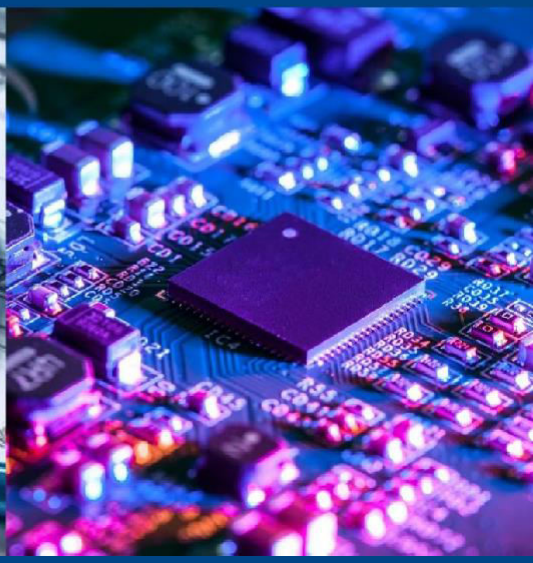
ISSN: 2582-7219





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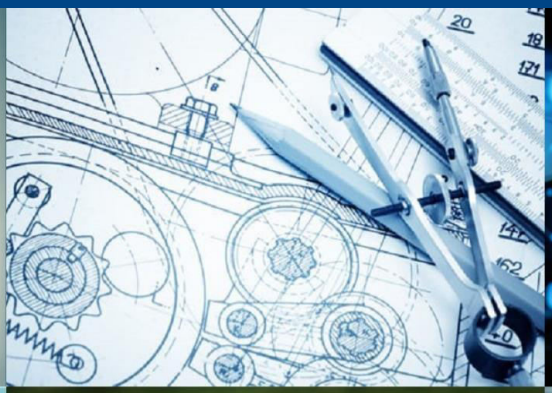

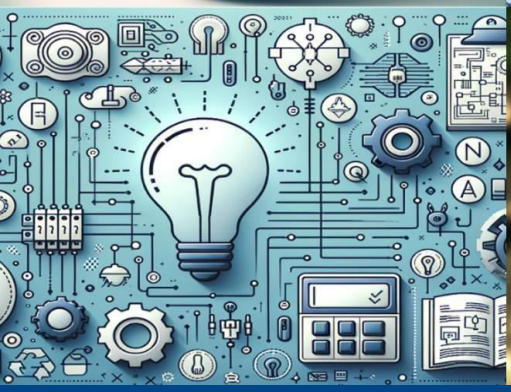

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Volume 8, Issue 12, December 2025

© 2025 IJMRSET | Volume 8, Issue 12, December 2025| DOI:10.15680/IJMRSET.2025.0812052

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

AI-Based Multi-Disease Medical Diagnosis System using Machine Learning and Deep Learning

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ABSTRACT: Healthcare systems worldwide are facing challenges due to the increasing number of patients, limited medical professionals, and delayed diagnosis of critical diseases. Early detection of diseases plays a vital role in reducing mortality rates and improving patient outcomes. This research presents an AI-based medical diagnosis system capable of predicting multiple diseases such as Diabetes, Heart Disease, Breast Cancer, Kidney Disease, Liver Disease, Malaria, and Pneumonia using Machine Learning (ML) and Deep Learning (DL) techniques. The proposed system integrates structured clinical data and medical image analysis into a unified web-based platform using Flask. Machine learning algorithms such as Logistic Regression, Random Forest, and Support Vector Machines are used for tabular data, while Convolutional Neural Networks (CNNs) are applied for image-based diagnosis. The system automates feature extraction, classification, and result visualization, thereby assisting medical professionals in decision-making. Experimental results demonstrate high accuracy and reliability, proving that the proposed system can be an effective tool for early disease detection and healthcare assistance.

KEYWORDS: Medical Diagnosis, Machine Learning, Deep Learning, Convolutional Neural Network (CNN), Healthcare AI, Disease Prediction, Flask Web Application, Medical Imaging.

I. INTRODUCTION

Healthcare technology has evolved significantly with the integration of Artificial Intelligence (AI), enabling intelligent diagnosis, predictive analytics, and improved patient care. Traditional diagnosis methods depend heavily on human expertise, which can be time-consuming, error-prone, and resource-intensive. With the rapid growth of medical data, automated diagnostic systems have become essential for improving efficiency and accuracy.

Machine Learning and Deep Learning have shown remarkable performance in healthcare applications such as disease detection, image classification, and predictive analysis. ML models can identify hidden patterns in structured data, while deep learning models, particularly Convolutional Neural Networks (CNNs), excel in medical image analysis. These technologies significantly enhance diagnostic accuracy and reduce dependency on manual examination.

