Artificial intelligence in healthcare: Improving Diagnostic Accuracy through deep learning and using several approaches

Savitri Pandurang Birajdar
MMCOE, Karvenagar, pune

***Abstract* - AI is transforming current healthcare by significantly improving diagnostic accuracy and minimizing treatment strategies. AI also improving clinical decision making [2],[3].This paper presents review of AI driven techniques, particularly deep learning models such as convolutional neural networks(CNN),Recurrent Neural Networks (RNNs), and transformer-based architectures, in medical diagnostics [6], [7].As compared to human ,AI systems perform better in applications like radiology, pathology , dermatology and ophthalmology.[4],[5].**

The study also shows several approaches in AI systems integrating image processing, electronic health records for deep diagnosis. Apart from notable advancements, there are many challenges such as data bias, lack of interpretability and privacy concerns[2]. This paper majorly analyzes these limitations and proposes future directions including explainable AI and personalized medicine[10],[15].The findings highlight AI as a powerful enabler of precision healthcare.

I. INTRODUCTION

The fastest growth of healthcare data, including medical imaging, clinical records , has necessitated advanced computational tools for efficient analysis [2]. AI, particularly deep learning, has emerged as a transformative technology capable of extracting meaningful insights from complex datasets[1],[3].

Traditionally diagnostic systems completely depend on human expertise,making them doubtful of errors,fatigue and variability[14].AI based systems overcome these limitations by providing automated,consistent and scalable solutions.Recent advancements in CNN,transformers and self supervised learning have further enhanced diagnostics capabilities,enabling accurate disease detection and prediction[6],[7],[13].

Moreover,AI integration into healthcare systems improves early diagnosis,reduces treatment delays,and enhances clinical decision making[2],[15].However ,challenges such as ethical concerns, model transparency, and data privacy remain critical barriers to adoption[2].

II. LITERATURE REVIEW

Extensive research demonstrates the effectiveness of AI in medical diagnostics. DL models have achieved expert level performance in several domains:
CNN based systems outperform radiologists in pneumonia detection [4].
AI models classify skin cancer with dermatologist level accuraccy[5]
Diabetic nephropathy detection systems show high sensitivity and specificity [9]
Recent studies also highlight the importance of transformer based architectures and multi modal systems that integrate imaging ,clinical and genomics data for improved diagnosis [6],[7],[8].

Additionally large scale reviews indicate that AI enhances healthcare efficiency ,supports personalized medicine and improves patient outcomes globally [2],[3].

Explainable AI techniques such as SHAP and Grad-CAM have been introduced to address interpretability challenges,improving clinical outcomes in AI systems[10].

III. METHODOLOGY

This study adopts a systematic review approach, analyzing research published between 2015 and 2025 [3].

3.1 Data sources

IEEE xplore ,scopus,web of science and PubMed were used for literature review.

3.2 Inclusion Criteria

AI-based diagnostics systems deep learning applications in healthcare and studies reporting performance metrics were considered .

3.3 Categorization of Models
AI models are classified into CNNs.RNNs/transformers, multimodal systems & self supervised learning models[6],[7].

3.4 Evaluation Metrics
Accuracy, sensitivity, specificity, AUC-ROC, and f1-score were used for evaluation.

IV. AI APPLICATIONS IN MEDICAL DIAGNOSTICS

4.1 Radiology.
AI enhances image analysis in x-rays, CT scans and MRI enabling early detection of diseases such as cancer and pneumonia [3],[4]. AI systems achieving higher sensitivity observed in study

4.2 Pathology
Precision in cancer detection and disease classification is possible due to AI

4.3 Dermatology
When skin analysis is done by using deep learning models accuracy is better compared to dermatologists.

4.4 Ophthalmology
AI systems detect diabetic and glaucoma using retinal imaging with better accuracy [9]

4.5 Multilodal Diagnosis
Integration of imaging, clinical and genomic data improves diagnostic efficiency.

V. ADVANTAGES OF AI IN HEALTHCARE

1) In diagnosis accuracy is improved [3]
2) Disease detection is now easy [2]
3) efforts are reduced [14]
4) In limited resources scalability increased [2]
5) Reduction in cost and efficiency increased.

