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Hear Failure Prediction Using ML Techniquies

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Abstract:

The Heart Failure Prediction Project uses machine learning to predict the likelihood of heart failure by analyzing medical attributes such as age, cholesterol levels, blood pressure, and heart rate. Early detection enables timely medical intervention, reducing risks and improving outcomes. The project employs multiple machine learning models, including Logistic Regression, Random Forest, and Gradient Boosting, with ensemble learning techniques to enhance accuracy and reliability.

A Flask-based web application provides an intuitive interface for healthcare professionals to input patient data and obtain immediate predictions. Data preprocessing, such as handling missing values and scaling features, ensures model robustness, while evaluation metrics like accuracy and F1-score measure effectiveness.

This project demonstrates the potential of AI in healthcare by automating and improving diagnostic processes. Future work includes integrating real-time data from wearable devices, expanding datasets for better generalization, and deploying the system in cloud environments for global accessibility.

INTRODUCTION

The **Heart Failure Prediction Project** focuses on developing a machine learning-based system to predict the likelihood of heart failure in patients by analyzing medical attributes such as age, cholesterol levels, blood pressure, and heart rate. With heart failure being one of the leading causes of death globally, early detection is crucial for effective treatment and improved outcomes. Traditional diagnostic methods often rely on manual processes, which are time-consuming and prone to errors. This project addresses these limitations by automating the prediction process using machine learning models like Logistic Regression, Random Forest, and Gradient Boosting, along with ensemble learning techniques to improve accuracy and reliability. A web- based application built with Flask provides a simple interface for healthcare professionals to input patient data and receive immediate predictions, enhancing diagnostic efficiency and supporting informed clinical decisions.This project highlights the potential of artificial intelligence in healthcare, offering faster and more accurate diagnostics. Future enhancements include real-time data integration from wearable devices, larger datasets for improved generalization, and cloud deployment for greater accessibility.

Proposed System

The proposed system uses machine learning models to automate heart failure risk predictions. It improves accuracy, scalability, and speed while minimizing the need for manual intervention. By analyzing patient data through a trained predictive model, it ensures consistent and reliable results.

DESIGN

Architectures

Project architecture represents number of components we are using as a part of our project and the flow of request processing i.e. what components in processing the request and in which order. An architecture description is a formal description and representation of a system organized in a way that supports reasoning about the structure of the system. Architecture is of two types. They are

