

USE OF ARTIFICIAL INTELLIGENCE-BASED TECHNOLOGIES IN THE HEALTHCARE INDUSTRY: A RESEARCH ARTICLE

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ABSTRACT

This study investigates the current state of artificial intelligence (AI)-based technology applications and their implications for the healthcare business. In addition to conducting a thorough analysis of the literature, this study examined many real-world instances of AI applications in healthcare. The findings show that large hospitals are currently adopting AI-enabled tools to assist medical professionals in patient diagnosis and treatment for a variety of ailments. Furthermore, AI technologies are helping to improve the efficiency of hospital nursing and management functions. While healthcare professionals are enthusiastically embracing AI, its applications offer both the utopian (new opportunities) and the dystopian (challenges to overcome). To present a fair perspective, we discuss the specifics of those opportunities and problems. The findings show that large hospitals are currently adopting AI-enabled tools to assist medical professionals in patient diagnosis and treatment for a wide range of disorders. Furthermore, AI systems are influencing the effectiveness of hospital nursing and management activities. While healthcare providers are enthusiastic about AI, its applications present both the utopian (new opportunities) and the dystopian (challenges to overcome). We go into the specifics of these potential and constraints in order to provide a balanced perspective on the value of AI applications in healthcare. Systems that support patients on all fronts are created by medical AI businesses. Clinical intelligence analyzes medical data from patients and offers insights to help them live better lives.

Keywords: AI-based technology; enthusiastically opportunities and challenges; policy and management support; healthcare industry, medical AI businesses

1. INTRODUCTION

There is a revolution taking on in the healthcare sector right now. Growing shortages of medical specialists and rising overall health care costs are the root causes of this transformation. Because of this, the healthcare sector is trying to put new IT-based procedures and solutions into place that can reduce costs and address these growing issues. A key component of digitalized companies, information and communication technology (ICT) can improve competitive advantage and operational effectiveness [1, 2, 3, 4]. Modern digital technology and gadgets are extensively used in the Fourth Industrial Revolution (4IR) period across all industries to foster innovation and create value [5]. No exception applies to the healthcare sector. Digital technologies like artificial intelligence (AI), machine learning, big data analytics, smart sensors and robots, and the Internet of Things (IoT) are being widely implemented by hospitals and care providers worldwide, particularly in developed economies, with the goal of enhancing both the quality of care and operational efficiency [4]. Over 60% of hospitals globally have integrated IoT into their facilities, according to a survey conducted by Hewlett-Packard Enterprise company Aruba [6]. AI-supported technologies have been widely used in healthcare facilities lately to increase the effectiveness of medical resources and the quality of care provided [2,7]. The knowledge-intensive healthcare sector has many prospects for innovation thanks to AI-based technologies, which include machine learning, natural language processing, and intelligent robotics [8, 9]. At the Radiological Society of North America (RSNA) conference, which took place in Chicago in December 2018, dozens of new and established image device companies gave presentations about their AI initiatives. These initiatives support the accurate and reliable diagnosis and appropriate treatment of patients based on the data obtained from clinical examinations [10]. Additionally, because of AI's potential to bring about revolutionary advances in the treatment of human diseases and public health, researchers, doctors, technology and program developers, and consumers in a variety of disciplines have expressed interest in the technology [2,9,11,12]. By 2021, hospitals will spend \$6.6 biBy 2021, hospitals are expected to invest \$6.6 billion yearly in AI-related technology, according to Accenture [13]. According to estimates from Safavi and Kalis [9] (p. 1), "AI applications might provide up to \$150 billion in yearly

savings for U.S. healthcare by 2026."A group of hospitals serving 500,000 people in southeast England, as demonstrated by Miyashita and Brady [21], fitted discharged patients with a Wi-Fi-enabled armband that remotely monitors vital signs, such as respiratory rate, oxygen levels, pulse, blood pressure, and body temperature. In this instance, the use of AI programs that analyze patient data in real-time resulted in a considerable reduction in hospital readmission rates and ER visits. There was also a 22% decrease in the necessity of costly house calls. Over time, treatment plan adherence rose to 96% as opposed to the industry average of 50%. Another instance is the \$4 million in savings that Grady Hospital, a public hospital in Atlanta, USA, reported from at risk patients.

