Exploring the impact and applications of artificial intelligence in advancing modern medical diagnostic practices-role of healthcare providers: Review article

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Abstract---**Introduction:** Since its inception in 1956, artificial intelligence (AI) has advanced significantly, especially in the past decade. AI's integration into healthcare has revolutionized medical diagnostic practices, enabling faster and more accurate analysis of medical records. By mimicking human intelligence, AI facilitates the processing of vast amounts of data, thus improving diagnosis, treatment, and patient care. **Aim:** This review article aims to explore the impact and applications of AI in modern medical diagnostics and evaluate its role across various healthcare providers, including physicians, pharmacists, nurses, radiologists, and pathologists. **Methods:** The article reviews recent advancements in AI technologies and their implementation in healthcare. It examines the benefits of AI across different medical domains and its impact on improving diagnostic accuracy, patient management, and treatment outcomes. **Results:** AI has demonstrated significant benefits in healthcare by enhancing diagnostic accuracy, personalizing treatment plans, and improving patient outcomes. Key technologies such as machine learning, artificial neural networks, and natural language processing have been pivotal in advancing medical diagnostics and patient care. **Conclusion:** AI is increasingly vital in modern medicine, offering solutions to complex diagnostic and treatment challenges. Its applications improve healthcare efficiency, accuracy, and patient satisfaction. However, continued advancements are needed to address the limitations of AI, such as the lack of emotional intelligence.

Keywords---Artificial Intelligence, Healthcare, Medical Diagnostics, Machine Learning, Natural Language Processing, Patient Care.

Introduction

Although artificial intelligence (AI) was first proposed in 1956, significant progress has mostly been made in the last 12 years. In order to enable quicker treatments with better results, artificial intelligence (AI) has become crucial in the analysis of enormous volumes of medical records. Artificial intelligence (AI) is able to learn, predict, evaluate, form conclusions, and even self-correct quickly by using computer systems to mimic human intelligence and processes. The planning,

imaging, voice recognition, and skill learning concerns in medicine are all addressed by this technology. AI systems are trained on particular data sets in order to improve prediction accuracy and help solve complicated problems with extraordinary precision [1-3]. By digitizing patient data and storing it digitally, AI helps healthcare teams by saving time on documentation and generating a digital database that can be used for diagnosis, treatment, and aftercare. Medical practitioners must work with software and hardware experts to create platforms specifically designed for normal operations and data collection in order to suit unique needs. Customizing generic software for specific uses is resulting in the creation of modules for diagnosis, treatment, and after-treatment care that are suited to the needs of specific patients. The performance of AI systems must be optimized through the examination of the gathered data.

Since AI can mimic human talents like reading medical data, texts, photos, bioinformatics, and financial transactions, it helps physicians and surgeons be more creative. They can understand human language, which allows them to make decisions with little error [4, 5]. Artificial intelligence (AI) helps surgeons perform precise procedures by giving pertinent information. It can also be used to collect enough high-quality patient data, which is essential for anticipating and decreasing risks during joint replacement surgeries, shortening hospital stays, and enhancing recovery results [6, 7]. AI is becoming one of the most important technologies for prolonging life in the modern world. In complicated circumstances, it allows for AI-assisted robotic surgery. It also generates information through many virtual support systems, allowing for regular patient communication. Artificial Intelligence can bridge the gap in healthcare provider shortages in rural areas. Furthermore, AI improves medical students' training to satisfy pressing needs in remote areas [8,9]. This technology provides direction to physicians for accurate diagnosis, increasing not only the productivity of healthcare workers but also the quality of healthcare services at lower costs [10,11]. In order to help with better informed patient care decisions, artificial intelligence (AI) is also a critical component of imaging technologies including computed tomography (CT), magnetic resonance imaging (MRI), X-rays, and 3D scanners. In addition, AI effectively handles patient reservations, including appointment reminders, and recommends appropriate food and lifestyle choices for better health [12–14].

Benefits of Artificial Intelligence in the Medical Field

AI is revolutionizing the medical field by addressing various challenges, such as managing different levels of complexity during intricate surgeries, leading to improved quality and outcomes. Patients now benefit from timely and accurate decision-making [15-17]. The numerous advantages of AI in medicine include:
- Detecting anomalies and recommending medical interventions
- Predicting potential future diseases
- Ensuring accurate and efficient diagnoses
- Assisting in complex and innovative treatments
- Regulating patient blood/glucose levels
- Providing comprehensive patient monitoring
- Enhancing comfort for both doctors and patients
- Offering effective training for medical students

- Improving hospital safety
- Gathering data during surgery to refine future procedures
- Contributing to positive patient outcomes
- Enhancing the experience of doctors and surgeons
- Improving overall medical outcomes
- Delivering enhanced pathological results
- Reducing diagnostic costs
- Maintaining clinical records
- Providing excellent patient services

AI is also instrumental in performing various tasks in the medical field, such as automated measurements, including carina angle measurement, aortic valve analysis, and pulmonary artery diameter assessment. It is currently being utilized to assess the severity of fractures and trauma in orthopedic patients [18,19].

Different Types of Artificial Intelligence Technologies in the Medical Field

AI has a profound impact on the medical field, driven by various innovative technologies that assist nurses, doctors, and surgeons in streamlining their work. These technologies are crucial for developing personalized treatment plans for patients and are applicable in medical diagnostic support systems, such as those used for diagnosing congenital heart diseases [20,21]. AI plays a vital role in electronically storing health records, enhancing the accuracy, speed, and consistency of diagnoses. These technologies can precisely predict patient outcomes and capture additional information that might be missed by doctors. In large-scale medical organizations, AI is utilized for the efficient management of health systems, including monitoring cost recovery, health expenditures, and treatment responses.