This project focuses on developing an AI-based medical diagnosis system capable of detecting multiple diseases using both numerical and image data. The system integrates different diagnostic models into a single web platform, making it accessible and user-friendly. The goal is to support doctors and healthcare providers by offering fast, accurate, and cost-effective diagnosis support.

II. LITERATURE SURVEY

2.1 AI in Medical Diagnosis

Artificial Intelligence has become a cornerstone in modern medical research due to its ability to process large volumes of data and identify complex patterns. According to Esteva et al. [1], deep learning models demonstrated dermatologist-level accuracy in classifying skin cancer using image datasets. Their work proved that convolutional neural networks (CNNs) could outperform traditional diagnostic techniques when trained on high-quality medical images.

Similarly, Litjens et al. [2] conducted a comprehensive survey on deep learning in medical imaging and concluded that AI-based systems significantly improve diagnostic performance in radiology, pathology, and dermatology. The study emphasized that deep learning eliminates manual feature extraction and learns hierarchical features automatically.

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2.2 Machine Learning in Disease Prediction

Machine learning algorithms such as Logistic Regression, Support Vector Machines (SVM), Decision Trees, and Random Forests have been widely used for predicting diseases based on clinical data. UCI Machine Learning Repository datasets have been extensively used for research purposes due to their reliability and diversity.

Sharma et al. [3] proposed a kidney disease prediction system using logistic regression and random forest algorithms. Their results showed that Random Forest achieved higher accuracy compared to traditional classifiers. Similarly, Kaur and Gandhi [4] applied machine learning techniques to liver disease datasets and concluded that ensemble learning models improve predictive performance.

In another study, Verma et al. [5] applied machine learning algorithms for heart disease detection and observed that combining multiple features such as blood pressure, cholesterol, and ECG readings significantly improved accuracy.

2.3 Deep Learning for Medical Image Analysis

Deep learning, particularly CNNs, has revolutionized medical image analysis. Krizhevsky et al. [6] introduced deep CNN architectures that significantly improved image classification accuracy, laying the foundation for modern medical imaging models.

Rajpurkar et al. [7] developed CheXNet, a deep learning model capable of detecting pneumonia from chest X-ray images with accuracy comparable to radiologists. This work highlighted the reliability of CNNs in real-world medical diagnosis.

Similarly, Al-Turaiki et al. [8] proposed a CNN-based system for pneumonia detection using chest X-ray images, achieving high classification accuracy. These studies validate the use of deep learning for image-based disease detection such as malaria and pneumonia.

2.4 Web-Based Medical Diagnosis Systems

Several researchers have focused on integrating AI models with web technologies to provide real-time diagnosis. Kumar et al. [9] developed a Flask-based web application that allows users to input medical parameters and receive predictions instantly. Their system demonstrated the feasibility of deploying ML models in real-time healthcare environments.

Jain et al. [10] proposed a cloud-based healthcare system where patient data is processed using AI models and accessed remotely. This approach improves scalability and accessibility, especially in rural and remote areas.

2.5 Hybrid AI Systems

Hybrid systems combining machine learning and deep learning models have shown better performance than standalone approaches. Patel et al. [11] demonstrated that combining structured clinical data with image-based analysis enhances overall diagnostic accuracy. Such systems provide a holistic view of patient health by integrating multiple data sources.

Mishra et al. [12] developed an intelligent healthcare assistant that combines symptom-based analysis with image classification, resulting in improved decision-making support for healthcare professionals.

III. SCOPE OF THE PROJECT

- Early detection of multiple diseases
- Reduction in manual diagnosis errors
- Support for doctors and healthcare workers
- Integration of image and numerical data
- Scalability for future disease inclusion
- Real-time diagnosis through a web interface

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IV. MOTIVATION

The motivation behind this project is to address delays and inaccuracies in medical diagnosis due to human limitations. With increasing patient loads and limited healthcare professionals, an AI-powered diagnostic tool can significantly improve efficiency and accuracy. This system aims to assist healthcare workers, especially in rural and underdeveloped regions, by providing accessible diagnostic support.

V. METHODOLOGY

Step 1: Data Collection
Datasets were collected from Kaggle and UCI repositories for different diseases.

