OSTEOPOROSIS RISK DETECTION WITH ASSISTANT

Dr Babu Rao K[1], Mohammed Ibrahim Nihal[2], Nihaal Ahammed[3], Nireeksha S[4] and Nisarga Suresh Poojary[5]

Professor, Computer Science & Engineering, Mangalore Institute of Technology & Engineering, Moodabidri, Karnataka, India[1]

Student, Computer Science & Engineering, Mangalore Institute of Technology & Engineering, Moodabidri, Karnataka, India[2,3,4,5]

Abstract: Osteoporosis is a commonly occurring bone disease among the aging population, which leads to the loss of mass in bone and increased fracture risks. This study aims to develop a model using machine learning, which detects osteoporosis risk and the percentage of risk affected to the person using demographic, lifestyle, and clinical factors. The features of this project include age, race, body weight category, gender, family history, medical conditions, and hormonal changes. In addition, an AI-driven chatbot is implemented to answer bone health-related queries for the users. From the evaluated models, such as Decision Tree, Logistic Regression, Random Forest, Support Vector Machines (SVM), and Neural Network, the Random Forest classifier got the highest accuracy of 85.20%. This proposed system provides early diagnosis and information about osteoporosis risk management.

Index Terms - Osteoporosis risk detection, Machine learning, Data Analytics, AI chatbot, Random Forest, Risk management.

I. INTRODUCTION

Osteoporosis is a bone disease associated with aging that causes bones to become weak and brittle. This condition affects both women and men, particularly older adults. Postmenopausal women are particularly affected, which decreases quality of life. As Osteoporosis is the "silent" disease, typically symptoms are less, and early detection is possibly less. One may not even know until the break of a bone. Preventive measures are following the healthy lifestyles implemented before the diseases reach advanced stages.

This study proposes a detective model that assesses osteoporosis risk based on various characteristics such as age, body weight category, gender, family history, race, medical conditions, and hormonal changes. By taking a variety of lifestyle and health factors, the model gives the users the percentage of risk he/she is affected by the osteoporosis. To know the weight category, BMI calculator is embedded. In addition to the osteoporosis risk prediction and detection, this research integrates an AI-driven chatbot to serve as a virtual health assistant. The chatbot is designed to address user queries on bone health, provide recommendations, and guide users through the diagnostic process. The integration of chatbot adds a user-friendly component that guides users with bone health information and support, promoting health management and care.

II. LITERATURE SURVEY

[1] This research enhances the potential of using machine learning models for predicting osteoporosis risk based on chronic disease data. The model that includes a set of variables such as age, chronic disease history, and gender demonstrates an approach to predict individuals having a high risk of osteoporosis.

[2] This research uses an XGBoost-driven model for the detection and management of osteoporosis risk in Asian populations. Focusing on adults above 40 years, a dataset containing demographic, genetic, nutrient, and lifestyle factors. Enhancing the prevention and early treatment of osteoporosis risk in Asians by early detection of risk in individuals.

[3] In this paper, the datasets are collected related to epidemiological and clinical criteria such as bone density and bone quality, the impact of fractures, race, risk factors, and nutritional and lifestyle factors. The research is done by taking multiple factors that affect the bone health, increasing the knowledge about new therapeutic options for osteoporosis.

[4] In this research paper, the study is mainly based on the osteoporosis in men, developed a clinical prediction nomogram model for male osteoporosis using the 1-minute osteoporosis risk test by IOF. The model offers good predictive effect and help for clinicians.

III. SCOPE AND METHODOLOGY

Scope

The project objective is to develop a risk detection system for Osteoporosis by integrating AI-driven assistants as user-friendly interfaces. It involves designing the software for data processing, integrating algorithms for seamless correlation and finding, and system will undergo various testing and validation of data. The project covers osteoporosis risk detection using features such as age, body weight category, gender, family history, race, and hormonal changes by using the machine learning algorithms. Additionally, the project integrates with an AI-driven chatbot for users to understand their queries.

Methodology

A diverse dataset that includes demographic, clinical, and lifestyle data on osteoporosis is collected. This dataset contains features such as age, body weight category, gender, family history, race, medical conditions, alcohol consumption and smoking habits. The collected data is then preprocessed to handle missing values and normalize numerical and categorical features. The missing data is addressed through imputation techniques using mean and mode for variables and categorical features. From the dataset, applicable features are selected for the risk detection of the person with the help of the trained dataset. The BMI calculator is also integrated, so that the user can know their weight category. The AI-driven assistance is integrated into the osteoporosis risk detection for the users to solve their queries regarding the lifestyle changes for the healthy lifestyle of the users.

