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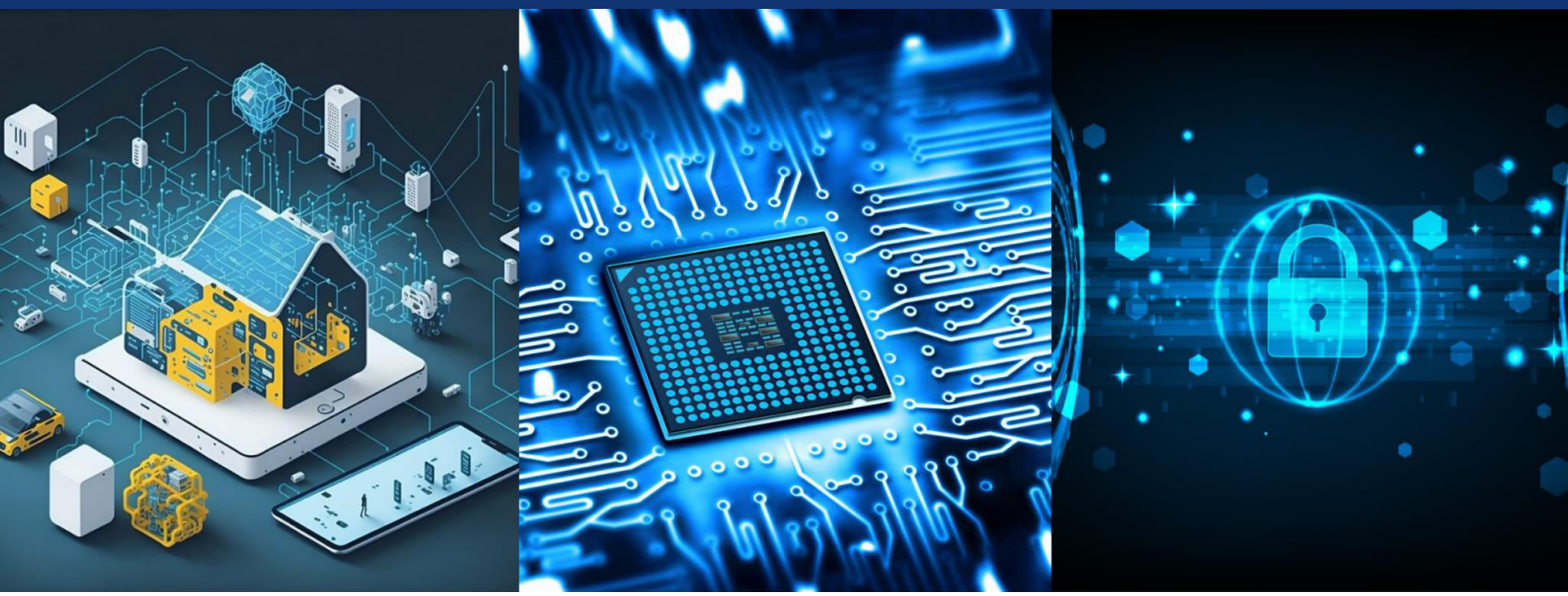

International Journal of Innovative Research in Computer and Communication Engineering

