Editorial

Artificial Intelligence In Medical Sciences

Artificial Intelligence (AI) is defined as 'a field of science and engineering concerned with the computational understanding of what is commonly called intelligent behaviour, and with the creation of artefacts that exhibit such behaviour'[1]. In today's world, Artificial Intelligence (AI) is playing a crucial role in revolutionizing various industries, including healthcare. A recent study revealed that AI can perform medical interviews and provide diagnoses based on a patient's medical history, potentially transforming the healthcare industry. This development can help doctors make more accurate diagnoses and provide better treatment options to patients.

AI can analyze vast amounts of data and identify patterns humans might miss. This ability of AI can help healthcare professionals detect diseases at an early stage, which can save lives. Moreover, AI can help create personalized patient treatment plans by considering their medical history, genetics, lifestyle, and other factors.

Alongside diagnostic capabilities, AI makes headway in unexpected areas such as human interaction. AI-powered assistants can provide emotional support to patients, which can help improve their mental health and well-being. Additionally, AI-powered technologies can help improve communication between healthcare professionals and patients, enhancing the overall quality of care (Fig 1).

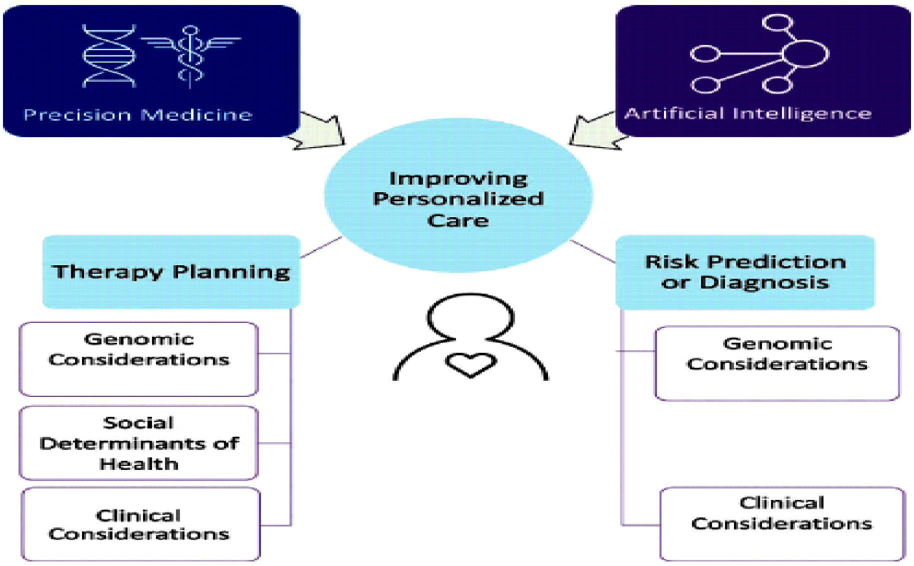

Fig 1 — AI and precision medicine collaborate to enhance personalized care by Leveraging Clinical, Genomic, Social and Behavioral Health Factors

A Better Bedside Manner ?

Articulate Medical Intelligence Explorer (AMIE) is a chatbot designed to communicate with patients and provide them with medical advice. In a recent study, AMIE was tested against human doctors to assess its empathy and conversation quality performance. The study found that AMIE outperformed physicians in 24 out of 26 criteria for conversation quality. This means that the chatbot could provide patients with a similar level of empathy and support as human doctors, and in some cases, even better.

This is a significant development in the healthcare field, as it suggests that AI-powered chatbots like AMIE can support patients in ways that human doctors may be unable to. For example, AI chatbots can provide patients with 24/7 medical advice, which is not always possible for human doctors who have limited availability. Additionally, AI chatbots can analyze vast amounts of patient data to provide personalized medical advice, which can be difficult for human doctors to do promptly.

Overall, the results of this study are promising and suggest that AI-powered chatbots like AMIE have the potential to revolutionize the healthcare industry by providing patients with more accessible and personalized medical advice.

AI for better Accessibility :

AI has the potential to improve healthcare access in remote or underserved areas. AI-powered telemedicine enables patients receive medical advice from doctors and specialists without needing physical visits or travel at any time and from anywhere. This can significantly benefit patients who might not otherwise have access to medical care due to distance or other barriers.

AI can also help streamline the healthcare process by automating routine tasks, simplifying administrative procedures, and reducing waiting times. For instance, AI-powered chatbots can help patients book appointments, manage prescriptions, and ask medical questions without human intervention. This can save time and resources for healthcare providers and improve the patient experience.

Moreover, AI can aid healthcare professionals in diagnosing and treating diseases accurately and efficiently. AI algorithms can analyze medical images, detect patterns, and provide insights that might be difficult for human experts to see. This can help doctors make more informed decisions and improve patient outcomes.

