Heart Disease Prediction Using SVM and Decision Tree

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***Abstract*— Heart disease is a most lethal condition in the current days. Historical numeric data shows that death rate due to cardiac arrest is high. Thus, it is important to diagnose the condition as fast as possible. With the patients' health data, a model is proposed to diagnose heart diseases. Fields like age, bp, glucose, cholesterol levels, etc. are given as input to the algorithms which in turn is then used to predict the chance of heart stroke to a person. Algorithms such as support vector machine, decision trees are used to predicate the chance of heart stroke, and each algorithm has different functionality such as decision trees is used to provide classified result. Support vector machine is used for regression and classification analysis. In this project, we use support vector machine and decision tree algorithm to classify data and predict the target.**

I. INTRODUCTION

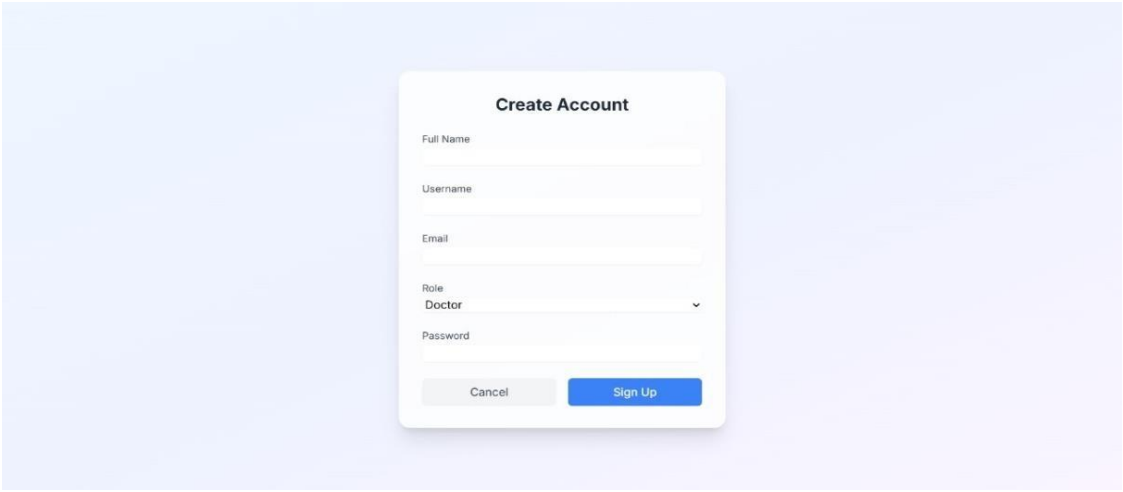
It is a very tedious task to diagnose cardiac disease[1,2,3,4,6] because there are many attributes[1,2,3,4] .it depends on such as glucose levels, blood pressure levels, cholesterol levels including abnormality in pulse rate and other attributes. Data processing and analysis has many medical practitioners have provided reliable and productive solutions for many Applications such as deep portraits of patients, computer-aided Liver Cancer software for diagnosis and medical image segmentation Diagnosis and the Detection of Lungs. In recent years, there have been versions of the neural network that has shown outstanding data efficiency. Forecast algorithms of deep learning have discovered an exceptional performance for data prediction. Deep learning algorithm[6] shave shown an important role in the medical domain for classification of diseases and discovery of knowledge like brain disease detection, glaucoma detection, diabetic detection and heart disease detection using the collected biomedical data. The essence of this heart disease[1,2,3,4,6] is very complex, and caution should also be taken to treat the disease. Not being cautious can cause the heart to degrade or lead to death. The view of data mining and medical science is widely used for finding different types of metabolic syndromes. Classification of data mining plays an important role in the heart disease prediction and data investigation.

II. SYSTEM ARCHEICTURE

The "Heart Disease Prediction[1,2,3,4] Using SVM and Decision Tree" system is built using the backend handles training and testing of the models using the scikit-learn library, where SVM and Decision Tree are applied to predict the presence of heart disease. The frontend is developed using HTML, CSS, and JavaScript, offering a simple user interface for data input and result visualization. The final model is integrated into a web application for easy accessibility and real- time predictions.