In light of these situations, where artificial intelligence (AI) supplements or enhances human diagnosis, treatment, and operational procedures, some may predict that doctors may become obsolete very soon. To investigate the prospects and difficulties related to AI applications in the healthcare sector, it is vital to first evaluate the role that AI can play. Numerous real-world applications of AI have demonstrated its huge and broad potential, ranging from simple operational process improvement to the most advanced treatments for emergency patients [9].

The widespread use of AI and digital devices is posing a number of significant challenges, some of which are privacy concerns, cybersecurity, data integrity concerns, data ownership, the issue of data-sharing by different organizational silos, medical ethics concerns, accountability for medical errors, and system failure risks [7,9,22]. Given the nature of healthcare services, ethical concerns are significant since AI technology has the potential to jeopardize patient privacy, safety, and preferences [2,7,19]. The speed of advancements in AI is currently outpacing the policies and ethical requirements for healthcare services that use AI and its applications [19]. AI-based technology should also incorporate human-centered values and flexibility in problem-solving. However, because not all healthcare practitioners have access to AI-based technology at this time, the field is still fairly divided on the subject. In order to predict the future of AI-based technologies' application in diagnosis, high-quality healthcare, and operational strategies, it is necessary to examine the examples of these technologies already in use. Based on this framework, this paper examines many real-world examples from the healthcare industry to better understand how AI impacts care services and operational operations. This line of research will allow us to offer a set of measures for improving patient treatment and illness prevention, as well as hospital operating efficiency. For this goal, we conducted a thorough assessment of the literature as well as a variety of real-world instances to identify AI-based technologies and their applicability in healthcare systems. This study is significant in that it provides new insights into the future of technology-based service operations management. Our study's findings are expected to provide valuable new information to hospital administrators, medical personnel, medical school curriculum developers, education and training managers, human-machine roles and responsibilities specialists, privacy and cybersecurity analysts, and medical ethics professionals.

2. REVIEW OF RELEVANT LITERATURE

Artificial intelligence (AI) is the emulation of human intelligence in devices such as computers or robots that are trained to perform cognitive processes that humans identify with other human brains, such as learning and problem solving. Artificial intelligence, machine learning, and deep learning are popular buzzwords that everyone appears to employ these days. As illustrated in Figure 1, AI is a more general phrase than the other two. Machine learning contains algorithms for a variety of tasks, such as regression and grouping, and these algorithms should be taught on data. The more data you feed into your algorithm, the better it becomes. Deep learning is a relatively new topic of artificial intelligence based on artificial neural networks. Deep learning systems also need data to learn to solve tasks.

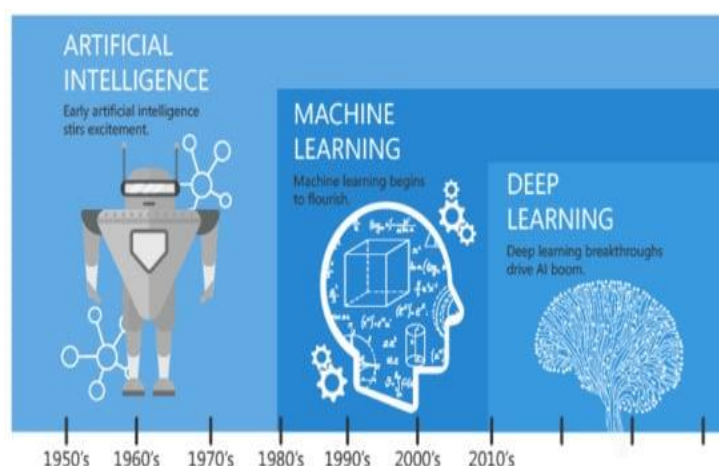


Figure 1. Evolution of Artificial Intelligence

Because AI-based technologies are now being integrated into daily life, implementing them will be critical for every enterprise [3,5,24]. Even though deep learning has improved in tackling challenges in AI for many years, firms must consider the computational expenses associated with training algorithms utilizing large amounts of data [25].