Diagnostics and drug discovery with AI :

AI has become an increasingly valuable tool in the healthcare industry. One of its most notable applications is diagnosing complex diseases like skin cancer. In recent years, AI-powered deep-learning models have been developed to assist dermatologists and doctors in identifying skin lesions. These models have been trained on tens of thousands of images, allowing them to improve diagnostic accuracy.

AI algorithms can analyze vast amounts of genetic information, clinical trial results, and patient history. This allows them to detect patterns and relationships that may not be immediately apparent to humans. Using this approach, researchers have discovered new medications and treatments for various conditions, including cancer and multiple myeloma.

Thanks to AI, researchers have identified new drug targets and designed more effective drugs targeting the underlying mechanisms of different diseases. This breakthrough may lead to better outcomes and quality of life for patients.

AI-powered systems can assist healthcare professionals in creating personalized treatments and therapies for patients based on their genetic makeup and medical history. This customized approach to treatment can result in improved patient outcomes as they receive treatments tailored to their specific needs and characteristics (Fig 2).

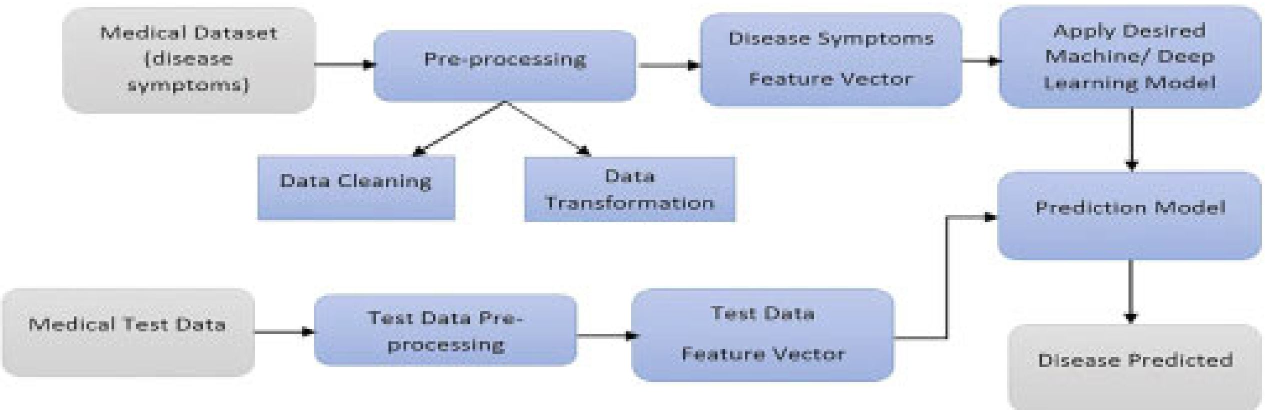

Fig 2 — Framework for an AI disease detection system

Diagnosis

ANNs have been used in the clinical diagnosis, image analysis in radiology and histopathology, data inter- pretation in intensive care setting and waveform analysis.

Stamey, *et al*[2] developed a neural network derived classification algorithm called ProstAsure Index which can classify prostates as benign or malignant. This model which was subsequently validated in prospective studies had a diagnostic accuracy of 90%, with a sensitivity of 81% and specificity of 92%. Some of the other surgically relevant diagnostic applications of ANNs include abdominal pain and appendicitis[3], retained common bile duct stones, 4 glaucoma, 5 and back pain[6].

ANNs have also been used in diagnosing cytological and histological specimens. PAPNET, a computerised automated screening system based on neural networks, has been developed to assist the cytologist in cervical screening and is one of the few ANN models which was promoted commercially .7 Breast,8 gastric, 9 thyroid,10 oral epithelial cells,11 urothelial cells,12 pleural and peritoneal effusion cytology 13 have all been subjected to analysis by neural networks with varying degree of success. In radiology, it is possible to use both human observations and direct digitised images as inputs to the networks. ANNs have been used to interpret plain radiographs,14 ultrasound,15 CT,16 MRI,17 and radioisotope scans[18].

ANNs pattern recognition ability has been used to analyse various wave forms including the interpretation

of ECGs to diagnose myocardial infarction,19 atrial fibrillation,20 and ventricular arrythmias. 21 Analysis of Electro-enchalograms (EEG) by neural networks has led to its application in the diagnosis of epilepsy 22 and sleep disorders. 23 They have also been trained to analyse Electromyographic (EMG)24 and Doppler ultrasound 25 wave forms as well as haemodynamic patterns in intensive care patients. 26

Drawbacks of Medical AI :

When considering the use of AI in healthcare, it is crucial to remember that although it may provide more accurate diagnoses than some doctors, it cannot replace the personal connection that patients can experience from face-to-face interactions. Patients often require more than accurate diagnoses and effective treatments; they also need emotional support and understanding from their healthcare providers. Without the human touch, patients may feel isolated, anxious, and even depressed. Therefore, it is essential to balance the use of AI with the importance of human relationships in healthcare.

