International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 11, CONFLUENCE - 2026

Artificial Intelligence Applications in the Medical Field: Enhancing Detection of Health Changes in Human Beings using Deep Learning

Harshitha D S
Seshadripuram Institute of Commerce and Management (SICM), Bengaluru 560020
Affiliated to Dr. Manmohan Singh Bengaluru City University
E-mail: harshithadsds@gmail.com

ABSTRACT - Healthcare sits at the intersection of computing, commerce, and community wellbeing, making it fertile ground for intelligent technologies. This paper examines how deep learning and related AI methods are reshaping the detection of physiological and pathological changes in the human body, shifting diagnosis from a slow, specialist-dependent process toward one that is faster, data-driven, and more accessible. The study situates this shift within a broader transformation, where hospitals and health-tech ventures are rethinking care delivery as a digital enterprise, and communities historically underserved by specialist care stand to benefit most from scalable, automated screening. It reviews how pattern-recognition models trained on medical imaging and clinical records can flag abnormalities early, support rather than replace clinical judgment, and enable a shift from reactive treatment to proactive monitoring. The paper also considers the human side of adoption — the trust clinicians and patients place in machine-generated findings, and the need for interpretable rather than opaque results. Drawing on secondary research and healthcare case studies, it outlines the promise of this technology in speed, consistency, and reach, alongside challenges such as data privacy, fairness across populations, and governance that keeps humans meaningfully involved. The paper closes by framing responsible AI-assisted diagnostics as both a technological and social undertaking.

Keywords: Deep Learning, Healthcare Innovation, Diagnostic Automation, Digital Health Transformation, Responsible AI.

INTRODUCTION

Health is the foundation of human productivity and wellbeing, and the early detection of change in the human body is often what separates a simple treatment from a serious illness. Traditionally, detecting such change depends on trained specialists such as radiologists, pathologists, ophthalmologists, and cardiologists, who interpret scans, slides, signals, and test reports. In many countries, including India, the number of specialists is small compared with the number of patients, which leads to delays, long waiting times, and uneven quality of care between cities and rural areas.

Artificial Intelligence (AI) has become a valuable tool to address this challenge. Within AI, deep learning uses layered neural networks to spot trends directly inside large datasets—such as X-rays, eye scans, skin photos, and patient files—without needing hand-coded rules. When trained on enough quality data, these systems can spot early warning signs of illness that humans might overlook or take a long time to find.

The integration of artificial intelligence in healthcare represents both a commercial imperative and a socioeconomic opportunity. Healthcare providers, diagnostic networks, and digital health enterprises are increasingly leveraging digital tools to optimize operational efficiency, mitigate costs, and democratize access to specialized clinical services. However, widespread adoption hinges on clinical trust, robust data governance, and algorithmic fairness. This paper evaluates the efficacy of deep learning methodologies for early and reliable biomarker and anomaly detection. Through a systematic literature review and case study analysis, we address critical deployment challenges—including data privacy, algorithmic bias, model interpretability, and the essential preservation of human-in-the-loop clinical oversight.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 11, CONFLUENCE - 2026

APPLICATIONS OF AI IN THE MEDICAL FIELD

1. Medical Imaging and Radiology

Deep learning models, especially convolutional neural networks (CNNs), analyse X-rays, CT scans, MRI images, and mammograms to highlight suspicious areas such as lung nodules, fractures, tumours, and signs of pneumonia. These tools act as a second reader that helps radiologists prioritise urgent cases and reduce missed findings.

2. Eye Disease Screening

AI systems can examine retinal photographs to detect diabetic retinopathy, a complication of diabetes that can cause blindness if not found early. Automated screening allows large numbers of patients to be checked in primary care centres where an eye specialist may not be available.

3. Skin Cancer and Dermatology

Image-based models classify photographs of skin lesions and help to separate harmless marks from potentially cancerous ones, supporting early referral to a dermatologist.

4. Pathology and Cancer Screening

Deep learning supports the study of tissue slides and screening images, helping to spot abnormal cells and patterns. In breast cancer screening, AI is used to assist in reading mammograms and to reduce both false alarms and missed cancers.