(1) Software Architecture

(2) Technical Architecture

Software Architecture

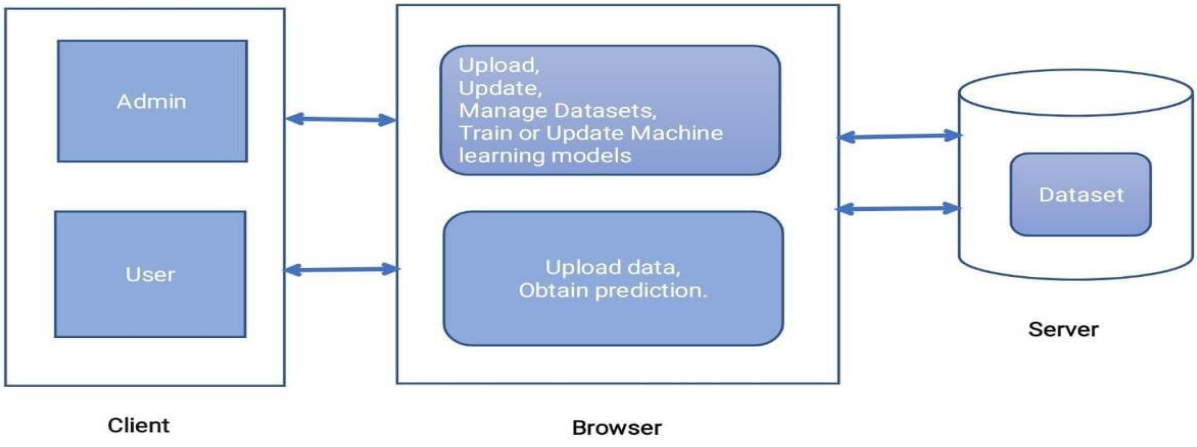


Fig 1 Software Architecture

Technical Architecture

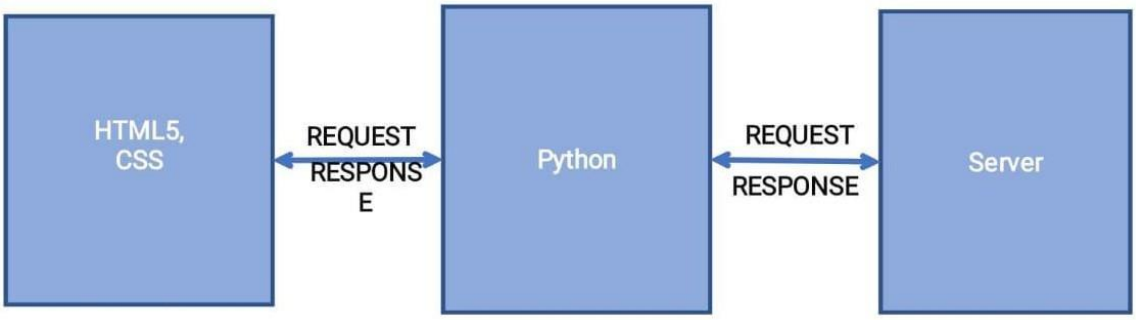


Fig 2 Technical Architecture

IMPLEMENTATION

Features of Python:

The implementation of the **Heart Failure Prediction** project involves several steps, from data

preprocessing to model building and evaluation. Below is a structured guide to implementing the project:

TESTING

Software testing is a process, to evaluate the functionality of a software application with an intent to find whether the developed software met the specified requirements or not