THE CEYLON MEDICAL JOURNAL

Established 1887
The Official Publication of the Sri Lanka Medical Association
Volume 68, No. 4, December 2023
Quarterly ISSN 0009–0875

Editors Emeritus

Chris G Uragoda MD, FRCP
Colvin Goonaratna FRCP, PhD
Janaka de Silva DPhil, FRCP
Anuruddha Abeygunasekera MS, FRCS
Varuni de Silva MD, FRANZCP
A Pathmeswaran MBBS, MD

Editors

Senaka Rajapakse MD, FRCP(Lon)
Athula Sumathipala MD, FRCPsych

Section Editor

B J C Perera MD, FRCPCH

Assistant Editors

Carukshi Arambepola MBBS, MD
Ajith de Silva Nagahawatte MBBS, MD
Ranil Fernando FRCS, PhD
Raveen Hanwella MBBS, MD
Renuka Jayatissa MD, MSc
Sarath Lekamwasam MD, PhD
Udaya K Ranawaka MD, FRCP
Sachith Mettananda MBBS, MD
Shamini Prathapan MBBS, MD
Sisira Siribaddana MD, FRCP

International Advisory Board

S Arulkumaran FRCOG, PhD
London, UK
Zulfiqar Ahmed Bhutta FRCPCH, PhD
Karachi, Pakistan
Andrew Dawson FRACP
Sydney, Australia
Barbara Gastel MD, MPH
Texas, USA
Kalle Hoppu MD, PhD
Helsinki, Finland
David Lallo MD, FRCP
Liverpool, UK
Ian Pearce BMBS, FRCS
Manchester, UK
Peush Sahni MS, PhD
New Delhi, India
Anita KM Zaidi MMBS, SM
Karachi, Pakistan

Artificial Intelligence in Medicine: is it a panacea for all ills?

DOI: https://110.4038/cmj.v68i4.9990

Ceylon Medical Journal 2023; **68**: 159-162

(Key words: artificial intelligence, artificial intelligence in medicine, narrow AI)

Since the 1950s, scientists have been striving to program computers to mimic human thinking and reasoning. In 1956, John McCarthy coined the term "Artificial Intelligence" (AI) with the goal of creating machines that could use language, solve complex problems, and even improve themselves [1]. Furthermore, they envisioned a future where computers could emulate doctors' diagnostic abilities, leading to the concept of "doctors in a box", though achieving this has taken far longer than predicted, nearly half a century.

There has been a surge in AI developments with the introduction of ChatGPT (Chat Generative Pre-trained Transformer) in 2022 [2], with 100 million using it within the first two months. AI is now aiding clinicians in tasks like radiological diagnosis, surgical assistance, and treatment prediction. Health experts predict that AI driven applications will reshape the landscape of medicine [3].

This article will explain the basic terms and concepts used in Artificial Intelligence in Medicine (AIM) and how AIM is currently used in medical practice. Furthermore, it will discuss the limitations and ethical issues of using AIM.

In 1950, Alan Turing, the father of computer science, proposed a test to ascertain whether a computer can exhibit intelligent behaviour similar to a human. A human evaluator is placed in a room separated from a human responder in the second room and a computer responder in the third room. The answers to evaluator's questions sent as text are answered in text format by both responders. If the evaluator cannot distinguish between the answers sent by the computer and human responder, the machine is said to have passed the test [4].

Emotional Intelligence (EI) is how humans recognize, understand and manage our own emotions and recognize the emotions of others [5]. Although intelligent machines do not have emotions of their own, they are capable of simulating emotions when conversing with a human.

Artificial Intelligence (AI) is a branch of computer science focused on creating intelligent machines capable of performing tasks that usually need human intelligence that includes understanding natural language, recognizing

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

images, making predictions, and engaging in decision-making processes. Artificial Intelligence in Medicine (AIM) uses AI technologies to analyze and interpret medical data, facilitate disease diagnosis, develop treatment plans, and predict patient outcomes [6]

The American Medical Association uses the term 'Augmented Intelligence' to explain AI's role in medical practice [7]. The clinician should be always in charge, and AI should play an assisting role to the physician.

There are frequently used terms in AI, which is best explained by the Venn diagram below.

