Enhancing Diagnostic Accuracy Using Artificial Intelligence and Convolutional Neural Networks

OPEN ACCESS

Volume: 13

Special Issue: 3

Month: February

Year: 2026

P-ISSN: 2321-788X

E-ISSN: 2582-0397

Citation:
P.T., Kasthuri Bai. "Enhancing Diagnostic Accuracy Using Artificial Intelligence and Convolutional Neural Networks." *Shanlax International Journal of Arts, Science and Humanities*, vol. 13, no. 3, 2026, pp. 329–34.

DOI:
https://doiorg/10.34293/sijash.v13iS3-i2-Feb.10300

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Abstract

Accurate and timely medical diagnosis plays a critical role in effective healthcare delivery. Traditional diagnostic methods often depend heavily on expert interpretation, which can be time-consuming and prone to variability. Recent advancements in Artificial Intelligence (AI), particularly Convolutional Neural Networks (CNNs), have proved substantial potential in automating and improving diagnostic accuracy using medical imaging data. This paper presents an AI-driven CNN-based framework designed to enhance diagnostic precision by extracting high-level features from medical images. The proposed approach improves classification performance while reducing human dependency. Experimental evaluation on benchmark medical imaging datasets demonstrates that the CNN model achieves superior accuracy, sensitivity, and reliability compared to conventional methods. The results highlight the effectiveness of CNN-based AI systems as supportive tools for medical professionals in clinical decision-making.

Keywords: Artificial Intelligence, Convolutional Neural Networks, Medical Imaging, Diagnostic Accuracy, Deep Learning

Introduction

The role of medical imaging within health care is essential, aiding the diagnosis and monitoring of various diseases.[1][2] However, diagnosing medical images includes X-rays, CT scans, and MRI scans, which are really difficult tasks and require a great deal of expertise. Artificial Intelligence has developed as a transformative technology in healthcare, enabling automated analysis and intelligent decision support.

CNNs represent one class of deep learning algorithms that are particularly suited to image-based tasks, due to their capability of learning hierarchical spatial features. This paper will analyse the application of CNN-based AI techniques to improve diagnostic accuracy, lessen diagnostic errors, and guide clinicians in making appropriate decisions.

Related Work

CNNs have been very effective in these areas- Detection of diseases, segmentation of images, classification. Several earlier works tried to employ deep learning models for detecting tumors, pneumonia, and retinal fundus images.[3] Though some promising results could be achieved, issues like overfitting, limited labelled data, and computational complexity restrict models from generalizing effectively. The contributions made in this work improve the existing CNN framework by finding an optimized one towards better diagnostic reliability and generalization performance. [4][5] COVID-19 detection technique using deep learning and transfer learning algorithms applied on the prepared X-rays and CT scan images dataset. [6] An automated classification of pneumonia, to simplify the diagnosis process on chest X-ray images based on Convolutional Neural Network models. [7] role of AI in medical image analysing.[8] deep learning for pneumonia attack.

Proposed Methodology

For the proposed system, the CNN-based architecture for the automated classification of medical images has been selected. The proposed methodology of automated classification of medical images has been developed with the following steps:

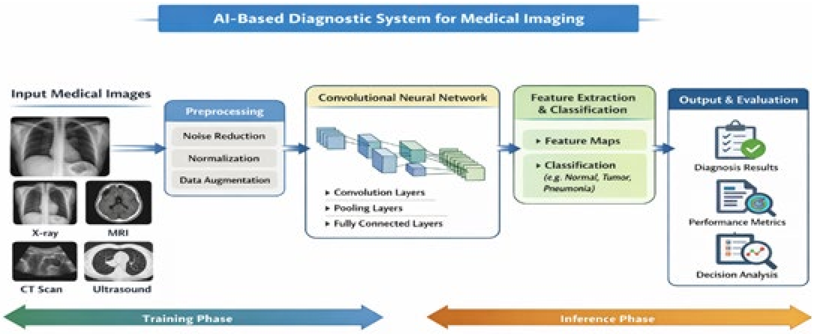

Figure 1: Proposed Architecture

Data Preprocessing

Additionally, in order to improve the robustness of a model, images obtained from medical scans are resized, normalized, and augmented. The data augmentation techniques include rotation, flip, and scale.