and to identify the defects to ensure that the product is defect free in order to produce the quality product.

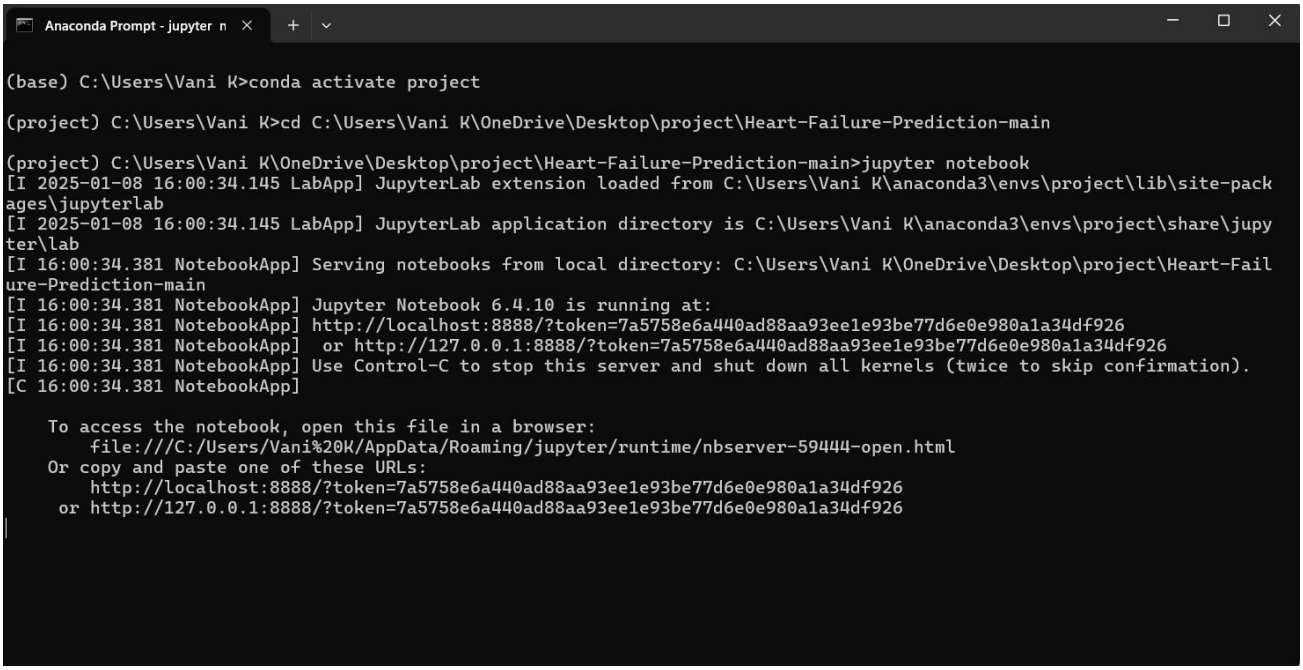
As per the current trend, due to constant change and development in digitization, our lives are improving in all areas. The way we work is also changed. We access our bank online, we do shop online; we order food online and many more. We rely on software's and systems. What if these systems turnout to be defective? We all know that one small bug shows huge impact on business in terms of financial loss and goodwill. To deliver a quality product, we need to have Software Testing in the Software Development Process.

