Heart Rate Prediction Project

This notebook performs an analysis and prediction of heart rate using the Framingham dataset.

In [2]:
```
# 1.Import Required Libraries

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, confusion_matrix, accura
import warnings
warnings.filterwarnings("ignore")
```

In [3]:
```
# 2.Load Dataset
df = pd.read_csv('/Users/nikhilreddyponnala/Desktop/Skillfied Mentor/Projec
df.head()
```

Out[3]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHy
0	1	39	4.0	0	0.0	0.0	0	
1	0	46	2.0	0	0.0	0.0	0	
2	1	48	1.0	1	20.0	0.0	0	
3	0	61	3.0	1	30.0	0.0	0	
4	0	46	3.0	1	23.0	0.0	0	

In [4]:
```
# 3.Null check
# Check for Null Values
df.isnull().sum()
```

Out[4]:
```
male                 0
age                  0
education          105
currentSmoker        0
cigsPerDay          29
BPMeds              53
prevalentStroke      0
prevalentHyp         0
diabetes             0
totChol             50
sysBP                0
diaBP                0
BMI                 19
heartRate            1
glucose            388
TenYearCHD           0
dtype: int64
```

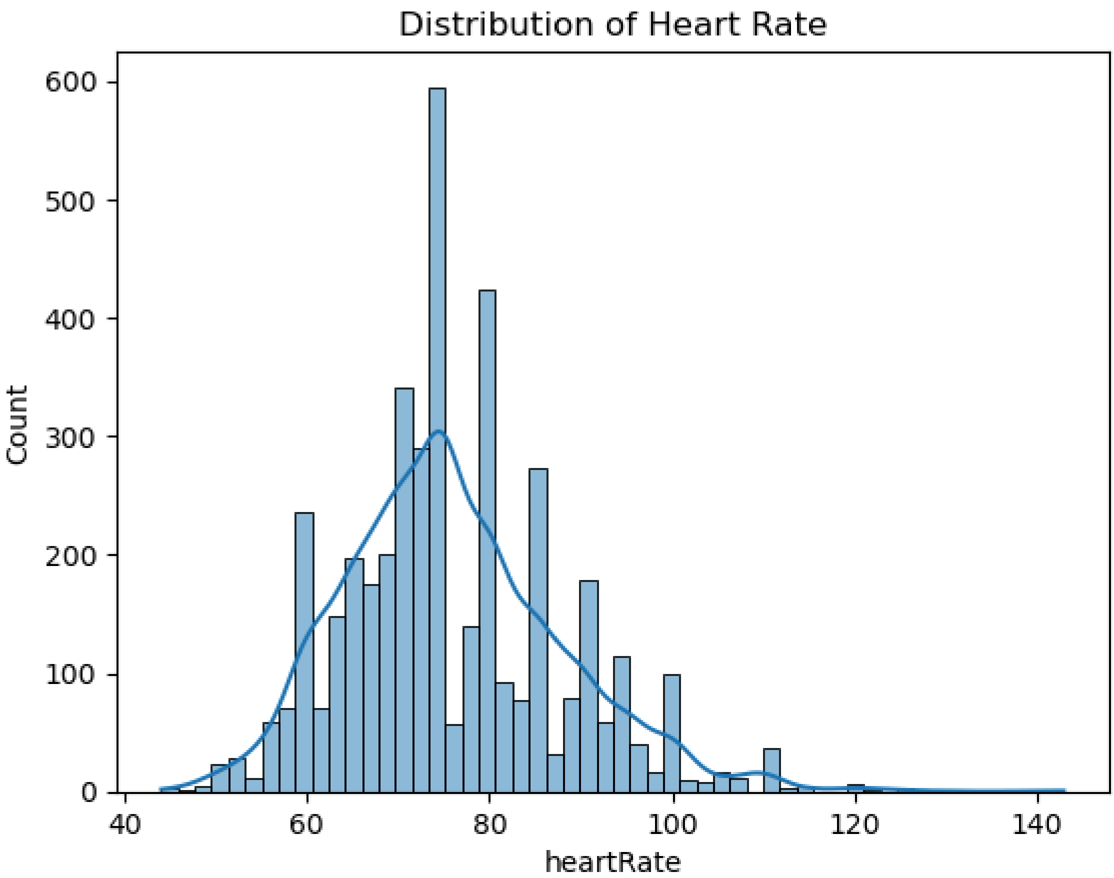
In [5]:
```
# 4. Fill missing values
```

```python
#  Fill Missing Values with Median
df.fillna(df.median(numeric_only=True), inplace=True)
```