Machine Learning (ML):

Machine Learning (ML) systems are advanced programs that continuously improve and learn without prior experience or training over time. These systems can automatically evaluate medical results and present them with a probabilistic degree of accuracy. ML algorithms utilize various methods, including supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning, to make informed decisions. In the medical field, ML technology is employed to assess the likelihood of diseases and is instrumental in maintaining patient records for more effective treatment [22-27].

Artificial Neural Networks (ANN):

Artificial Neural Networks (ANN) are computational models inspired by the neural structure of the human brain, operating on concepts such as backpropagation and layered architecture, including input, hidden, and output layers. ANN functions similarly to neurons, with each neuron connected to others and assigned weights, analogous to the bond strength in human brain neurons. By training ANN with large datasets, the optimal path is determined, ensuring accurate decision-making and forecasting disease incidence [28-33].

Natural Language Processing (NLP):

Natural Language Processing (NLP) encompasses techniques for speech recognition and language evaluation. This field includes various independent algorithms, such as parsing and part-of-speech (POS) tagging, often utilizing Hidden Markov Models (HMM). In the medical domain, NLP is valuable for clinical decision support, analyzing unstructured data, and facilitating automated coding and the maintenance of clinical documentation for patients [34-37].

Support Vector Machines (SVM):

Support Vector Machines (SVM) are a type of algorithm used to classify data into distinct groups based on input data. They address the fundamental challenge of data classification and are commonly employed in applications such as email spam filtering. Once trained, an SVM classifier can process and analyze new and previously unseen data points for future correlations. In the medical field, SVMs are utilized for the collection and processing of medical data, aiding in patient management and supporting evidence-based decision-making [38-42].

Heuristic Analysis (HA):

Heuristic Analysis (HA) employs a trial-and-error approach to detect and solve problems. The fundamental algorithm behind heuristic techniques is to implement practical solutions that may not yield the optimal outcome but are sufficient to achieve the desired goal. In the context of healthcare, heuristic analysis is particularly effective in promoting patient safety and efficiently identifying various issues [43-46]. These technologies are broadly applied across various health-related domains, including orthopedics, neurology, cardiology, and oncology, providing patients with more precise and effective care. AI enables doctors to minimize manual tasks, enhancing their ability to plan, make clinical decisions, and refine treatment techniques [47,48]. Patient medical histories can now be quickly accessed, and notifications can be automatically sent to the patient's family. Through backend processing and data storage, AI efficiently manages routine requests. For instance, if a lab test is overdue, AI systems can promptly notify the relevant patient [49,50].

Advancement of Artificial Intelligence:

Artificial Intelligence (AI) has introduced disruptive innovations in the medical field, significantly enhancing the analysis of information, medical records, and systems while advancing digital automation to deliver faster and more consistent results. This technology is particularly valuable for digital consultations and medication management, aiding doctors in achieving superior outcomes, as detailed below [1,6,8].

1. **Medicine**: AI has advanced the fields of diagnosis, treatment personalization, and drug development by streamlining traditionally time-consuming processes. It plays a crucial role in clinical trials, facilitating effective monitoring to achieve accurate results. Additionally, AI enhances patient monitoring and ensures proper communication of vital information.

2. **Surgery**: In surgery, AI is increasingly being integrated by doctors and surgeons to capture data across all phases of surgical procedures. It shows great promise in enhancing the quality of patient care by generating evidence-based clinical decisions that improve both patient outcomes and surgical workflows. AI is particularly effective in delivering efficient results in complex surgeries.

3. **Radiology**: AI-assisted radiology enhances the consistency and accuracy of surgical procedures while learning from real-time working conditions. This technology assists surgeons in achieving better surgical and treatment outcomes, contributing to active patient recovery and increasing the success rates of medical procedures. AI has also made significant strides in the perception and interpretation of complex sensory data, allowing for improved representation and analysis of medical information.

4. **Hospital Administration and Medical Records**: In the healthcare industry, AI optimizes the digital management of records, enhancing efficiency and accuracy. AI integration into Hospital Management Systems has led to improved synchronization of data, automated patient and customer data storage, and more efficient data collection and results processing. This technology also tracks vital patient statistics, providing real-time updates to doctors and patients' families. It plays a crucial role in verifying health systems, effectively leading hospital operations, and accurately predicting the causes of diseases. Moreover, AI offers digital control over hospital administration, increasing the efficiency of doctors, surgeons, and hospital staff.

5. **Cardiology**: AI's application in cardiology is instrumental in reducing the risk of sudden cardiac death. It integrates evidence-based data regarding cardiac diseases and alerts healthcare providers to potential blockages in heart valves, thereby reducing the likelihood of heart attacks. Additionally, AI provides critical information on blood flow, supporting comprehensive patient care from hospital admission through treatment to recovery.

6. **Process Chart of Artificial Intelligence in the Medical Field**: AI facilitates precise and rapid communication during complex surgeries and supports busy doctors by automatically scheduling appointments, checking follow-ups, and improving the efficiency of treatments with minimal diagnostic risks. Researchers, scientists, and healthcare professionals leverage AI technology to benefit humanity [51,52]. AI's successful applications include automatic Electrocardiogram (ECG) interpretation, cardiac monitoring, clinical laboratory analysis, medical imaging, electroencephalography, respiratory monitoring, and anesthesia management. This emerging technology can quickly analyze blood tests, sugar levels, medical images, and various other tasks [53,54]. When patient data is incorporated into algorithms, AI can extract essential information to address specific medical problems.

By leveraging AI, computers can interpret human speech and writing to effectively manage and assess patients using various advanced technologies. This capability provides guidance to doctors, surgeons, and physicians on improving patient outcomes and acquiring real-time skills. AI closely follows the surgeon's steps, analyzing them to make continuous improvements and achieve superior results (55,56). Additionally, it offers suggestions for potential innovations in the medical

field and assesses doctors' adherence to treatment protocols, aiding in the management of new medical challenges. In everyday medical applications, AI significantly enhances efficiency while minimizing risks. It possesses a remarkable ability to gather information through neural networks, advanced imaging, and natural language processing [57,58].