RESULTS

SCREENSHOTS

To run jupyter notebook:

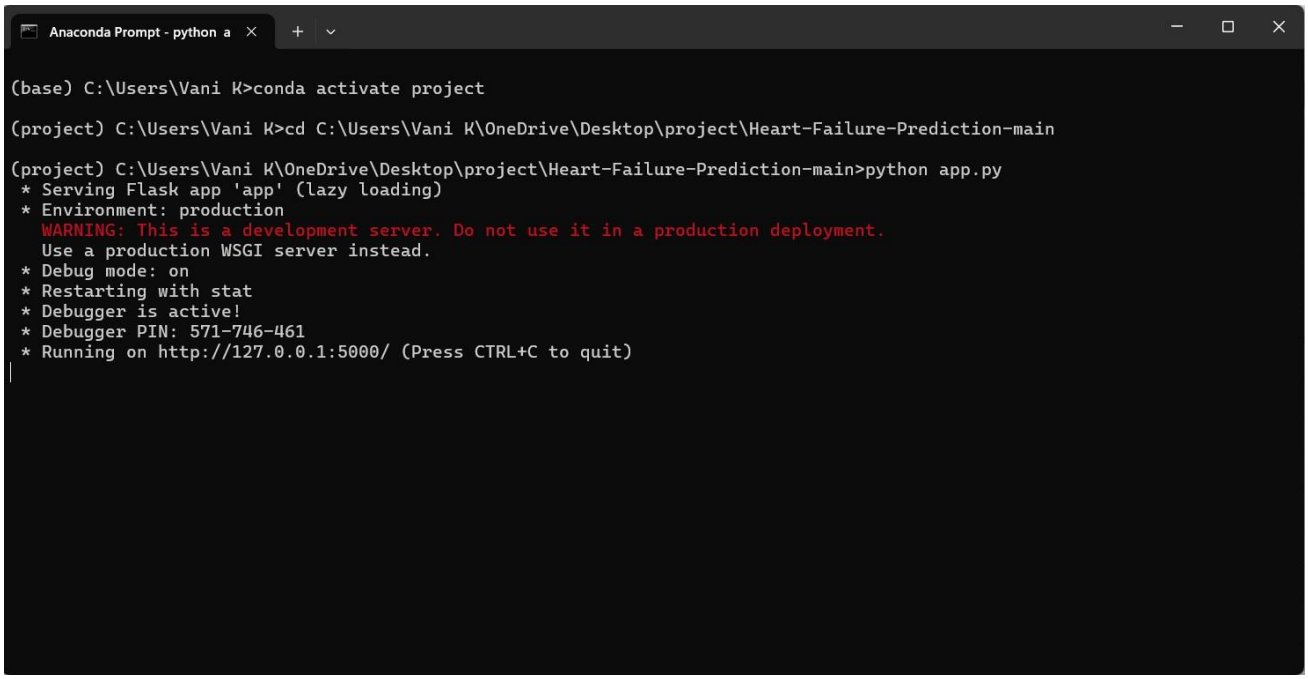
Anaconda prompt



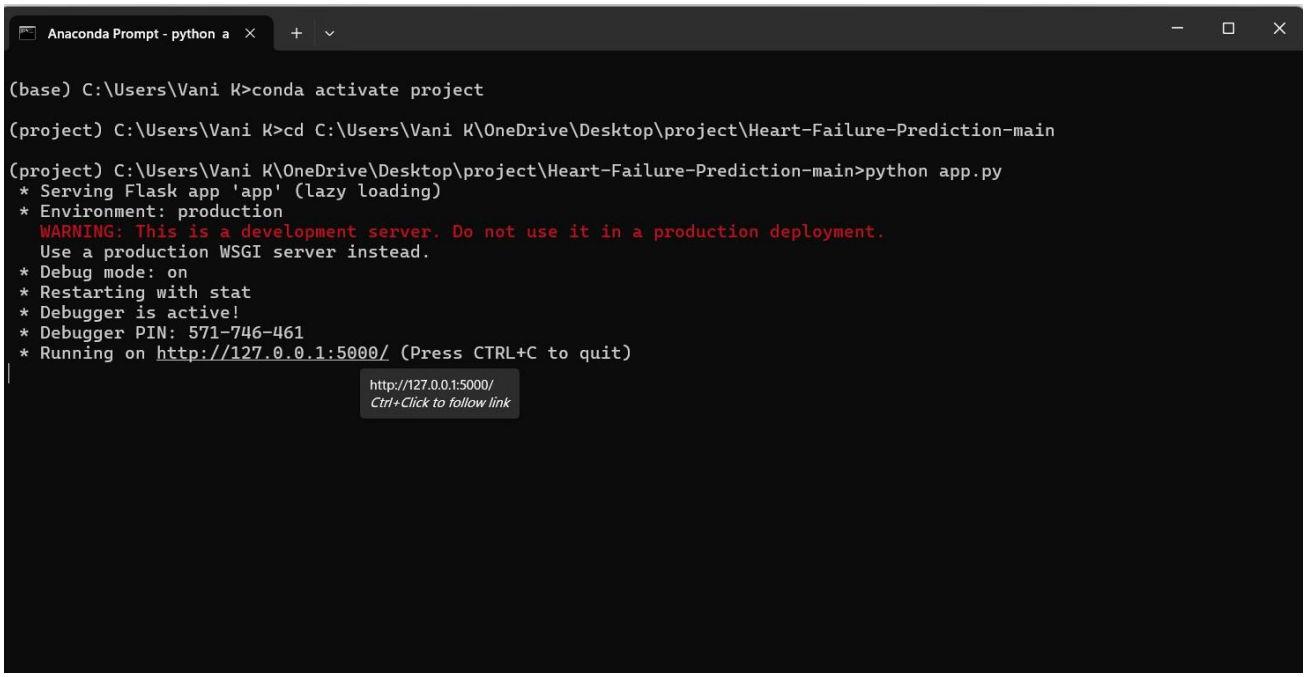
Jupyter Notebook

To open flask app:

