Role of Artificial Intelligence in Healthcare: A Review

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Abstract. Artificial Intelligence (AI) is transforming healthcare by enhancing diagnostic accuracy, improving patient outcomes, and optimizing clinical workflows. This review discusses the major applications of AI in healthcare, including medical imaging, predictive analytics, drug discovery, personalized medicine, and robotic surgery. AI-driven tools assist clinicians in early disease detection, treatment planning, and monitoring. Additionally, AI helps streamline administrative tasks, reducing healthcare costs and improving efficiency. Despite these advancements, challenges such as data privacy, ethical concerns, regulatory issues, and implementation barriers remain. This paper highlights the benefits, limitations, and future perspectives of AI in healthcare, emphasizing the need for responsible integration to ensure safe and effective patient care.

Keywords: Artificial Intelligence, Healthcare, Medical Imaging, Drug Discovery, Personalized Medicine

1 Introduction

Artificial Intelligence (AI) refers to computer systems capable of performing tasks that typically require human intelligence. Artificial intelligence (AI) and its use in contemporary healthcare have flourished since its inception in the 1950s due to scientific and technological advancements [1]. AI is now a vital component of the development and innovation of health care and medical diagnosis, serving as a key catalyst for the emergence and growth of industry 4.0. Algorithms and programs that examine symbolic representations of diseases and their connections to patient indications and symptoms are made possible by medical AI technology [2-5]. In healthcare, AI has emerged as a powerful tool for improving diagnosis, treatment, and patient management.

The application of AI technology in the medical field promotes disease prediction, diagnosis, and treatment, which is advantageous to both patients and healthcare professionals [6]. Improving diagnostic precision is one of AI's most promising fascinating applications in healthcare. AI can help medical professionals diagnose symptoms more quickly than most doctors [7]. By quickly evaluating patients' electronic health records both horizontally and vertically, AI can replicate the predictive ability of human physicians to increase diagnosis accuracy [8]. AI can also enhance patients' quality of life, boost drug adherence, and assist patients in monitoring complicated symptoms [9]. An AI platform, for instance, successfully improved medication adherence in stroke

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patients receiving anticoagulant therapy by 50%, according to a randomized clinical trial research [10]. This paper highlights various applications of AI in healthcare and its challenges and limitations as shown in Figure 1.

2 Applications of AI in Healthcare

AI is widely used in areas such as medical imaging, predictive analytics, clinical decision support, and virtual health assistants. The processing of related research is advanced by the extensive use of AI in healthcare. The corpus of pertinent literature is expanding quickly. As a result, AI research pertaining to healthcare is flourishing in the most recent medical literature. Few bibliometric evaluations concentrate on AI applications in certain types of health problems, such depression, despite the growing popularity of health care-related AI research [11].

2.1 AI in Medical Imaging

AI algorithms analyze medical images such as X-rays, MRIs, and CT scans to detect abnormalities with high accuracy, aiding early diagnosis. Research has shown that AI can match or surpass human experts in image-based diagnosis across a number of medical specialties, such as radiology (a convolutional neural network trained with labelled frontal chest X-ray images outperformed radiologists in detecting pneumonia), dermatology (a convolutional neural network trained with clinical images was found to classify skin lesions accurately), pathology (one study trained AI algorithms with whole-slide pathology images to detect lymph node metastases of breast cancer and compared the results with those of cardiologists) [12-14].

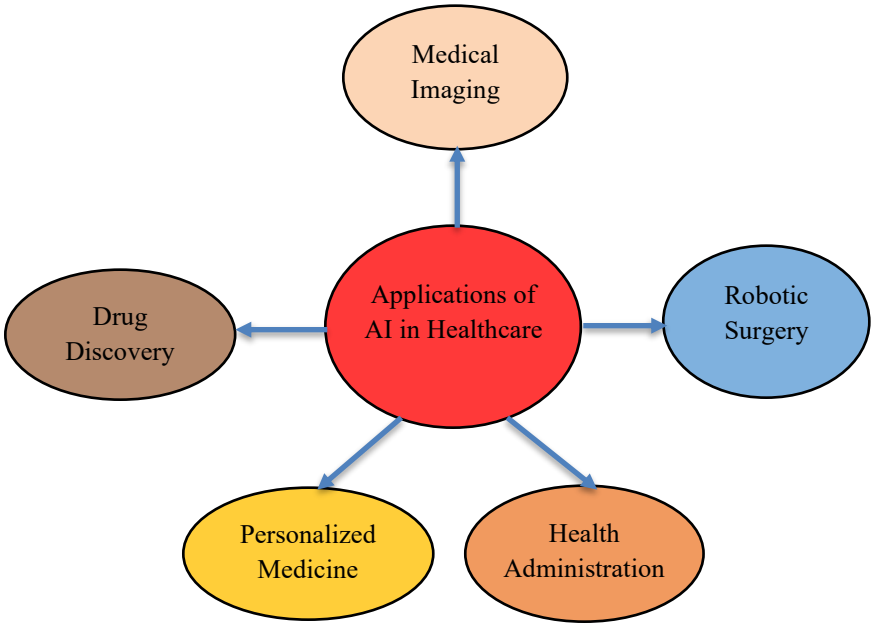


Fig. 1. Various applications of AI in health care

2.2 AI in Drug Discovery

AI will significantly improve clinical trial design and medication manufacturing process optimization. In general, AI has the potential to replace any combinatorial optimization method in the healthcare industry. With the recent releases from DeepMind and AlphaFold, we have already witnessed the beginning of this, which now paves the way for a better understanding of disease processes, the prediction of protein structures, and the development of more focused therapies (for both common and rare diseases. [15-17].

