical big data [15]–[17].

The potential of this technology also includes reducing care costs, streamlining repetitive operations, and enabling the medical profession to focus on critical thinking and clinical creativity [12]. Existing healthcare systems can significantly benefit from this technology by alleviating pressure [18]. In 2020, Babylon, a digital health tech company, developed a new AI-based symptom checker that improves disease diagnosis and could reduce diagnostic errors in primary care. The University of Bonn also developed an AI-based machine learning program to improve leukemia diagnosis by evaluating the presence of cancer in the lymphatic system in blood or bone marrow.

At Queen Mary University in London, researchers have discovered a way to analyze blood from rheumatoid arthritis patients using AI and predict their response to treatment in advance. Meanwhile, Dr. Vathsala Patil and colleagues in India have explored the potential of AI to improve the work of radiologists, noting that learning algorithms have significantly improved in recent years, enabling machines to perform tasks previously limited to humans.

The use of AI in analyzing data from various sources such as government and healthcare can aid in predicting and monitoring the spread of communicable diseases. With its potential in global public health, AI can serve as a significant tool in combating pandemics such as COVID-19 and other illnesses.

However, despite significant research efforts, the overall diagnostic accuracy of AI still lags behind that of doctors [19]. As Dr. Jonathan Richens and colleagues at Babylon conclude,

the combined diagnosis of doctors and algorithms is likely to be more accurate than either one alone.

2.4 Impact of AI on Education and Personalized Learning

Education perhaps has witnessed the most application of AI in recent times. Education in this context refers to all forms of education as well as the medium they exist in, including edutainment. From virtual classrooms to the metaverse, AI is actively revolutionizing the learning process across various areas for both students and teachers. With AI algorithms, educational institutions can offer tailored learning experiences that identify learning gaps and provide resources for improvement [20]. AI can also automate grading, offer instant feedback, and create virtual tutors that offer personalized guidance.

AI has the potential to revolutionize the education sector by facilitating interactive and captivating learning experiences, improving precision and efficiency in educational materials, and providing data-driven insights that help educators understand their students' needs better. Additionally, AI-driven technology can assist educators in developing more effective assessments and adjusting instruction to enhance student learning outcomes.

AI technology allows educators to create an efficient and personalized learning environment that promotes student engagement and motivation. It offers data-driven insights to assist educators in improving instruction and assessment and providing students with a customized learning experience. However, despite its numerous benefits, AI-powered personalized learning has its limitations. The major challenge is its cost as implementing AI-powered systems demands significant investments in hardware and software, which may be expensive for educational institutions. Moreover, these systems require ongoing maintenance and updates, which could further increase the cost. Another potential challenge is the lack of human interaction since AI cannot substitute the role of human instructors, leading to a lack of social interaction between students and their instructors, which is an essential element of the learning process.

3. LANDSCAPE OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) has become an integral part of our lives, revolutionizing various sectors and offering unprecedented opportunities for advancement. From cybersecurity and online privacy to social media and transportation, AI has significantly transformed the way we navigate and interact with the world. However, along with its undeniable benefits, AI also presents a series of risks, ethical concerns, and potential implications that require careful examination [9]. In this article, we delve into the multifaceted landscape of AI, exploring its impact on cybersecurity, online privacy, social media, transportation, logistics, ethical decision-making, and its potential future impact on society [4]. By investigating these crucial areas, we aim to shed light on the challenges and opportunities that AI brings, ultimately paving the way for a deeper understanding of its complex influence on our lives.

3.1 The Risks of AI in Cybersecurity and Online Privacy

Artificial Intelligence (AI) has become an essential tool for enhancing cybersecurity by automating threat detection and response. However, it also introduces new vulnerabilities that can be exploited by attackers. Adversarial attacks are one of the most significant risks of AI in cybersecurity, where attackers manipulate AI algorithms to evade detection or cause false positives [21]. Such attacks are particularly concerning in critical infrastructure such as power grids or water treatment plants, where successful attacks can cause severe damage.

Another risk of AI in cybersecurity is the bias in AI algorithms. AI algorithms learn from large datasets, and if the data is biased, the algorithms will be biased too. For example, if an AI algorithm is trained on data that contains a disproportionate number of male subjects, it may have difficulty accurately identifying females [22]. AI algorithms can also be vulnerable to poisoning attacks, where an attacker manipulates the training data to bias the algorithm's output. For instance, an attacker may add fake data to trick the algorithm into identifying a specific type of malware as benign.

