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The Potential Applications Of Artificial Intelligence In Medical Field

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ABSTRACT

Artificial intelligence (AI) is a technique of utilising computer technology, or a robot controlled by computer to carry out such tasks that are commonly associated with intelligent beings. The term is applicable to a computer or machine that possesses problem-solving and decision-making abilities like humans. With the advent of new AI technology, the traditional medical environment has transformed completely. The emergence of new artificial intelligence technologies has completely changed the traditional medical environment. Using AI, a patient's diagnosis and treatment can be done more quickly, efficiently, and accurately. In addition to it, AI has a significant role in medical drug formation, medical education, and medical management as well. The aim of this review is to establish the application and potential of AI in medicine and discuss the coming trends.

Key Words : Artificial intelligence, medicine, healthcare, technology, intelligence assistance.

INTRODUCTION

Artificial intelligence (AI) is a technique of utilising computer technology, or a robot controlled by computer to carry out such tasks that are commonly associated with intelligent beings. The term is applicable to a computer or machine that possesses problem-solving and decision-making abilities like humans. When a computer system is furnished with cognitive and abstract processes characteristic of human, like the ability to reason, generalise or learning from experiences, computer can carry out very complex task with huge amount of ease and in no time.

The concept of AI first appeared in 1950. The scientist Alan Turing, who is named as the "father of artificial intelligence", developed the "Turing test" and described AI like but more complex than the human brain [1, 2]. With the evolution of artificial intelligence in the recent past, there has been a upswing of interest regarding this new technical discipline. Because of this upsurge, it has led to the promotion of a series of artificial intelligent systems in practical applications, like the Internist-1 system [3], MYCIN system [4], CASNET system [5], and some databases and record systems [6].

The combination of AI and medicine is very promising, and it can transform the traditional medical environment due to the possible prospects in the future. This paper intent to review the latest implementations of AI in medicine.

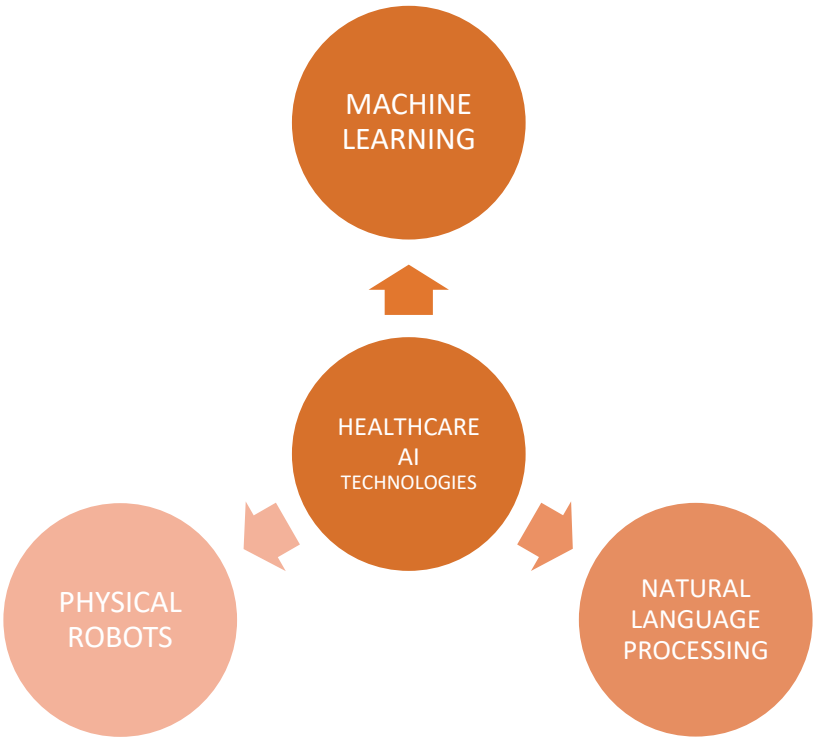
AI TECHNOLOGIES RELEVANT TO MEDICAL HEALTHCARE

- Machine learning
  It is one of the most common forms of AI used in the field of medicinal healthcare. This type of method involves predicting the course of treatment based on patient medical history and attributes [7]. Complex forms of machine learning include neural network [8] and deep learning [9].
- Natural language processing (NLP)

- This field includes speech recognition, analysis of text and other language related goals. Using this form, the clinical notes of patients can be analysed, reports can be prepared, and conversational AI can be conducted.
- Physical robots

  Today the world is very familiar with the robots. In the recent past, the robots have become cooperative with the humans and are well programmed to carry out the desired task. They are becoming more intelligent with the introduction of new AI technologies into their operative systems.