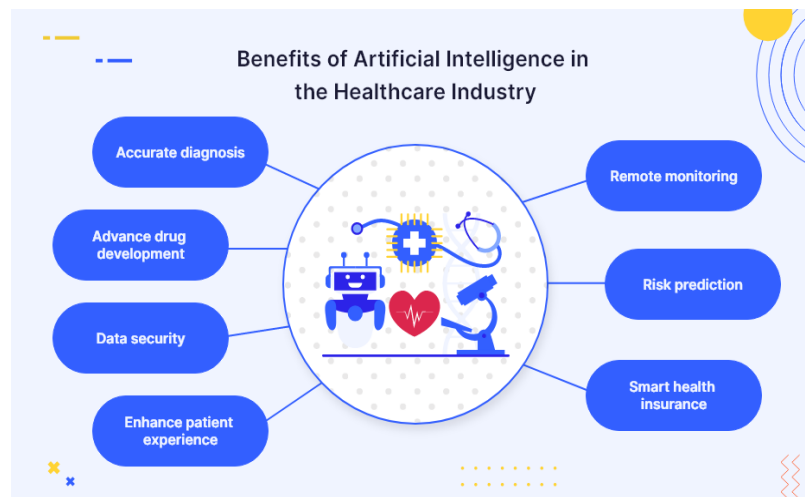
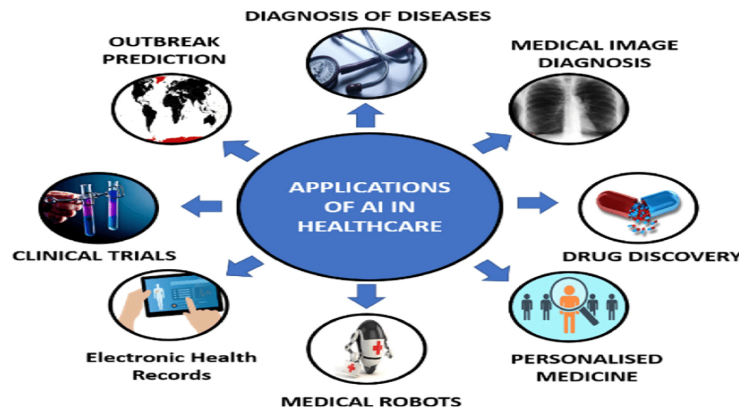
AI-powered technology are becoming interwoven into our daily life [5]. For example, SK Telecom's AI speaker "Aria" is a smart voice-activated device [26]. Aria can place emergency calls when the bearer is unable to use other devices due to accidents, physical limitations, or unusual circumstances. When an elderly person falls and pleads, "Aria, please help," Aria contacts the care center, a chosen family member for emergencies, or ADT Caps. If the center determines that there is an emergency, it will contact 119 (South Korea's emergency call number). This support has already saved a lot of elderly persons. Aria can advise the best credit card to use based on the interest rate and annual fees, as well as remind the user of the credit card payment due date in a particular month. Because AI-based technologies are now being integrated into daily life, implementing them will be critical for every enterprise [3,5,24]. As smart mobile apps and devices grow more common in the digital era, consumers expect differentiated, personalized, and responsive services with secure flexibility. In this context, it is important to analyze real-world cases of current AI use by healthcare organizations for patient care and operations management, as well as to identify the requirements (e.g., regulation and responsibility) and support needs (e.g., ethics, training programs, or consulting services).