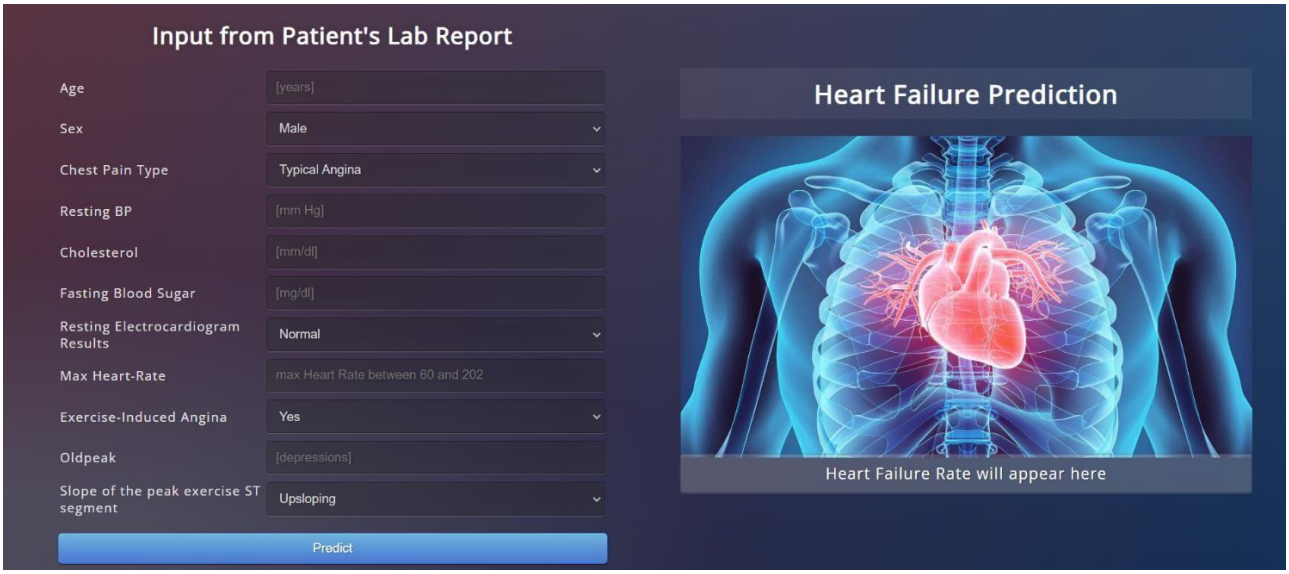
Take another anaconda prompt:



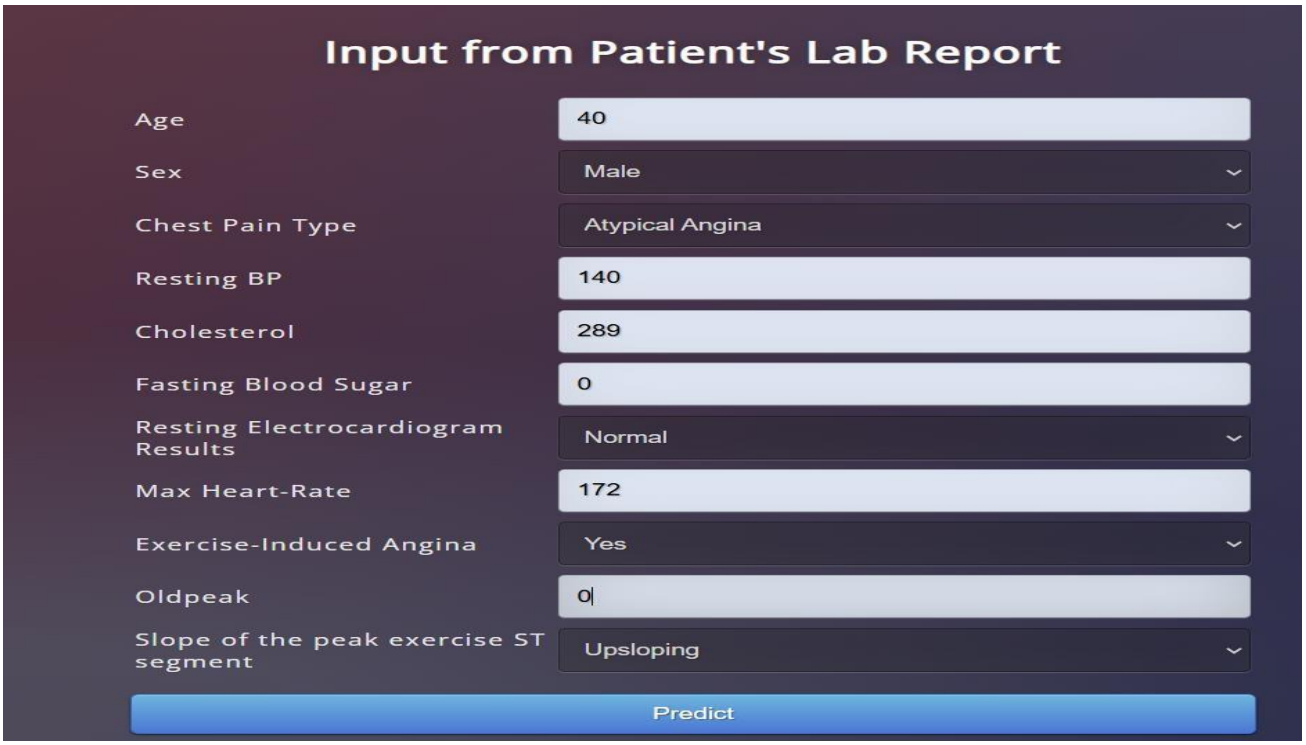
We have click the URL in the anaconda prompt it redirects to the home page