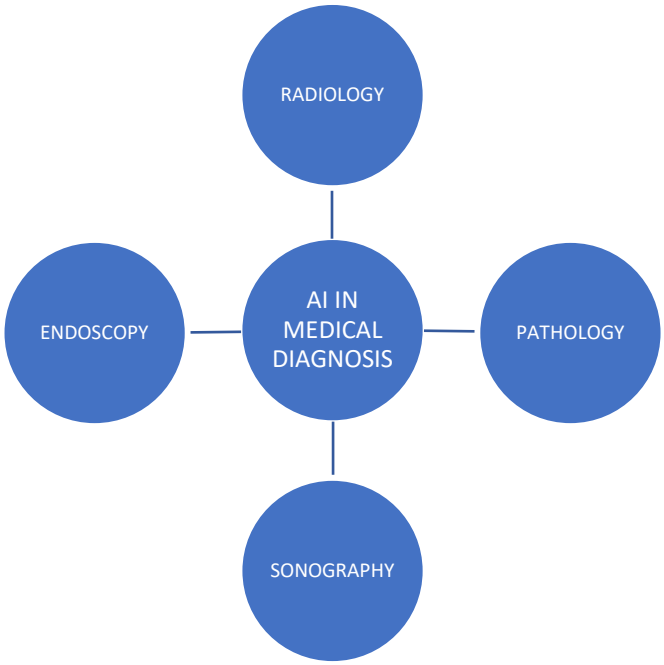
Surgical robots have proven to be a boon for the surgeons. They assist in the ability to see, make precise and minimally invasive incisions [10]. Prostate surgery neck and head surgery can be performed with the help of robots.



1. MEDICAL DIAGNOSIS USING AI

When the doctors diagnose a patient with a certain condition with the use of AI, the time period of the diagnosis is appreciably reduced, and the efficiency is greatly enhanced.

When the clinical data from radiology, pathology, sonography, and endoscopy is analysed using AI the diagnosis is quick and effective unlike the traditional medical method. This application is particularly very useful in case of complicated diagnosis. Hence, using AI doctors can plan the treatment of patients more reasonably and consciously.



1. a) APPLICATIONS OF AI IN RADIOLOGY

The demand for radiological diagnosis has increased immensely over the years but we cannot cultivate the medical workforce overnight. Therefore, AI can play significant role to temper the need of the hour. Various applications of AI in radiological diagnosis include early screening and grading of retinal diseases [11], classification of malignant and benign lung cancer, diagnosis of breast cancer and inflammation in rheumatoid arthritis [12].

1. b) APPLICATIONS OF AI IN ENDOSCOPY

Use of AI technology in endoscopy have made great advances in effective detection of lesions, stomach and intestinal diseases, oesophageal and gastric cancer [13]. Endoscopy combined with AI provides more accurate and highly sensitive results for localization of the bowel lesions [14].

1. c) APPLICATIONS OF AI IN PATHOLOGY

Automatic and rapid analysis to obtain accurate diagnosis from conventional pathological images demands a modern solution. Use of AI algorithms for pathological image segmentation, tumour identification and melanocytic lesions detection can give quick and high-quality results [15]. Multi-scale patch imagining for pathological analysis can be done using multi-task model of AI.

1. d) APPLICATIONS OF AI IN ULTRASONOGRAPHY

Image-based computer aided diagnosis combined with AI have raised the level of analysis and successfully enhanced the results of thyroid nodule classification [16]. Highly accurate and efficient results can be produced for ultra-sonographic detection of breast tumours, bronchial cysts, thyroid cancer, and gynaecological lesions using AI. Use of deep AI learning for diagnosis of initial asthma can be remarkably promoted.