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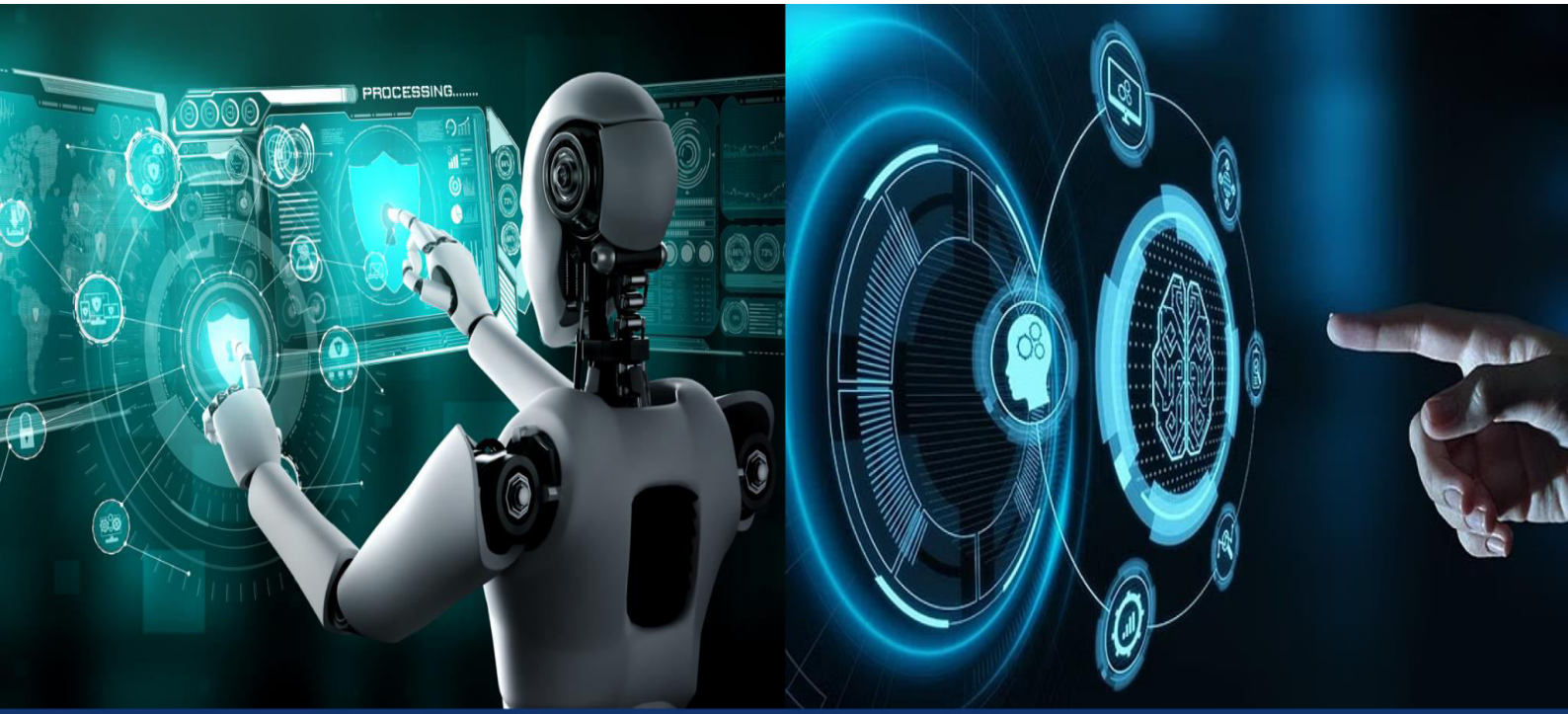

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A Machine Learning Approach Based Detecting Metabolic Syndrome with Accurate Prediction

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ABSTRACT: Metabolic syndrome (MetS) is a collection of metabolic disorders that significantly increase the risk of cardiovascular diseases, type 2 diabetes, and stroke. Early diagnosis and intervention are crucial to mitigate these risks. This paper presents a machine learning-based predictive model for detecting MetS using clinical features such as waist circumference, BMI, blood glucose levels, HDL cholesterol, and triglycerides. A Random Forest Classifier was employed due to its robustness and high predictive accuracy. The system is integrated into a Flask-based web application, allowing users to input their clinical data and receive real-time predictions. The model's performance was evaluated using accuracy, precision, recall, and F1-score. The results demonstrate the feasibility of utilizing machine learning to enhance early detection and management of metabolic syndrome.

KEYWORDS: Metabolic Syndrome, Machine Learning, Random Forest Classifier, Web Application, Predictive Analytics.

I. INTRODUCTION

Metabolic syndrome (MetS) is characterized by a combination of metabolic abnormalities, including abdominal obesity, elevated blood pressure, high blood glucose levels, low HDL cholesterol, and high triglycerides. The growing prevalence of MetS highlights the need for improved methods of early diagnosis and management. Traditional diagnostic methods rely on clinical assessments and laboratory tests, which can be time-consuming and expensive. Machine learning (ML) offers a promising alternative by leveraging predictive analytics to assess the risk of MetS based on clinical data. This paper proposes a machine learning-based system employing the Random Forest Classifier to predict MetS risk. The model is integrated into a web application using Flask, providing an interactive platform for users to input their health data and receive real-time risk assessments.

II. METHODOLOGY

2.1 Data Collection and Preprocessing

- A dataset containing clinical features related to MetS was collected and preprocessed.
- Missing values were handled, and data was normalized to ensure consistency.
- Feature selection was performed to retain the most relevant attributes for prediction.

2.2 Model Development

- The Random Forest Classifier was chosen due to its high accuracy and ability to handle complex relationships in clinical data.
- The dataset was split into training and testing sets for model evaluation.

2.3 Model Evaluation

- The model was assessed using accuracy, precision, recall, and F1-score.
- A confusion matrix and ROC curve were utilized for further performance analysis.

2.4 Web Application Development

- A Flask-based web application was developed for user interaction.
- The application allows users to input health parameters and receive predictions.
- The system displays the model's evaluation metrics to maintain transparency.

