

# Leveraging Artificial Intelligence for Predictive Healthcare: A Machine Learning Approach to Early Disease Detection

Dr.Nitesh Sharma\*

Corresponding Author: sushilphalke1331+test777@gmail.com

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## ABSTRACT

Recent advancements in artificial intelligence (AI) and machine learning (ML) have transformed the healthcare industry, enabling data-driven insights for improved diagnosis, treatment, and patient management. This research explores the implementation of machine learning algorithms for early disease detection using clinical and demographic data. We evaluate the performance of various supervised learning models—such as logistic regression, random forest, and deep neural networks—on a curated dataset comprising patient health records. The study demonstrates that the proposed hybrid model achieves higher accuracy and recall compared to traditional diagnostic methods. Our findings suggest that integrating AI-driven predictive systems within healthcare frameworks can enhance preventive care, reduce diagnosis time, and support medical decision-making. The paper concludes with recommendations for real-world deployment and outlines ethical considerations in AI-based healthcare systems.

## KEYWORDS

**Artificial Intelligence, Machine Learning, Predictive Analytics, Healthcare, Disease Detection, Data Mining, Medical Diagnosis**

## Introduction

The integration of artificial intelligence (AI) into healthcare has emerged as one of the most transformative trends of the 21st century. With the increasing availability of electronic health records (EHRs) and advanced computational resources, machine learning (ML) models have shown significant potential in analyzing complex medical data to uncover patterns that may not be evident to human practitioners. Early disease detection is a particularly promising area, as timely intervention can drastically improve patient outcomes and reduce healthcare costs.

Traditional diagnostic approaches often rely on manual evaluation, which can be subjective and time-consuming. In contrast, AI-driven predictive systems can process vast datasets rapidly, identify subtle correlations, and provide probabilistic predictions that assist clinicians in making informed decisions. However, despite the progress made, challenges remain regarding data quality, model interpretability, and ethical deployment.

This paper investigates how various machine learning models can be applied to predict early stages of diseases such as diabetes, cardiovascular disorders, and cancer. We present a comparative analysis of different algorithms, evaluate their predictive performance, and propose an optimized framework for integrating AI tools into existing healthcare infrastructures. The overarching goal is to demonstrate that data-driven models can enhance both the accuracy and efficiency of disease diagnosis, ultimately contributing to more proactive and personalized patient care.