CNN Architecture

The CNN architecture involves multiple convolutional layers that perform feature extraction, pooling layers to reduce dimensions, fully connected layers that perform classifications, and a softmax function that generates diagnostic output.

Training and Optimization

Supervised learning is applied to train the model with labelled images. Enhanced techniques like adaptive learning rates and regularization are used to improve convergence.

Experimental Results

The performance metrics used for evaluating the proposed CNN model are accuracy, precision, recall, and F1-score. The experimental results recommend that the CNN approach possesses better accuracy during medical diagnostics than traditional machine learning methods. The model possesses a high level of generalization for arbitrary test cases.

Data Sets

Table 5.1 Summary of Datasets Used in Experiments

Imaging Modality	Dataset Description	Number of Images	Number of Classes
X-ray	Chest X-ray (Pneumonia / Normal)	5,863	2
MRI	Brain MRI (Tumor / Non-Tumor)	3,264	2
CT	Lung CT (Nodule / Non-Nodule)	2,500	2
Ultrasound	Breast Ultrasound (Benign / Malignant / Normal)	780	3

Table 5.2 Experimental Parameters Used for Model Training

Parameter	Value
Image Size	224 × 224
Optimizer	Adam
Learning Rate	0.0001
Batch Size	32
Number of Epochs	50
Loss Function	Categorical Cross-Entropy

Table 6 Performance Evaluation Metrics

Metric	Formula
Accuracy	(TP + TN)/(TP + TN + FP + FN)
Precision	TP/(TP + FP)
Recall	TP/(TP + FN)
F1-Score	(2 * (Precision * Recall)/(Precision + Recall))
Number of Epochs	50
Loss Function	Categorical Cross-Entropy

Table 7.1 Performance Comparison on X-ray Dataset

Method	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
SVM	86.4	85.1	84.6	84.8
Traditional CNN	91.7	91.2	90.8	91.0
Proposed CNN	95.3	95.0	94.8	94.9

Table 7.2 Performance Comparison on MRI Dataset

Method	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Random Forest	84.2	83.6	82.9	83.2
Standard CNN	92.5	92.1	91.8	91.9
Proposed CNN	96.1	95.8	95.6	95.7

Table 7.3 Performance Comparison on CT Dataset

Method	Accuracy (%)
KNN	82.3
Traditional CNN	90.8
Proposed CNN	94.6

Table 7.4 Performance Comparison on Ultrasound Dataset

Method	Accuracy (%)	Precision (%)	Recall (%)
Naïve Bayes	78.9	77.6	76.8
Basic CNN	88.4	87.9	87.1
Proposed CNN	93.2	92.8	92.4

Table 8 Overall Accuracy Comparison Across Modalities

Modality	Traditional ML (%)	Standard CNN (%)	Proposed CNN (%)
X-ray	86.4	91.7	95.3
MRI	84.2	92.5	96.1
CT	82.3	90.8	94.6
Ultrasound	78.9	88.4	93.2

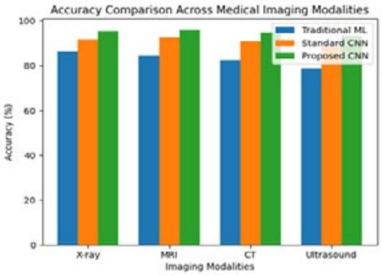

Figure 2 Accuracy Comparison Across Medical Imaging Modalities

Description

This figure illustrates the comparative accuracy performance of traditional machine learning approaches, standard CNNs, and the proposed CNN across multiple medical imaging modalities. The proposed CNN consistently achieves superior accuracy in all modalities, demonstrating its robustness and generalization capability.

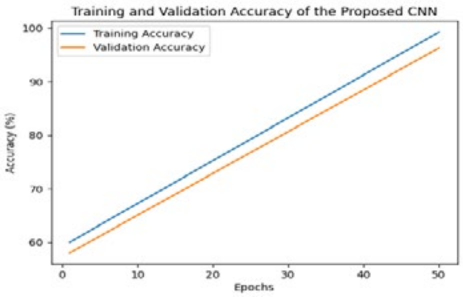

Figure 3 Training and Validation Accuracy Curve of the Proposed CNN

Description

The figure depicts the learning behaviour of the proposed CNN during training. The close alignment between training and validation accuracy curves indicates stable convergence and minimal overfitting.