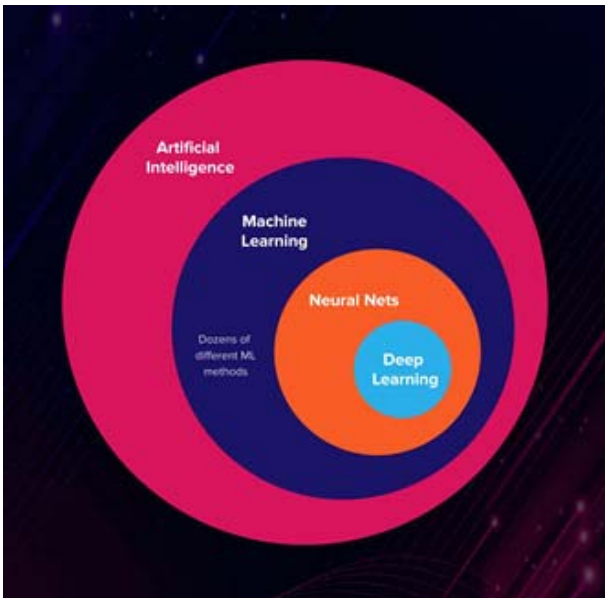


Figure 1. **Frequently used terms in AI.**

Machine Learning (ML) is branch of Artificial Intelligence that use data and a precise set of commands a computer must follow (algorithms) to imitate how humans learn, gradually improving its accuracy. It is highly unlikely that a consultant will teach each and every disease to a trainee. The consultant will give a collection of case studies and request to study how they were diagnosed and treated. We provide computers with large amounts of data (similar to the case studies) and let the computers analyze it using data analysis algorithms built into them. The computers find patterns of data and identify different diseases. When we provide data of a new patient, the computer will identify the disease by pattern matching.

Neural Networks (NN) is a type of a machine learning model inspired by the structure and functioning of the human brain. A NN can be trained to analyze chest X-rays by showing a large number of chest X-rays that are labeled. Similarly, CT, MRI scans can be analyzed. However, each type of MRI scan, brain or lung, etc., must be trained independently requiring more than hundred thousands of training data scans.

Deep Learning is a subset of Machine Learning that utilizes multiple layers of neural networks that can learn complex patterns.

Large Language Models (LLM) are AI applications that can understand and use human language. Imagine a huge filing cabinet containing an enormous number of documents such as books, articles and even computer code. In addition, this cabinet knows how to use the data for different purposes and can generate new documents. LLM can be compared to a highly advanced filing cabinet having an 'Autocomplete' function. It can take a part of a sentence you start and complete it in a way that makes sense. It can even write a story with a few keywords you provide. The most popular LLM known worldwide is ChatGPT [2]. AI has two main categories, Strong AI and Narrow AI (Weak AI) that depends on the capability of the AI system [8]. Strong AI, also known as artificial general intelligence (AGI), refers to AI systems that possess human-like intelligence with capabilities of learning like a human, solve new problems and to adapt to different situations. Narrow AI, refers to AI systems designed to perform specific task within a limited scope. AI programs that analyse medical images such as X-rays, CT or MRI fall into this category. A narrow AI system that is trained to detect lung abnormalities cannot be used to detect abnormalities of the brain.

AI in Mammography is an example of narrow AI. A systematic review of standalone performances of AI of digital mammography and digital breast tomosynthesis (DBT) included 497 091 women. Standalone AI for screening digital mammography performed as well as or better than radiologists [9]

Other such examples are AI applications designed to analyze ECGs, haemoglobin levels detecting anaemia, diagnosing diabetes, pre-diabetes and hyperthyroidism in addition to the normal ECG findings [10].

AI is used in drug development. AI helped in identifying the genomic sequencing of the SARS-CoV-2 virus and rapid discovery of new variants significantly reducing the time to find effective medications and vaccines [11]. Machine learning is expanding its footprint from general surgery to neurosurgery. It's mind-boggling how robotics, neuro-navigation, machine vision and image fusion technologies assist in minimally invasive surgery to remove lesions in the brain [12]. AI technologies are used to compute single-patient predictions in stroke outcome in the acute, subacute and chronic stage using demographic, clinical, electrophysiological and imaging data [13].

ChatGPT is a LLM, that can have a conversation with a human. It can answer questions from science, arts, and humanities and in addition, assists tasks such as writing essays and even writing computer code. However, ChatGPT is not specifically designed to be used in healthcare.

Examples of Narrow AI applications similar to ChatGPT are Google Gemini https://gemini.google.com, Microsoft Bing Ai https://www.bing.com/chat?form =CONVRD. There are LLM AI applications specifically designed for use in healthcare such as Med-PaLM https:/ /sites.research.google/med-palm/ .

AIM is a relatively new area in medicine that is rapidly developing. It will be difficult to explain how exactly a deep neural network using millions of learned parameters works and produces the resulting output – a 'blackbox' element in AI. It will take time for doctors to trust AI applications for diagnosis and treatment [14]. AIM application that use LLM have to be informed about 'Hallucinations' [15], which refers to instances that the model generates information or facts that are inaccurate and fabricated. The majority of new applications in AI are developed by private institutions that have commercial/ financial interests. This may need special consideration when these AI applications are used by doctors in both the public and private sectors [16].