2. AI IN MEDICAL TREATMENT

Artificial Intelligence (AI) used in surgical planning, perioperative care of the patient, 3DP model technology for complex anatomy, bone structure determination, digital holographic imagining, anaesthesiology, and postoperative rehabilitation have assisted patients in achieving an improved level of recovery.

2. a) APPLICATIONS OF AI IN SURGERY

AI plus surgical system has made advances in giving clearer image, performing operations with convenience and accuracy. Using AI remote operations can be performed which revolutionized the traditional surgical model. AI in thyroid surgery improved postoperative cosmesis, voice outcomes [17]. AI gave high surgical success rate with low complications in surgical intervention for the treatment of prostatic, gastric and lung cancer. It yielded advantageous outcomes for patients regarding their recuperation post-surgery.
Three-dimensional printing model(3DP) using AI technology have helped doctors to repair the damaged area using CT scan as a basis for treatment intervention and preoperative simulation enhances surgical proficiency

by providing an opportunity to practice on a model beforehand [18]. 3DP using AI can enhance operator's confidence for the surgery by providing accurate position of surgical angle, confirming the edge cutting and retaining normal tissue as far as possible. 3DP technology using AI reduced operation time and improved efficiency for total knee arthroplasty [19].
Anaesthesiology, one of the most crucial aspects of the surgical procedure, could be monitored deeply using AI thus increasing the safety of patients.
Artificial Intelligence (AI) has emerged as a critical component in the postoperative rehabilitation process, facilitating patient recovery. The alleviation of challenges in the Intensive Care Unit is facilitated by effectively collecting patient's information, reducing false alarms and obtain better degree of recovery [20].

3. APPLICATIONS OF AI IN DRUG PRODUCTION

Involvement of AI in the development of pharmaceutical product can revolutionize the traditional machine learning approach. Traditionally, the process of drug production is time-consuming and tedious. Several tasks need to be performed including designing the ingredients of the drug, performing various clinical tests to ensure safety and finally marketing of the drug. Even after following such time-consuming processes, it is not sure that the drug can be launched in the market for general use. With the advent of AI, the scenario of drug production has transformed completely. This has facilitated the discovery of new drugs [21,22]. The drugs manufactured using AI possess originality and prove to be better in quality [23]. The combination of AI and drug synthesis has accelerated the process of clinical trials and reduced the research and development costs [24]. Using the abilities of AI technology, assembly of cancer drugs was efficiently carried out and the drugs possessed better therapeutic properties [25]. In addition to it, AI-assisted methods are very promising in the field of small molecule drug therapy [26]. The above mentioned 3DP technology allows to attain the desired drug size and shape [27]. Through 3DP technology, the parameters like number of layers in drug coating and drug release rates can be controlled. [28,29]

4. AI IN MEDICAL EDUCATION AND MANAGEMENT

Traditionally, the management in hospitals is taken care of by the administrative department. The department is responsible for overall planning but there are always chances of mismanagement. Here the AI technology comes to the rescue. Scholars used AI to their advantage and developed a prediction model so that the database of patients' hospital-stay time could be analysed. This helped predicting the exact waiting timings, which enhanced the efficiency of hospitals and promoted the medical resources redistribution. [30]
The prediction model precisely predicted the readmission rate which led to efficient management of hospital.[31] In nutshell it can be stated that AI has revolutionised the medical management may it be in terms of counselling of patients, management of hospital, allocation of medical resources and even personalised medical care.[32]
Since they are the future, medical students' education is crucial. However, the medical students' course of study is tedious because of strenuous training. The training and professional knowledge of the students will be hampered if they only read the books.
Hence, students can use AI technology to have better learning experiences. AI-based problem-based learning can improve the outcomes of learning. [33]
Moreover, surgical training based on AI simulation effectively blends AI and simulation proving itself very advantageous for students [34]. 3DP model can be utilised by students to study 3-D anatomical structures and surgical techniques. [35, 36]

Advantages and limitations of Medical AI

The main essence of the evidence-based machine is making clinical decisions through insights from past data. Al provides easy techniques to uncover complex associations with the help of "machine learning". For an example-Neural network works similarly to the human brain [37].