With the increasing use of AI technology in healthcare, there is a growing concern about the possibility of conveying misinformation to patients through these tools. This can happen for various reasons, such as incorrect data input or flawed algorithms. Patients may receive inaccurate information from AI tools, which can sow confusion, mistrust, and frustration, ultimately damaging the relationship between patients and physicians.

Continuous monitoring and evaluation of the AI tools' performance can help identify and rectify errors or biases, enhancing the effectiveness and reliability of the tools. It is essential to conduct comprehensive testing and validation to ensure these systems are safe and effective before implementing them in clinical care. Regulatory bodies such as the World Health Organization have issued guidelines for developing and evaluating AI in healthcare to ensure that AI algorithms remain transparent, explainable, and impartial.

However, despite these guidelines, the results of studies with AI systems have not yet been peer-reviewed, which means there is still uncertainty about their safety and efficacy. Therefore, it is crucial to proceed with caution and continue to monitor the use of AI in healthcare. This will help ensure that the technology is not only accurate, but also safe, effective, and ethical.

A Future Fueled by Technological Innovations :

As research in the field of healthcare advances, the potential benefits of AI in the healthcare industry are becoming increasingly evident. AI can revolutionize healthcare in several ways, such as improving diagnoses and drug recommendations, which can save lives and reduce healthcare costs. With further research and development, AI systems could be designed to detect early signs of diseases and monitor patients' health in real-time, providing patients with better health outcomes and greater peace of mind.

Although the use of AI in healthcare is associated with specific challenges like ethical considerations and privacy concerns, the potential benefits are too significant to be ignored. As AI technology evolves, it will likely become a standard healthcare tool. This would enhance diagnostic accuracy, provide timely and cost-effective care to patients, and offer greater peace of mind to everyone involved.

Looking towards the future of healthcare, we have reasons to be optimistic about the positive impact of AI on the lives of patients and healthcare professionals. AI-powered assistants can help patients manage their health more effectively by providing personalized advice and reminders while freeing doctors to focus on complex cases. Additionally, AI can assist healthcare institutions in streamlining their operations, reducing costs, and improving patient outcomes. Overall, the future of healthcare seems significantly brighter thanks to the continued development and integration of AI system.

Further Readings

1 https://www.insideprecisionmedicine.com/topics/informatics/medical-artificial-intelligence-a-new-frontier-in-precision-medicine/?gad_source=2HYPERLINK "https://www.insideprecisionmedicine.com/topics/informatics/medical-artificial-intelligence-a-new-frontier-in-precision-medicine/?gad_source=2&gclid=CjwKCAiA2pyuBhBKEiwApLaIO0ZrG2qTD-OGFWrDR0KbISAQKCbmLFHwXNKiyGom_KZsEIR6YOrEshoCXIEQAvD_ BwE"&HYPERLINK "https://www.insideprecisionmedicine.com/topics/informatics/medical-artificial-intelligence-a-new-frontier-in-precision-medicine/?gad_source=2&gclid= CjwKCAiA2pyuBhBKEiwApLaIO0ZrG2qTD-OGFWrDR0KbISAQKCbmLFHwXNKiyGom_KZsEIR6YOr EshoCXIEQAvD_BwE"gclid= CjwKCAiA2pyuBhBKEiwApLaIO0ZrG2qTD-OGFWrDR0KbISAQKCbmLFHwXNKiyGom_KZsEIR6YOrEshoCXIEQAvD_BwE

2 Shapiro SC — Artificial intelligence. In: Shapiro SC. (ed) *Encyclopedia of Artificial Intelligence*, vol. 1, 2nd edn. New York: Wiley, 1992.

3 Stamey TA, Barnhill SD, Zang Z — Effectiveness of ProstAsureTM in detecting prostate cancer (PCa) and benign prostatic hyperplasia (BPH) in men age 50 and older. *J Urol* 1996; **155:** 436A.

4 Pesonen E, Ohmann C, Eskelinen M, Juhola M — Diagnosis of acute appendicitis in two databases. Evaluation of different neighborhoods with an LVQ neural network. *Methods Inf Med* 1998; **37:** 59-6436.

5 Golub R, Cantu Jr R, Tan M — The prediction of common bile duct stones using a neural network. *J Am Coll Surg* 1998; **187:** 584-90.

6 Henson DB, Spenceley SE, Bull DR — Artificial neural network analysis of noisy visual field data in glaucoma. *Artif Intell Med* 1997; **10:** 99-113.

7 Bounds DG, Lloyd PJ, Mathew BG — A comparison of neural network and other pattern recognition approaches to the diagnosis of low back disorders. *Neural Networks* 1990; **3:** 583-91.