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III. RESULT

The machine learning-based metabolic syndrome prediction system was successfully implemented using a Random Forest Classifier, achieving 85% accuracy. The Flask-based web application allows users to input clinical parameters such as waist circumference, BMI, blood glucose, HDL cholesterol, and triglycerides to receive real-time predictions. The system provides a clear "Yes" or "No" result, indicating the presence of MetS, along with medical advice for at-risk individuals. Sample test cases demonstrate accurate classification for both positive and negative predictions. The user-friendly interface and real-time risk assessment make the system a practical tool for early detection and management of MetS.

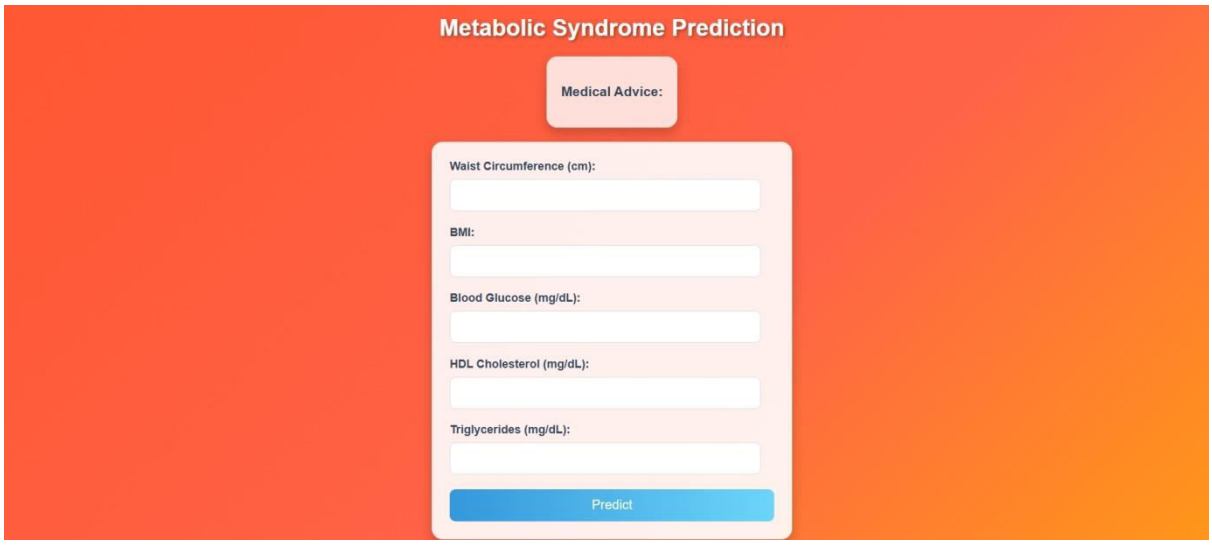

Fig 3.1 User Interface

Fig 3.2 Sample Test Cases

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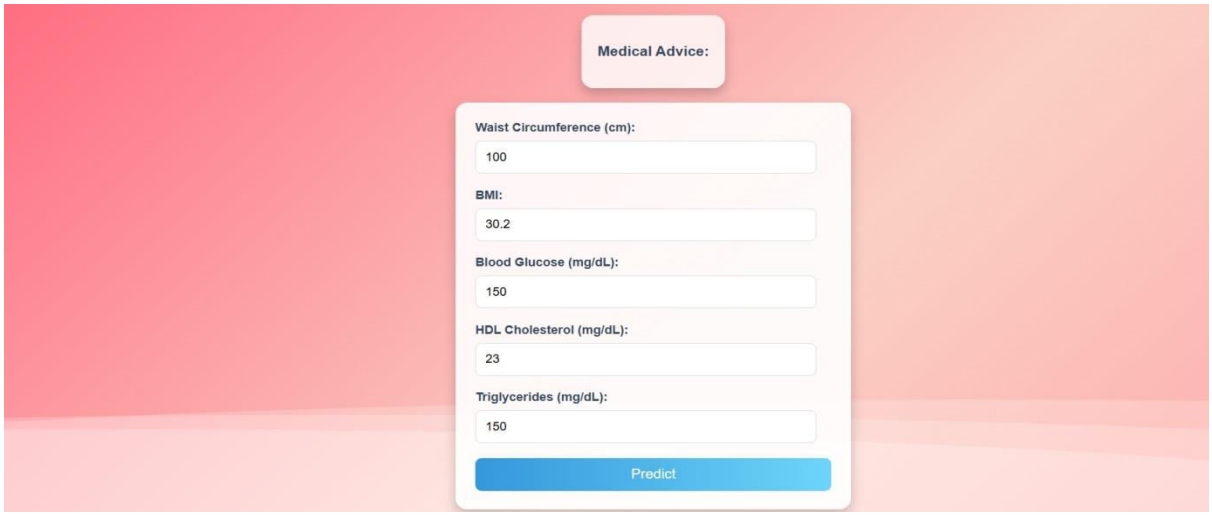