ADVANTAGES OF AI IN HEALTHCARE-

- REVEALING DISEASE RISK- AI keeps patient's data and utilizes it to keep a watch on previous and current health problems, resulting in diagnosis that is more accurate. These Al-driven tools can predict future possibilities about health. Lung disease is the leading cause for cancer death among humans. AI provides an effective screening by providing early diagnosis [38].
- SAVES TIME AND COST- Examining and diagnosing becomes easier. Certain human body illnesses can be detected using biomarker technology. This technology saves time by automating the manual work.
- SURGERY ASSISTANCE- Al Technologies performs robot-assisted surgeries allowing the most accurate movements resulting in minimum pain, negligible blood loss, and a low probability of adverse effects. They provide magnified 3-D view and its seven-degree freedom tools provides high accuracy [39].

LIMITATIONS OF AI IN HEALTHCARE-

- DEFECTIVE DIAGNOSIS- Just like doctors, machine algorithms can see patterns but need a lot of concrete examples to learn, depending on the symptoms and conditions noted. Lack of proper information can lead to inaccurate diagnosis.
- SECURITY RISK- Advancements in AI sometimes make people mistake it for people and provide consent for more convert data than required resulting into privacy concerns [40].
- INCREASED UNEMPLOYMENT RATE- Jobs that were earlier performed by humans are done by machines leading to less requirement of men power. The condition of a patient's mental health to physical health can be analyzed via Chatbots and robots. It might even replace doctors in the future just like X-rays have replaced radiologist's reports.

NEW SET OF CHALLENGES FOR AI-

- PROFESSIONAL LIABILITY- This is made even more challenging by the fact that developing proper legal concepts and guidelines frequently takes longer than technological advancements. Another issue is that healthcare professionals may get comfortable and less willing to question errors and double-check outcomes because of AI [41].
- PROVIDES COMPETENCIES- Education for the health professions will need to go beyond the fundamental biology and clinical disciplines. Curriculum revisions will need to include skills like using intelligence tools with massive datasets, machine learning, and robotics, while still ensuring that people-centred care is mastered [42].
- ETHICAL CONSIDERATIONS- The current strength of AI is on its capacity to spot patterns and learn from large, complicated datasets. Since AI mostly operate as “Black Boxes”, it becomes quite difficult to analyse and explain its behaviour. The problems in evaluating AI system outputs have highlighted questions about accountability, transparency, and human control [43].
- REGULATORY COMPLIANCE- One of the major challenges for AI in the future will be its development in accordance with people’s interest along with inspiring and stimulating innovation in the industry. This implies that technologies for AI should be designed innovatively which also ensures the safety of patient’s private information for unauthorised third parties, respecting the patient’s right to privacy [44].
- DOCTOR-PATIENT RELATIONSHIP- Healthcare providers' empathy skills have proven to be beneficial for a recovering patient. Although the role of doctors has no changes till date but AI in future could revolutionize the doctor, patient and caregiver relation and prove itself to be a great cognitive assistant [45].

CONCLUSION

The scope is artificial intelligence is expanding and it has applications in numerous fields other than healthcare like data analysis and management, digital consultation, drug discovery and many more. The need of the hour is that researchers should come out with results stating that AI techniques could be used at a practical level to improve the present healthcare scenario. The clinicians should also accept the fact that the science of AI can help them to deliver healthcare in a more efficient manner. Looking to the future, AI is unlikely to replace humans given the history of technology, but it will redefine its role as an essential intelligence assistant [46].
It is known to everyone that AI is a developing market. Hence, the future of AI in the field of healthcare seems bright and medical AI can evidently play a vital role in this field.

