Presented By: Glitch Fix

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Report

Title: Development of a Predictive Model for Early Detection of Heart Disease Using Machine Learning

Introduction:

Heart disease remains a leading cause of mortality worldwide, significantly impacting public health. Early detection is critical to prevent severe complications such as heart attacks and strokes. Traditional diagnostic methods are often invasive, costly, and inaccessible, particularly in underserved areas. This report details the development of a machine learning-based solution for non-invasive heart disease risk prediction, utilizing a conversational chatbot powered by Flask and Gemini AI to collect prediction data, with a model trained on preprocessed data.

Problem Statement:

The primary challenge is the lack of accessible, non-invasive tools for early heart disease de- tection. Traditional methods, such as ECGs and stress tests, require significant resources and medical infrastructure, limiting their reach. This project aims to provide an efficient, user- friendly, and scalable solution to

predict heart disease risk using a machine learning model, enabling timely interventions to improve patient outcome

Objective:

The objective is to deploy a pre-trained machine learning model for heart disease risk prediction, integrated with a conversational chatbot to collect user inputs for real-time predictions. The solution emphasizes accessibility, ease of use, and ethical considerations, delivering reliable risk assessments through a web-based interface.

Why This Problem?

Heart disease is a global health crisis with increasing prevalence, necessitating early detection to reduce mortality and healthcare costs. By offering a non-invasive screening tool, this project addresses accessibility gaps, particularly for individuals in remote or resource-constrained areas, aligning with the Sustainable Development Goal of Good Health and Well-Being.

Solution:

- The solution involves a pre-trained Random Forest Classifier, trained on preprocessed medical data, and deployed via a Flask web application. A Gemini AI-powered chatbot collects user
- inputs for predictions, offering a non-invasive, scalable, and user-friendly screening tool for heart disease risk assessment.

Features

- Early Detection: Identifies high-risk individuals before symptoms manifest, enabling timely interventions.
- Non-Invasive and Efficient: Collects prediction data through a chatbot, eliminating the need for medical procedures.
- Scalable Solution: Deployed via Flask, allowing integration into healthcare systems or mobile apps.
- User-Friendly Interface: Gemini AI provides empathetic, clear communication, guiding users through input collection with validations.

Technical Implementation

Data Collection for Predictions

- Chatbot Input: Collects 13 medical parameters (e.g., age, cholesterol, chest pain type) via a conversational interface powered by Gemini AI.

- Input Validation: Uses regex and predefined ranges (e.g., age: 1–120, cholesterol: 100–600 mg/dl) to ensure data accuracy for predictions.
- Features: Fixed set of 13 parameters: age, sex, chest pain type, resting blood pres- sure, cholesterol, fasting blood sugar, resting ECG, maximum heart rate, exercise-induced angina, oldpeak, slope, number of major vessels, and thalassemia.

Deployment
- Chatbot Interface: Built with Flask and HTML templates, guiding users through input collection with Gemini AI's empathetic responses.
- Web Deployment: Hosted via Flask, enabling real-time predictions accessible on any internet-enabled device.
- User Experience: Provides clear results (e.g., "LOW RISK, 85% confidence") with dis- claimers urging professional consultation.

Tools and Resources
- Flask Framework: Hosts the web application and chatbot interface, enabling scalable deployment.
- Gemini AI: Powers conversational data collection with professional, empathetic guidance for predictions.
- Joblib: Loads the pre-trained Random Forest model for real-time predictions.

Why These Tools?
- Flask: Lightweight and flexible, ideal for rapid web app development and deployment.
- Gemini AI: Enhances user experience with natural language processing, making medical data collection accessible to non-experts.
- Joblib: Ensures efficient loading of the pre-trained model, supporting real-time predic- tions.
- Security and Ethics: The chatbot includes disclaimers to address ethical concerns, em- phasizing the need for professional medical advice.

1 Conclusion
- This project delivers a heart disease risk prediction model using a pre-trained Random Forest Classifier, trained on preprocessed data, and integrated with a Flask-based web application and Gemini AI chatbot. The solution collects prediction data through a user-friendly interface, addressing accessibility gaps in heart disease screening. Future work

includes retraining with larger datasets, adding multilingual support, and enhancing ethical safeguards for data privacy and bias mitigation.

2 References

- Flask Documentation: https://flask.palletsprojects.com/
- Google Gemini AI API: https://ai.google.dev/
- UCI Heart Disease Dataset: https://archive.ics.uci.edu/ml/datasets/Heart+Disease
- Trained Model Link: https://github.com/Shubham17112/hearth/tree/main/model
- Github Repo Link: https://github.com/Shubham17112/hearth
- Deployed App link: https://hearth-1.onrender.com/