



IMPACT OF AI ON ENVIRONMENT AND SOCIETY

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ABSTRACT

Artificial Intelligence (AI) has significantly altered both the natural world and human societies. This abstract highlight the positive effects and drawbacks of artificial intelligence on certain domains. Artificial intelligence has shown itself to be a promising force for good in the field of environmental sustainability. AI-powered machine learning algorithms are useful for optimizing energy use in homes and businesses. AI has a significant impact on wildlife conservation, helping to protect threatened and endangered species. Regarding society, artificial intelligence has revolutionized the field of healthcare. AI-powered technologies are improving treatment planning and early disease detection. AI has made telemedicine possible, expanding access to medical care, especially in rural places, and enhancing public health in general. Medical imaging data, including MRIs and X-rays, can be analyzed by AI algorithms to find anomalies. These developments are not without difficulties, though. Artificial intelligence (AI) creates issues with employment displacement and privacy, but it also improves healthcare and accessibility and offer hopeful answers to environmental problems. Careful thought and regulation are required to fully utilize AI while addressing its societal and ethical ramifications. The secret to a sustainable and just AI-driven future is striking a balance between innovation and responsibility.

KEYWORDS: Artificial Intelligence, Environment, Society, Environmental Sustainability, Agriculture

The use of Artificial Intelligence (AI) has result in a technological revolution with implications for both the environment and society. AI applications span various domains, offering innovative solutions to long-term challenges and presenting new opportunities. In terms of environmental impact, AI has emerged as a promising force for a positive change. Machine learning algorithms, driven by AI, are optimizing energy consumption, managing electricity distribution, and revolutionizing agriculture practices.

These advancements hold the potential to reduce costs, control greenhouse gas emissions, and introduce more sustainable approaches to resource management. Simultaneously, AI's influence extends to societal realms, particularly in healthcare, where tools powered by AI enhance disease detection and treatment planning, and in telemedicine, extending healthcare accessibility.

However, this transformative wave of AI is not without its challenges. Job displacement, ethical concerns surrounding privacy, biases in algorithms, and the environmental footprint of AI hardware are among the critical issues that demand careful consideration. This interplay between the positive contributions of AI and its potential drawbacks underscores the need for comprehensive regulation, ethical frameworks, and responsible innovation. Striking the right balance between harnessing the benefits of AI for environmental sustainability and societal well-being, while reducing its

challenges, is crucial for shaping a future where technology serves as a positive force for humanity and the planet. (Nilsson, 2014; Nils, 1998)

WHAT IS ARTIFICIAL INTELLIGENCE

By programming machines to replicate human intellect, artificial intelligence (AI) allows them to think, learn, and do tasks that typically require human cognitive abilities. By programming machines to replicate human intellect, artificial intelligence (AI) allows them to think, learn, and do tasks that typically require human cognitive abilities. Artificial intelligence (AI) is the umbrella term for a variety of tools and techniques that enable machines to process data, find patterns, decide what to do, and improve over time.

Robotics, computer vision, machine learning, and natural language processing are key components of artificial intelligence. (Tavor, 2023)

While there are various definitions, artificial intelligence (AI) is generally believed to be associated with devices and computers that assist humans in solving problems and streamlining workflows (Table 1).

To put it briefly, artificial intelligence (AI) is human-created intelligence manifested in machines. Artificial Intelligence (AI) refers to the capabilities of tools created by humans that imitate the "cognitive" functions of human intelligence. (Russell and Norvig, 2009)

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Recently, cybernetic technology has advanced so quickly that artificial intelligence (AI) is already present in almost every area of our life.

Some AI technologies have grown so ubiquitous in our daily lives that we no longer recognize them as AI, such as optical character recognition (OCR) and Siri (voice interpretation and recognition interface), which are employed in computerized information search engines. (Schank, 1991)

The term "strong AI" describes the idea that artificial intelligence (AI) can be trained to behave like a human mind, with intelligence in every task it is given and even perception, belief, and other cognitive capacities that are normally only found in humans. (Jerry, 2016)

Table 1: Benefits of implementing AI

Benefit	Example
Increased Efficiency	Automated customer support
Cost Reduction	Optimized supply chains
Improved Accuracy	Predictive maintenance
Enhanced User Experience	Personalized content
Scalability	Cloud based solutions

ENVIRONMENTAL TRANSFORMATION BY AI

AI has already made its mark in various sectors including banking, finance, marketing, agriculture, healthcare, safety systems, space exploration, robotics, and transportation technology (Singh and Nager, 2012; Singh 2023). The use of AI is also seen in the management of city transport systems with self-driving vehicles and in the deployment of robots to serve in restaurants and fix urban infrastructure.

