IJTMGH International Journal of Travel Medicine and Global Health

Int J Travel Med Glob Health. 2024 Dec;12(4):229-231 doi 10.30491/IJTMGH.2024.463459.1418
http://ijtmgh.com

Mini Review Open Access

Is Artificial Intelligence (AI) Effective in Diagnosing Diseases?

Saeed Alizadeh[1], Ghazal Vakilzadeh [2]*, Fazel Moghadas Hosseinzadeh[1]

[1] Applied Virology Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.
[2] Department of Pathobiology, Faculty of Veterinary, Science and Research Branch, Islamic Azad University, Tehran, Iran.

***Corresponding Author:** Ghazal Vakilzadeh, Department of Pathobiology, Faculty of Veterinary, Science and Research Branch, Islamic Azad University, Tehran, Iran. Email: ghazalvakilzadeh@yahoo.com, Phone: +989982363808.

Received 2024-06-17; **Accepted** 2024-09-18; **Online Published** 2024-12-01

Abstract

Artificial Intelligence (AI) has transformed the realm of disease diagnosis, providing unparalleled accuracy and efficiency. By utilizing sophisticated algorithms and extensive data sets, AI systems can uncover patterns that are imperceptible to the human eye. These systems enhance diagnostic precision, minimize human errors, and enable early identification of ailments, which is crucial for favorable treatment results. AI's capabilities span diverse medical imaging modalities like MRI, CT scans, and X-rays, aiding in the detection of abnormalities such as tumors or fractures. Furthermore, AI assists pathologists by scrutinizing tissue samples for disease indicators at a cellular level. The incorporation of AI into diagnostic procedures not only expedites decision-making but also individualizes patient care by predicting specific disease risks and proposing customized treatment strategies. As AI technology progresses, its potential to revolutionize healthcare and enhance patient outcomes becomes increasingly apparent. This article succinctly examines the role of artificial intelligence in disease diagnosis.

Keywords: Artificial Intelligence, Diagnostic, Diseases

Citation: Alizadeh S, Vakilzadeh GH, Moghadas Hosseinzadeh F. Is Artificial Intelligence (AI) Effective in Diagnosing Diseases?. Int J Travel Med Glob Health, 2024;12(4):229-231. doi: 10.30491/IJTMGH.2024.463459.1418

Introduction

Globally, the pace of technological and industrial advancement is hastening due to the extensive adoption of next-generation information and communication technologies like AI [1]. Ironically, AI is a longstanding concept that began to be structured in the 1940s, with the actual term "artificial intelligence" being introduced by John McCarthy in 1956 [2]. Artificial intelligence (AI) has been widely employed across various medical sectors to advance the progress of therapeutic development [3]. Deep learning algorithms have the capability to manage growing volumes of data sourced from wearables, smartphones, and various mobile monitoring sensors across diverse medical domains [4]. Researchers have employed a range of AI-driven methods, including machine learning and deep learning models, to identify diseases such as skin conditions, liver ailments, heart diseases, Alzheimer's, and others that require early diagnosis [5]. Present uses of Artificial Intelligence in the field of medicine include applications in Cardiology, Pulmonary Medicine, Endocrinology, Nephrology, Gastroenterology, Neurology, Computational Cancer Diagnosis in Histopathology, Medical Imaging, and Verification of AI-driven Technologies[4]. The prevailing belief is that AI technologies will augment and improve human tasks rather than supplant the roles of physicians and healthcare professionals. AI stands prepared to assist healthcare personnel in a range of responsibilities, encompassing administrative processes, clinical record-keeping, patient communication, as well as offering specialized aid in areas like image interpretation, medical equipment automation, and patient surveillance[6]. Therefore, there arose a necessity for an automated diagnostic system that combines human expertise with the precision of machine capabilities [7].

AI applications to analyze medical data

Machine learning, a facet of AI, involves setting up systems to autonomously learn and improve from their training data without the need for explicit programming[8]. Machine learning algorithms hold promise for extensive integration across various medical domains, spanning from drug exploration to clinical judgment, fundamentally transforming the practice of medicine. The recent accomplishments of machine learning algorithms in computer vision tasks align well with the growing digitalization of medical records [9] . Consequently, it is feasible to detect critical medical crises like relapses or shifts to alternate disease conditions, such as forecasting the advancement from prediabetes to type 2 diabetes utilizing regularly gathered electronic health information. An instance includes employing machine learning classification techniques and contrasting them with various statistical assessments[10].