2.3 Personalized Medicine

Customizing medical therapy to each patient's distinct genetic and molecular traits is known as personalized medicine. AI has a lot of potential to advance personalized medicine. Beyond the technology that makes it possible, the idea of personalized medicine—that medical care can be tailored to an individual's genomic and molecular profile has broad ramifications. Healthcare infrastructure, diagnostic and pharmaceutical business models, government and private payer payment policies, and a new regulatory oversight approach will all need to alter. Additionally, personalized medicine will redefine the roles of both the doctor and the patient and shift medical

practices from reactive disease treatment to proactive healthcare management, including screening, early treatment, and prevention [18,19].

2.4 Robotic Surgery

Surgeons can execute many surgical treatments in a patient's body through incisions thanks to robot-assisted surgical devices. Robots and intelligent computer programs are combined in robot-assisted surgery to help physicians execute procedures more precisely. These robots support surgeons during procedures by utilizing comprehensive data from scans and patient information. They can reduce the invasiveness of procedures, resulting in smaller incisions and quicker recovery times [20,21]. Additionally, the intelligent systems anticipate issues and recommend more efficient methods for surgeons to operate, which expedites patients' recovery.

2.5 Administrative Applications

AI automates administrative tasks such as scheduling, billing, and electronic health record management, enhancing efficiency. AI is not limited to monitoring, diagnosis, or caregiving—areas that people might naturally focus on. Rather, we investigate its possible effects on clinical decision support (CDS), staff rota planning, bed management, and predictive maintenance. It is crucial to distinguish between AI used for therapeutic purposes and AI used for hospital administration at this point. The former focuses on using AI technology to optimize administrative procedures, boost operational effectiveness, and increase non-clinical decision-making. The latter entails optimizing administrative tasks directly relevant to patient care and treatment and utilizing AI to help decision-making processes [22,23].

3 Challenges and Limitations

Challenges include data privacy concerns, ethical issues, high implementation costs, and the need for regulatory frameworks. Obstacles include the requirement for regulatory frameworks, significant implementation costs, ethical dilemmas, and data privacy problems. Ensuring strong cybersecurity and protecting patient privacy are crucial concerns. AI in healthcare creates moral mysteries that include decision-making that lacks transparency, algorithms that are biased because of training data that is not representative, and concerns about accountability.

AI technology adoption calls for sophisticated infrastructure, qualified workers, and ongoing system upkeep. This restricts universal accessibility by making AI implementation costly, particularly for developing nations and smaller healthcare facilities. Additionally, there are few uniform standards, confusing clearance procedures for AI-based products, and a lack of clarity regarding legal duty in the event of malpractice. Adoption and incorporation into therapeutic practice are questionable as a result.

Even though AI has enormous potential in the healthcare industry, issues including data privacy, ethical dilemmas, exorbitant expenses, and a lack of legal frameworks need to be resolved.

Successful implementation requires a balanced strategy that incorporates ethical and legal protections with technical innovation [24].

4 Conclusion

In the healthcare industry, artificial intelligence (AI) has become a game-changer, greatly improving patient monitoring, treatment planning, diagnostic accuracy, and operational efficiency. Its potential to enhance patient outcomes and lessen the workload for medical personnel is demonstrated by its applications in fields including clinical decision support systems, drug development, medical imaging, and personalized medicine. AI-driven solutions facilitate quicker and more accurate decision-making, which eventually improves healthcare delivery systems and care quality. Nevertheless, a number of obstacles prevent AI from being widely used in healthcare despite these encouraging developments. Significant obstacles include problems with data security and privacy, ethical issues such algorithmic bias and lack of transparency, expensive implementation costs, and the lack of clear legislative frameworks. Its integration into standard clinical practice is further complicated by issues with data quality, interoperability, and an excessive dependence on automated technologies.

References

[1] Kermany, D. S., Goldbaum, M., Cai, W., Valentim, C. C., Liang, H., Baxter, S. L., ... & Zhang, K. Identifying medical diagnoses and treatable diseases by image-based deep learning. Cell, 172(5), 1122–1131 (2018).

[2] McFarland, M. Google's artificial intelligence breakthrough may have a huge impact on self-driving cars and much more. Washington Post. URL: https://www.washingtonpost.com/news/innovations/wp/2015/02/25/googles-artificial-intelligence-breakthrough-may-have-a-huge-impact-on-self-driving-cars-and-much-more/ [accessed 2020-02-15], (2020).