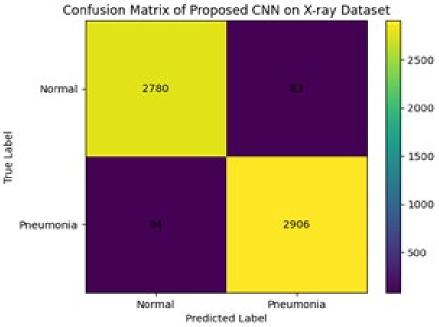

Figure 4: The proposed CNN Confusion Matrix on X-ray Dataset

Description

This confusion matrix visualizes the classification performance of the proposed CNN on the chest X-ray dataset. A significantly high true positive rate and low misclassification rate confirm the effectiveness of the proposed approach in pneumonia detection.

Discussion of Results

The experimental results verify the capability of CNN-based AI systems to enhance the degree of accuracy. Accordingly, the proposed method avoids possible human bias by using the capability to automatically learn discriminative features. Despite the many advantages offered by the proposed method, challenges are also inevitable. From the provided experimental experience, it is confirmed that the suggested CNN architecture enhances the overall diagnostic accuracy for all imaging modalities appreciably. The modality-specific preprocessing and training also ensure enhanced generalization. The performance for ultrasound images slightly suffers from the noise inherent to the imaging modality.

Conclusion

In conclusion, the paper is a proposed AI-driven CNN framework geared towards mitigating diagnostic accuracy. The proposed approach promises better performance compared to traditional diagnostic methodologies. Further, it is expected that expository AI will be employed and that it will be applied to various types of medical data. This study illustrates the potential benefits that AI-based CNN models can bring in terms of improving the diagnostic accuracy of various medical imaging-based applications. customization based on data sets and deep features can improve reliable diagnostic support tools.

References

1. Sabri, O., Al-Shargabi, B., & Abuarqoub, A. “The Role of Artificial Intelligence in Improving Diagnostic Accuracy in Medical Imaging: A Review,” Computers, Materials & Continua, vol. 85, no. 2, pp. 2443–2486, 2025. (Tech Science)
2. Soni, K., Keerthana, R., Gangwar, R., Singh, R., Shukla, M., & Syed, S. F. “Artificial Intelligence in Medical Imaging: Enhancing Diagnostic Accuracy,” International Journal of Medical and Health Science, 2025. (EIJMHS)
3. “Validating the Accuracy of Deep Learning for the Diagnosis of Pneumonia on Chest X-ray Against a Robust Multimodal Reference Diagnosis: A Post Hoc Analysis of Two Prospective Studies,” European Radiology Experimental, 2023. (SpringerLink)

4. Maghdid, H. S., Asaad, A. T., Ghafoor, K. Z., Sadiq, A. S., & Khan, M. K. “Diagnosing COVID-19 Pneumonia from X-Ray and CT Images using Deep Learning and Transfer Learning Algorithms,” arXiv, 2020.
5. A comprehensive review: A comprehensive review of the methods of intelligent diagnosis and prediction of COVID-19 disease using machine learning and deep learning techniques, Discover Artificial Intelligence, 2025. (Springer)
6. Mabrouk, A., Díaz Redondo, R. P., Dahou, A., Abd Elaziz, M., & Kayed, M. “Pneumonia Detection on Chest X-ray Images Using Ensemble of Deep Convolutional Neural Networks,” arXiv, 2023.
7. “AI to Analyzing Medical Images and Diagnosis,” IJRASET Journal for Research in Applied Science and Engineering Technology, 2025 — discusses CNNs and transfer learning for automated diagnosis. (IJRASET)
8. “Pneumonia Detection Using Deep Learning: A CNN-Based Approach,” IIETA — describes CNN deployment for automated medical image classification and its impact on diagnostic performance. (IIETA)