8 Boon ME, Kok LP — Neural network processing can provide means to catch errors that slip through human screening of pap smears. *Diagn Cytopathol* 1993; **9:** 411-6.

9 Downs J, Harrison RF, Kennedy RL, Cross SS — Application of the fuzzy ARTMAP neural network model to medical pattern classification tasks. *Artif Intell Med* 1996; **8:** 403-28.

10 Karakitsos P, Stergiou EB, Pouliakis A, Tzivras M, Archimandritis A, Liossi AI, *et al* — Potential of the back propagation neural network in the discrimination of benign from malignant gastric cells. *Anal Quant Cytol Histol* 1996; **18:** 245-50.

11 Karakitsos P, Cochand-Priollet B, Guillausseau PJ, Pouliakis A — Potential of the back propagation neural network in the morphologic examination of thyroid lesions. *Anal Quant Cytol Histol* 1996; **18:** 495–500.

12 Brickley MR, Cowpe JG, Shepherd JP — Performance of a computer simulated neural network trained to categorise normal, premalignant and malignant oral smears. *J Oral Pathol Med* 1996; **25:** 424-8.

13 Hurst RE, Bonner RB, Ashenayi K, Veltri RW, Hemstreet 3rd GP — Neural net-based identification of cells expressing the p300 tumor-related antigen using fluorescence image analysis. *Cytometry* 1997; **27:** 36-42.

14 Truong H, Morimoto R, Walts AE, Erler B, Marchevsky A — Neural networks as an aid in the diagnosis of lymphocyte-rich effusions. *Anal Quant Cytol Histol* 1995; **17:** 48-54.

15 Ashizawa K, Ishida T, MacMahon H, Vyborny CJ, Katsuragawa S, Doi K — Artificial neural networks in chest radiography: application to the differential diagnosis of interstitial lung disease. *Acad Radiol* 1999; **6:** 2-9.

16 Tailor A, Jurkovic D, Bourne TH, Collins WP, Campbell S — Sonographic prediction of malignancy in adnexal masses using an artificial neural network. *Br J Obstet Gynaecol* 1999; **106:** 21-30.

17 Matsuki Y, Nakamura K, Watanabe H, Aoki T, Nakata H, Katsuragawa S, *et al* — Usefulness of an artificial neural network for differentiating benign from malignant pulmonary nodules on high-resolution CT: evaluation with receiver operating characteristic analysis. *Am J Roentgenol* 2002; **178:** 657-63.

18 Lucht R, Delorme S, Brix G — Neural network-based segmentation of dynamic MR mammographic images. *Magn Reson Imaging* 2002; **20:** 147-54.

19 Fisher RE, Scott JA, Palmer EL — Neural networks in ventilation-perfusion imaging. *Radiology* 1996; **198:** 699-706.

20 Heden B, Edenbrandt L, Haisty Jr WK, Pahlm O — Artificial neural networks for the electrocardiographic diagnosis of healed myocardial infarction. *Am J Cardiol* 1994; **74:** 5-8.

21 Yang TF, Devine B, Macfarlane PW — Artificial neural networks for the diagnosis of atrial fibrillation. *Med Biol Eng Comput* 1994; **32:** 615-9.

22 Dassen WR, Karthaus VL, Talmon JL, Mulleneers RG, Smeets JL, Wellens HJ — Evaluation of new self-learning techniques for the generation of criteria for differentiation of wide-QRS tachycardia in supraventricular tachycardia and ventricular tachycardia. *Clin Cardiol* 1995; **18:** 103-8.

23 Walczak S, Nowack WJ — An artificial neural network approach to diagnosing epilepsy using lateralized bursts of theta EEGs. *J Med Syst* 2001; **25:** 9-20.

24 Schaltenbrand N, Lengelle R, Toussaint M, Luthringer R, Carelli G, Jacqmin A, *et al* — Sleep stage scoring using the neural network model: comparison between visual and automatic analysis in normal subjects and patients. *Sleep* 1996; **19:** 26-5.

25 Abel EW, Zacharia PC, Foster A — Neural network analysis of the EMI interference pattern. *Med Eng Phys* 1996; **18:** 12-7.

26 Smith JH, Graham J, Taylor RJ — The application of an artificial neural network to Doppler ultrasound waveforms for the classification of arterial disease. *Int J Clin Monit Comput* 1996; **13:** 85–91.

27 Spencer RG, Lessard CS, Davilla F, Etter B. Self-organising discovery, recognition and prediction of haemodynamic patterns in the intensive care unit. *Med Biol Eng Comput* 1997; **35:** 117-23.

[1]Hony Editor, JIMA **Sanjoy Banerjee[1]**

[2]MCH (Neurosurgery), **Chirantan Benerjee[2]**

Associate Professor, Department of Neurosurgery,
Bankura Sammilani Medical College and Hospital,
Bankura, West Bengal 722102