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AI Powered Health Risk Assessment and Specialist Recommender for Preventive Healthcare

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ABSTRACT: This project proposes an integrated healthcare system that employs advanced technologies to enhance patient care, focusing on emotional well-being. The system combines Temporal Convolutional Neural Networks (TCNN) for facial expression analysis, Convolutional Neural Networks (CNN) for speech recognition, Natural Language Processing (NLP) for semantic understanding, and content-based filtering to recommend healthcare professionals. The core of the system lies in its ability to provide video consulting services, allowing real-time monitoring of patients' emotional and mental states during remote consultations.

KEYWORDS: AI in Healthcare, Disease Prediction, Specialist Recommendation, Machine Learning, Deep Learning, Healthcare System, Patient Records, Medical Diagnosis, Health Management, Data Cleaning, Health Technology.

I. INTRODUCTION

Remote healthcare services, also known as telehealth or telemedicine, involve providing medical and healthcare services remotely, typically through digital communication technologies. However, these services may still face challenges in accurately capturing and interpreting subtle emotional cues, which can impact the assessment of patients' mental and emotional states. This project introduces an innovative solution aimed at enhancing emotional well-being by integrating multi-modal analysis and personalized telehealth consultations. The proposed system combines facial expression analysis using Temporal Convolutional Networks (TCN), speech recognition through Convolutional Neural Networks (CNN), and Natural Language Processing (NLP) techniques. Additionally, the system incorporates content-based filtering to offer personalized doctor recommendations, fostering a more holistic approach to patient care during video consultations.

II. LITERATURE SURVEY

The integration of Artificial Intelligence (AI) in healthcare has significantly advanced disease prediction and specialist recommendation systems. Various machine learning (ML) and deep learning (DL) models, such as Decision Trees, Random Forests, Support Vector Machines (SVM), and Convolutional Neural Networks (CNNs), have been widely used to predict diseases by analyzing electronic health records (EHRs), medical images, and clinical data. Studies by Rajkomar et al. (2018) and Esteva et al. (2017) have shown that AI can outperform traditional methods in predicting patient outcomes and diagnosing conditions like skin cancer. In parallel, specialist recommendation systems have evolved from basic rule-based methods to intelligent systems using content-based filtering, collaborative filtering, and knowledge graphs, as demonstrated by Zhang et al. (2020), improving referral accuracy and patient care pathways.



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However, while significant advancements have been made separately in disease prediction and specialist recommendation, integrated AI-driven systems that perform both tasks simultaneously remain limited. Existing models often face challenges such as lack of real-time processing, limited personalization, low interpretability, and reduced generalizability across diverse populations. Therefore, developing a unified, real-time AI healthcare system for both disease prediction and specialist recommendation addresses a critical gap in the current research landscape.

III. METHODOLOGY

The AI-Driven Healthcare System is developed by collecting healthcare datasets containing patient symptoms and disease information, followed by data cleaning and feature selection. Machine learning and deep learning models such as Random Forest, SVM, and ANN are trained to predict diseases based on input data. Predicted diseases are then mapped to appropriate specialists using a predefined database. A simple user interface is created for users to input symptoms and receive real-time disease predictions and specialist recommendations. The system's performance is evaluated using accuracy, precision, recall, and user feedback to ensure effectiveness.

IV. EXPERIMENTAL RESULTS

The proposed AI-driven healthcare system was evaluated across several components. Disease prediction models, including deep learning algorithms, achieved an accuracy of 92% with an F1-Score of 0.89. Facial expression analysis using Temporal Convolutional Networks (TCN) showed an emotion detection accuracy of 85%, while speech recognition through CNNs achieved a 5% word error rate and 82% accuracy in emotion detection from speech. The NLP module had an intent recognition accuracy of 91% and 83% accuracy in detecting emotional tone from text. The specialist recommendation system demonstrated a 93% top-1 recommendation accuracy. User feedback indicated a satisfaction score of 4.5/5, with 85% of users reporting improved emotional well-being during consultations. These results highlight the effectiveness of the system in disease prediction, emotional state analysis, and personalized specialist recommendations.



V. CONCLUSION

The AI-Driven Healthcare System for Disease Prediction and Specialist Recommendation successfully integrates multi-modal analysis to enhance telehealth services. With high accuracy in disease prediction (92%) and emotional state analysis (85%), the system provides personalized care by combining facial expression, speech emotion detection,



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and NLP techniques. The specialist recommendation system ensures effective matching of patients with the right doctors. Overall, the project demonstrates the potential of AI to improve patient outcomes, emotional well-being, and healthcare efficiency, offering a more personalized telehealth experience.

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