REFERENCES

1. Mintz Y, Brodie R. Introduction to artificial intelligence in medicine. Minim Invasive Ther Allied Technol, 2019,28(2):73-81.
2. Kaul V, Enslin S, Gross SA. The history of artificial intelligence in medicine. Gastrointest Endosc, 2020, 92(4):807-812.
3. Miller RA, Pople HJ, Myers JD. Internist-1, an experimental computer-based diagnostic consultant for general internal medicine. N Engl J Med, 1982,307(8):468-476.
4. Shortliffe EH, Davis R, Axline SG, *et al*. Computer-based consultations in clinical therapeutics: explanation and rule acquisition capabilities of the MYCIN system. Comput Biomed Res, 1975,8(4):303-320.
5. Weiss S, Kulikowski CA, Safir A. Glaucoma consultation by computer. Comput Biol Med, 1978,8(1):25-40.
6. Kulikowski CA. Beginnings of Artificial Intelligence in Medicine (AIM): Computational Artifice Assisting Scientific Inquiry and Clinical Art - with Reflections on Present AIM Challenges. Yearb Med Inform, 2019, 28(1):249-256.
7. Lee SI, Celik S, Logsdon BA *et al.* A machine learning approach to integrate big data for precision medicine in acute myeloid leukemia. *Nat Commun* 2018; 9: 42.
8. Hussain A, Malik A, Halim MU, Ali AM. The use of robotics in surgery: a review. *Int J Clin Pract* 2014; 68: 1376 – 82.

