G H Patel College of Engineering & Technology
(A Constituent College of CVM University)
Vallabh Vidyanagar

Heart Disease Prediction

An AiMl Mini Project report submitted
In partial fulfilment of the requirements for the
Degree of Bachelor of
Engineering/Technology

In
Computer Engineering (CP)
Semester – VI

Submitted By

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**Artificial Intelligence &
Machine Learning (202046702)**

A.Y. 2024-25 ODD TERM

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CERTIFICATE

This is to certify that **Meet Dadhaniya** (**12202040501038**) & **Param Dholakia** (**12202040501049)** has submitted the Aiml Mini Project report on **" Heart Disease Prediction "** for partial fulfilment of the degree of Bachelor of Engineering in **Computer Engineering**, **G H Patel College of Engineering and Technology**, at The Charutar Vidya Mandal (CVM) University, Vallabh Vidyanagar, during the academic year 2024 – 25.

Dr. Priyang Bhatt

(Internal Faculty Guide)

INTRODUCTION

This project aims to predict the likelihood of heart disease in individuals based on various health metrics using machine learning models. The primary goal is to leverage data-driven insights to identify patterns and risk factors associated with heart disease, enabling early detection and intervention. The dataset includes a range of health-related features, and three machine learning models—

- Random Forest,
- K-Nearest Neighbors (KNN), and
- Gradient Boosting

—are employed to classify individuals as having heart disease or not.

DATASET DESCRIPTION

The dataset contains the following features:

ID	Unique identifier for each individual
Age	Age of the individual (in years)
Gender	Gender of the individual (Male/Female)
Height_c	Height in centimeters
Weight_kg	Weight in kilograms
BMI	Body Mass Index
Daily_Steps	Number of steps taken daily
Calories_Intake	Daily calorie intake (in calories)
Hours_of_Sleep	Hours of sleep per day
Heart_Rate	Resting heart rate (in beats per minute)
Blood_Pressure	Blood pressure reading (in mmHg)
Exercise_Hours_per_Week	Hours of exercise per week
Smoker	Smoking status (Yes/No)
Alcohol_Consumption_per_Week	Alcohol consumption per week (in units)
Diabetic	Diabetic status (Yes/No)
Heart_Disease	Presence of heart disease (Yes/No, target variable)

The dataset provides a comprehensive view of each individual's health profile, with Heart_Disease as the target variable.

