

Artificial Intelligence and Healthcare

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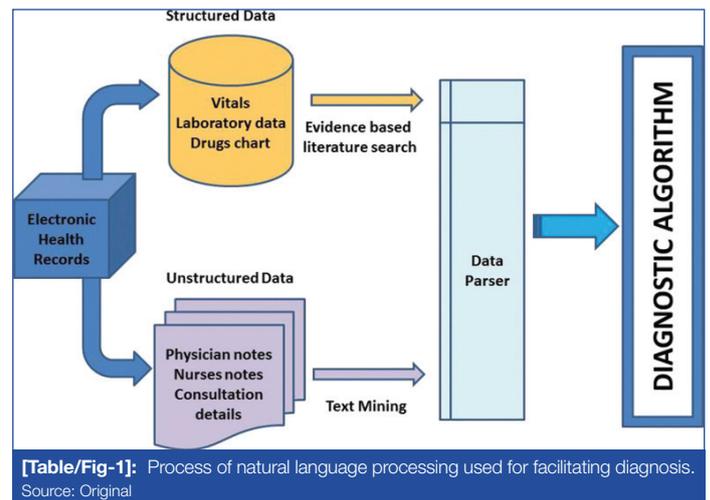
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INTRODUCTION

Indian economy is rapidly growing with the world's second largest population where the young people are eager to adopt Artificial Intelligence (AI) to resolve complex problems. "AI is a branch of computer science capable of analysing complex medical data". The ability of AI to establish significant relationships within a data set can be employed in various clinical situations for diagnosis, therapy and prognosis [1]. The AI has brought a paradigm in the advent of technology in the areas of education, healthcare, financial services and others. AI has been applied to increase productivity and simplify the processes of various areas. The spectrum of usage spans from the smartphones to the diagnosis of diseases [2]. With the increasing societal burden of both communicable and non communicable diseases in the healthcare sector AI is set to change the outlook of healthcare delivery. AI is utilised in multifarious settings of hospitals, diagnostic laboratories and research facilities. The technology is used to understand and construct data from various medical data sets and analyse like humans. This created an opportunity which is still not completely explored to enhance patient care by engaging patients and improving patient compliance [3]. However, a lacuna of knowledge exists about the concepts of AI and its potential in healthcare delivery system among healthcare professionals. This article attempts to introduce the reader to the myriad of uses of AI in the medical realm.

What is AI?: A computer simulating the characteristics of human intellectual processes including capacity and potential to rationalise, apprehend, simplify, or analyse from prior experience to obtain outcomes without being specifically programmed for distinctive action represents AI [4]. The general consensus is any machine which reasons, develops strategy, solves problems, and makes "judgements under uncertainty representing knowledge, including common sense knowledge, plans, learns, communicates in natural language and integrates all these skills towards common goals" conforms intelligence [5].

Machine Learning and Natural Language Processing (NLP) are subfields of AI and it is worth noting nuances between the two. In machine learning, the device analyses structured data such as raw data of cardiac electrophysiology, diagnostic imaging and genetics. For healthcare applications, the machine learning allows phenotyping of individuals' health facilitating targeted diagnostic or therapeutic approaches to diseases. AI with natural language processing can be applied for clinical data to extract information from free text such as clinical observations or health journals and converting into standard clinical terminologies. This can be used to fill specified templates enhancing structured health check data, a process called as "Structured Data Capture (SDC)". NLP technique helps in data improvement of data generated from clinical work and clinical notes in human language and once processed the data is investigated by machine learning leading to clinical decision-making [6,7]. The process how the NLP facilitates to arrive at a diagnosis is shown in [Table/Fig-1].



Why AI is needed?: Clinical case management involves decision-making in its integrated phases of diagnosis, therapy and prognosis. Clinical decision-making is a crucial event in the medical field which is multifarious and many a times compounded by co-morbidities of the patient. This can lead to a delay in diagnosis or there may be a remote chance of improper medication. This occurs due to the confounding variables which ought to be taken into consideration as a potential source of difference of opinions amongst practitioners. The need for an effective tool that can contemplate all of the variables and suggest the outcomes in different situations in a patient led to the application of AI in the medical field [8].

What are the applications of AI in medicine?: The evolution of AI in biomedicine has been remarkable. The AI systems already in use for patient care are IBM Watson and Babylon's AI Chatbot. IBM Watson has transformed the field of Oncology care as an advisory device using NLP to abridge patients' electronic medical records and search databases. This can be made use to advise the best feasible treatment options in cancer chemotherapy. It has facilitated customised drug selection for treatment of cancer patients and revealed to be equal or better in efficiency than human experts. Apart from this, IBM Watson AI has been implemented as genomic analysis tool for cancer, training tool for medical students, diagnostic tool and clinical decision support tool [9].