Applications of AI tools in Healthcare Industry:

Artificial Intelligence (AI) tools are revolutionizing the healthcare industry by improving patient care, accelerating diagnostics, enhancing treatment outcomes, and streamlining operations. The application of AI in healthcare is vast and holds immense potential to transform the way healthcare services are delivered. Here are some key areas where AI tools are making a significant impact in the healthcare industry:

- **Diagnosis and Medical Imaging:** AI-powered tools are being used to analyze medical images such as X-rays, MRIs, and CT scans to assist radiologists in detecting abnormalities and diseases. AI algorithms can identify patterns and markers that may not be easily visible to the human eye, leading to more accurate and timely diagnoses. This helps in early detection of diseases like cancer, stroke, and other conditions, improving patient outcomes.
- **Personalized Treatment Plans:** AI algorithms analyzed vast amounts of patient data to identify personalized treatment plans based on genetic makeup, medical history, and other factors. This personalized approach to medicine can lead to more targeted and effective treatments, minimizing trial-and-error approaches and reducing adverse effects.
- ***Predictive Analytics*:** AI tools can analyze patient data to predict potential health issues before they arise. By monitoring trends and patterns in patient data, healthcare providers can intervene early, prevent complications, and provide proactive care to patients with chronic conditions.
- **Telemedicine and Remote Monitoring:** AI-powered telemedicine platforms enable healthcare providers to remotely monitor patients, provide consultations, and offer timely interventions. AI algorithms can analyze patient data in real-time, alerting healthcare providers to potential issues and enabling quick responses.
- ***Drug Discovery and Development*:** AI is being used to accelerate the drug discovery process by identifying potential drug candidates, predicting drug interactions, and optimizing clinical trials. This can lead to faster development of new drugs and therapies, ultimately benefiting patients by providing more effective treatments.
- **Administrative Efficiency:** AI tools are streamlining administrative tasks in healthcare facilities, such as scheduling appointments, managing medical records, and processing insurance claims. This automation of routine tasks allows healthcare providers to focus more on patient care and reduces the likelihood of errors.
- **Natural Language Processing (NLP):** NLP technologies enable AI systems to analyze and extract valuable information from unstructured clinical notes, research papers, and patient records. This helps healthcare providers make informed decisions based on a comprehensive analysis of relevant data.
- **Robotics and Surgery:** AI-powered robotic systems are assisting surgeons in performing complex procedures with precision and accuracy. These robotic systems can enhance the capabilities of healthcare providers and improve surgical outcomes by reducing human error and enabling minimally invasive procedures.
- **Healthcare Chatbots:** AI-powered chatbots are being used to provide real-time assistance to patients by answering questions, scheduling appointments, and offering basic medical advice. These chatbots help in improving patient engagement, reducing wait times, and enhancing overall patient experience.

- ***Patient Monitoring and Adherence*:** AI tools are used to monitor patients' vital signs, medication adherence, and overall health status. By continuously collecting and analyzing patient data, healthcare providers can intervene promptly in case of any deviations from normal parameters, ensuring better health outcomes for patients.



Nursing and Managerial Assistance:

As is commonly known, healthcare professionals are frequently swamped with paperwork during the care process. This workload has driven the industry to switch to electronic systems that integrate and digitize medical records, helped by AI-based technology. Furthermore, chatbots have been highlighted as a potentially effective method for communicating with patients and family members in hospitals [44].

The Cleveland Clinic, a nonprofit multispecialty academic medical facility in Cleveland, Ohio, started utilizing Microsoft's AI digital assistant Cortana in 2016 to "identify potential at-risk patients under ICU care" using predictive and advanced analytics. Cortana is linked into the Cleveland Clinic's e-Hospital system and monitors "100 beds in 6 ICUs" between 7 p.m. and 7 a.m. The University of Pittsburgh Medical Center's AI-assisted system may also listen to and learn from doctor-patient talks in hospital rooms [45].