DATA PREPROCESSING

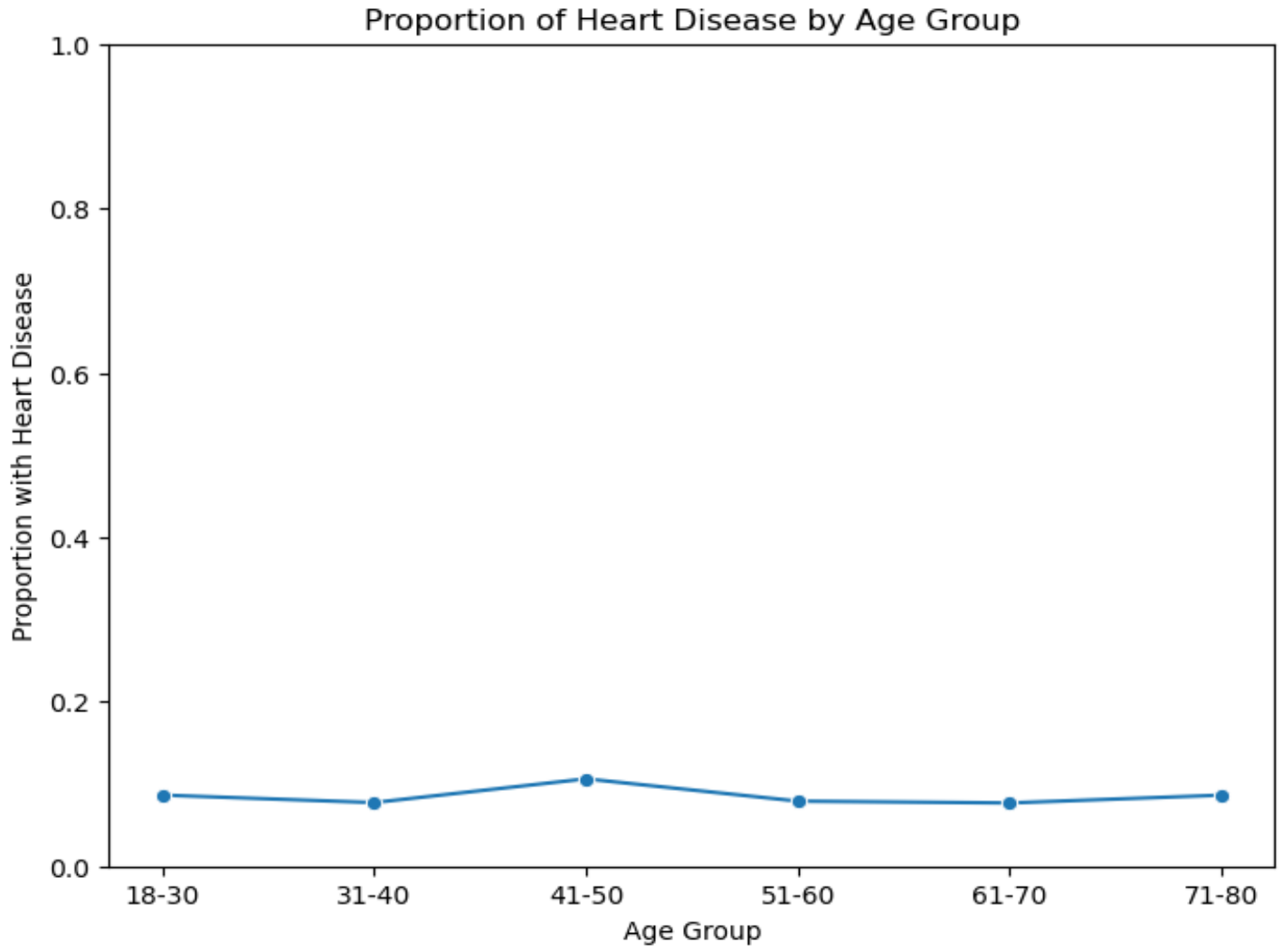
To prepare the dataset for modeling, the following preprocessing steps were applied:

- Categorical Variable Encoding: Categorical features such as
- Gender (Male=0, Female=1),
- Smoker (No=0, Yes=1),
- Diabetic (No=0, Yes=1), and
- Heart_Disease (No=0, Yes=1) were mapped to numerical values.
- Blood Pressure Transformation: The Blood_Pressure feature was split into two numerical features: Max_BP (systolic) and Min_BP (diastolic).

These steps ensured the dataset was numerical and ready for modeling.

EXPLORATORY DATA ANALYSIS

A line plot was created to show the proportion of individuals with heart disease across age groups, highlighting age as a potential risk factor.



MODEL TRAINING AND EVALUATION

Three models were trained:

- Random Forest: Ensemble of decision trees.
- KNN: Distance-based classifier.
- Gradient Boosting: Sequential tree ensemble.

