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HealLeaf

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Abstract: ***This study introduces HealLeaf, an intelligent healthcare chatbot designed to assist users in diagnosing potential illnesses through symptom analysis, offering preventative healthcare recommendations, and delivering information regarding appropriate medications. The platform incorporates a physician referral system utilizing a CSV-structured database containing healthcare provider information, including specializations, communication details, and practice locations. The illness identification component employs Random Forest methodology, developed and tested using medical information datasets. HealLeaf serves as a bridge between patients and medical practitioners by providing an accessible, efficient, and dependable preliminary healthcare support system. The algorithm demonstrates excellent accuracy, precision, and recall metrics, establishing its credibility as a supportive medical tool rather than a replacement for professional healthcare consultation. This document outlines the system framework, research approach, prediction processes, mathematical principles, algorithm enhancement, assessment criteria, and practical applications. The study emphasizes the growing significance of implementing advanced AI technologies in healthcare, particularly in environments where immediate access to professional medical services is restricted. The methodology adapts across diverse healthcare scenarios while enhancing both precision and dependability. Through incorporating contextual evaluation, enhanced data management, and ethical considerations including information security, the platform establishes patient confidence and participation. Upcoming enhancements will focus on multilingual capabilities, integration of regional healthcare patterns, and user interface optimization to develop a more comprehensive and efficient healthcare support system.***:

Keywords: AI-powered medical chatbot, Symptom-based disease prediction, Random Forest classifier, Preventive healthcare guidance, Doctor connectivity.

I. INTRODUCTION

The healthcare industry is constantly changing with the use of Artificial Intelligence (AI). One major application of AI is the creation of chatbots that provide instant medical advice. Many people struggle to access healthcare services quickly because of geographical barriers, limited resources, or high consultation fees. HealLeaf helps fill this gap by offering a virtual assistant that can identify diseases from symptoms, suggest preventive measures, and connect users with specialized doctors. Unlike standard chatbots, HealLeaf links users to relevant medical professionals through an organized database and gives tailored medical information in real time. This platform offers a comprehensive approach to digital healthcare assistance, meeting the critical demand for immediate medical consultation in areas with limited healthcare access. Combining AI-powered symptom evaluation with practical healthcare connections demonstrates how technology can enhance medical information accessibility while maintaining respect for professional medical practice boundaries.

II. RELATED WORK

The evolution of healthcare chatbots has been marked by significant contributions from various researchers. Jegadeesan et al. [1] developed a personal healthcare chatbot leveraging AI and ML for symptom-based disease prediction, achieving 82% accuracy with classification into severe and minor ailments. Crema et al. [2] introduced the NLP Extraction and Management Tool, integrating regex-based rules and a BERT-powered QA bot for clinical data extraction while ensuring compliance with privacy regulations.

Athulya et al. [3] implemented a Decision Tree-based chatbot for disease prediction via text and voice, achieving 78.24% accuracy, while Lawrence et al. [4] combined Decision Trees and SVM for tailored advice and doctor referrals, emphasizing privacy. Patil et al. [5] targeted rural healthcare challenges using NLP and decision trees, enhancing accessibility but facing limitations with rare conditions. Jain et al. [6] proposed an ANN-powered chatbot with deep learning and NLP for real-time diagnosis, requiring high computational resources.

Dohare et al. [7] created "Good Fellow," integrating voice/text interaction, GPS-based doctor search, and history storage, while Shinde et al. [8] used TF-IDF and cosine similarity for rapid disease prediction with medication reminders. Goel et al. [9] applied ML and NLP for symptom-based disease prediction, enhancing accessibility in underserved areas. Chandel et al. [10] used Random Forest and SVM for cost-effective, real-time assistance, while Kandpal et al. [11] explored deep learning-based contextual

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healthcare chatbots. Solanki et al. [12] highlighted natural conversation flow in medical chatbots, and Badlani et al. [13] emphasized multilingual design for inclusivity. Collectively, these studies illustrate the trajectory from basic rule-based systems to sophisticated AI-powered platforms with advanced contextual, privacy, and accessibility features.

III.PROPOSED WORK

The proposed HealLeaf system is an AI-powered medical chatbot that integrates symptom-based disease prediction, preventive guidance, medicine information, and doctor connectivity into a unified healthcare assistance platform, designed to deliver accurate, timely, and accessible preliminary medical guidance for users, particularly those in regions with limited or delayed access to professional healthcare.