In Oregon, USA at the Oregon Health and Science University (OHSU) Knight Cancer Institute, the AI based Project Hanover of Microsoft has predicted the most effective chemotherapeutic drugs customised for individual patients with efficiency similar to that of human subject experts leading to precision cancer therapy. United Kingdom's Royal Free London NHS Foundation Trust, used an AI-based phone application called Streams working on Google's DeepMind platform for detecting health risks by analysing medical data collected from NHS patients [10].

An algorithm developed by Stanford's researchers was able to diagnose pneumonia better than human radiologists and in ophthalmology, the computer was as efficient as an expert

Ophthalmologist in making a referral decision for diabetic retinopathy [11]. AI-assisted screening and diagnosis of diseases based on images is presently evolving; especially in the field of Ophthalmology with a focus on diseases of high incidence like diabetic retinopathy, cataract, glaucoma and retinal vein occlusion. There is software available that integrate AI and machine learning for processing the fundal images and assessment [12].

At Alexandru Ioan Cuza University in Iasi, Romania the Computer Science faculty has collaborated with the University of Medicine, Iasi on the REVERT (taRgeted thErapy for adVanced colorectal canceR paTients) project with the main goal of improving personalised approach to drugs using AI which identifies the best possible therapeutic intervention for patients with metastatic colorectal cancer [13].

Thurzo A et al., (2021) explored the application of 3 Dimensional (3D) Convolutional Neural Networks (3D CNN) in forensic research from five perspectives for application: (i) age estimation (ii) gender determination (iii) facial growth vectors prediction (iv) 3D cephalometric landmark detection for craniofacial morphometry (v) facial probabilistic estimation from the skull and vice versa [14].

During the pandemic, AI involving both machine learning based diagnostic applications and deep learning based diagnostic applications have been deployed to aid in the diagnosis of Coronavirus Disease-2019 (COVID-19). AI facilitated the rapid review of electronic medical records and medical images (Chest Computed Tomography, X-ray) and differentiating COVID-19 from other pneumonia. Another feature of AI, the percentage involvement of lobes of the lung can be quantified and the changes in the follow-up scans evaluated the infection progression under various treatment modalities of COVID-19 [15].

With the advent of healthcare delivery systems the result is a change in demographics with increased life expectancy. The elderly individuals require living assistance characteristic to the spatial, temporal and activity variance. AI based physical assistance systems process information acquired from the physical environment using cyber resources and deliver living assistance as well as interfaces to further medical services.

Critical analysis of AI revolution leading to high value care:

For AI to be utilised successfully in healthcare delivery systems, sustained access to appropriate data is quintessential. The complex data sets may be analysed rapidly and with greater precision by AI to identify patterns. The scientific literature can be searched for pertinent studies and systematic reviews for information retrieval and combining the diverse data using AI, for facilitating in drug discovery. AI based mobile applications related to the medical field have the ability to allow people to assess their own symptoms and seek appropriate medical attention aiding in secondary prevention.

The potential applications of AI are limited by the discrepancies in the accessibility and quality of data as AI depends on digital data. Other problems of implementing AI in healthcare delivery system are regulatory compliance requirements, adoption of the AI by patient and healthcare provider, and also dearth of data exchange.

Current Perspectives

In a survey conducted by Ranjana V et al., (2021) to evaluate the awareness among dental students regarding the utility of AI medicine it was observed that 56% were aware that the analysis of the huge data generated from patient information in the medical field can be carried out without direct human input using AI and 57% felt that AI can revolutionise the clinical decision-making [16].

From an epistemological perspective, Arnold MH (2021) has proposed that clinicians should neither accept AI without critically analysing nor irrationally resist the developments in medical field utilising AI [17].

In his commentary on algorithms, machines and medicine Coiera E (2019) stated that the current medical practitioners should know "the difference between what a machine says and what we must do" [18].

What are the AI adoption challenges in India?: In India there are no clear laws that regulate the data transfer. Healthcare providers should be cautious when sharing patient data with third party who is not obliged with maintaining the confidentiality of the patient. The patients must be informed when such data sharing is done and consent must be obtained. As an effort to minimise the data exchange the data which is collected without explicit consent of patients may be identified and published in public domain by a statutory body. The key challenge with AI adoption in India will be data privacy, misuse and accountability.

Infrastructural and financial feasibility of adoption are also relevant factors in India. AI systems can be expensive to train, test and deploy. India is long overdue for AI in healthcare delivery but from an economic perspective the expansion costs of healthcare delivery acts as a deterrent.