Data shift is the mismatch between the data set with which an AI system was developed and the data on which it is being deployed. In Sri Lanka there is a paucity of large patient data sets in electronic format to develop AI applications. The patients will have to be informed that the AI applications used by clinicians are based on non-Sri Lankan data.

When a new drug is released, it has the approval of an agency such as the Food and Drugs Agency (FDA) USA. Although FDA has a regulatory framework for AI applications, 'Software as a Medical Device' [17] there is no legal obligation to obtain approval for AI applications.

There are reports that AI applications discriminate against women, minorities, other cultures, or ideologies. [14]. A Facial Recognition System was found to be more accurate in identifying individuals with lighter skin colour.

At present the clinician who uses an application or technology is liable for consequences, unless there is a technological malfunction. However, it will be difficult to pinpoint the cause of the error when using an AI application and the liability will be mainly on the user.

Eric Topol, a cardiologist, geneticist and expert in AI in his book, 'Deep Medicine' [18] states, 'What is wrong in healthcare today is that it is missing care. As doctors, we don't get to really care for patients enough. And patients don't feel they are cared for. The greatest opportunity offered by AI is not reducing errors or even curing cancer: it is the opportunity to restore the precious and time-honored connection and trust-the human touch-between patients and doctors. What AI will do is to look at all of patient data and present to the doctor a summary so that the doctor and patient has more time together enabling far deeper communication and compassion'.

Conflict of interests

None.

Acknowledgements

Prof. A. Pathmeswaran commented on previous versions of the manuscript.

References

1. McCarthy J, Minsky ML, Rochester N, Shannon CE. A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence, 1955. http://jmc.stanford.edu/articles/ dartmouth.html (accessed on March 05, 2025).
2. OpenAI, ChatGPT (Mar 5 version). https://openai.com. (accessed on March 5, 2025)
3. Beam AL, Drazen JM, Kohane IS, Leong TY, Manrai AK, Rubin EJ. Artificial Intelligence in Medicine. *N Engl J Med.* 2023; **388**(13): 1220-21.
4. Turing, Alan. Computing machinery and intelligence. *Mind* 1950; **5**9 (October): 433-60.
5. Psychology Today. Emotional Intelligence. https://www. psychologytoday.com/us/basics/emotional-intelligence. (accessed on March 5, 2025)
6. IBM. What is Artificial Intelligence in Medicine? 2021. https://www.ibm.com/topics/artificial-intelligence-medicine. (accessed on March 5, 2025).
7. American Medical Association. Augmented intelligence in medicine. 2025.https://www.ama-assn.org/practice-management/digital/augmented-intelligence-medicine. (accessed on March 5, 2025)
8. IBM. What Is Strong AI? 2021. https://www.ibm.com/ topics/strong-ai. (accessed on March 5, 2025).
9. Yoon JH, Strand F, Baltzer PAT, *et al.* Standalone AI for Breast Cancer Detection at Screening Digital Mammography and Digital Breast Tomosynthesis: A Systematic Review and Meta-Analysis. *Radiology.* 2023; **307**(5). (accessed on March 5, 2025)
10. Eric Topol. Can AI Catch What Doctors Miss? TED. 2023. https://www.youtube.com/watch?v=ll5LY7wI_Xc (accessed on March 5, 2025)
11. Bagabir SA, Ibrahim NK, Bagabir HA, Ateeq RH. COVID-19 and Artificial Intelligence: Genome sequencing, drug development and vaccine discovery. *J Infect Public Health.* 2022; **15**(2): 289-96.
12. Amin A, Cardoso SA, Suyambu J, *et al.* Future of Artificial Intelligence in Surgery: A Narrative Review. *Cureus.* 2024; **16**(1).
13. Bonkhoff AK, Grefkes C. Precision medicine in stroke: towards personalized outcome predictions using artificial intelligence. *Brain*. 2022; 145(2): 457-75.
14. Meskó B, Görög M. A short guide for medical professionals in the era of artificial intelligence. *NPJ Digit Med.* 2020; **3**(1): 126.

15. Alkaissi H, McFarlane SI. Artificial Hallucinations in ChatGPT: Implications in Scientific Writing. *Cureus*. 2023; **15**(2).

16. Haug CJ, Drazen JM. Artificial Intelligence and Machine Learning in Clinical Medicine. *N Engl J Med.* 2023; **388**(13): 1201-8.

17. U.S. Food and Drug Administration. Artificial Intelligence and Machine Learning in Software as a Medical Device. 2024 https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-software-medical-device. (accessed on March 5, 2025).

18. Topol E. Deep Medicine. New York. Basic Books. 2019.

Kumara Mendis, *Department of Primary Care and Family Medicine, Faculty of Medicine, Sabaragamuwa University of Sri Lanka.*

Correspondence: KM, e-mail *<kmendis1956@gmail.com>.* *Received 25 June 2023 and revised version 25 October 2023 accepted 11 December 2023*