IV. SYSTEM ARCHITECTURE

The system consists of two main components: a machine learning model for osteoporosis risk detection and AI-driven assistance to assist users. Collection of datasets that consist of demographic, lifestyle, and clinical features relevant to osteoporosis. In the manual data input module, users enter age, body weight category, gender, family history, race and medical conditions. This data is fed into a machine learning algorithm, specifically Random Forest, to predict the risk. The model detects the percentage of risk affected to the individual, helping them to take preventive measures early. The AI-driven assistance is integrated to enhance the user experience provide relevant answers to user queries regarding bone health and lifestyle changes. AI-driven assistance is designed to provide real-time assistance.
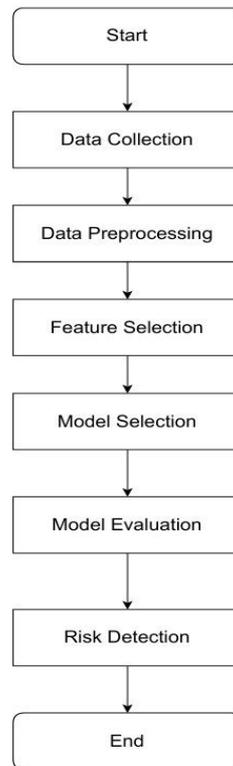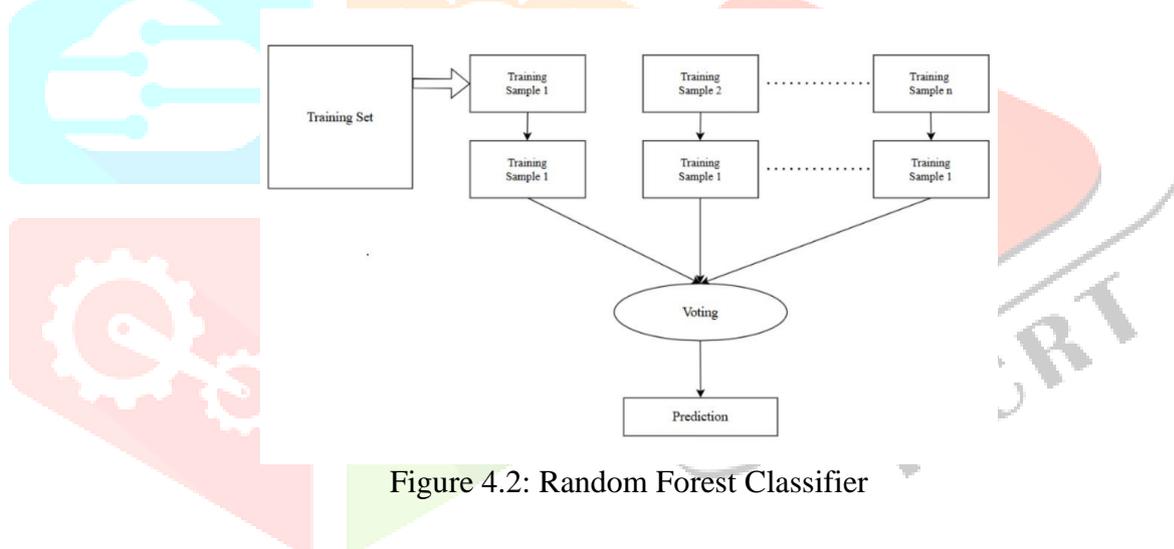
Figure 4.1: System Architecture