VI. CHALLENGES AND LIMITATIONS

6.1 Data bits
Datasets for Model training is limited so models are not generalized across populations[2]

6.2 Lack of interpretability
Black box nature of DL reduces clinical trust[10].
6.3 Data privacy and security
Serious patient data handling may raise ethical concerns[2]
6.4 Regulatory issues
AI deployment in healthcare may have lack of standardized guidelines.[2]
6.5 Integration challenges
It is difficult to integrate AI systems with clinical workflows [3].

VII. FUTURE DIRECTIONS

Future research should focus on:
1) Explainable AI for transparency [10]
2) Federated Learning for privacy preserved training
3) Several model AI systems for deep diagnosis [8]
4) genomic data used for personalized medicine [2]

VIII. CONCLUSION

AI is reshaping healthcare by enhancing diagnostic accuracy, improving efficiency and enabling personalized medicine[2],[3].DL models ,particularly CNNs and transforms have demonstrated remarkable performance across various medical domains [6],[7].
However, challenges related to ethics ,interpretability and data security must be addressed for widespread adoption[2].With continued advancements and responsible implementation ,AI has the potential to transform global healthcare systems and improve patient outcomes significantly[15].

REFERENCES

[1]. T. K. Chauhan, K. Chauhan, and V. Bansal, “The role of AI in enhancing the accuracy of medical diagnostics: A deep learning approach in healthcare,” International Journal of Creative Research Thoughts, vol. 13, no. 6, pp. g738–g742, Jun. 2025.
[2]. Y. A. Fahim, I. W. Hasani, S. Kabba, and W. M. Ragab, “Artificial intelligence in healthcare and medicine: Clinical applications, therapeutic advances, and future perspectives,” European Journal of Medical Research, vol. 30, p. 848, 2025.

[3]. O. Sabri, B. Al-Shargabi, and A. Abuarqoub, "The role of artificial intelligence in improving diagnostic accuracy in medical imaging: A review," Computers, Materials & Continua, vol. 85, no. 2, pp. 2444–2451, 2025.
[4]. T. Rajpurkar et al., "CheXNet: Radiologist-level pneumonia detection on chest X-rays with deep learning," arXiv preprint arXiv:1711.05225, 2017.
[5]. A. Esteva et al., "Dermatologist-level classification of skin cancer with deep neural networks," Nature, vol. 542, no. 7639, pp. 115–118, 2017.
[6]. A. Dosovitskiy et al., "An image is worth 16x16 words: Transformers for image recognition at scale," arXiv preprint arXiv:2010.11929, 2020.
[7]. J. Chen et al., "TransUNet: Transformers make strong encoders for medical image segmentation," arXiv preprint arXiv:2102.04306, 2021.
[8]. T. Y. Lee et al., "Multimodal deep learning in healthcare: A review," IEEE Reviews in Biomedical Engineering, vol. 14, pp. 1–15, 2021.
[9]. V. Ting et al., "Development and validation of a deep learning system for diabetic retinopathy," JAMA, vol. 318, no. 22, pp. 2211–2223, 2017.
[10]. S. Lundberg and S.-I. Lee, "A unified approach to interpreting model predictions," in Proc. Advances in Neural Information Processing Systems (NeurIPS), 2017, pp. 4765–4774.
[11]. K. He et al., "Deep residual learning for image recognition," in Proc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR), 2016, pp. 770–778.
[12]. A. Krizhevsky, I. Sutskever, and G. Hinton, "ImageNet classification with deep convolutional neural networks," in Proc. Advances in Neural Information Processing Systems (NeurIPS), 2012, pp. 1097–1105.
[13]. J. Devlin et al., "BERT: Pre-training of deep bidirectional transformers for language understanding," in Proc. NAACL-HLT, 2019, pp. 4171–4186.
[14]. Z. Obermeyer and E. J. Emanuel, "Predicting the future—Big data, machine learning, and clinical medicine," New England Journal of Medicine, vol. 375, no. 13, pp. 1216–1219, 2016.
[15]. E. J. Topol, "High-performance medicine: The convergence of human and artificial intelligence," Nature Medicine, vol. 25, pp. 44–56, 2019. add citation in IEEE format