AI and heart

One of the initial uses of AI in the field of cardiovascular medicine was in cardiovascular pharmacotherapy. Various cardiovascular medications like clopidogrel, warfarin, and statins, especially simvastatin, are being investigated as potential treatment options. Additionally, AI systems based on deep learning hold promise for revolutionary roles in drug exploration, tailored drug treatments, and precision medicine [11]. When integrated into electronic medical records, AI has been utilized to forecast the likelihood of cardiovascular ailments such as acute coronary syndrome and heart failure more effectively than conventional risk assessment tools [4]. AI technologies offer novel opportunities to improve the precision of image analysis in clinical echocardiography, particularly among healthcare professionals who are not specialists in the field. Machine learning algorithms, which are taught to identify various characteristics within an image, can detect specific disease patterns by considering individual pixels and their interconnections [12].

AI and Alzhemier

Alzheimer's disease (AD) is a degenerative neurological condition that gradually impairs cognitive abilities, eventually leading to dementia. Diagnosis of AD relies on identifiable cognitive deficiencies, often characterized by significant memory loss. Advanced artificial intelligence techniques have demonstrated encouraging outcomes in AD studies, offering accurate, efficient, and convenient tools for evaluating AD diagnoses and monitoring Mild Cognitive Impairment (MCI) progression across various contexts. This is made possible by AI's capacity to analyze extensive datasets encompassing clinical, biological, environmental, and lifestyle information [13, 14].

AI and Cancer

The field of oncology has been leading the way in leveraging artificial intelligence for comprehensive cancer care. This encompasses early detection, customized treatment through analyzing patients' genetic data, and forecasting future prognoses [15]. Artificial intelligence algorithms, capable of analyzing extensive multi-modal data to detect subtle signals that may be challenging to identify, could play a part in enhancing this procedure in the upcoming years. Additionally, AI holds the potential to streamline cancer diagnosis by prompting further examination or referral for individuals undergoing screening based on clinical criteria, as well as automating clinical processes in situations where resources are constrained[16]. Innovative developments in the field of clinical oncology have incorporated novel molecular approaches based on artificial intelligence (AI). Next-generation sequencing represents the optimal platform for producing extensive datasets efficiently[17].

AI and Medical imaging analysis

The evaluation of artificial intelligence (AI) in diagnostic medical imaging is currently undergoing thorough scrutiny. AI has exhibited remarkable precision and sensitivity in detecting imaging irregularities and holds the potential to improve the detection and characterization of tissue-based anomalies[18]. In the global battle against COVID-19 in 2018, medical imaging methods like X-ray and computed tomography (CT) played a crucial role, while the newfound advancements in artificial intelligence (AI) technology have bolstered the capabilities of imaging tools, aiding healthcare professionals. The emergence of artificial intelligence (AI) in the realm of medical imaging has actively supported efforts against the COVID-19 pandemic[19, 20].

Conclusion

In summary, Artificial Intelligence (AI) has demonstrated impressive efficiency in the realm of medical diagnostics. By utilizing sophisticated algorithms and machine learning, AI has improved the precision and effectiveness of diagnosing intricate conditions like Alzheimer's, cardiovascular disease, and cancer. Additionally, its utilization in medical imaging has transformed how healthcare providers analyze scans, resulting in timelier and more accurate identification of diverse ailments. The proof outlined in this paper highlights the transformative capacity of AI in the healthcare sector, suggesting a future where technology and medicine merge to significantly enhance patient results.

Highlights

What Is Already Known?

Artificial intelligence (AI) is increasingly being incorporated and involved in various medical fields, increasing diagnostic accuracy and efficiency. Previous studies have shown that AI systems can analyze large data sets and identify patterns that are often undetectable by human physicians. Applications of AI have been successfully used in fields such as cardiology, oncology, and neurology, demonstrating their potential to improve patient outcomes through early disease detection and personalized treatment strategies.

What Does This Study Add?

This study adds to the existing body of knowledge by providing a comprehensive overview of current applications and advances in AI in disease diagnosis. It highlights the transformative impact of AI technologies on medical imaging, cardiovascular medicine, Alzheimer's disease, and cancer care. Furthermore, it emphasizes the importance of integrating AI into clinical workflows to increase diagnostic accuracy and support healthcare professionals in informed decision-making, ultimately paving the way for a more efficient and effective healthcare system.

Authors' Contributions

All authors contributed equally to the conception, design, and writing of the manuscript. No specific contributions were made by individual authors.

Acknowledgements

This section is not applicable as there are no individuals or organizations to acknowledge.

Conflicts of Interest Disclosures

The authors declare that there are no conflicts of interest related to this manuscript.

Consent For Publication

Consent for publication is not applicable as there are no identifiable individuals involved in the study.

Ethics approval

Ethics approval is not applicable as the research did not involve human or animal subjects.

Funding/Support

The authors declare that there was no funding or support received for this study.