The leveraging of AI by healthcare professionals to improve patient care may be deterred by low familiarity and whether the medical professional are ready for accepting AI within established healthcare practices is a factor which cannot be ignored. The patient doctor relation and related entities are likely to be transformed with the use of AI.

CONCLUSION(S)

In India AI applications which are being developed and made use of, include algorithms that analyse radiology images like chest X rays and other images, read electrocardiograms and spot abnormal patterns, evaluate fundus photographs for signs of retinopathy and scan pathology slides. There are resource gaps in India and these can be bridged with the advent of technology by exploring the prospects of AI to bring forth advances in healthcare delivery system.

REFERENCES

- [1] Ramesh AN, Kambhampati C, Monson JR, Drew PJ. Artificial intelligence in medicine. *Ann R Coll Surg Engl*. 2004;86(5):334-38. Doi: 10.1308/147870804290. PMID: 15333167; PMCID: PMC1964229.
- [2] Dwivedi YK, Hughes L, Ismagilova E, Aarts G, Coombs C, Crick T, et al. Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *Int J of Information Management*. 2019;57:101994.
- [3] Panch T, Szolovits P, Atun R. Artificial intelligence, machine learning and health systems. *J Global Health*. 2018;8(2): 020303
- [4] Copeland BJ. Artificial Intelligence: Definition, Examples, and Applications [Internet]. *Encyclopedia Britannica*. 2018 [updated on 2022 March 18, cited 2022 May 20]. Available from: <https://www.britannica.com/technology/artificial-intelligence>.
- [5] Bali J, Garg R, Bali RT. Artificial intelligence (AI) in healthcare and biomedical research: Why a strong computational/AI bioethics framework is required? *Indian J Ophthalmol*. 2019; 67(1):3-6.
- [6] Jiang F, Jiang Y, Zhi H, Dong Yi , Li Hao, Ma S, et al., Artificial intelligence in healthcare: Past, present and future. *Stroke and Vascular Neurology*. 2017;2(4):230-43.
- [7] Datta S, Barua R, Das J. Application of artificial intelligence in modern healthcare system. *Alginates-recent uses of this natural polymer*. 2019. *IntechOpen*. Doi: 10.5772/intechopen.90454. Available from: <https://www.intechopen.com/chapters/70446>
- [8] Islam MS, Hasan MM, Wang X, Germack HD, Noor-E-Alam M. A systematic review on healthcare analytics: Application and theoretical perspective of data mining. *Healthcare (Basel)*. 2018;6(2):54.
- [9] Bali J, Nayak S. Artificial Intelligence. *J Clin Ophthalmol Res*. 2020;8(1):1.
- [10] Hamilton JG, Genoff Garzon M, Westerman JS, Shuk E, Hay JL, Walters C, et al., "A tool, not a crutch": patient perspectives About IBM Watson for Oncology trained by Memorial Sloan Kettering. *J Oncol Prac*. 2019;15(4):e277-88.
- [11] Kumar A, Padhy S, Takkar B, Chawla R. Artificial intelligence in diabetic retinopathy: A natural step to the future. *Indian J Ophthalmol*. 2019;67:1004.
- [12] Padhy SK, Takkar B, Chawla R, Kumar A. Artificial intelligence in diabetic retinopathy: A natural step to the future. *Indian J Ophthalmol*. 2019;67(7):1004-09.
- [13] Iftene A. Using Artificial Intelligence in Medicine. In *Proceedings of the Conference on Mathematical Foundations of Informatics MFOI2020*. 2021;161-69.
- [14] Thurzo A, Kosnáčová HS, Kurilová V, Kosmel' S, Beňuš R, Moravský N, et al. Use of advanced artificial intelligence in forensic medicine, forensic anthropology and clinical anatomy. *Healthcare*. 2021;9:1545.

- [15] Huang S, Yang J, Fong S, Zhao Q. Artificial intelligence in the diagnosis of COVID-19: Challenges and perspectives. *Int J Biol Sci.* 2021;17(6):1581-87.
- [16] Ranjana V, Gayathri R, Priya VV, Kavitha S. Awareness on application of artificial intelligence in medicine among dental students- A survey. *Annals of the Romanian Society for Cell Biology.* 2021;20:1137-53.
- [17] Arnold MH. Teasing out artificial intelligence in medicine: An ethical critique of artificial intelligence and machine learning in medicine. *J Bioethical Inquiry.* 2021;18(1):121-39.
- [18] Coiera E. On algorithms, machines, and medicine. *The Lancet Oncology.* 2019;20(2):166-67.

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