9. Loria K. Putting AI in radiology. *Radiology Today* 2018; 19: 10.
10. Rysavy M. Evidence-based medicine: A science of uncertainty and an art of probability. *Virtual Mentor* 2013; 15: 4 – 8.
11. Sorrentino FS, Jurman G, De NK, et al. Application of Artificial Intelligence in Targeting Retinal Diseases. Curr Drug Targets, 2020,21(12):1208-1215
12. Stoel BC. Artificial intelligence in detecting early RA. Semin Arthritis Rheum, 2019,49(3S):S25-S28
13. Namikawa K, Hirasawa T, Yoshio T, et al. Utilizing artificial intelligence in endoscopy: a clinician's guide. Expert Rev Gastroenterol Hepatol, 2020:1-18
14. Hwang Y, Lee HH, Park C, et al. An Improved Classification and Localization Approach to Small Bowel Capsule Endoscopy Using Convolutional Neural
15. Network. Dig Endosc, 2020,33(4):598-607.
16. Wang S, Yang DM, Rong R, et al. Pathology Image Analysis Using Segmentation Deep Learning Algorithms. Am J Pathol, 2019,189(9):1686-1698
17. Nguyen DT, Pham TD, Batchuluun G, et al. Artificial Intelligence-Based Thyroid Nodule Classification Using Information from Spatial and Frequency Domains. J Clin Med, 2019,8(11):1976
18. Tae K. Robotic thyroid surgery. Auris Nasus Larynx, 2020,48(3):331-338
19. Tejo OA, Buj CI, Fenollosa AF. 3D Printing in Medicine for Preoperative Surgical Planning: A Review. Ann Biomed Eng, 2020,48(2):536-555
20. Zhou F, Xue F, Zhang S. The application of 3D printing patient specific instrumentation model in total knee arthroplasty. Saudi J Biol Sci, 2020,27(5):1217-1221
21. Poncette AS, Mosch L, Spies C, et al. Improvements in Patient Monitoring in the Intensive Care Unit: Survey Study. J Med Internet Res, 2020,22(6):e19091
22. Bajorath J, Kearnes S, Walters WP, *et al.* Artificial Intelligence in Drug Discovery: Into the Great Wide Open. J Med Chem, 2020,63(16):8651-8652
23. Brown N, Ertl P, Lewis R, *et al.* Artificial intelligence in chemistry and drug design. J Comput Aided Mol Des, 2020,34(7):709-715
24. 23. Zhavoronkov A. Medicinal Chemists versus Machines Challenge: What Will It Take to Adopt and Advance Artificial Intelligence for Drug Discovery? J Chem Inf Model,
25. 24. Russo G, Reche P, Pennisi M, *et al.* The combination of artificial intelligence and systems biology for intelligent vaccine design. Expert Opin Drug Discov, 2020:1-15
26. Liang G, Fan W, Luo H, *et al.* The emerging roles of artificial intelligence in cancer drug development and precision therapy. Biomed Pharmacother, 2020,128: 110255
27. Takakusagi Y, Takakusagi K, Sakaguchi K, *et al.* Phage display technology for target determination of small-molecule therapeutics: an update. Expert Opin Drug Discov, 2020:1-13
28. Awad A, Fina F, Goyanes A, *et al.* 3D printing: Principles and pharmaceutical applications of selective laser sintering. Int J Pharm, 2020,586:119594
29. Pandey M, Choudhury H, Fern J, *et al.* 3D printing for oral drug delivery: a new tool to customize drug delivery. Drug Deliv Transl Res, 2020,10(4):986-1001
30. Tsintavi E, Rekkas DM, Bettini R. Partial tablet coating by 3D printing. Int J Pharm, 2020,581:119298
31. Cheng N, Kuo A. Using Long Short-Term Memory (LSTM) Neural Networks to Predict Emergency Department Wait Time. Stud Health Technol Inform, 2020,272:199-202
32. Saab A, Saikali M, Lamy JB. Comparison of Machine Learning Algorithms for Classifying Adverse-Event Related 30-Day Hospital Readmissions: Potential Implications for Patient Safety. Stud Health Technol Inform, 2020,272:51-54
33. Lin YW, Zhou Y, Faghri F, *et al.* Analysis and prediction of unplanned intensive care unit readmission using recurrent neural networks with long short-term memory. PLoS One, 2019,14(7):e218942
34. Wu D, Xiang Y, Wu X, *et al.* Artificial intelligence-tutoring problem-based learning in ophthalmology clerkship. Ann Transl Med, 2020,8(11):700
35. Mirchi N, Bissonnette V, Yilmaz R, *et al.* The Virtual Operative Assistant: An explainable artificial intelligence tool for simulation-based training in surgery and medicine. PloS One, 2020,15(2):e229596
36. Bertin H, Huon JF, Praud M, *et al.* Bilateral sagittal split osteotomy training on mandibular 3-dimensional printed models for maxillofacial surgical residents. Br J Oral Maxillofac Surg, 2020,58(8):953-958
37. Bohl MA, McBryan S, Pais D, *et al.* The Living Spine Model: A Biomimetic Surgical Training and Education Tool. Oper Neurosurg (Hagerstown), 2020-19(1):98- 106
38. Burgess M. The NHS is trialling an AI chatbot to answer your medical questions . *Wired*. 2017. Jan 5 http://www.wired.co.uk/article/babylon-nhs-chatbot-app
39. Espinoza L. J., Dong J. L., Artificial Intelligence Tools for Refining Lung Cancer Screening, DOI: 10.3390/jcm9123860
40. Giri S, Sarkar DK. Current status of robotic surgery. *Indian J Surg*. 2012;74:242–247.
41. S. Ji, Q. Gu, H. Weng, Q. Liu, P. Zhou, Q. He, R. Beyah, T. Wang, De-health: all your online health information are belong to us. arXiv preprint.

42. Wartman S, Combs C. Medical education must move from the information age to the age of artificial intelligence. *Acad Med.* 2018;93(8):1107–19. [PubMed] [Google Scholar]
43. Nuffield Council on Bioethics Bioethics Briefing Note. Artificial intelligence (AI) in healthcare and research. http://nuffieldbioethics.org/project/briefing-notes/artificial-intelligence-ai-healthcare-research
44. Kortz M, Doshi-Velez F. Accountability of AI under the law: the role of explanation Berkman Klein Center for Internet & Society at Harvard University; http://nrs.harvard.edu/urn-3:HUL.InstRepos:34372584
45. Burrell J. How the machine 'thinks': understanding opacity in machine learning algorithms. *Big Data Soc* 2016;3(1): 10.1177/2053951715622512.
46. Del Canale S, Louis DZ, Maio V, et al.. The relationship between physician empathy and disease complications. *Acad Med.* 2012;87(9):1243–9.
47. The return of the machinery question. Economist, 23 June 2016. http://www.economist.com/sites/default/files/ai_mailout.pdf