Artificial Intelligence Applications in the Medical Field:

In contemporary healthcare, there is an increasing demand for innovative technologies that positively impact human lives. AI plays a crucial role in fostering innovation within the medical field, enabling doctors to monitor and treat patients remotely without requiring clinic or hospital visits. This technology is now widely accessible for providing online services to patients, allowing healthcare professionals to promptly address various health issues [59,60]. AI's applications extend to treatment planning, where it plays a pivotal role in achieving better clinical outcomes.

1. **Recording and Storage of Medical Data:** AI facilitates the collection, storage, and analysis of medical data, enabling faster access and decision-making. Electronic storage of patient data enhances diagnosis and treatment, provides day-to-day updates on patient progress, aids in identifying disease causes, and supports research and development activities. It also allows for the comparison of individual patient records with broader illness databases [61-65].

2. **Analyzing Different Tests:** AI accurately analyzes various medical tests such as X-rays, ultrasounds, MRIs, and CT scans. It can assess disease progression and identify significant causes, quickly sharing patient information in emergencies to assist doctors and surgeons. AI efficiently performs, evaluates, validates, predicts, and analyzes data using different scanning technologies [66,67].

3. **Patient Monitoring:** AI supports continuous monitoring of patient conditions and the follow-up of treatments. It ensures comprehensive monitoring of patient exercise routines, needs, and habits, facilitating access to crucial patient information [68,69].

4. **Managing Medication Systems:** AI aids in managing patient conditions by enabling the early prediction of vascular diseases and recommending suitable medications, protein, and diet plans [70-74].

5. **Proper Diagnosis and Treatment:** AI employs computer techniques for clinical diagnosis and treatment, managing complex clinical situations and predicting outcomes. It demonstrates intelligent approaches in healthcare by storing health records digitally, which aids in the treatment process [73,74].

6. **Medication Alerts:** AI functions as a personal virtual assistant, alerting patients to take their medications through apps. It provides monitoring, education, and assistance with personal clinical needs, offering innovative solutions for better health management [75-77].

7. **Complex and Customized Treatment:** AI is utilized to perform complex and customized treatments for individual patients, accurately predicting diseases from digitally stored data. It comprehends human commands to deliver successful treatments and offers proactive alerts and customized experiences for each patient [78-80].

8. **Patient Management and Service:** AI enhances patient services within hospitals, accommodating critical needs such as billing, time scheduling, and other clinical applications. It quickly analyzes medical images like X-rays, CT scans, and MRIs [81,82].
9. **Training:** The shortage of medical specialists and facilities has led to high mortality rates in certain diseases. Many patients die during training exercises with new doctors, who, due to lack of experience, pose significant risks. AI technology is now available to train new doctors, helping to meet various medical requirements [83,84].
10. **Decision Making:** AI provides human-like intelligence through computer technology, granting health professionals access to data that aids in designing and customizing decision support systems. It is an effective tool for supporting medical decision-making, fostering innovation, and ultimately improving staff efficiency and patient outcomes [85-87].

AI offers remarkable capabilities in the medical field, allowing tasks to be performed with minimal human intervention. It is increasingly recognized as an essential tool for clinical judgment, analysis, and training. The technology has demonstrated its ability to deliver accurate and rapid diagnoses, which are critical for patient safety—a primary concern in healthcare. By reducing human errors during treatment and surgery, AI enhances the safety and reliability of medical procedures (88,89). Moreover, it assists medical teams in investigating complex medical tests and analyzing data, including genetic profiles of individual patients. This technology is adept at capturing and processing data related to patient histories, case studies, and health conditions, and it can alert patients regarding medication, diet, and exercise to promote better health outcomes (90-92).

Role of AI for Different Healthcare Providers:

Artificial Intelligence (AI) is transforming various aspects of healthcare, providing significant benefits to a range of healthcare providers including physicians, pharmacists, nurses, radiologists, pathologists, and others. Each of these roles leverages AI to enhance their effectiveness and improve patient outcomes.

Physicians:

AI aids physicians by enhancing diagnostic accuracy and decision-making processes. AI algorithms can analyze patient data, including medical histories and lab results, to provide actionable insights. For instance, AI-driven tools can support physicians in diagnosing complex conditions by analyzing patterns that may not be immediately apparent. Additionally, AI assists in personalizing treatment plans by predicting patient responses to different therapies based on historical data and genetic information. This leads to more precise and effective interventions, ultimately improving patient outcomes and reducing the likelihood of medical errors.

Pharmacists:

Pharmacists benefit from AI through improved medication management and patient safety. AI systems can automate the process of dispensing medications,

reducing the risk of human error. Additionally, AI helps pharmacists in drug interactions and contraindications by analyzing patient records and medication histories. AI-driven systems can also optimize medication therapy management by providing recommendations for dosage adjustments and monitoring adherence. This ensures that patients receive the correct medications in the right doses, enhancing the overall effectiveness of pharmacological treatments.

Nurses:

For nurses, AI streamlines administrative tasks and supports patient care. AI-powered systems can assist in managing patient records, scheduling, and monitoring patient vitals, allowing nurses to focus more on direct patient care. AI-driven monitoring systems can detect early signs of deterioration in patient conditions, alerting nurses to take timely action. Furthermore, AI tools can support nurses in managing chronic conditions by providing real-time data on patient health and recommending adjustments to care plans based on the latest evidence.