AI also poses new risks to online privacy. One of the significant concerns is the use of AI to infer sensitive information about individuals. For example, an AI algorithm could analyze a person's browsing history and infer their political affiliation or sexual orientation [23]. AI can also be used to de-anonymize data, where an attacker can identify an individual's identity from anonymized data. For instance, researchers at the University of Texas were able to identify individuals in a large dataset of anonymized taxi rides using machine learning algorithms [24]. Moreover, AI can be used to create realistic deep fakes, which are videos or images that are manipulated using AI to make them appear authentic. Deep-fakes can be used to spread disinformation, defame individuals, or even extort them [25].

To mitigate the risks of AI in cybersecurity and online privacy, several solutions can be implemented. First, AI algorithms must be transparent and explainable, so that their outputs can be audited and validated. This will enable experts to detect and correct any biases or adversarial attacks [26]. Second, data privacy laws and regulations must be strengthened to protect individuals' privacy rights. Companies that collect and use personal data must be held accountable for the security of that data and be transparent about how it is being used [27]. Third, security systems must be multi-layered and incorporate multiple types of AI algorithms to reduce the risk of adversarial attacks. For example, using multiple machine learning algorithms with different architectures and training data can increase the system's resilience to attacks [28]. Finally, individuals must be educated about the risks of AI and how to protect their online privacy. They must be aware of the data they share online and how it can be used to infer sensitive information. They must also be vigilant about the authenticity of online content and be cautious about sharing personal information with unreliable sources [29].

3.2 The Influence of AI in Social Media and Spread of Misinformation

Artificial Intelligence (AI) has become an essential tool in the world of social media. With its capability to learn and analyze vast amounts of data, AI has revolutionized social media by enabling businesses, organizations, and individuals to reach their target audiences more effectively. Nevertheless, the increasing use of AI in social media has sparked concerns over the dissemination of fake news, propaganda, and misinformation.

Gu and Xu [30] provided a comprehensive review of AI in social media in their article, "A Comprehensive Review of AI in Social Media,". They discuss how AI has revolutionized social media, from personalization to content moderation. According to them, AI has enabled social media platforms to tailor content to the interests and behavior of individual users, thus improving the user experience. The use of AI algorithms in social media advertising has also led to higher engagement rates, conversion rates, and ROI for businesses. They also acknowledge that one of the biggest challenges of AI in social media is the spread of misinformation.

Misinformation refers to intentionally or unintentionally false or misleading information. Chen and Subrahmanian [31] discuss the role of algorithms in the spread of misinformation on social media platforms, through deep fake videos, fake social media accounts, and bots, which can be used to spread false information and manipulate public opinion.

The propagation of misinformation on social media can have grave real-world implications. For example, the use of social media to spread fake news and propaganda during the 2016 US presidential election influenced the election's outcome. Moreover, during the COVID-19 pandemic, the spread of misinformation on social media has led to mistrust, confusion, and non-compliance with public health guidelines.

Chen and Subrahmanian [31] also argue that AI can be leveraged to address the problem of misinformation on social media by using it to detect and remove false information quickly. Additionally, social media users must be educated about the risks of misinformation and taught how to identify false information. Social media platforms must also take responsibility for the content posted on their platforms and be transparent about their content moderation policies. Finally, governments and regulatory bodies can implement laws and regulations to address the spread of misinformation on social media.

3.3 Impact of AI in Transportation

According to research, the global AI transportation industry is valued to grow by 100% of its initial value in 2017 by 2023. Through innovations that enable different modes of transportation, resulting in safer and cleaner travel, the impact of Artificial intelligence (AI) in revolutionizing transportation is huge.

One of its applications is the prediction of accidents based on environmental and other factors. Several companies, such as Geotab, Sfara, and Zendrive, are utilizing AI to predict crashes, enabling proactive measures to prevent accidents.

Another significant development is the integration of electric vehicles with AI. Electric vehicles have lower emissions and can greatly aid in reducing environmental pollution. Connect Transit is an example of a company using electric buses integrated with AI to optimize the routes and reduce energy consumption. The AI system adjusts the bus schedules based on traffic and weather conditions, providing a more efficient and eco-friendly service.

AI-powered self-driving cars are another development that has the potential to make transportation safer. Self-driving cars equipped with AI have the ability to detect and avoid collisions with pedestrians and cyclists, reducing the number of accidents caused by human error. Companies such as Waymo, Tesla, and Uber are already testing self-driving cars on roads.

In addition, AI can be used to reduce traffic congestion and ensure a smooth flow of traffic. AI-powered traffic management systems are used by many smart cities worldwide to optimize traffic flow and reduce congestion.

3.4 Artificial Intelligence in Logistics

The logistics industry has experienced a significant transformation over the last few years due to the adoption of artificial intelligence (AI).

AI's impact has been seen in several areas, including supply chain management, warehouse management, and transportation management. AI algorithms can help optimize supply chain management by analyzing data on inventory levels, shipping times, and customer demand, leading to efficient inventory management, reduced shipping times, and enhanced customer satisfaction. Warehouse management can also benefit from AI-powered robots that automate picking and packing, optimize warehouse layouts, and improve inventory management.