Energy Efficiency

The impact of Artificial Intelligence (AI) on energy efficiency is significant, revolutionizing the way we manage and consume energy. AI optimizes energy usage through advanced algorithms that analyze patterns, predict demand, and dynamically adjust systems for maximum efficiency. In industries, smart grids guided by AI algorithms intelligently distribute electricity, reducing energy wastage and enhancing overall grid performance. Additionally, AI applications in buildings and homes enable adaptive control systems that respond to occupancy patterns, optimizing lighting, heating, and cooling to minimize energy consumption. This not only lowers costs but also contributes to a more sustainable

and environmentally friendly approach to energy management. AI's ability to continuously learn and adapt further ensures ongoing improvements in energy efficiency practices, marking a transformative shift towards a more resource-conscious energy landscape. (Tavor, 2023; Raksha, 2020)

PRECISION AGRICULTURE

The impact of Artificial Intelligence (AI) on precision agriculture has been transformative, revolutionizing traditional farming practices. AI-driven technologies, such as smart sensors and machine learning algorithms, empower farmers with real-time data on soil conditions, weather patterns, and crop health. This data-driven approach allows for precise decision-making in areas like irrigation, fertilization, and pest control, optimizing resource usage and reducing environmental impact. Farmers can implement targeted interventions, ensuring that crops receive exactly what they need, when they need it. This not only enhances overall agricultural productivity but also minimizes the use of water, fertilizers, and pesticides. AI in precision agriculture facilitates a more sustainable and efficient farming ecosystem, contributing to increased yields and a reduced ecological footprint in the agricultural sector. Thus, the application of all available advanced technologies towards managing crop variability and maintaining or improving yields and reducing negative impacts on environmental quality, namely advancements in precision agriculture (Agriculture. Adv. Agron, 1999) is central to approaching these issues. There has been a drastic shift in many industries across the globe with the advent of technology (Kakkad *et al.*, 2019).

Wildlife Conservation

The impact of Artificial Intelligence (AI) on wildlife conservation has been instrumental in enhancing monitoring, protection, and preservation efforts. AI-powered technologies, including drones and cameras equipped with computer vision, play a crucial role in real-time wildlife surveillance. These systems aid in detecting and preventing illegal activities such as poaching and habitat destruction, contributing significantly to the protection of endangered species. AI's ability to analyze vast amounts of data, including satellite imagery and acoustic recordings, supports researchers in monitoring biodiversity, assessing ecosystems, and understanding animal behaviors. Furthermore, AI facilitates the rapid analysis of data from wildlife surveys, leading to more efficient conservation strategies. Overall, AI has become a valuable tool in the conservationist's toolkit, offering innovative solutions for safeguarding biodiversity and preserving natural habitats. (Thapar, 1998; Tritsch, 2001)

Waste Management

The Impact of Artificial Intelligence (AI) on waste management has been transformative, optimizing various aspects of waste collection, sorting, and recycling processes. AI-powered systems enhance efficiency in waste sorting facilities by automating the identification and separation of recyclable materials. Smart sensors, guided by AI, facilitate real-time monitoring of waste levels in bins, enabling optimized waste collection routes and reducing unnecessary emissions. Moreover, AI algorithms analyze historical data to predict waste generation patterns, aiding in long-term planning for waste management strategies. By streamlining recycling processes, AI contributes to minimizing environmental pollution and promoting a more sustainable approach to waste disposal. Overall, AI's integration into waste management systems enhance resource efficiency and supports the transition towards a circular economy. (Tavor, 2023; Raksha, 2020)

Air and Water Quality Monitoring

The impact of Artificial Intelligence (AI) on air and water quality monitoring has been substantial, ushering in a new era of more accurate and efficient environmental oversight. AI-powered sensors and monitoring systems analyze vast datasets in real time, providing rapid and precise assessments of air and water quality. These technologies can detect pollutants, identify pollution sources, and predict environmental trends, enabling proactive measures to address issues promptly. In air quality monitoring, AI contributes to identifying patterns of pollution, assisting in the development of targeted interventions for cleaner air. Similarly, in water quality monitoring, AI aids in detecting contaminants and assessing the health of aquatic ecosystems. The integration of AI into environmental monitoring enhances our ability to maintain healthier ecosystems and respond effectively to environmental challenges, ultimately contributing to improved public health and ecological well-being.