Radiologists:

Radiologists utilize AI to enhance image analysis and interpretation. AI algorithms can analyze medical imaging data such as X-rays, CT scans, and MRIs to detect abnormalities with high precision. These tools assist radiologists in identifying conditions such as tumors, fractures, and other pathologies that may be difficult to discern manually. AI enhances the accuracy and speed of image analysis, leading to quicker diagnoses and more informed treatment decisions. Additionally, AI can help in prioritizing urgent cases, ensuring that critical patients receive timely care.

Pathologists:

Pathologists benefit from AI through improved accuracy in analyzing tissue samples and laboratory results. AI systems can assist in identifying and classifying cellular and molecular abnormalities, enhancing the diagnostic process for conditions such as cancer. AI algorithms can analyze large volumes of data from biopsies and pathology slides, providing insights that may be missed by traditional methods. This leads to more precise diagnoses and helps pathologists in developing targeted treatment plans based on detailed analysis.

Others:

AI's impact extends to various other healthcare providers and roles. For example, medical researchers can use AI to analyze vast datasets, uncovering trends and patterns that inform new treatments and interventions. Administrative staff benefit from AI through automated scheduling, billing, and patient communication systems, which improve efficiency and reduce operational costs. AI also plays a role in telemedicine, enabling remote consultations and monitoring, thus expanding access to care for patients in underserved areas. Overall, AI is revolutionizing healthcare by enhancing the capabilities of various healthcare providers, leading to more accurate diagnoses, personalized

treatments, and improved patient outcomes across the spectrum of medical practice.

Discussion

AI employs sophisticated algorithms and specialized software to analyze complex and extensive medical data, delivering precise and actionable results without direct human input. This technology's ability to interpret and process information through smart machines is central to its function. AI's primary goal is to explore the relationship between treatment or prevention techniques and patient outcomes, thereby supporting hospitals in enhancing patient satisfaction, reducing costs, and meeting staffing needs. The use of AI has led to improvements in computing power and expedited data collection. For example, robot-assisted surgeries can be optimized using AI integrated with electronic health record systems. This technology evaluates the outcomes of surgeries and therapies to ensure better results and can communicate potential disease risks. Given that each patient presents unique data, AI's ability to collect and store this information digitally proves invaluable for diagnosis and treatment. It continuously monitors patient progress by analyzing lab tests and identifying the primary causes of diseases, offering critical insights during emergencies. Furthermore, AI is instrumental in training new doctors and medical students, enhancing their knowledge and surgical performance. By leveraging available patient and medical data, AI facilitates informed decision-making to improve patient outcomes.

In the coming years, AI will increasingly assist doctors and physicians in making better clinical decisions across all medical specialties. This technology will continue to provide up-to-date information and knowledge essential for patient care. The future of healthcare stands to benefit significantly from the proper implementation of AI, particularly in transforming unstructured text into machine-readable data that can be stored electronically. AI will also play a pivotal role in financial management and healthcare innovation, performing medical tasks more efficiently in terms of both time and cost. It will enhance the digital collection, storage, and categorization of data, leading to improved health outcomes. AI will be capable of answering patient queries in real-time, even in the absence of doctors, and will outperform humans in processing unstructured data and visual images. The technology is poised to revolutionize education, training, research, and development within the medical field. By ensuring proper treatment, AI has the potential to reduce mortality rates, recommending appropriate actions to prevent diseases through its speech recognition capabilities. However, one limitation remains: AI still lacks the ability to mimic or express human emotions to a satisfactory degree, as it does not possess emotional intelligence.

Conclusion

Artificial Intelligence (AI) has become a transformative force in the healthcare sector, significantly advancing medical diagnostic practices and enhancing the roles of various healthcare providers. The integration of AI technologies, such as machine learning, artificial neural networks, and natural language processing,

has revolutionized the way medical data is analyzed and utilized, leading to substantial improvements in diagnostic accuracy, treatment efficacy, and patient management. AI systems are particularly beneficial in providing actionable insights from large volumes of medical data, enabling healthcare professionals to make more informed and timely decisions. For physicians, AI enhances diagnostic precision and treatment personalization by analyzing complex data sets, including medical histories and genetic information. Pharmacists benefit from AI through improved medication management and safety, while nurses can leverage AI to streamline administrative tasks and monitor patient conditions more effectively. Radiologists and pathologists utilize AI to improve image analysis and tissue sample evaluation, respectively, which enhances the accuracy and speed of diagnoses. The broader applications of AI extend to optimizing hospital administration, managing medical records, and supporting remote consultations, thereby addressing gaps in healthcare provision and improving access to care, particularly in underserved areas. Despite its transformative potential, AI in healthcare still faces challenges, such as the need for continued advancements to improve its emotional intelligence and address ethical concerns. Nevertheless, the ongoing development and integration of AI technologies promise significant benefits for the future of healthcare, including enhanced patient outcomes, reduced diagnostic errors, and more efficient healthcare delivery. In summary, AI's role in healthcare is multifaceted and evolving. It holds the promise of delivering more accurate diagnoses, personalized treatments, and improved patient experiences, while also contributing to advancements in medical research and education. As AI technology continues to progress, its applications will likely become even more integral to modern medical practices, driving innovation and improving the overall quality of healthcare.

References

1. Haleem, A., Vaishya, R., & Javaid, M. K. I. (2019). Artificial intelligence (AI) applications in orthopaedics: An innovative technology to embrace. Journal of Clinical Orthopaedics and Trauma. https://doi.org/10.1016/j.jcot.2019.06.012
2. Jha, S., & Topol, E. J. (2018). Information and artificial intelligence. Journal of the American College of Radiology, 15(3 Pt B), 509–511.
3. Lupton, M. (2018). Some ethical and legal consequences of the application of artificial intelligence in the field of medicine. Trends in Medicine, 18(4), 1-7.
4. Murdch, T. B., & Detsky, A. S. (2013). The inevitable application of big data to health care. JAMA, 309(13), 1351–1352.
5. Misawa, M., Kudo, S. E., Mori, Y., et al. (2018). Artificial intelligence-assisted polyp detection for colonoscopy: Initial experience. Gastroenterology, 154, 2027–2029.
6. Caocci, G., Baccoli, R., Vacca, A., Mastronuzzi, A., Bertaina, A., Piras, E., Littera, R., Locatelli, F., Carcassi, C., & La Nasa, G. (2010). Comparison between an artificial neural network and logistic regression in predicting acute graft-vs-host disease after unrelated donor hematopoietic stem cell transplantation in thalassemia patients. Experimental Hematology, 38, 426–433.

