Artificial Intelligence in Medical Imaging : A Review

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ABSTRACT

Artificial intelligence is the science of making machines that can think and act same as like humans. 'Artificial' are the objects created by the human beings and 'Intelligence' is the capability to perform the given task by interacting with a huge information. The AI in healthcare has made dramatic progress in recent years. Artificial intelligence may give better treatment to patients by taking the excellent decision in healthcare and medicine by prevention, detection, diagnosis, and treatment of the disease.

Keywords: Artificial Intelligence, Healthcare, Patients, Medicine, Treatment

I. INTRODUCTION

Artificial Intelligence (AI), also referred to as the new electricity, is the emerging focus area in India. AI refers to the ability of machines to perform cognitive tasks like thinking, perceiving, learning, problem solving and decision making. Most of the AI systems rely on historical large datasets for predicting future trends and outcomes at a pace which humans would not be able to match.[1] Artificial Intelligence is being applied extensively for the analysis of images. Machine Learning and Deep learning, the subsets of AI are used widely for the analysis purpose. Many readymade software frameworks like Nifty Net, MI Scan are being employed. Various parts of the body like brain, lungs, retina, and breast are studied. Various processes or Neural Networks have been used for the analysis of medical images.[3]

In healthcare, AI could be beneficial in mining medical records; designing treatment plans; forecasting health events; assisting repetitive jobs; doing online consultations; assisting in clinical decision making; medication management; drug creation; making healthier choices and decisions; and solving public health problems etc. AI could be very helpful in areas where there is scarcity of human resources, such as rural and remote areas.[1] The increase in the amount of data and the possibility to use AI to identify findings either detectable or not by the human eye, radiology is now moving from a subjective perceptual skill to a more objective science. Radiologists, who were on the

forefront of the digital era in medicine, can guide the introduction of AI into healthcare. The higher efficiency provided by AI will allow radiologists to perform more value-added tasks, becoming more visible to patients and playing a vital role in multidisciplinary clinical teams. [2]

In short, AI refers to computer algorithms that can mimic features that are characteristic of human intelligence, such as problem solving or learning. The latest success of AI has been made possible thanks to tremendous growths of both computational power and data availability. In particular, AI applications based on machine learning (ML) algorithms have experienced unprecedented breakthroughs during the last decade in the field of computer vision.

The medical community has taken advantage of these extraordinary developments in order to build AI applications that get the most of medical images, automating different steps of the clinical practice or providing support for clinical decisions. Disease diagnosis, image segmentation or outcome prediction are some of the tasks that are experiencing a disruptive transformation thanks to the latest progress of AI.[4]

II. BUILDING-BLOCKS OF AI FOR MEDICAL IMAGING

The AI has been approached from two directions: computationalism techniques of image processing like classification, segmentation, localization, detection and registration have been dealt with in case of medical images. Convolutional Neural Networks and Deep and connectionism. The former attempts to mimic formal reasoning and logic directly, regardless of its biological implementation. Mostly based on hardcoded axioms and rules that are combined to deduce new conclusions, computationalism is conceptually similar to computers, storing and pro cessing symbols. Connectionism, on the other hand, rather follows a bottom-up approach, starting from models of biological neurons that are interconnected

in large numbers and from which intelligence is intended to emerge by learning from experience.[5] Medical AI stands for "Medical Artificial Intelligence". It uses computer techniques to clinical diagnoses and suggest treatments. AI has the capability to detecting the relationships in a dataset and has been widely used to diagnose, treat, and predict the results. In the research and studies of medical AI, we primarily focus on the viability and feasibility to incorporate various computer AI techniques in medical information modelling.

The state-of-the-art AI methods have shown great capabilities in recognition of meaningful data patterns and thus been widely experimented as tools for clinical trials, especially, to aid the decision making in each phase for diagnoses and subsequent treatments.[6] Proof of real-world clinical performance involves testing a system on a large dataset that accurately and fully reflects the expect ed variability of images in the intended us age setting. With few exceptions, such a test set should be multi-institutional and consist of images collected consecutively according to explicit eligibility criteria and including all relevant variations in patient demographics and disease state.