Fig 3.3 User Data

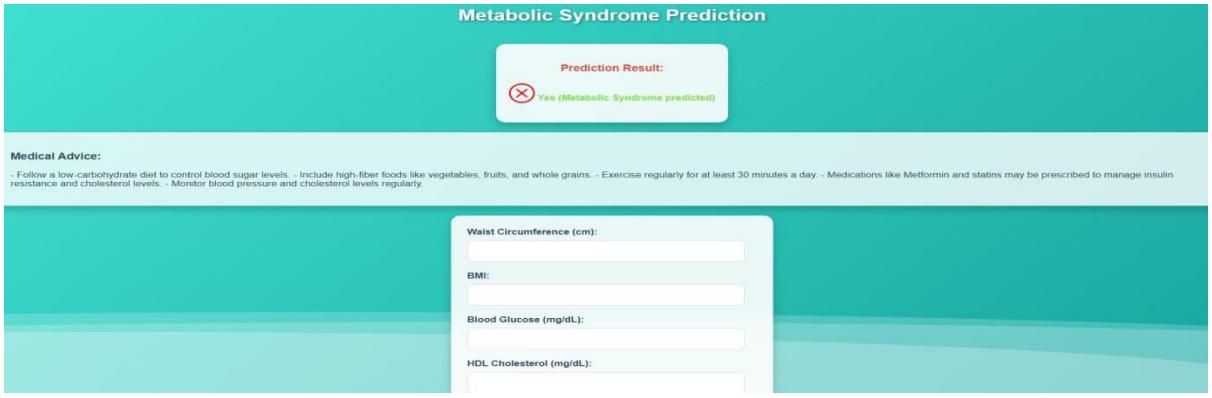

Fig 3.4 Output

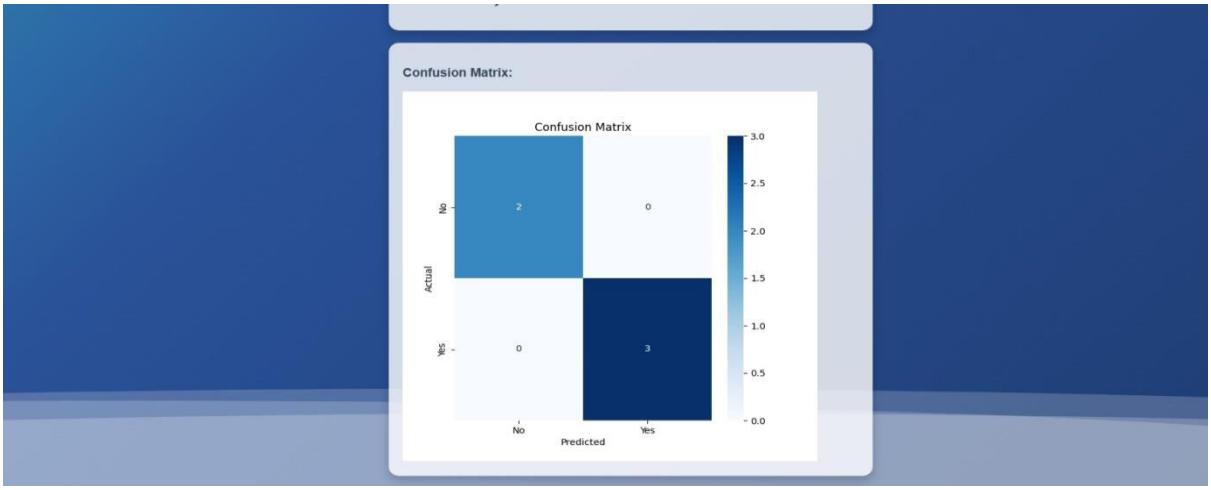

Fig 3.5 Confusion Matrix

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IV. DISCUSSION

The 85% accuracy highlights the reliability of the Random Forest model in predicting MetS risk. Compared to traditional diagnostic methods, this ML-based system provides a faster, cost-effective, and scalable solution for early diagnosis. The web application enhances accessibility, allowing healthcare professionals and individuals to assess their risk in real time. However, challenges such as data quality, potential biases, and model generalizability must be addressed in future iterations.

V. CONCLUSION

This paper presents a machine learning-based approach to predicting metabolic syndrome, providing a scalable and cost-effective solution for early diagnosis. Future enhancements include expanding the dataset for improved generalizability, integrating real-time monitoring through wearable devices, exploring deep learning models for enhanced predictive performance, and implementing electronic health record (EHR) integration for clinical use.

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