Figure 4.2: Random Forest Classifier

V. IMPLEMENTATION

Implementation refers to the execution of the new of system. The starting step of implementing Osteoporosis risk detection with assistant is collection of dataset from the Kaggle. The dataset contains the features such as age, race, weight category, gender, hormonal changes and medical conditions. The collected data is preprocessed by handling the null values using mean, median, and mode. The data was split into 80% for training and 20% for testing. Model is trained using machine learning algorithms such as Decision Tree, Logistic Regression, Random Forest, Support Vector Machines (SVM), and Neural Network, the Random Forest got the highest accuracy and was selected for the further process. Connected model in the Django backend. Python Programming language is used for all these processes.
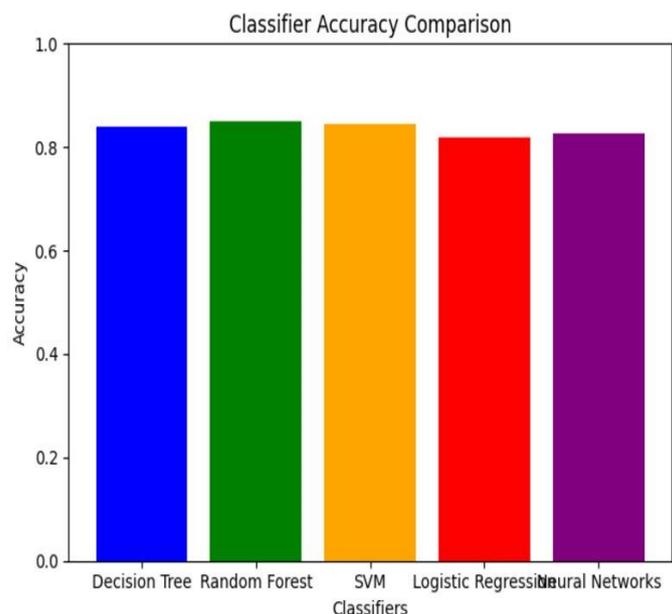
Figure 5.1: Algorithms

AI-driven assistant is built using NVIDIA API, for user-friendly access for users, it handles user queries for lifestyle changes and suggesting recommendations. BMI calculator is integrated for the user to know their weight category (example: underweight, normal, overweight). Frontend and user interface is designed using HTML, CSS, and JavaScript. Interactive AI-driven assistant is embedded into the web application.
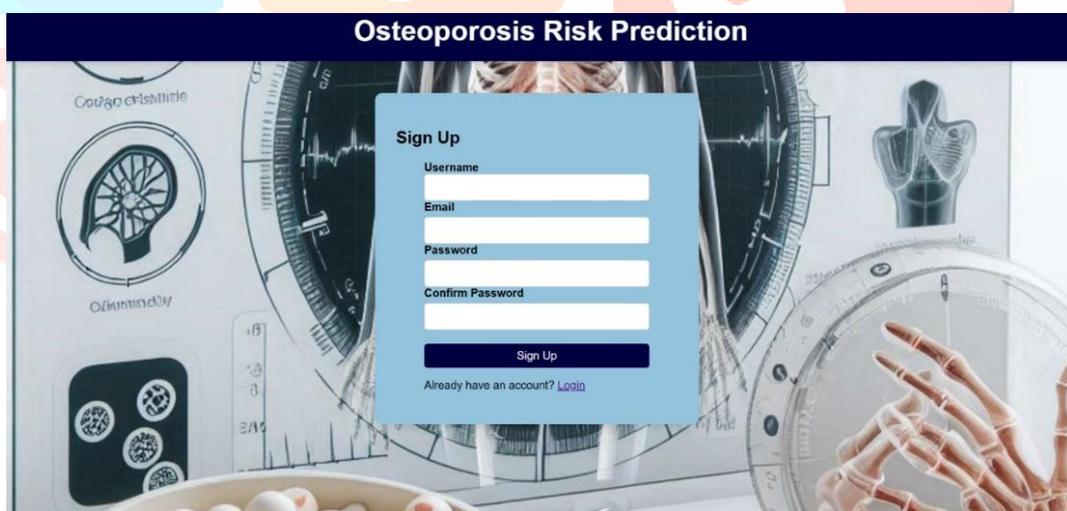
VI. RESULTS