Conservation and Biodiversity

The impact of Artificial Intelligence (AI) on conservation and biodiversity is profound, offering advanced tools to address environmental challenges and preserve ecosystems. AI technologies, including machine learning and data analytics, enable the efficient analysis of vast datasets related to biodiversity, ecosystem health, and climate patterns. These insights empower conservationists with a deeper understanding of species distribution, habitat changes, and the overall health of ecosystems. AI-driven monitoring systems, such as drones and satellite imagery, provide real-time

surveillance against illegal activities like poaching and deforestation, contributing significantly to wildlife protection. Moreover, AI assists in developing adaptive strategies to mitigate the impact of climate change on biodiversity. By fostering a data-driven and proactive approach to conservation, AI is playing a pivotal role in safeguarding endangered species, preserving biodiversity, and promoting sustainable practices for the long-term health of our planet. (Raksha, 2020)

Carbon Footprint

As we know, our actions also give birth to reaction so carbon footprint is the reaction of that action. Carbon Footprint is the total amount of Greenhouse gases (including Carbon di oxide and methane).

Approx. 1.9 to 2.5 metric tons of CO₂ per year is the estimated amount of Carbon Footprint per person in India which is relatively less than half of the global average i.e. 4.8 metric tons of CO₂ per year. Carbon Footprint can be reduced by taking some measures like reduced Waste, Recycling, save water, save electricity, save fuel and reduced emission and save paper (CCDGG, 2015).

AI can help in saving electricity by using smart grids, Integration with IoT like smart sensors and devices and automated controls. AI can also play heavy role in water saving by smart irrigation system like precision agriculture. And use smart sensors that can detect leakages. There are smart meters that are used for managing the urban water. Also, Industrial water can be used by using process optimization.

We can also manage paper work and save paper by using Robotic Process Automation (RPA) this can automate repetitive tasks that traditionally require paper. And Intelligent Document processing (IDP) that can extract and process Information from documents, eliminating the need to print forms for manual data entry. (Chang and Vaduva, 2024)

SOCIETAL TRANSFORMATION ENABLED BY AI

The integration of artificial intelligence (AI) has the potential to catalyze profound societal transformations across various domains such as healthcare, economy, education, smart city, public safety and security, etc.

Health Care

AI-driven technologies enhance medical diagnosis, personalized treatment plans, and drug discovery. This not only improves patient outcomes but

also transforms healthcare delivery, making it more accessible and efficient.

AI, as discussed in the referenced article (Nguyen, 2023), encompasses the science and engineering dedicated to creating intelligent computers that emulate human cognitive processes, such as learning and problem-solving. These AI systems are dynamic, autonomous, and capable of adapting based on experience and new data (Batty, 2018). Their strength lies in recognizing patterns and relationships within extensive, diverse datasets. An example is the ability to distill a patient's entire medical history into a concise representation, potentially aiding in diagnosis (Bifulco *et al.*, 2016; Zhao, 2023). Furthermore, AI systems exhibit flexibility and autonomy, continuously learning and adjusting as new information emerges.

Economic Reshaping

Automation and AI-driven productivity improvements redefine the job market. While certain tasks become automated, new opportunities emerge, requiring skills in AI development, data analysis, and problem-solving, shaping the future of work.

AI holds the potential to revolutionize the global economy by lowering communication and transportation costs, enabling businesses to operate globally. The combination of cloud computing and the internet facilitates easy access to data and international collaboration. Furthermore, AI aids businesses in optimizing supply chains and streamlining logistics, thereby reducing time and costs associated with delivering goods and services. This has the potential to foster economic growth, especially in emerging markets with limited access to technology. However, the widespread adoption of AI raises concerns about data privacy, security, and the possibility of monopolies emerging due to AI-powered technologies. (Green, 2018)

Education Transformation

AI facilitates personalized learning experiences, adapting to individual student needs. Virtual tutors, automated grading systems, and smart educational platforms contribute to a more inclusive and effective educational landscape.

Using the widespread appeal of video games, educators can combine game elements and education to create a more interactive and engaging learning experience. AI has the potential to enhance gaming experiences by enabling interactions with lifelike nonplayer characters (NPCs), tailoring gameplay to individual students, and gathering data for learning analytics. An example is Crystal Island, a microbiology

game where players diagnose a disease on an island. The game's storyline adjusts based on the student's actions, goals, and progress. For instance, AI can predict the student's objectives and modify the plot accordingly, allowing students to self-regulate their learning with adaptive support when required. (Nguyen, 2023)

Smart Cities and Infrastructure

AI optimizes urban living through smart city initiatives. Intelligent traffic management, energy efficient buildings, and predictive maintenance of infrastructure enhance the quality of life and promote sustainable urban development.

Leveraging AI in smart city management offers numerous advantages, such as improved efficiency, superior service delivery, sustainability enhancements, and heightened citizen involvement. Nonetheless, it introduces potential drawbacks like bias and discrimination, technical hurdles, and social and ethical considerations. (Batty, 2018)

Smart city management involves employing technology and data to effectively oversee and enhance different facets of urban living, including transportation, energy, waste, public safety, and citizen engagement. This approach utilizes sensors, data analytics, and various technologies to gather and analyze information related to city systems and services, with the aim of optimizing and enhancing their functionality. Smart city management can include a wide range of applications, such as smart transportation, smart energy, smart waste management, etc. (Bifulco *et al.*, 2016).