The highest-quality study would be a randomized controlled trial in which a large number of patients undergoing imaging for a specific clinical indication are randomized to have the images interpreted by a machine learning algorithm or a radiologist.[8] Medical imaging is often a key part of the medical diagnosis and treatment process. Typically, a radiologist reviews the acquired medical images and write a summarizing report of their findings. The referring physician defines a diagnosis and treatment plan based on the images and radiologist's report. Often, medical imaging is ordered as part of a patient's follow up to verify successful treatment. In addition, images are becoming an important component of invasive procedures, being used both for surgical

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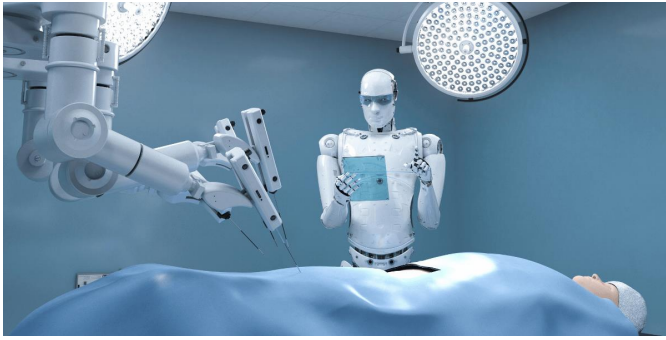planning as well as for real-time imaging during the procedure itself.[9]

Fig .1 AI4Health: A Collab for the Future of Health Care [7]

Radiologists and pathologists are routinely called upon to evaluate and interpret a range of macroscopic and microscopic images to render diagnoses and to engage in a wide range of research activities. The assessments that are made ultimately lead to clinical decisions that determine how patients are treated and predict outcomes. Precision medicine is an emerging approach for administering healthcare that aims to improve the accuracy with which clinical decisions are rendered towards improving the delivery of personalized treatment and therapy planning for patients. [10]

III. ADVANTAGES OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

- AI helps in robot assisted surgeries.
- It can perform early detection of symptoms and triage.
- It can also help us in patient care and medication management.
- AI assistant can help and assist the patients by providing virtual care through online medical records.
- AI has the capability to design proper treatment plans for the patients.
- AI can reduce human error and can able to free up the time of doctors.
- AI can increase the efficiency of operations in hospitals, clinics, pharmacies and labs.

- AI can help the doctors in finding new inventions for solving the major problems in the human health.
- AI plays a major advantage in the discovery of new drugs.
- AI plays a major advantage in cardiac management by providing artificial oxygen for the patients.[11]

IV. LIMITATIONS OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

- Data Collection Concern:

The first problem is the inaccessibility of relevant data. Massive datasets are required for ML and DL models to properly classify or predict a wide range of jobs. The greatest significant advances in ML's ability to generate more refined and accurate algorithms have occurred in sectors with easy access to large datasets. The healthcare business has a com plex issue with information accessibility.[12]

- Algorithms Developments Concerns:

One typical criticism level toward AI systems is the so-called "black-box" problem. Deep learning algorithms typically lack the ability to provide convincing explanations for their forecasts. If the recommendations are wrong, the system has no way to defend itself legally. It also makes it harder for scientists to understand how the data connects to their predictions.[13]

- Social Concern:

Humans have always feared that artificial intelligence (AI) in healthcare might eliminate their jobs. This perspective, however, is largely based on a misinterpretation of AI in its various manifestations.[14]

- Clinical Implementation Concerns:

Lack of empirical data validating the effectiveness of AI based medications in planned clinical trials is the main obstacle to successful deployment. Most research on AI's application has been conducted in the business

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setting; thus, we lack information on how it affects the final results for patients.[15]

V. CONCLUSION

We can conclude that at present Artificial Intelligence is the growing and developing technology and has a potential to increase the development of many sectors. In the 21st century there are many evidences proved that medical AI can play an important role in helping the doctors and patients to deliver healthcare much more professionally. Hence AI will play a significant role in increasing the growth of healthcare industry.

VI. REFERENCES

[1]. Nirupam Bajpai and Manisha Wadhwa, "Artificial Intelligence and Healthcare in India", January 2020, pp. 1-3.