[3] Yoo, I., Alafaireet, P., Marinov, M., Pena-Hernandez, K., Gopidi, R., Chang, J. F., & Hua, L. Data mining in healthcare and biomedicine: a survey of the literature. Journal of Medical Systems, 36(4), 2431–2448, (2012).

[4] Wimmer, H., Yoon, V. Y., & Sugumaran, V. A multi-agent system to support evidence based medicine and clinical decision making via data sharing and data privacy. Decision Support Systems, 88, 51–66, (2016).

[5] Holmes, J., Sacchi, L., & Bellazzi, R. Artificial intelligence in medicine. Annals of the Royal College of Surgeons of England, 86(86), 334–338, (2004).

[6] Reddy, S. Use of artificial intelligence in healthcare delivery. eHealth—Making Health Care Smarter, 81–97, (2018).

[7] Saifi, S., Taylor, A. J., Allen, J., & Hendel, R. The use of a learning community and online evaluation of utilization for SPECT myocardial perfusion imaging. JACC: Cardiovascular Imaging, 6(7), 823–829, (2013).
[8] Choi, E., Bahadori, M. T., Schuetz, A., Stewart, W. F., & Sun, J. Doctor ai: Predicting clinical events via recurrent neural networks. In Machine Learning for Healthcare Conference, pp. 301–318, (2016).
[9] Kreps, G. L., & Neuhauser, L. Artificial intelligence and immediacy: designing health communication to personally engage consumers and providers. Patient Education and Counseling, 92(2), 205–210, (2013).
[10] Labovitz, D. L., Shafner, L., Reyes Gil, M., Virmani, D., & Hanina, A. Using artificial intelligence to reduce the risk of nonadherence in patients on anticoagulation therapy. Stroke, 48(5), 1416–1419, (2017).
[11] Tran, B. X., McIntyre, R. S., Latkin, C. A., Phan, H. T., Vu, G. T., Nguyen, H. L. T., ... & Ho, R. C. The current research landscape on the artificial intelligence application in the management of depressive disorders: a bibliometric analysis. International Journal of Environmental Research and Public Health, 16(12), 2150, (2019).
[12] Esteva, A., Robicquet, A., Ramsundar, B., Kuleshov, V., DePristo, M., Chou, K., ... & Dean, J. A guide to deep learning in healthcare. Nature Medicine, 25(1), 24–29, (2019).
[13] Ehteshami Bejnordi, B., Veta, M., Johannes van Diest, P., Van Ginneken, B., Karssemeijer, N., Litjens, G., ... & Venâncio, R. Diagnostic assessment of deep learning algorithms for detection of lymph node metastases in women with breast cancer. JAMA, 318(22), 2199–2210, (2017).
[14] Strodthoff, N., & Strodthoff, C. Detecting and interpreting myocardial infarction using fully convolutional neural networks. Physiological Measurement, 40(1), 015001, (2019).
[15] Senior, A. W., Evans, R., Jumper, J., Kirkpatrick, J., Sifre, L., Green, T., ... & Hassabis, D. Improved protein structure prediction using potentials from deep learning. Nature, 577(7792), 706–710, (2020).
[16] Team, A. AlphaFold: A Solution to a 50-year-old Grand Challenge in Biology. DeepMind, November 30, (2020).
[17] Das, P., & Mazumder, D. H. An extensive survey on the use of supervised machine learning techniques in the past two decades for prediction of drug side effects. Artificial Intelligence Review, 56(9), 9809–9836, (2023).
[18] Abrahams, E., Ginsburg, G. S., & Silver, M. The personalized medicine coalition: goals and strategies. American Journal of Pharmacogenomics, 5(6), 345–355, (2005).
[19] Parekh, A. D. E., Shaikh, O. A., Manan, S., & Al Hasibuzzaman, M. Artificial intelligence (AI) in personalized medicine: AI-generated personalized therapy regimens based on genetic and medical history. Annals of Medicine and Surgery, 85(11), 5831–5833, (2023).
[20] Quazi, S., Saha, R. P., & Singh, M. K. Applications of artificial intelligence in healthcare. Journal of Experimental Biology and Agricultural Sciences, 10, (2022).
[21] Knudsen, J. E., Ghaffar, U., Ma, R., & Hung, A. J. Clinical applications of artificial intelligence in robotic surgery. Journal of Robotic Surgery, 18(1), 102, (2024).
[22] Pathan, R. R., Osei-Asiamah, J., Jadhav, P. N., Saravanan, S., Singh, A. K., & Sahoo, S. K. Developing decision support systems for healthcare administration using AI. Journal of Neonatal Surgery, 14(10S), (2025). https://doi.org/10.52783/jns.v14.2791
[23] Suresh, N. V., Selvakumar, A., & Sridhar, G. Operational efficiency and cost reduction: the role of AI in healthcare administration. In Revolutionizing the Healthcare Sector with AI, IGI Global Scientific Publishing, pp. 262–272, (2024).

[24] Devasis, P., Atul, V., & Simerpreet, S. A Critical Review on Challenges and Limitations in Artificial Intelligence-Based e-Health Applications. Engineering Technology Open Access, 5(1), 555654, (2023). DOI: 10.19080/ETOAJ.2023.05.555654.