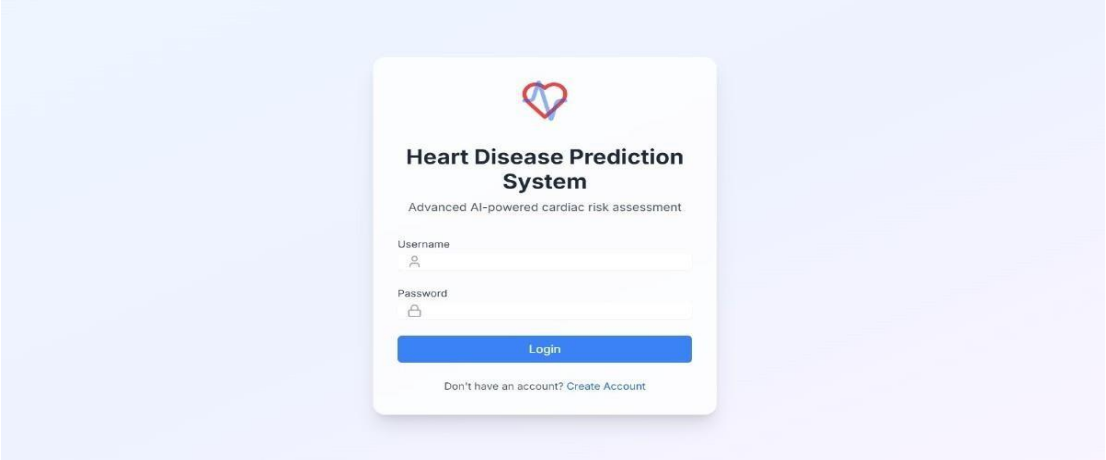
a) Create Account

The interface allows users to register by entering their full name, username, email, selecting a role (e.g., Doctor), and setting a password. It provides a clean and responsive design with options to cancel or complete the sign-up process.



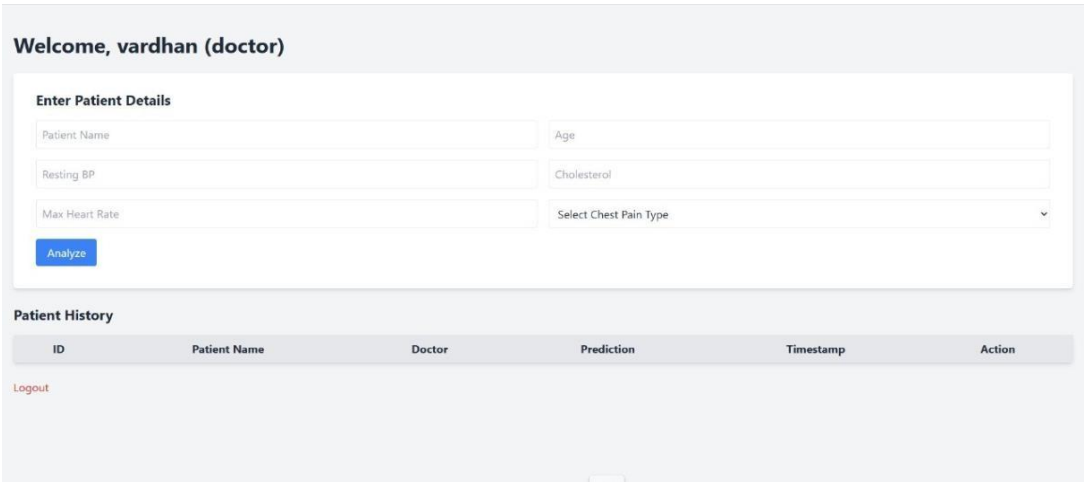
b) Login Page

The page of the Heart Disease Prediction System provides a secure gateway for users to access the platform. It features fields for username and password input, along with a clear call-to-action button for logging in. Users without an account are prompted to create one via a convenient link.