7. Haleem, A., Javaid, M., & Vaishya, R. (2019). Industry 4.0 and its applications in orthopaedics. Journal of Clinical Orthopaedics and Trauma, 10(3), 615-616.

8. Guo, J., & Li, B. (2018). The application of medical artificial intelligence technology in rural areas of developing countries. Health Equity, 2(1), 174–181.

9. Atasoy, H., Greenwood, B. N., & McCullough, J. S. (2018). The digitization of patient care: A review of the effects of electronic health records on health care quality and utilization. Annual Review of Public Health, 40, 1. https://doi.org/10.1146/annurev-publhealth-040218-044206

10. Jiang, F., Jiang, Y., Zhi, H., Dong, Y., Li, H., Ma, S., Wang, Y., Dong, Q., Shen, H., & Wang, Y. (2017). Artificial intelligence in healthcare: Past, present and future. Stroke and Vascular Neurology, 2, 230–243.

11. Haleem, A., & Javaid, M. (2019). Industry 5.0 and its expected applications in the medical field. Current Medicine Research and Practice, 9(4), 167-169.

12. Buch, V. H., Ahmed, I., & Maruthappu, M. (2018). Artificial intelligence in medicine: Current trends and future possibilities. British Journal of General Practice, 68(668), 143-144.

13. Kulikowski, C. A. (2019). Beginnings of artificial intelligence in medicine (AIM): Computational artifice assisting scientific inquiry and clinical art - with reflections on present AIM challenges. Yearbook of Medical Informatics. https://doi.org/10.1055/s-0039-1677895

14. Upadhyay, A. K., & Khandelwal, K. (2019). Artificial intelligence-based training learning from application. Development and Learning in Organizations: An International Journal, 33(2), 20-23.

15. Hashmi, S. (2015). 'Coming of age' of artificial intelligence: Evolution of survivorship care through information technology. Bone Marrow Transplantation, 51, 41–42.

16. Mintz, Y., & Brodie, R. (2019). Introduction to artificial intelligence in medicine. Minimally Invasive Therapy & Allied Technologies, 28(2), 73-81.

17. Javaid, M., & Haleem, A. (2019). Industry 4.0 applications in the medical field: A brief review. Current Medicine Research and Practice, 9(3), 102-109.

18. Lee, E. J., Kim, Y. H., Kim, N., et al. (2017). Deep into the brain: Artificial intelligence in stroke imaging. Journal of Stroke, 19, 277–285.

19. Muhsen, I. N., El Hassan, T., & Hashmi, S. K. (2018). Artificial intelligence approaches in hematopoietic cell transplantation: A review of the current status and future directions. Turkish Journal of Haematology, 35(3), 152-157.

20. Miller, D. D., & Brown, E. W. (2018). Artificial intelligence in medical practice: The question to the answer? American Journal of Medicine, 131, 129–133.

21. Xu, J., Yang, P., Xue, S., Sharma, B., Sanchez-Martin, M., Wang, F., Beaty, K. A., Dehan, E., & Parikh, B. (2019). Translating cancer genomics into precision medicine with artificial intelligence: Applications, challenges, and future perspectives. Human Genetics, 138(2), 109-124.

22. Kinnings, S. L., Liu, N., Tonge, P. J., Jackson, R. M., Xie, L., & Bourne, P. E. (2011). A machine learning-based method to improve docking scoring functions and its application to drug repurposing. Journal of Chemical Information and Modeling, 51, 408–419.

23. Varnek, A., & Baskin, I. (2012). Machine learning methods for property prediction in chemoinformatics: Quo Vadis? Journal of Chemical Information and Modeling, 52, 1413–1437.

24. Ain, Q. U., Aleksandrova, A., Roessler, F. D., & Ballester, P. J. (2015). Machine-learning scoring functions to improve structure-based binding affinity prediction and virtual screening. Wiley Interdisciplinary Reviews: Computational Molecular Science, 5(6), 405-424.

25. Erickson, B. J., Korfiatis, P., Akkus, Z., & Kline, T. L. (2017). Machine learning for medical imaging. Radiographics, 37(2), 505-515.

26. Zeng, X., & Luo, G. (2017). Progressive sampling-based Bayesian optimization for efficient and automatic machine learning model selection. Health Information Science and Systems, 5(1), 2. https://doi.org/10.1007/s13755-017-0023-z

27. Li, D., Madden, A., Liu, C., Ding, Y., Qian, L., & Zhou, E. (2018). Modelling online user behaviour for medical knowledge learning. Industrial Management & Data Systems, 118(4), 889-911.

28. Wesolowski, M., & Suchacz, B. (2012). Artificial neural networks: Theoretical background and pharmaceutical applications: A review. Journal of AOAC International, 95, 652–668.

29. Saravanan, K., & Sasithra, S. (2014). Review on classification based on artificial neural networks. International Journal of Ambient Systems and Applications (IJASA), 2(4), 11–18.

30. Pastur-Romay, L. A., Cedrón, F., Pazos, A., & Porto-Pazos, A. B. (2016). Deep artificial neural networks and neuromorphic chips for big data analysis: Pharmaceutical and bioinformatics applications. International Journal of Molecular Sciences, 17(8), 1313. https://doi.org/10.3390/ijms17081313

31. Li, H., Zhang, Z., & Liu, Z. (2017). Application of artificial neural networks for catalysis: A review. Catalysts, 7(10), 306.