Opportunities and Challenges involves in AI Applications:

The opportunities presented by AI in healthcare are vast and offer immense potential for transforming the industry. Here are some key opportunities that AI presents in healthcare:

- **Improved Diagnostics:** AI algorithms can analyze vast amounts of medical data, including imaging results, lab tests, and patient records, to provide more accurate and timely diagnoses. By identifying patterns and anomalies that may go unnoticed by human clinicians, AI can help improve diagnostic accuracy and enable early detection of diseases.
- **Personalized Medicine:** AI tools can analyze patient data to create personalized treatment plans based on individual characteristics such as genetic makeup, lifestyle factors, and medical history. This tailored approach to healthcare can lead to more effective treatments, reduced side effects, and better outcomes for patient

- **Predictive Analytics:** AI can leverage predictive analytics to forecast potential health issues, identify at-risk populations, and intervene proactively to prevent complications. By analyzing data trends and patterns, healthcare providers can anticipate healthcare needs and deliver timely interventions to improve patient outcomes.
- **Remote Monitoring and Telemedicine:** AI-powered remote monitoring systems can track patients' vital signs, medication adherence, and overall health status in real-time. This enables healthcare providers to deliver care remotely, monitor patients more effectively, and intervene promptly when necessary. Telemedicine platforms powered by AI allow for virtual consultations, expanding access to care and improving patient engagement.
- ***Drug Discovery and Development*:** AI is revolutionizing the drug discovery process by accelerating the identification of potential drug candidates, optimizing clinical trials, and predicting drug interactions. AI tools can analyze vast amounts of biological data to uncover new insights and identify novel therapeutic targets, leading to faster and more effective drug development.
- **Operational Efficiency:** AI technologies can streamline administrative tasks, automate workflows, and optimize resource allocation in healthcare facilities. By automating routine processes such as appointment scheduling, billing, and medical coding, AI can reduce administrative burden on healthcare staff, improve operational efficiency, and enhance overall productivity.
- **Enhanced Imaging and Robotics:** AI-powered imaging and robotic systems can assist healthcare providers in performing complex procedures with greater precision and accuracy. From interpreting medical images to guiding surgical instruments, AI technologies enhance the capabilities of healthcare professionals, reduce human error, and improve patient outcomes.
- **Behavioral Health and Mental Wellness:** AI tools can help in monitoring and addressing mental health conditions by analyzing patient behavior, sentiments, and interactions. AI-powered chatbots and virtual assistants can provide support, counseling, and resources to individuals struggling with mental health issues, improving access to mental healthcare services.
- **Data Security and Privacy:** With the increasing adoption of AI in healthcare, there is a growing need to ensure the security and privacy of patient data. Opportunities exist for AI technologies to enhance cybersecurity measures, protect sensitive health information, and ensure compliance with data protection regulations.
- **Research and Innovation:** AI facilitates medical research by analyzing large datasets, identifying patterns, and generating new hypotheses. By leveraging AI tools for data analysis, researchers can accelerate the pace of scientific discovery, uncover new insights, and drive innovation in healthcare.

Challenges involves in AI Applications:

While AI offers great promise in revolutionizing healthcare, it also presents several challenges that need to be addressed to realize its full potential. Here are some key challenges involved in AI in healthcare:

- **Data Privacy and Security:** Healthcare data is highly sensitive and subject to strict privacy regulations. Ensuring the security of patient data and protecting it from cyber threats is a significant challenge when implementing AI systems in healthcare. Data breaches can have serious consequences for patient trust and healthcare organizations' reputations.
- **Ethical and Legal Concerns:** The use of AI in healthcare raises complex ethical dilemmas, such as the implications of AI decision-making in medical diagnosis and treatment. Issues related to accountability, transparency, bias, and equity need to be carefully analyzed to ensure that AI applications in healthcare adhere to ethical standards and 3. ***Interoperability and Integration*:** Healthcare systems often use multiple technologies and platforms that may not be compatible with each other, leading to challenges in integrating AI solutions into existing workflows. Achieving interoperability among different systems and data sources is essential for maximizing the impact of AI in healthcare and delivering seamless patient care.
- **Data Quality and Standardization:** The effectiveness of AI algorithms in healthcare depends on the quality and consistency of the data used for training and testing. Ensuring that healthcare data is accurate, complete, and standardized across different sources is essential to avoid bias, errors, and misleading results in AI-driven applications.
- **Regulatory Compliance:** Healthcare regulations and standards are constantly evolving, presenting challenges for AI developers and healthcare providers in ensuring compliance with legal requirements. Navigating regulatory frameworks, obtaining necessary approvals, and adhering to data protection laws can be complex and time-consuming, hindering the adoption of AI technologies in healthcare. 6. ***Human-AI Collaboration*:** Integrating AI into clinical practice requires a shift in traditional roles and workflows, necessitating collaboration between

healthcare professionals and AI systems. Ensuring effective communication, trust, and understanding between human users and AI technologies is essential for successful implementation and acceptance of AI in healthcare.