[2]. Filippo Pesapane, Marina Codari and Francesco Sardanelli,

[3]. "Artificial intelligence in medical imaging: threat or opportunity? Radiologists again at the forefront of innovation in medicine", October - 2018, pp. 1-5.

[4]. Mukesh Bhardwaj, Vivek Singh Kushwah, Subhrendu Guha Neogi, "A Review on Medical Image Analysis using Deep Learning", Engineering and Technology Journal for Research and Innovation (ETJRI) ISSN 2581-8678, Volume IV, Issue I, January 2022, pp. 1-3.

[5]. Ana Barragán-Montero, Umair Javaid, Gilmer Valdés, Dan Nguyen, Paul Desbordes, Benoit Macq, Siri Willems, Liesbeth Vandewinckele, Mats Holmström, Fredrik Lofman, Steven Michiels, Kevin Souris, Edmond Sterpin, John A. Lee1, "Artificial intelligence and machine learning for medical imaging: a technology review", HHS Public Access, 09 May 2022, pp. 1-3.

[6]. Ana Barragan-Monteroa, Umair Javaida, Gilmer Valdesb, Dan Nguyenc, Paul Desbordesd, Benoit Macqd, Siri Willemse, Liesbeth Vandewinckelef, Mats Holmstr¨ omg, Fredrik L¨ ofmang, Steven Michielsa, Kevin Sourisa, Edmond Sterpina,f, John A. Lee, "Artificial intelligence and machine learning for medical imaging: A technology review", Associazione Italiana di Fisica Medica, 09 May 2021,pp. 2-5.

[7]. Jissa George, Dr. Bijimol T.K, "AI in Medical Field", International Conference on Interllectual Property Rights, 20 February 2021, pp. 1-2.

[8]. Julia Cohen , "AI4Health: A Collab for the Future of Health Care", 22 November 2022

[9]. Joseph R. England, Phillip M. Cheng, "Artificial Intelligence for Medical Image Analysis: A Guide for Authors and Reviewers", March 2019, pp. 2-3.

[10]. S. Kevin Zhou, Hayit Greenspan, Christos Davatzikos, James S. Duncan, Bram van Ginneken, Anant Madabhushi, Jerry L. Prince, Daniel Rueckert, Ronald M. Summers, "A review of deep learning in medical imaging: Imaging traits, technology trends, case studies with progress highlights, and future promises", 5 March 2021, pp. 1-2.

[11]. Andreas S. Panayides, Senior Member, IEEE, Amir Amini Ashish Sharma, Sotirios A. Tsaftaris Nhan Do, Fellow, IEEE, Nenad D. Filipovi , Senior Member, IEEE, Alistair Young, DavidForan, Spyretta Golemati Konstantina S. Nikita, Member, IEEE, Tahsin Kurc, Kun Huang, Fellow, IEEE, Ben P. Veasey, Student Member, IEEE, Michalis Zervakis, Senior Member, IEEE, Joel H. Saltz, Senior Member, IEEE, and Constantinos S. Pattichis, "AI in Medical Imaging Informatics: Current Challenges and Future Directions", IEEE Journal Of Biomedical And Health Informatics, Vol. 24, No. 7, July 2020, pp. 13-14.

[12]. Karthikeyan BM, "Advantages of AI in Medical Field", January 2021, pp. 5-8.

[13]. 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". Ar Xiv preprint. (2019).

[14]. J. Wolff, J. Pauling, A. Keck, J. Baumbach, "The economic impact of artificial intelligence in health care: systematic review", J Med. Internet Res. 22(2), e16866 (2020)

[15]. Bangul khan1, Hajira Fatima, Ayatullah Qureshi, Sanjay Kumar, Abdul Hanan, Jawad Hussain, Saad Abdullah, "Drawbacks of Artificial Intelligence and Their Potential Solutions in the Healthcare Sector", 19 January 2023, pp. 3-9.

[16]. H. Alami, P. Lehoux, J.-L. Denis, A. Motulsky, C. Petitgand, M. Savoldelli et al., "Organizational readiness for artificial intelligence in health care: insights for decision-making and practice", J Health Organ Manag. 35(1), 2021, pp. 106–114.

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