5. Continuous Monitoring and Predictive Health

Models trained on clinical records, ECG signals, and data from wearable devices can detect changes such as irregular heart rhythms or early warning signs of deterioration. This supports a shift from reactive treatment, where care begins after symptoms appear, to proactive monitoring.

REVIEW OF LITERATURE

Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs (Gulshan et al., JAMA, 2016)

- **Focus & Method:** The study trained a deep convolutional neural network on a development set of 128,175 retinal images graded by a panel of ophthalmologists, and tested it on two independent validation sets.

Key Findings:

- The algorithm showed high sensitivity and specificity in detecting referable diabetic retinopathy; at a high-sensitivity setting, sensitivity was above 96% and specificity was above 93% on both validation sets.
- The network learned to identify disease without being told in advance which lesions to look for, showing the strength of learning directly from data.

Dermatologist-Level Classification of Skin Cancer with Deep Neural Networks (Esteva et al., Nature, 2017)

- **Focus & Method:** A deep neural network was trained on a large set of clinical skin images, about 129,000, covering many skin conditions, and its performance was compared with that of board-certified dermatologists.

Key Findings:

- The network performed at a level comparable to the dermatologists on the skin cancer classification tasks tested.
- The authors noted that such tools, when deployed on smartphones, could extend diagnostic care to a very large number of people.

CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning (Rajpurkar et al., 2017)

- **Focus & Method:** A 121-layer convolutional neural network was trained on more than 100,000 frontal-view chest X-ray images labelled for 14 conditions, and compared with practising radiologists on pneumonia detection.

Key Findings:

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 11, CONFLUENCE - 2026

- The model matched or exceeded the average performance of the radiologists compared on pneumonia detection.
- The study showed the possibility of automated chest X-ray screening in places with few radiologists.

International Evaluation of an AI System for Breast Cancer Screening (McKinney et al., Nature, 2020)

- **Focus & Method:** The study evaluated an AI system for reading mammograms using data from the United Kingdom and the United States, and compared its results with those of radiologists.

Key Findings:

- The AI system reduced both false positives and false negatives compared with the human readers in the data sets studied.
- The results indicated that AI can support breast screening programmes and potentially reduce the workload of specialists.

High-Performance Medicine: The Convergence of Human and Artificial Intelligence (Topol, Nature Medicine, 2019)

- **Focus & Method:** A review article that examines the use of deep learning across medical fields and the evidence for its use in clinical practice.

Key Findings:

- Deep learning has strong potential to improve accuracy and efficiency in medicine, but many results come from retrospective studies and need validation in real clinical settings.
- Concerns such as bias, privacy, security, and the need for explainable results must be addressed, and the best outcomes come from combining machine and clinician rather than replacing the clinician.

Dissecting Racial Bias in an Algorithm Used to Manage the Health of Populations (Obermeyer et al., Science, 2019)

- **Focus & Method:** The study analysed a widely used healthcare risk-prediction algorithm in the United States to check whether its predictions were fair across racial groups.

Key Findings:

- The algorithm underestimated the health needs of Black patients because it used past healthcare spending as a stand-in for health need.
- This showed that even well-meant algorithms can produce unfair results, so fairness must be tested across populations before use.

STATEMENT OF PROBLEM

In spite of rapid advances in medical technology, many health systems still struggle with delayed diagnosis, shortage of specialists, and unequal access to quality care, especially in rural and low-income areas. Manual interpretation of scans and reports is time-consuming, can vary from one doctor to another, and may cause important early changes to be missed.

Clinicians also face heavy workloads, which increase the chance of fatigue and error. Patients in remote areas may reach a specialist only after the disease has progressed.

There is a need to understand how deep learning can help detect health changes earlier, faster, and more consistently, and how this can be done responsibly, with attention to privacy, fairness, trust, and human oversight.

OBJECTIVES OF THE STUDY

This study is guided by the following objectives:

1. To understand the role of deep learning in detecting physiological and pathological changes in the human body from medical images and clinical data.
2. To examine how AI-assisted detection improves speed, consistency, and early diagnosis in healthcare.
3. To study the potential of AI-based screening in extending healthcare to underserved and remote communities.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 11, CONFLUENCE - 2026

4. To identify the challenges and ethical issues in adopting AI in healthcare, such as data privacy, bias, interpretability, and trust.
5. To offer suggestions for hospitals, health-tech organisations, and policymakers for the responsible use of AI-assisted diagnostics.