Public Safety and Security

AI contributes to enhanced public safety through predictive policing, disaster response planning, and cybersecurity measures. These applications help anticipate and mitigate potential risks, making societies more secure.

Artificial intelligence (AI) is revolutionizing public safety and security by providing innovative solutions across various domains. Predictive policing leverages AI algorithms to anticipate crime hotspots, optimizing law enforcement resource allocation. AI-powered surveillance systems enhance monitoring in public spaces through facial recognition and anomaly detection, aiding in prompt threat identification. From cybersecurity defense to border security and critical infrastructure protection, AI plays a vital role in fortifying our defenses. During mass gatherings, AI facilitates efficient crowd management, ensuring public safety. Moreover, AI supports community policing through improved communication and engagement, while crime

investigation benefits from data analysis and pattern recognition. (Zhao, 2023)

CHALLENGES POSED BY AI INTEGRATION

The impact of Artificial Intelligence (AI) on the environment and society comes with several challenges such as ethical concerns (Table 2) and many more that need careful consideration and proactive management:

Job Displacement

The automation brought about by AI in various industries raises concerns about job displacement. Certain tasks being automated may lead to a shift in employment dynamics, necessitating comprehensive reskilling and upskilling initiatives.

Privacy Concerns

AI applications, especially in surveillance and data analytics, raise privacy concerns. The extensive collection and analysis of personal data may infringe on individuals' privacy rights, demanding robust regulations and ethical considerations.

Electronic Waste

The rapid advancement and turnover of AI devices contribute to electronic waste. Proper management and recycling of AI hardware are crucial to mitigate environmental impact (Parmar, 2023). According to Forti (2020), 54.6 metric tons of e-waste were generated worldwide in 2019, and the amount is expected to increase to 74 metric tons, that is by 38% by the year 2030 (Forti *et al.*, 2020). Recycling of e-waste is comparatively more difficult to extract economically (E-Waste). Various methods are used to recycle metal from e-waste but are expensive. Advance technology recovers a lot of metals but produces waste. Some environment-friendly options of extracting metals like bioleaching and vacuum metallurgy exist but still need improvement for use in real life (Zhang and Xu, 2016).

Energy Consumption

Training complex AI models, especially deep learning models, requires significant computational power and energy consumption. This poses environmental challenges and emphasizes the need for energy efficient AI algorithms and hardware (Russell and Norvig, 2009).

Security Risks

AI systems are susceptible to adversarial attacks, where malicious actors manipulate inputs to deceive AI models (Akram *et al.*, 2023). Ensuring the security of AI systems is essential to prevent potential misuse.

Lack of Regulation

The rapid pace of AI development often outpaces regulatory frameworks. The absence of comprehensive regulations can lead to uncontrolled deployment, increasing the risk of unintended consequences (Batty, 2018).

Accessibility Divide

The deployment of AI technologies may exacerbate existing societal inequalities, creating a divide between those who have access to AI-driven benefits and those who do not. Ensuring equitable access and addressing digital divides are essential. (Quinn *et al.*, 2021)

Environmental Footprint of AI

The manufacturing, training, and deployment of AI systems contribute to their environmental footprint. (Zhao, 2023) Balancing the positive impact of AI with its environmental costs requires a focus on sustainable practices.

Addressing these challenges requires a multidisciplinary approach involving collaboration between policymakers, industry leaders, ethicists, and researchers to ensure the responsible and ethical development and deployment of AI technologies.

Table 2: Ethical Concerns in AI

Ethical Concern	Impact
Bias in AI Models	Discriminatory outcomes
Privacy Issues	Data breach and misuse
Job Displacement	Economic inequality
Accountability	Ambiguity in decision making
Transparency	Lack of Explainability

CONCLUSION

Globally, people are depending more and more on artificial intelligence, and this trend is predicted to continue. If privacy and the security of personal data are not adequately handled through the adoption of appropriate rules, laws, and regulations, then the advancement of AI for the benefit of society will be hampered. Strong governance combined with consistent execution is crucial. It is crucial to make sure that, in the process of safeguarding privacy, authorities do not apply too stringent or unjustified rules, as this could impede the advancement of AI and impede societal progress. While creating AI programs, authorities need to be careful to follow moral guidelines. Since society expects strong data privacy protection while also looking to profit from AI, India's lack of an AI legislation could impede growth. A

consistent, sensible, and workable AI policy is necessary to strike this balance.

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