Transportation management can be optimized using AI algorithms to reduce fuel consumption, improve delivery times, and optimize routes. Self-driving trucks and drones can transport goods over long distances and deliver small packages efficiently, respectively. Although AI technology's implementation in logistics can automate some job roles, it also creates new job opportunities in data analysis, robotics, and AI development.

However, AI technology's use in logistics poses a significant challenge to data privacy and security. Sensitive data, such as customer information, could be at risk of data breaches and cyber-attacks. It is critical for logistics companies to implement robust security measures to safeguard their data and comply with data privacy regulations.

3.5 AI and the Ethical Implications of Decision-making

Despite its potential to improve efficiency, reduce costs, and speed up research and development, there are certain ethical and social concerns regarding AI. This is a result of Private companies employing AI software to make critical decisions

concerning health, employment, creditworthiness, and criminal justice, without any substantial oversight from the government. Consequently, there are concerns about how these companies ensure that their programs are not structurally biased either consciously or unconsciously [32]. That is to say that AI has become integral to the strategy of virtually every big company, and AI systems are being used to manage more sophisticated assignments. This could cause more societal harm than economic benefits.

Some researchers believe that AI offers a way to remove human subjectivity and bias, while others warn that many algorithms used in decision-making processes may already be influenced by societal biases. There are however opinions that concerns about AI injecting bias into everyday life on a large scale may be exaggerated [32]. The sentiment is that biases already exist, especially situations where human decision-making is involved.

When used carefully and thoughtfully, AI can help to reduce the potential for human favoritism or prejudice although some philosophers think that AI will always reproduce human biases.

3.6 The Future of AI and its Potential Impact on Society

Artificial Intelligence is rapidly evolving and driving the emergence of other technologies. AI will continue to expand in its innovations and adoptions, with approximately 44% of companies planning to make serious investments in it. IBM inventors received 2,300 AI-related patents out of 9,130 patents in 2021 [33]. ChatGPT and AI art generators have already gained mainstream attention as examples of generative AI.

The potential applications of Artificial Intelligence (AI) are not limited to technological advancements alone. In addition, AI has the potential to significantly impact sustainability, climate change, and environmental concerns. One of the areas where AI can have a positive impact is in the development of smart cities. The use of advanced sensors and machine learning algorithms in cities can result in reduced congestion, pollution, and improved quality of life for citizens. For instance, AI can be used to optimize traffic flow, reduce energy consumption, and improve waste management practices.

According to a report by the United Nations [34], the use of AI in smart cities has the potential to reduce energy consumption by up to 30% and reduce greenhouse gas emissions by up to 15%. Moreover, the deployment of AI-powered sensors in the transportation sector can help to reduce emissions by optimizing routes and reducing congestion. These applications of AI in smart cities are expected to create new job opportunities in the fields of data analysis, machine learning, and smart city planning, among others.

At present, AI cannot fully understand language, unlike humans who can translate machine language. However, if AI can understand human languages, it could read and understand everything ever written. While AI can improve efficiency and augment human work, it can also have both positive and negative impacts on society. The use of AI has the potential to improve job satisfaction and increase human productivity, as repetitive or hazardous tasks can be delegated to machines. This allows humans to focus on creative and empathetic work, leading to a more fulfilling work environment [35].

AI can also impact healthcare by enhancing the operations of medical facilities, and reducing operating costs. Patients could also benefit from personalized treatment plans and drug protocols.

The use of AI in the judiciary, including facial recognition technology, presents opportunities to solve crimes effectively without compromising individuals' privacy.

Overall, AI will have a tremendous impact on the society while the misuse and ethical concerns eventually become bearable.

4. CONCLUSION AND RECOMMENDATION

The rapid growth of AI holds immense potential for revolutionary advancements across various domains, including healthcare, finance, transportation, and marketing. However, the widespread application of AI technologies raises significant concerns. The societal impacts of AI have sparked extensive debates in scholarly literature. Some researchers argue that AI has the capacity to bring substantial benefits to society, such as improved healthcare outcomes. Conversely, others express concerns about potential repercussions such as widespread unemployment, data breaches, privacy violations, cybercrime, and negative effects on social and environmental sustainability.

In conclusion, the influence of AI on society is complex and multifaceted. While the future of AI remains uncertain, it is clear that its impact will continue to expand across numerous industries and societal aspects. However, it is vital to address the ethical and social implications associated with AI. This necessitates a comprehensive assessment of the ethical and societal consequences during the development and implementation of AI technologies, along with responsible governance practices. By doing so, we can minimize unfavorable effects and maximize positive outcomes, ensuring that AI contributes to a better society.

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