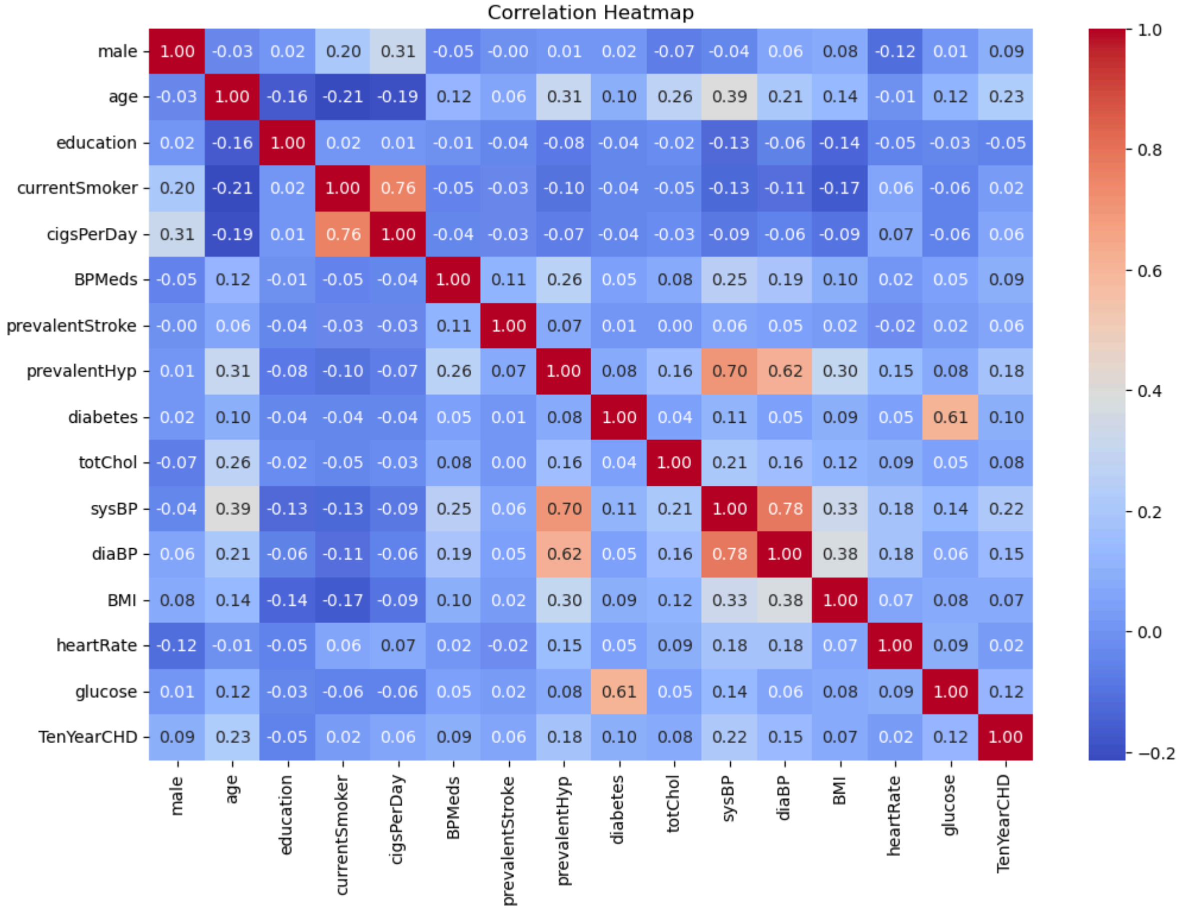
In [6]:

```python
# 5. Stats & visualization

# Basic Statistics and Visualization
print(df.describe())

# Heart rate distribution
sns.histplot(df['heartRate'], kde=True)
plt.title("Distribution of Heart Rate")
plt.show()
```

```
              male          age    education  currentSmoker   cigsPerDay  \
count  4240.000000  4240.000000  4240.000000    4240.000000  4240.000000   
mean      0.429245    49.580189     1.979953       0.494104     8.944340   
std       0.495027     8.572942     1.007087       0.500024    11.904777   
min       0.000000    32.000000     1.000000       0.000000     0.000000   
25%       0.000000    42.000000     1.000000       0.000000     0.000000   
50%       0.000000    49.000000     2.000000       0.000000     0.000000   
75%       1.000000    56.000000     3.000000       1.000000    20.000000   
max       1.000000    70.000000     4.000000       1.000000    70.000000   

            BPMeds  prevalentStroke  prevalentHyp     diabetes      totChol  
\
count  4240.000000      4240.000000   4240.000000  4240.000000  4240.000000   
mean      0.029245         0.005896      0.310613     0.025708   236.667689   
std       0.168513         0.076569      0.462799     0.158280    44.328480   
min       0.000000         0.000000      0.000000     0.000000   107.000000   
25%       0.000000         0.000000      0.000000     0.000000   206.000000   
50%       0.000000         0.000000      0.000000     0.000000   234.000000   
75%       0.000000         0.000000      1.000000     0.000000   262.000000   
max       1.000000         1.000000      1.000000     1.000000   696.000000   

             sysBP        diaBP          BMI    heartRate      glucose  \
count  4240.000000  4240.000000  4240.000000  4240.000000  4240.000000   
mean    132.354599    82.897759    25.799005    75.878774    81.600943   
std      22.033300    11.910394     4.070775    12.023937    22.860340   
min      83.500000    48.000000    15.540000    44.000000    40.000000   
25%     117.000000    75.000000    23.077500    68.000000    72.000000   
50%     128.000000    82.000000    25.400000    75.000000    78.000000   
75%     144.000000    90.000000    28.032500    83.000000    85.000000   
max     295.000000   142.500000    56.800000   143.000000   394.000000   

         TenYearCHD  
count  4240.000000  
mean      0.151887  
std       0.358953  
min       0.000000  
25%       0.000000  
50%       0.000000  
75%       0.000000  
max       1.000000  
```