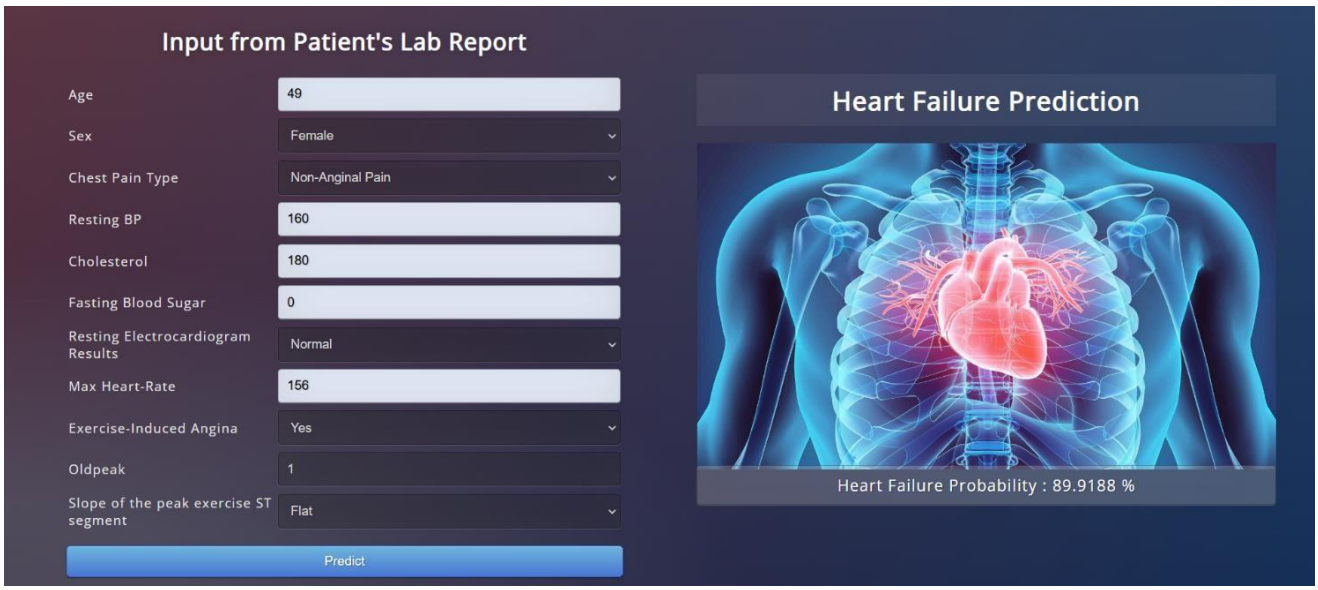


Web site home page



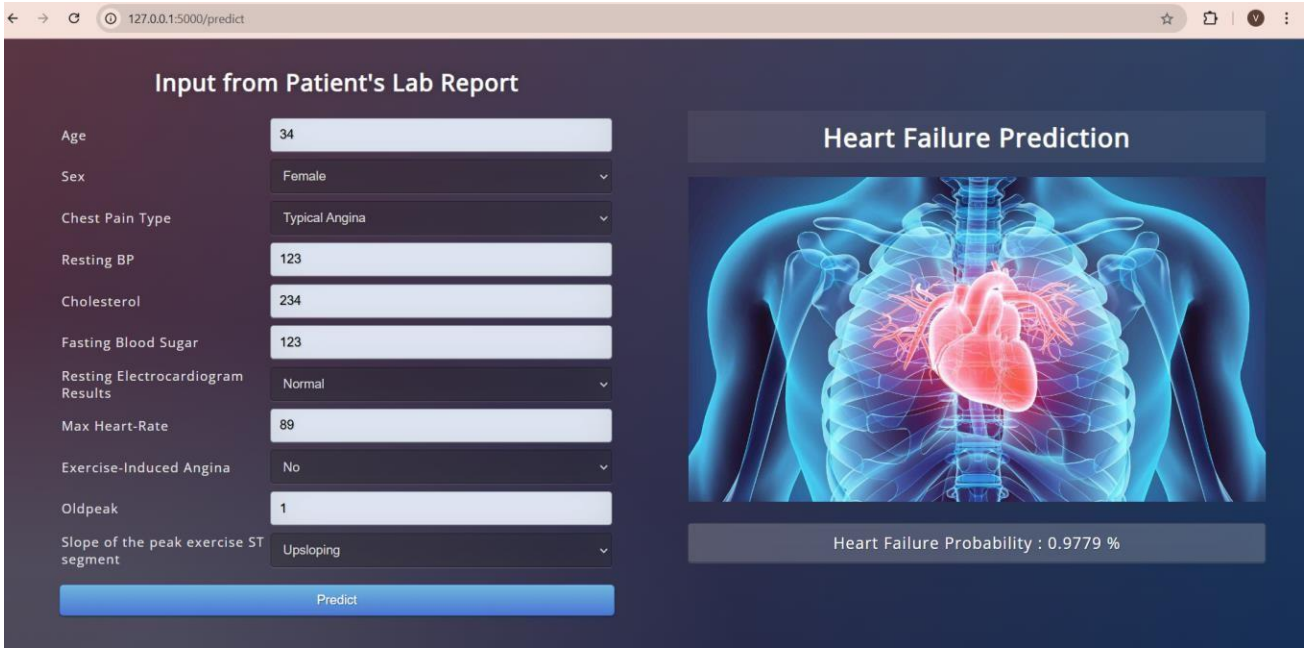
Taking inputs





Getting High Acuracy

Getting Low Accuracy



Conclusion

The Heart Failure Prediction Project used machine learning to forecast the probability of heart failure by examining medical variables like age, cholesterol levels, blood pressure, and heart rate. Prompt identification facilitates prompt medical action, mitigating risks and enhancing results. The research utilizes many machine learning models, such as Logistic Regression, Random Forest, and Gradient Boosting, with ensemble learning methods to improve accuracy and dependability.

A Flask-based web application offers a user-friendly interface for healthcare practitioners to enter patient data and get instant forecasts. Data preparation, including the management of missing data and feature scaling, guarantees model resilience, whilst assessment criteria like as accuracy and F1-score assess efficacy.

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