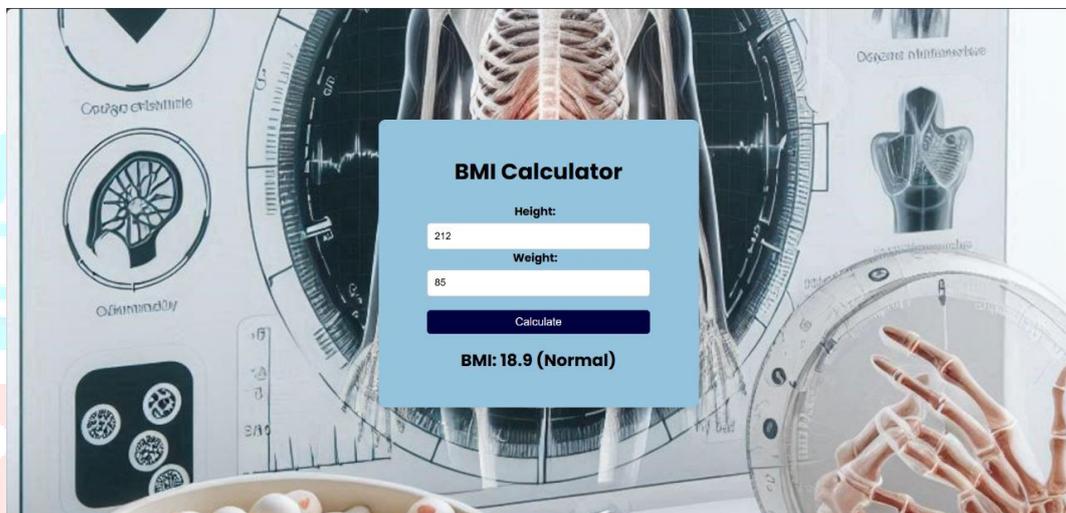Figure 6.1: Sign Up Page

Figure 6.2: Login Page
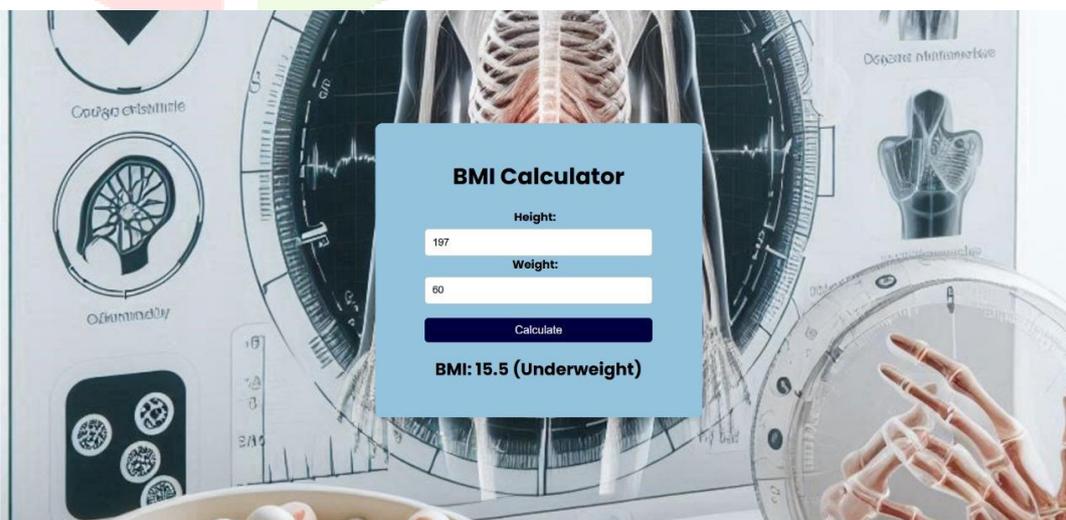

Figure 6.3: Normal Weight Category
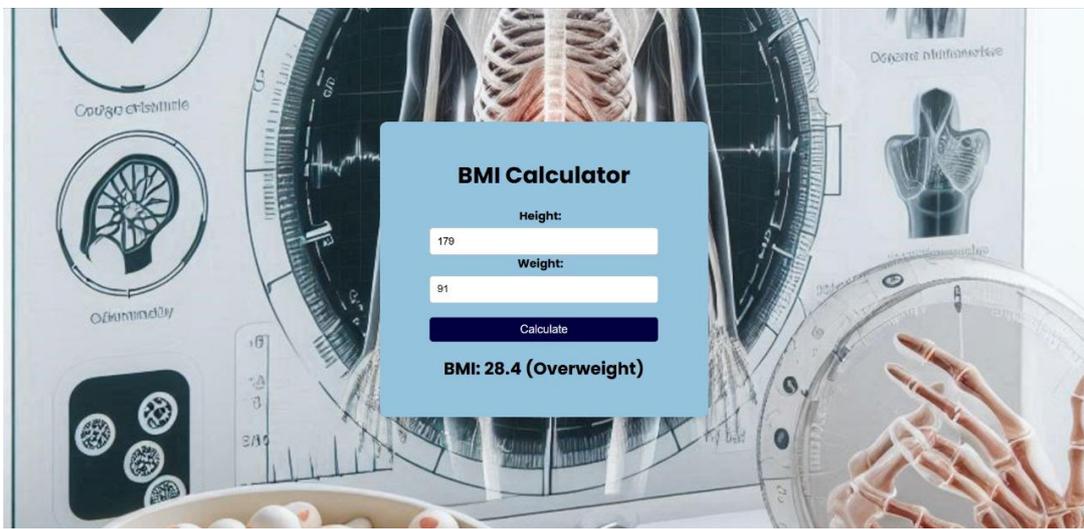

Figure 6.4: Underweight Category
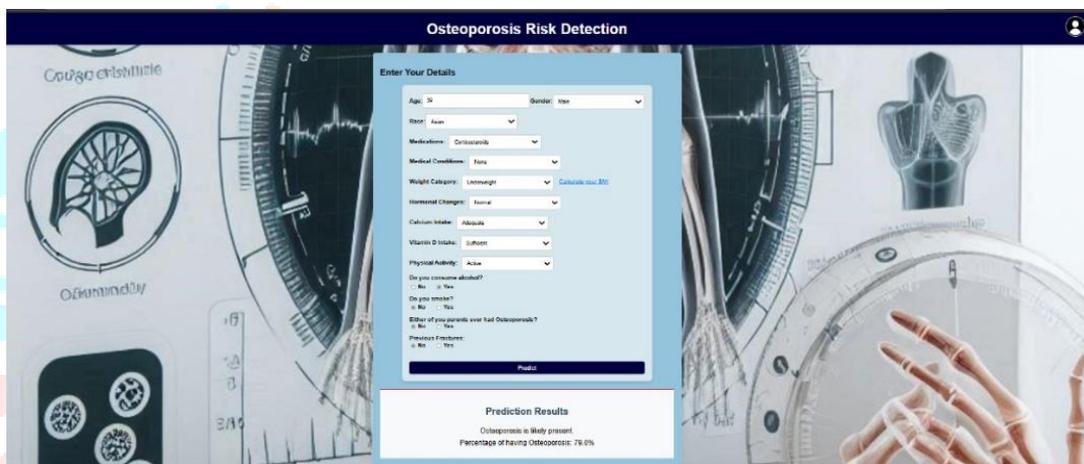
Figure 6.5: Overweight Category

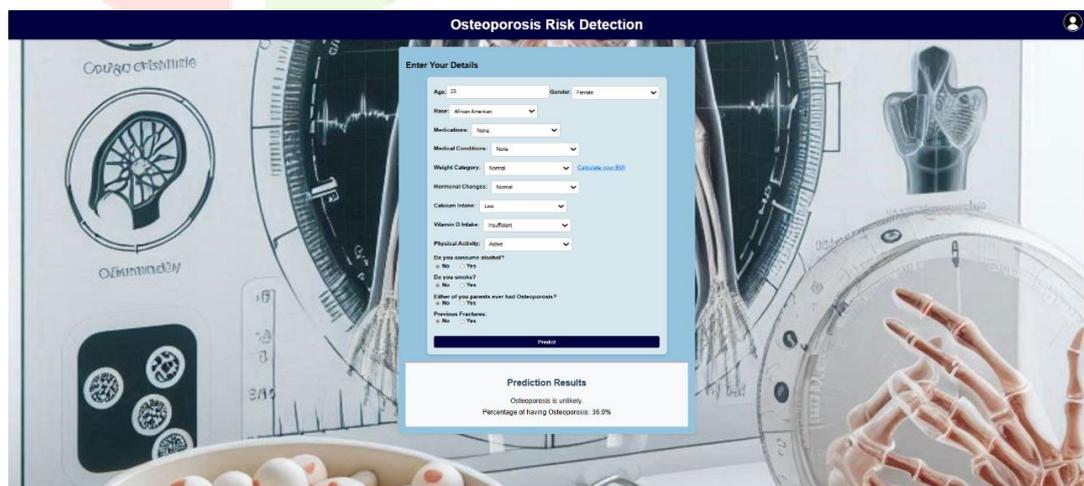Figure 6.6: Osteoporosis Risk Prediction

Figure 6.7: Osteoporosis Risk Not Present

Figure 6.8: AI Driven Assistant

VII. CONCLUSION

This project aims to develop a new system for predicting and detecting of osteoporosis risk and integrating an interactive AI-driven chatbot for users. The model identifies the risk based on the various lifestyle factors and demographic factors; the model achieved an accuracy of 85.20% using the random forest algorithm. The AI-driven assistance offers real-time information on bone health and lifestyle suggestions. It will be easy to use and improve healthcare professional workflow. The project is feasible with existing resources and could significantly improve the osteoporosis risk detection early, leading to better treatment outcomes. This dual approach of integrating the detective model and AI-driven assistance strengthens the system.

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