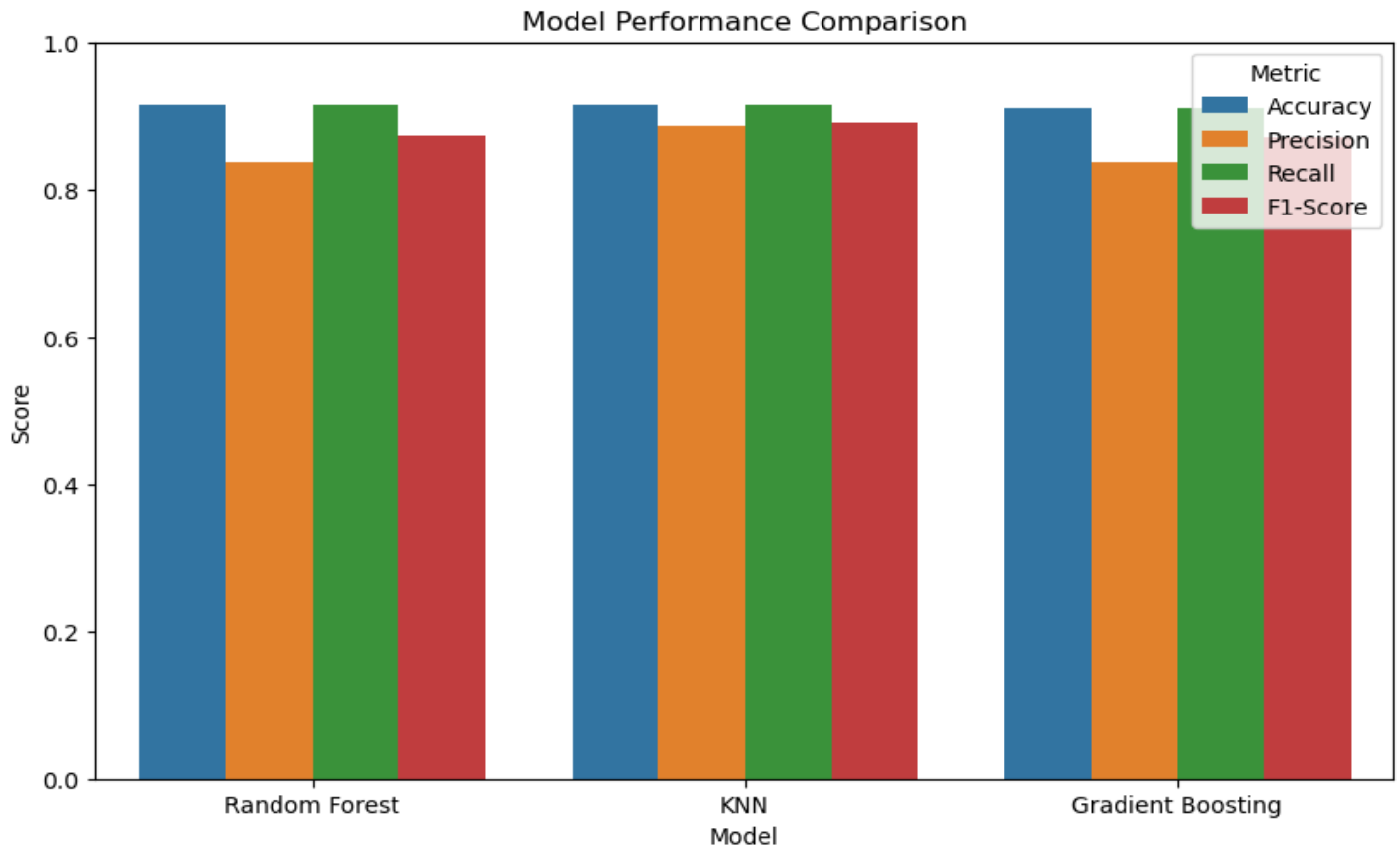
Performance was evaluated using accuracy, precision, recall, and F1-score.

MODEL PERFORMANCE METRICS

Model	Accuracy	Precision	Recall	F1-Score
Random Forest	0.915	0.837	0.915	0.874
KNN	0.915	0.887	0.915	0.890
Gradient Boosting	0.910	0.837	0.910	0.872

MODEL PERFORMANCE VISUALIZATION

A bar plot compares the models' performance across metrics.



CONCLUSION

- The project demonstrates the use of machine learning to predict heart disease, with GBC, KNN and RF showing strong performance.
- Age was identified as a key risk factor.
- Additional features could further improve predictions.
- This work provides a foundation for early heart disease detection tools.