32. Abiodun, O. I., Jantan, A., Omolara, A. E., Dada, K. V., Mohamed, N. A., & Arshad, H. (2018). State-of-the-art in artificial neural network applications: A survey. Heliyon, 4(11), e00938. https://doi.org/10.1016/j.heliyon.2018.e00938

33. Shahid, N., Rappon, T., & Berta, W. (2019). Applications of artificial neural networks in health care organizational decision-making: A scoping review. PLoS One, 14(2), e0212356. https://doi.org/10.1371/journal.pone.0212356

34. Dutta, S., Long, W. J., Brown, D. F., & Reisner, A. T. (2013). Automated detection using natural language processing of radiologists' recommendations for additional imaging of incidental findings. Annals of Emergency Medicine, 62(2), 162–169.

35. Heintzelman, N. H., Taylor, R. J., Simonsen, L., Lustig, R., Anderko, D., Haythornthwaite, J. A., Childs, L. C., & Bova, G. S. (2013). Longitudinal analysis of pain in patients with metastatic prostate cancer using natural language processing of medical record text. Journal of the American Medical Informatics Association, 20(5), 898-905.

36. Cai, T., Giannopoulos, A. A., Yu, S., Kelil, T., Ripley, B., Kumamaru, K. K., Rybicki, F. J., & Mitsouras, D. (2016). Natural language processing technologies in radiology research and clinical applications. Radiographics, 36(1), 176–191.

37. Savova, G. K., Tseytlin, E., Finan, S., Castine, M., Miller, T., Medvedeva, O., Harris, D., Hochheiser, H., Lin, C., Chavan, G., & Jacobson, R. S. (2017). DeepPhe: A natural language processing system for extracting cancer phenotypes from clinical records. Cancer Research, 77(21), e115–e118.

38. Verma, R., & Melcher, U. (2012). A support vector machine based method to distinguish proteobacterial proteins from eukaryotic plant proteins. BMC Bioinformatics, 13(Suppl 15), S9. https://doi.org/10.1186/1471-2105-13-S15-S9

39. Zhu, B., Chen, H., Chen, B., Xu, Y., & Zhang, K. (2014). Support vector machine model for diagnosing pneumoconiosis based on wavelet texture features of digital chest radiographs. Journal of Digital Imaging, 27(1), 90–97. https://doi.org/10.1007/s10278-013-9620-9

40. Gu, X., Ni, T., & Wang, H. (2014). New fuzzy support vector machine for the class imbalance problem in medical datasets classification. Scientific World Journal. https://doi.org/10.1155/2014/536434

41. Retico, A., Bosco, P., Cerello, P., Fiorina, E., Chincarini, A., & Fantacci, M. E. (2015). Predictive models based on support vector machines: Whole-brain versus regional analysis of structural MRI in Alzheimer's disease. Journal of Neuroimaging, 25(4), 552–563.

42. Wang, Z. L., Zhou, Z. G., Chen, Y., Li, X. T., & Sun, Y. S. (2017). Support vector machines model of computed tomography for assessing lymph node metastasis in esophageal cancer with neoadjuvant chemotherapy. Journal of Computer Assisted Tomography, 41(3), 455–460.

43. Davies, N., Manthorpe, J., Sampson, E. L., & Iliffe, S. (2015). After the Liverpool Care Pathway—development of heuristics to guide end of life care for people with dementia: Protocol of the ALCP study. BMJ Open, 5(9), e008832.

44. Davies, N., Mathew, R., Wilcock, J., Manthorpe, J., Sampson, E. L., Lamahewa, K., & Iliffe, S. (2016). A co-design process developing heuristics for practitioners providing end of life care for people with dementia. BMC Palliative Care, 15, 68. https://doi.org/10.1186/s12904-016-0146-z

45. Mohan, D., Rosengart, M. R., Fischhoff, B., Angus, D. C., Farris, C., Yealy, D. M., Wallace, D. J., & Barnato, A. E. (2016). Testing a videogame intervention to recalibrate physician heuristics in trauma triage: Study protocol for a randomized controlled trial. BMC Emergency Medicine, 16(1), 44. https://doi.org/10.1186/s12873-016-0108-z

46. Davies, N., Manthorpe, J., Sampson, E. L., Lamahewa, K., Wilcock, J., Mathew, R., & Iliffe, S. (2018). Guiding practitioners through the end of life care for people with dementia: The use of heuristics. PLoS One, 13(11), e0206422.

47. Patel, V. L., Shortliffe, E. H., Stefanelli, M., Szolovits, P., Berthold, M. R., Bellazzi, R., & Abu-Hanna, A. (2009). The coming of age of artificial intelligence in medicine. Artificial Intelligence in Medicine, 46, 5–17.

48. Wahl, B., Cossy-Gantner, A., Germann, S., & Schwalbe, N. R. (2018). Artificial intelligence (AI) and global health: How can AI contribute to health in resource-poor settings? BMJ Global Health, 3(4), e000798.

49. Bashiri, A., Ghazisaeedi, M., Safdari, R., Shahmoradi, L., & Ehtesham, H. (2017). Improving the prediction of survival in cancer patients by using machine learning techniques: Experience of gene expression data: A narrative review. Iranian Journal of Public Health, 46(2), 165–172.

50. Long, E., Lin, H., Liu, Z., Wu, X., Wang, L., Jiang, J., An, Y., Lin, Z., Li, X., Chen, J., et al. (2017). An artificial intelligence platform for the multihospital collaborative management of congenital cataracts. Nature Biomedical Engineering, 1, 24.