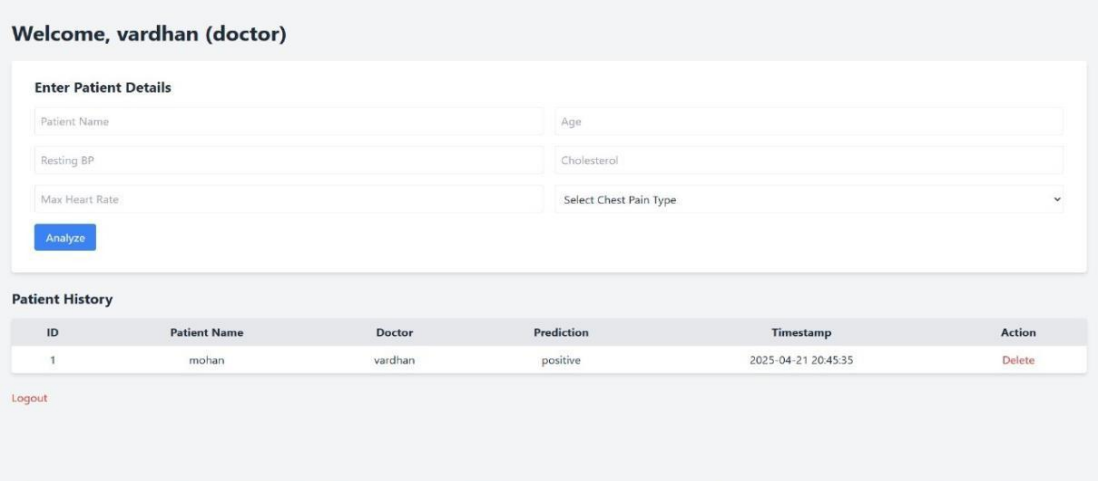
c) Patient Details

The doctor dashboard provides a personalized interface where medical professionals can input patient details such as age, blood pressure, cholesterol, heart rate, and chest pain type for heart disease analysis. Upon clicking "Analyze," the system generates predictions using AI models. It also includes a patient history table to review past predictions, with details like timestamp and doctor assigned.



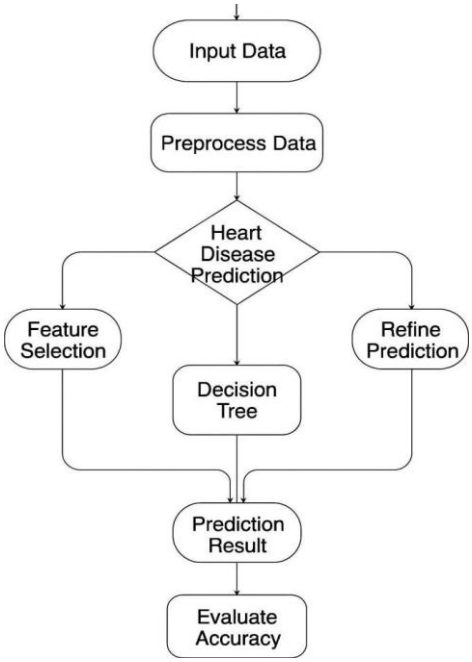
d) Patient History

The dashboard allows doctors to enter patient details and generate heart disease predictions. It displays a patient history table showing previous diagnoses with timestamps, assigned doctors, and an option to delete records.



e) Use Case Diagram

This illustrates the heart disease prediction process using a Decision Tree model. It starts with input data, followed by preprocessing to clean and prepare the dataset. Based on the data, heart disease prediction is performed, involving feature selection and prediction refinement. The Decision Tree algorithm then processes the data to generate a prediction result, which is subsequently evaluated for accuracy.



III. SOFTWARE TESTING

The heart disease prediction system undergoes comprehensive software testing to ensure accuracy, reliability, and usability. Unit testing is performed on individual components like data preprocessing, feature selection, and prediction logic to verify correctness. Integration testing ensures that the modules (input, prediction, and output) work seamlessly together.

System testing validates the entire workflow from user input to final prediction. Additionally, usability testing checks the interface for user-friendliness, while performance testing evaluates the system's response time and accuracy under various loads. These tests collectively ensure a robust and dependable prediction platform.

IV. CONCLUSION

Processing and identification of health data of heart will help in prediction of a normal conditions in heart and rescuing human lives as fast as possible. ML techniques have been used to process relevant data to provide a new approach to heart disease. In the medical world, the prevention of heart disease is complicated and significant.

However, once the condition is diagnosed in the early stages and prevention can be achieved as soon as possible, the lethal rate can be managed.

The project titled "Heart Disease Prediction Using SVM and Decision Tree Hybrid Analysis" successfully demonstrates the potential of machine learning in assisting medical diagnosis, particularly in predicting the likelihood of heart disease based on patient data. By integrating Support Vector Machine (SVM) and Decision Tree algorithms in a hybrid model, the system leverages the strengths of both classifiers to enhance prediction accuracy and reliability.

The implementation using Python (Flask) for the backend and React.js for the frontend provides a user-friendly and interactive web interface, allowing users to input health- related information and receive instant prediction results. This real-time functionality makes the system both accessible and practical for non-technical users such as patients and medical practitioners.

The hybrid approach has shown improved performance over individual models in terms of accuracy and robustness, indicating that ensemble techniques can play a significant role in clinical decision support systems. Furthermore, the modular design and use of modern web technologies make the application scalable and adaptable for future enhancements, such as adding more algorithms, improving visualization, or connecting to real-time health databases.

In conclusion, this project demonstrates how data-driven solutions can contribute to early detection and preventive care in healthcare, potentially reducing the risk of severe cardiac conditions through timely intervention.

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