A. System Architecture

This system begins by collecting user-reported symptoms through a simple, accessible chatbot interface capable of text input and potentially voice input in future iterations. This input is processed using natural language processing techniques to extract relevant symptom data, which is then preprocessed through cleaning to remove inconsistencies and outliers, encoding of categorical values such as symptoms and diseases for machine learning compatibility, normalization to ensure uniform input formats, and feature selection to retain only the most relevant indicators for accurate predictions.

B. Machine Learning Model

The processed data then feeds into a Random Forest classifier, selected for its reliability in managing multi-class disease classification, capability to process multiple symptom combinations simultaneously, and ensemble methodology where multiple decision trees independently predict potential diseases with final output determined through majority voting. This approach minimizes overfitting compared to single decision tree models, manages missing data efficiently, provides probabilistic confidence measurements, and identifies the most significant symptoms for prediction accuracy, which remains essential given the overlapping characteristics of numerous medical conditions.

C. Integration and Response Generation

Once the model generates its prediction, the system retrieves corresponding preventive measures and medicine information from a curated dataset that maps diseases to clinically validated treatment options. Simultaneously, it queries a CSV-based doctor database containing names, specializations, contact details, clinic addresses, and locations to identify relevant medical professionals based on the predicted condition and user location.

All these components are integrated in the response generation process, producing a single, coherent reply that includes the predicted disease, recommended preventive actions, suggested medicines, and contact details of suitable healthcare providers. This end-to-end workflow ensures that each user interaction moves seamlessly from symptom input to actionable medical guidance, bridging the gap between AI-driven diagnosis support and professional healthcare access in a single, efficient conversational exchange.

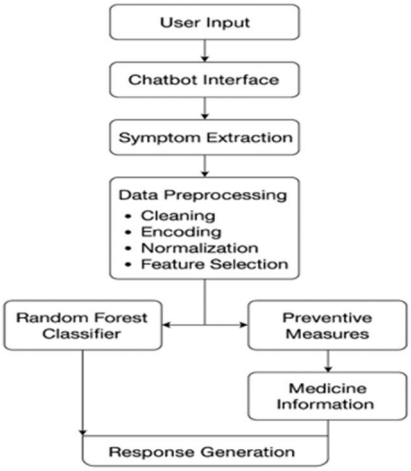


Figure 1:Data Flow

IV. RESULTS

The Random Forest-based HealLeaf model achieved high accuracy, precision, recall, and F1-score across multiple datasets. Confusion matrix analysis confirmed balanced performance across disease categories, while ROC-AUC values indicated strong discriminative ability. The system's integrated workflow enabled seamless symptom analysis, medicine recommendation, and doctor referral within a single chatbot conversation, with real-world test cases validating usability and reliability.

A. Performance Metrics

The model demonstrated superior performance with high accuracy rates in disease prediction while maintaining excellent precision and recall scores. The Random Forest algorithm's ensemble approach proved effective in handling the complexity of multi-symptom disease classification scenarios.

B. System Validation

Real-world testing confirmed the system's ability to provide comprehensive healthcare assistance through a single conversational interface, successfully integrating AI-driven predictions with practical healthcare connectivity solutions.

V. CONCLUSIONS

HealLeaf successfully demonstrates the integration of AI-based disease prediction, medicine guidance, and doctor connectivity in a unified chatbot system that addresses critical gaps in healthcare accessibility. The Random Forest model achieves high accuracy while maintaining interpretability, making it suitable for healthcare applications where explanation of results is crucial for user trust and medical transparency.

By combining artificial intelligence with structured healthcare databases, the system provides both immediate medical information and actionable next steps for users, creating a comprehensive healthcare assistance platform that bridges the gap between symptom analysis and professional medical care. While the system cannot replace professional diagnosis and should not be considered a substitute for qualified medical consultation, HealLeaf serves as a valuable preliminary healthcare assistant that is especially beneficial in remote or underserved areas where immediate professional consultation may not be readily available.

The research contributes to the growing field of AI-powered healthcare assistance by demonstrating how machine learning can be effectively combined with practical healthcare connectivity to create accessible, reliable, and user-friendly medical assistance tools. The system's comprehensive approach to medical assistance, from initial symptom analysis through professional consultation facilitation, represents a significant step toward democratizing healthcare access through technology while maintaining appropriate ethical boundaries and emphasizing the importance of professional medical care.