51. Yi, P. H., Hui, F. K., & Ting, D. S. W. (2018). Artificial intelligence and radiology: Collaboration is key. Journal of the American College of Radiology, 15(5), 781–783.
52. Winter, J. S., & Davidson, E. (2019). Governance of artificial intelligence and personal health information. Digital Policy, Regulation and Governance. https://doi.org/10.1108/DPRG-08-2018-0048
53. Hai, T. S., & Thuy, N. T. (2012). Image classification using support vector machine and artificial neural network. International Journal of Information Technology and Computer Science, 4, 32–38.
54. Balkanyi, L., & Cornet, R. (2019). The interplay of knowledge representation with various fields of artificial intelligence in medicine. Yearbook of Medical Informatics. https://doi.org/10.1055/s-0039-1677899
55. Ghahramani, Z. (2015). Probabilistic machine learning and artificial intelligence. Nature, 521(7553), 452–459.
56. Weidlich, V., & Weidlich, G. A. (2018). Artificial intelligence in medicine and radiation oncology. Cureus, 10(4), e2475. https://doi.org/10.7759/cureus.2475
57. Kantarjian, H., & Yu, P. P. (2015). Artificial intelligence, big data, and cancer. JAMA Oncology, 1, 573–574.
58. Wartman, S. A., & Combs, C. D. (2018). Medical education must move from the information age to the age of artificial intelligence. Academic Medicine, 93(8), 1107–1109.
59. Krittanawong, C., Zhang, H., Wang, Z., Aydar, M., & Kitai, T. (2017). Artificial intelligence in precision cardiovascular medicine. Journal of the American College of Cardiology, 69, 2657–2664.
60. Hamet, P., & Tremblay, J. (2017). Artificial intelligence in medicine. Metabolism, 69, 36–40.
61. Sachs, P. B., Gassert, G., Cain, M., Rubinstein, D., Davey, M., & Decoteau, D. (2013). Imaging study protocol selection in the electronic medical record. Journal of the American College of Radiology, 10, 220–22.
62. Luxton, D. D. (2014). Recommendations for the ethical use and design of artificial intelligent care providers. Artificial Intelligence in Medicine, 62(1), 1–10.
63. Jha, S., & Topol, E. J. (2016). Adapting to artificial intelligence: Radiologists and pathologists as information specialists. JAMA, 316, 2353–2354.
64. Noorbakhsh-Sabet, N., Zand, R., Zhang, Y., & Abedi, V. (2019). Artificial intelligence transforms the future of health care. American Journal of Medicine. https://doi.org/10.1016/j.amjmed.2019.03.020
65. Tran, B. X., Vu, G. T., Ha, G. H., Vuong, Q. H., Ho, M. T., Vuong, T. T., La, V. P., Ho, M. T., Nghiem, K. P., Nguyen, H. L. T., Latkin, C. A., Tam, W. W. S., Cheung, N. M., Nguyen, H. T., Ho, C. S. H., & Ho, R. C. M. (2019). Global evolution of research in artificial intelligence in health and medicine: A bibliometric study. Journal of Clinical Medicine, 8(3), 360. https://doi.org/10.3390/jcm8030360
66. Chouard, T., & Venema, L. (2015). Machine intelligence. Nature, 521(7553), 435.
67. Scherer, M. U. (2016). Regulating artificial intelligence systems: Risks, challenges, competencies, and strategies. Harvard Journal of Law & Technology, 29, 354–400.

68. Patel, J. L., & Goyal, R. K. (2007). Applications of artificial neural networks in medical science. Current Clinical Pharmacology, 2, 217–226.

69. Fernandez-Luque, L., & Imran, M. (2018). Humanitarian health computing using artificial intelligence and social media: A narrative literature review. International Journal of Medical Informatics, 114, 136–142.

70. Ramesh, A. N., Kambhampati, C., Monson, J. R. T., & Drew, P. J. (2004). Artificial intelligence in medicine. Annals of the Royal College of Surgeons of England, 86(5), 334–338.

71. He, J., Baxter, S. L., Xu, J., Xu, J., Zhou, X., & Zhang, K. (2019). The practical implementation of artificial intelligence technologies in medicine. Nature Medicine, 25(1), 30–36.

72. Yu, K. H., & Kohane, I. S. (2019). Framing the challenges of artificial intelligence in medicine. BMJ Quality & Safety, 28(3), 238–241.

73. Dilsizian, S. E., & Siegel, E. L. (2014). Artificial intelligence in medicine and cardiac imaging: Harnessing big data and advanced computing to provide personalized medical diagnosis and treatment. Current Cardiology Reports, 16(12), 441.

74. Pesapane, F., Volonté, C., Codari, M., & Sardanelli, F. (2018). Artificial intelligence as a medical device in radiology: Ethical and regulatory issues in Europe and the United States. Insights into Imaging, 9(6), 745–753.

75. Buzeav, I. V., Plechev, V., Nikolaeva, I. E., et al. (2016). Artificial intelligence: Neural network model as the multidisciplinary team member in clinical decision support to avoid medical mistakes. Chronic Diseases Translational Medicine, 2(4), 166–172.

76. Shaban-Nejad, A., Michalowski, M., & Buckeridge, D. L. (2018). Health intelligence: How artificial intelligence transforms population and personalized health. NPJ Digital Medicine, 1, 53. https://doi.org/10.1038/s41746-018-0058-9

77. Vuong, Q. H., Ho, M. T., Vuong, T. T., La, V. P., Ho, M. T., Nghiem, K. P., Tran, B. X., Giang, H. H., Giang, T. V., Latkin, C., Nguyen, H. T., Ho, C. S. H., & Ho, R. C. M. (2019). Artificial Intelligence vs Natural Stupidity: Evaluating AI readiness for the Vietnamese Medical Information System. Journal of Clinical Medicine, 8(2), 168. https://doi.org/10.3390/jcm8020168

78. Douali, N., Csaba, H., De Roo, J., Papageorgiou, E. I., & Jaulent, M. C. (2014). Diagnosis support system based on clinical guidelines: Comparison between case-based fuzzy cognitive maps and Bayesian networks. Computers in Biology and Medicine, 113, 133–143.