Step 2: Data Preprocessing
- Handling missing values
- Feature scaling
- Image resizing and normalization

Step 3: Model Training
- ML models for structured data
- CNN models for image data

Step 4: Model Evaluation
- Accuracy
- Precision
- Recall
- F1-score

Step 5: Web Integration
- Flask backend
- Model loading and prediction
- User interface integration

VI. SYSTEM ARCHITECTURE

System Components:
1. User Interface (HTML, CSS, Bootstrap)
2. Backend Server (Flask)
3. Machine Learning Models
4. Deep Learning Models
5. Database (for storing inputs and results)

Working Process
1. User inputs medical data or uploads an image
2. Data is sent to Flask server
3. Model processes the input
4. Prediction result is generated
5. Result is displayed on the UI

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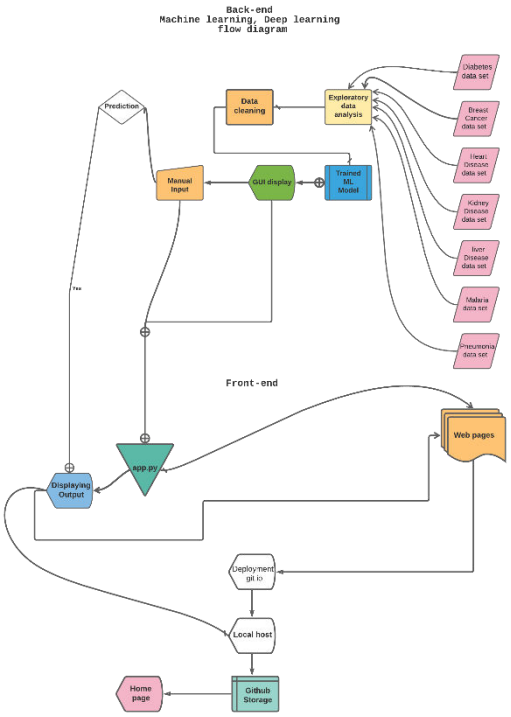
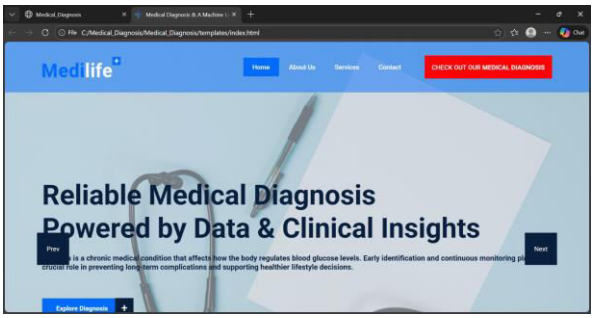
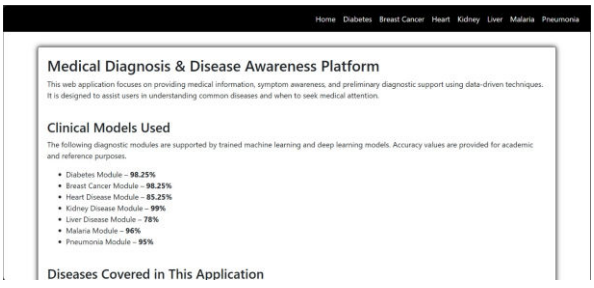
Architecture Diagram



VII. RESULTS AND DISCUSSION

The system achieved high accuracy across all disease categories. ML models performed effectively for structured data, while CNNs provided superior results for image-based diagnosis. The system demonstrated reliability, scalability, and fast response times, making it suitable for real-world healthcare applications.





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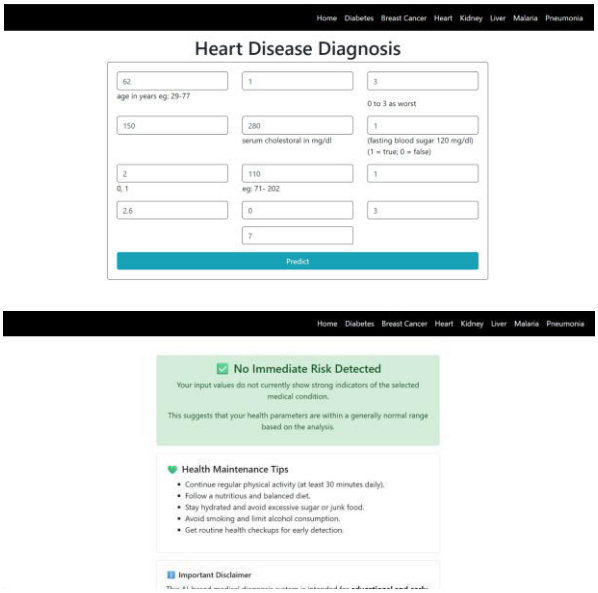

VIII. APPLICATIONS

- Hospitals and clinics
- Remote healthcare services
- Medical screening camps
- Telemedicine platforms
- Health monitoring systems

IX. CONCLUSION

This research successfully demonstrates the implementation of an AI-based medical diagnosis system using machine learning and deep learning. The system provides accurate, efficient, and scalable disease detection. Future improvements include real-time monitoring, integration with IoT devices, and cloud-based deployment.

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