Reference

1. Zhang, C. and Y. Lu, *Study on artificial intelligence: The state of the art and future prospects.* Journal of Industrial Information Integration, 2021. **23**: p. 100224. doi: 10.1016/j.jii.2021.100224.
2. Barragán-Montero, A., et al., *Artificial intelligence and machine learning for medical imaging: A technology review.* Physica Medica, 2021. **83**: p. 242-256. doi: 10.1016/j.ejmp.2021.04.016.
3. Shen, J., et al., *Artificial Intelligence Versus Clinicians in Disease Diagnosis: Systematic Review.* JMIR Med Inform, 2019. **7**(3): p. e10010. doi: 10.2196/10010.
4. Briganti, G. and O. Le Moine, *Artificial intelligence in medicine: today and tomorrow.* Frontiers in medicine, 2020. **7**: p. 509744. doi: 10.3389/fmed.2020.00027.
5. Kumar, Y., et al., *Artificial intelligence in disease diagnosis: a systematic literature review, synthesizing framework and future research agenda.* Journal of Ambient Intelligence and Humanized Computing, 2023. **14**(7): p. 8459-8486. doi: 10.1007/s12652-021-03612-z.
6. Bohr, A. and K. Memarzadeh, *The rise of artificial intelligence in healthcare applications*, in *Artificial Intelligence in healthcare*. 2020, Elsevier. p. 25-60. doi: 10.1016/B978-0-12-818438-7.00002-2.
7. Kaur, S., et al., *Medical diagnostic systems using artificial intelligence (ai) algorithms: Principles and perspectives.* IEEE Access, 2020. **8**: p. 228049-228069. doi: 10.1109/ACCESS.2020.3042273.
8. Khan, Z.F. and S.R. Alotaibi, *Applications of artificial intelligence and big data analytics in m-health: A healthcare system perspective.* Journal of healthcare engineering, 2020. **2020**(1): p. 8894694. doi: 10.1155/2020/8894694.
9. Ker, J., et al., *Deep learning applications in medical image analysis.* Ieee Access, 2017. **6**: p. 9375-9389. doi: 10.1002/9781119711278.ch11.
10. Butryn, B., et al., *Application of Machine Learning in medical data analysis illustrated with an example of association rules.* Procedia Computer Science, 2021. **192**: p. 3134-3143. doi: 10.1016/j.procs.2021.09.086.
11. Mathur, P., et al., *Artificial intelligence, machine learning, and cardiovascular disease.* Clinical Medicine Insights: Cardiology, 2020. **14**: p. 1179546820927404. doi: 10.1177/1179546820927404.
12. Romiti, S., et al., *Artificial intelligence (AI) and cardiovascular diseases: an unexpected alliance.* Cardiology Research and Practice, 2020. **2020**(1): p. 4972346. doi: 10.1155/2020/4972346.
13. Fabrizio, C., et al., *Artificial intelligence for Alzheimer's disease: promise or challenge?* Diagnostics, 2021. **11**(8): p. 1473. doi: 10.3390/diagnostics11081473.
14. Frizzell, T.O., et al., *Artificial intelligence in brain MRI analysis of Alzheimer's disease over the past 12 years: A systematic review.* Ageing Research Reviews, 2022. **77**: p. 101614. doi: 10.1016/j.arr.2022.101614.
15. Dlamini, Z., et al., *Artificial intelligence (AI) and big data in cancer and precision oncology.* Computational and structural biotechnology journal, 2020. **18**: p. 2300-2311. doi: 10.1016/j.csbj.2020.08.019.
16. Hunter, B., S. Hindocha, and R.W. Lee, *The role of artificial intelligence in early cancer diagnosis.* Cancers, 2022. **14**(6): p. 1524. doi: 10.3390/cancers14061524.
17. Iqbal, M.J., et al., *Clinical applications of artificial intelligence and machine learning in cancer diagnosis: looking into the future.* Cancer cell international, 2021. **21**(1): p. 270. doi: 10.1186/s12935-021-01981-1.
18. Oren, O., B.J. Gersh, and D.L. Bhatt, *Artificial intelligence in medical imaging: switching from radiographic pathological data to clinically meaningful endpoints.* The Lancet Digital Health, 2020. **2**(9): p. e486-e488. doi: 10.1016/S2589-7500(20)30160-6.
19. Shi, F., et al., *Review of artificial intelligence techniques in imaging data acquisition, segmentation, and diagnosis for COVID-19.* IEEE reviews in biomedical engineering, 2020. **14**: p. 4-15. doi: 10.1109/RBME.2020.2987975.
20. Wang, B., et al., *AI-assisted CT imaging analysis for COVID-19 screening: Building and deploying a medical AI system.* Applied Soft Computing, 2021. **98**: p. 106897. doi: 10.1016/j.asoc.2020.106897.