79. Mayo, R. C., & Leung, J. (2018). Artificial intelligence and deep learning – Radiology's next frontier? Clinical Imaging, 49, 87–88.

80. Shortliffe, E. H. (2019). Artificial Intelligence in Medicine: Weighing the accomplishments, hype, and promise. Yearbook of Medical Informatics. https://doi.org/10.1055/s-0039-1677891

81. Pomprapa, A., MuangKhong, D., Köny, M., Leonhardt, S., Pickerodt, P., Tjarks, O., Schwaiberger, D., & Lachmann, B. (2015). Artificial intelligence for closed-loop ventilation therapy with hemodynamic control using the open lung concept. International Journal of Intelligent Computing and Cybernetics, 8(1), 50–68.

82. Komorowski, M., Celi, L. A., Badawi, O., Gordon, A. C., & Faisal, A. A. (2018). The artificial intelligence clinician learns optimal treatment strategies for sepsis in intensive care. Nature Medicine, 24(11), 1716–1720.

83. Tien, B. D., Bui, Q. T., Nguyen, Q. P., Pradhan, B., Nampak, H., & Trinh, P. T. (2017). A hybrid artificial intelligence approach using GIS-based neural-fuzzy inference system and particle swarm optimization for forest fire susceptibility modelling at a tropical area. Agricultural and Forest Meteorology, 233, 32–44.

84. Vellido, A. (2019). Societal issues concerning the application of artificial intelligence in medicine. Kidney Diseases (Basel), 5(1), 11–17.

85. Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. Nature Medicine, 25(1), 44–56.

86. Bur, A. M., Shew, M., & New, J. (2019). Artificial intelligence for the otolaryngologist: A state of the art review. Otolaryngology–Head and Neck Surgery, 160(4), 603–611.

87. Additive Manufacturing Applications in Industry 4.0: A Review. (2019). Journal of Industrial Integration and Management, 4(2). https://doi.org/10.1142/S2424862219300011

88. Van Hartskamp, M., Consoli, S., Verhaegh, W., Petkovic, M., & van de Stolpe, A. (2019). Artificial intelligence in clinical health care applications: Viewpoint. Interactive Journal of Medical Research, 8(2), e12100. https://doi.org/10.2196/12100

89. Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639), 115–118.

90. Wang, R., Pan, W., Jin, L., Li, Y., Geng, Y., Gao, C., Chen, G., Wang, H., Ma, D., & Liao, S. (2019). Artificial intelligence in reproductive medicine. Reproduction. https://doi.org/10.1530/REP-18-0523

91. Hashimoto, D. A., Rosman, G., Rus, D., & Meireles, O. R. (2018). Artificial intelligence in surgery: Promises and perils. Annals of Surgery, 268(1), 70–76.

92. Hosny, A., Parmar, C., Quackenbush, J., Schwartz, L. H., & Aerts, H. J. W. L. (2018). Artificial intelligence in radiology. Nature Reviews Cancer, 18(8), 500–510.

استكشاف تأثير وتطبيقات الذكاء الاصطناعي في تحسين ممارسات التشخيص الطبي الحديثة ـ دور مقدمي الرعاية الصحية: مقال مراجعة

الملخص:

المقدمة: منذ نشأته في عام 1956، تقدم الذكاء الاصطناعي (AI) بشكل ملحوظ، خاصةً في العقد الماضي. لقد أحدث دمج الذكاء الاصطناعي في الرعاية الصحية ثورة في ممارسات التشخيص الطبي، مما يتيح تحليل أسرع وأكثر دقة للسجلات الطبية. من خلال تقليد الذكاء البشري، يسهل الذكاء الاصطناعي معالجة كميات هائلة من البيانات، مما يحسن التشخيص والعلاج ورعاية المرضى.

الهدف: يهدف هذا المقال إلى استكشاف تأثير وتطبيقات الذكاء الاصطناعي في التشخيص الطبي الحديث وتقييم دوره عبر مقدمي الرعاية الصحية المختلفين، بما في ذلك الأطباء والصيادلة والممرضين وأطباء الأشعة وأطباء الأمراض.

الطرق: يستعرض المقال التقدمات الأخيرة في تقنيات الذكاء الاصطناعي وتنفيذها في الرعاية الصحية. كما يفحص فوائد الذكاء الاصطناعي عبر مختلف المجالات الطبية وتأثيره على تحسين دقة التشخيص وإدارة المرضى ونتائج العلاج.

النتائج: أظهر الذكاء الاصطناعي فوائد كبيرة في الرعاية الصحية من خلال تعزيز دقة التشخيص، وتخصيص خطط العلاج، وتحسين نتائج المرضى. كانت التقنيات الرئيسية مثل تعلم الآلة، والشبكات العصبية الاصطناعية، ومعالجة اللغة الطبيعية حاسمة في تقدم التشخيص الطبي ورعاية المرضى.

الاستنتاج: أصبح الذكاء الاصطناعي أكثر أهمية في الطب الحديث، حيث يقدم حلولاً للتحديات المعقدة في التشخيص والعلاج. تسهم تطبيقاته في تحسين كفاءة الرعاية الصحية ودقتها ورضا المرضى. ومع ذلك، هناك حاجة إلى استمرار التقدم لمواجهة قيود الذكاء الاصطناعي، مثل نقص الذكاء العاطفي.

الكلمات المفتاحية: الذكاء الاصطناعي، الرعاية الصحية، التشخيص الطبي، تعلم الآلة، معالجة اللغة الطبيعية، رعاية المرضى.