**Heart Disease Prediction System**

**Overview**

This project implements a heart disease prediction system using machine learning models as Decision Tree and an expert system. It processes patient health data, selects important features, and evaluates predictive models to assess heart disease risk.

**Features**

* Data preprocessing and feature selection
* Machine learning models for prediction
* Expert system based on medical rules
* Model evaluation and comparison
* Decision tree explainability

**Installation**

**Prerequisites**

Ensure you have Python installed along with the required dependencies.

**Install Dependencies**

**Install python, pandas, numpy, experta, sklearn with its components for processing the data and implementing the machine learining models,joblib. matlplotlip and seaborn**

**Dataset**

The dataset should be stored as a CSV file. Update the features=pd.read\_csv('heart.csv') line in the script to load your dataset.

**Usage**

**1. Data Preprocessing**

* Handles missing values
* Normalizes selected numerical features
* Encodes categorical variables
* Selects relevant features based on correlation
* Save cleaned data

This generates cleaned\_data.csv.

**2. Training Models**

* Split the data into 80 percent training and 20 percent test
* Train the model
* Implement the hyperparameter tuning
* Evaluate model
* Save the model

**3. Expert System Risk Assessment**

To assess risk using the expert system, run

This will prompt user input for health parameters and return the risk level.

**4. Model Comparison & Explainability**

Run the analysis script to compare model performance

This will generate feature importance plots and visualize the decision tree structure.

**Results**

* Machine learning models provide automated risk assessment based on data patterns.
* The expert system uses predefined medical rules to assess risk.
* Comparison of decision tree predictions with expert system rules for explainability.