- **Bias and Fairness:** AI algorithms are susceptible to biases inherent in the data they are trained on, which can result in unfair or discriminatory outcomes, especially in healthcare decision-making. Addressing bias in AI models, promoting fairness and equity, and ensuring transparency in algorithmic decision-making are critical challenges in deploying AI responsibly in healthcare.
- **Patient Acceptance and Trust:** Patients may have concerns about the use of AI in healthcare, including fears about privacy breaches, loss of human touch in care delivery, and uncertainty about the reliability of AI-generated recommendations. Building patient trust, addressing concerns, and involving patients in the decision-making process are important for ensuring the successful adoption of AI technologies in healthcare.
- ***Skill Gaps and Training*:** Healthcare professionals may require additional training and skills to effectively use AI tools and interpret their outputs. Bridging skill gaps, providing education on AI concepts and applications, and fostering a culture of lifelong learning are essential for empowering healthcare workers to leverage AI technologies for improved patient care.
- **Resource Allocation and Cost:** Implementing AI systems in healthcare can require upfront investment in infrastructure, training, and maintenance, posing challenges for resource-constrained healthcare organizations. Determining the cost-effectiveness of AI solutions, identifying sustainable funding models, and maximizing the value derived from AI investments are key considerations for healthcare stakeholders.

3. CONCLUSIONS

In today's rapidly changing digital age, innovation is critical. Rapidly evolving technologies are the principal tools for implementing and integrating value-creating concepts [5].

As a result, the use of AI and related technologies is not an option, but rather a trend that enterprises must embrace and harness for a competitive edge. Because of its revolutionary character, the healthcare business is particularly vulnerable to AI's novel application potential. AI applications are transforming not only the nature of care delivery in terms of diagnosis and treatment processes, but also the patients' lifestyles, as their well-being necessitates a comprehensive set of healthy living habits.

AI tools have the potential to transform the healthcare industry by improving efficiency, accuracy, and patient outcomes. By leveraging AI technologies in various aspects of healthcare delivery, providers can deliver better care, reduce costs, and ultimately improve the overall healthcare experience for patients. It is essential for healthcare organizations to embrace and integrate AI tools into their systems to stay competitive and provide cutting-edge care in the rapidly evolving healthcare landscape.

AI has the potential to revolutionize healthcare by enhancing diagnostics, improving treatment outcomes, and driving innovation, addressing the challenges involved in its implementation is crucial for realizing these benefits. By proactively addressing issues such as data security, ethical considerations, interoperability, and bias, healthcare organizations can navigate the complexities of AI in healthcare and leverage its transformative potential to provide better, more efficient, and more equitable care to patients.

Limitations and Future Research Needs:

The 5G network is projected to accelerate the adoption of AI in the healthcare service business in the near future. Medical imaging systems, such as MRIs, produce extremely big files, and 5G networks can improve the quality and accessibility of care services by allowing large-capacity medical image data to be sent fast and precisely. Because the 5G network may be utilized for telemedicine on networks without a LAN connection, patients can obtain medical care or consult with professionals more quickly.

Ericsson, a global leader in communications technology and services, predicts that the 5G market for healthcare services would present a revenue opportunity of around \$76 billion by 2026. The proposals made in this study are based on the existing use of AI-based technologies, which may limit our knowledge of future technologies' true potential. This study has presented some recommendations for effective AI use and management based on a survey of the literature and real-world uses of AI systems in healthcare organizations.

We believe that our findings will motivate more rigorous theoretical and empirical research into the most effective use of AI systems to provide the best possible medical care and preventive public health.

Conflicts of Interest:

The authors declare no conflict of interest.

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