RESEARCH METHODOLOGY

The study is based on secondary data collected through literature review and analysis.

The review includes research papers, review articles, and healthcare case studies published in recognised journals and other research material available on the internet.

RESEARCH HYPOTHESIS

H_1: The use of deep learning in medical diagnosis significantly improves the early detection of health changes, the speed and consistency of diagnosis, and access to screening.

H_0: The use of deep learning in medical diagnosis has no significant impact on the early detection of health changes, the speed and consistency of diagnosis, or access to screening.

FINDINGS

Early Detection of Abnormalities:

The studies reviewed show that deep learning models can identify signs of disease in retinal images, skin images, chest X-rays, and mammograms, in several cases at a level comparable to that of trained specialists.

Speed and Consistency:

Automated systems analyse images within moments and apply the same standard every time, which reduces delays and the variation that can occur between different human readers.

Support for Clinicians:

AI works best as a second reader or a screening aid. It helps doctors prioritise urgent cases and reduces routine workload, allowing more time for patient care and complex decisions.

Reach and Accessibility:

Automated screening can bring early checks to primary care centres and remote areas where specialists are few, which is important for communities historically underserved by specialist care.

Challenges Identified:

- Concerns about the privacy and security of sensitive patient data.
- Bias and unfair results when the training data does not represent all populations.
- Lack of interpretability, as many models give results without clear reasons, which affects trust.
- Need for validation in real clinical settings, since many results come from retrospective studies.
- High cost of infrastructure, and the need for training of doctors and staff.
- Risk of over-dependence on machines, reducing human judgment.

SUGGESTIONS

1. Keep Humans in the Loop:

Use AI as a support tool, with the final decision always taken by a qualified doctor.

2. Protect Data Privacy:

Adopt strong policies and security measures for collecting, storing, and sharing patient data, with patient consent.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 11, CONFLUENCE - 2026

3. Ensure Fairness:

Train and test models on diverse populations, and check regularly for bias across groups.

4. Promote Explainable AI:

Prefer systems that show why a result was produced, so clinicians and patients can trust and verify it.

5. Validate in Real Settings:

Test AI tools in actual hospitals and screening programmes before wide adoption, and monitor them continuously.

6. Train Healthcare Professionals:

Conduct workshops so that doctors, nurses, and technicians can use AI tools effectively and understand their limits.

7. Make Solutions Affordable:

Encourage partnerships between government, hospitals, and health-tech firms to extend low-cost AI screening to rural and underserved areas.

CONCLUSION

AI is not here to replace doctors, but to work alongside them as a helpful partner. It helps spot health issues early and supports a doctor's final decision. When used the right way, AI makes medical testing faster, more reliable, and easier for everyone to reach. This helps doctors catch problems early instead of just treating people after they get sick. To make this work, hospitals, tech companies, and lawmakers need to team up. They must protect patient privacy, ensure the tech treats everyone fairly, make sure the systems are easy to understand, and train medical staff to use them. Truly responsible AI is a team effort between human doctors and smart technology.

REFERENCES

[1] Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639), 115–118. https://doi.org/10.1038/nature21056

[2] Gulshan, V., Peng, L., Coram, M., Stumpe, M. C., Wu, D., Narayanaswamy, A., et al. (2016). Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. JAMA, 316(22), 2402–2410. https://doi.org/10.1001/jama.2016.17216

[3] McKinney, S. M., Sieniek, M., Godbole, V., Godwin, J., Antropova, N., Ashrafian, H., et al. (2020). International evaluation of an AI system for breast cancer screening. Nature, 577(7788), 89–94. https://doi.org/10.1038/s41586-019-1799-6

[4] Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. Science, 366(6464), 447–453. https://doi.org/10.1126/science.aax2342

[5] Rajpurkar, P., Irvin, J., Zhu, K., Yang, B., Mehta, H., Duan, T., et al. (2017). CheXNet: Radiologist-level pneumonia detection on chest X-rays with deep learning. arXiv:1711.05225. https://arxiv.org/abs/1711.05225

[6] Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. Nature Medicine, 25(1), 44–56. https://doi.org/10.1038/s41591-018-0300-7

(This work is licensed under a Creative Commons Attribution 4.0 International License.)