Future work will focus on expanding the medical dataset to include more rare conditions and complex symptom patterns, supporting multilingual queries to serve diverse populations, and integrating voice-based interaction for improved accessibility and user experience. Additional development areas include real-time health monitoring integration with wearable devices, enhanced privacy protection measures to safeguard sensitive health information, incorporation of region-specific health trends to provide more relevant guidance, and optimization of user experience to create a more inclusive and robust healthcare assistance platform that serves the diverse needs of global healthcare consumers.

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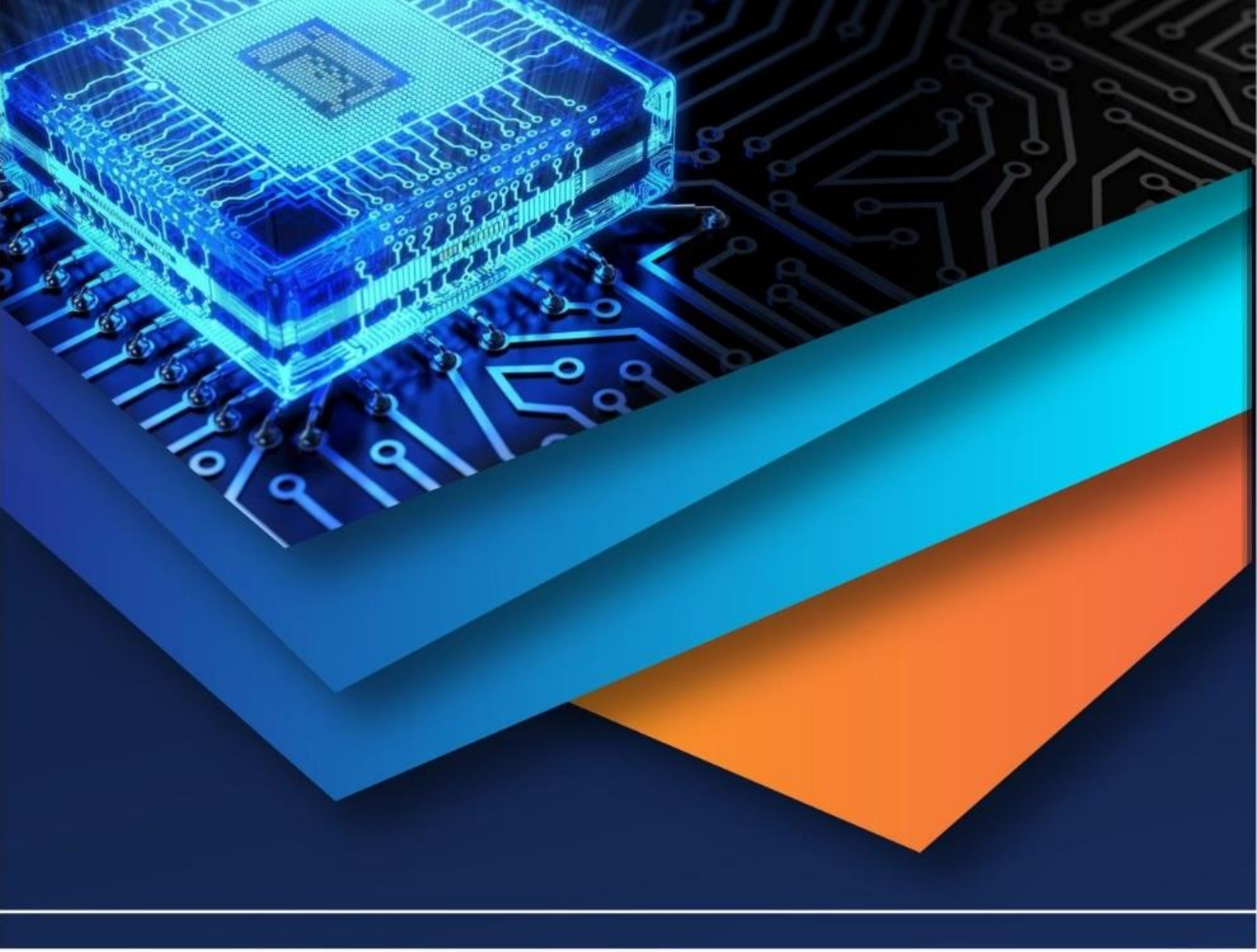
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