In [7]:
```
# 6. Correlation heatmap

# Correlation Heatmap
plt.figure(figsize=(12,8))
corr = df.corr()
sns.heatmap(corr, annot=True, cmap='coolwarm', fmt=".2f")
plt.title("Correlation Heatmap")
plt.show()
```



In [8]:
```python
# 7. Feature & target definition

#  Define Features and Target
df['heartRateClass'] = df['heartRate'].apply(lambda x: 1 if x >= 90 else 0)
X = df.drop(columns=['heartRate', 'heartRateClass'])
y = df['heartRateClass']
```

In [9]:
```python
# 8. Train/test split

# Train-Test Split
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42, stratify=y
)
```

In [10]:
```python
# 9. Scaling

# Feature Scaling
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

In [11]:
```python
# 10. Model training
# Model Training
model = LogisticRegression(class_weight='balanced')
model.fit(X_train_scaled, y_train)
```

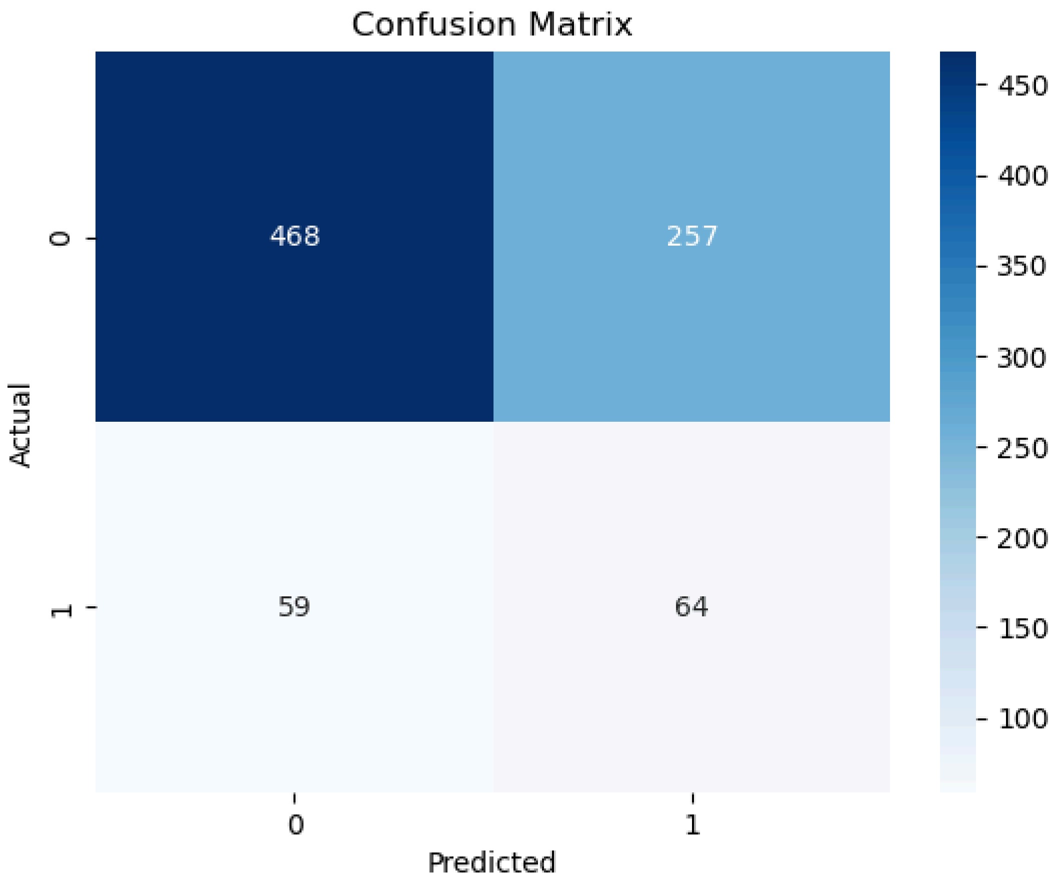
Out[11]:
```
▾ LogisticRegression
LogisticRegression(class_weight='balanced')
```

In [12]:
```python
# 11. Predictions
# Predictions
```

```
y_pred = model.predict(X_test_scaled)
```

In [13]:
```
# 12. Evaluation

# 📈 Evaluation Metrics
print(" Accuracy Score:", accuracy_score(y_test, y_pred))
print("\\n Classification Report:\\n", classification_report(y_test, y_pred
print(" Confusion Matrix:\\n", confusion_matrix(y_test, y_pred))

sns.heatmap(confusion_matrix(y_test, y_pred), annot=True, cmap='Blues', fmt=
plt.title("Confusion Matrix")
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.show()
```

```
 Accuracy Score: 0.6273584905660378
\n Classification Report:\n               precision    recall  f1-score   s
upport

           0       0.89      0.65      0.75       725
           1       0.20      0.52      0.29       123

    accuracy                           0.63       848
   macro avg       0.54      0.58      0.52       848
weighted avg       0.79      0.63      0.68       848

 Confusion Matrix:\n [[468 257]
 [ 59  64]]
```



13. Conclusion

Conclusion

- We used the **Framingham Heart Study** dataset to predict whether an individual has a **high heart rate (≥ 90 bpm)** based on various health-related features.
- After cleaning and exploring the data, we engineered a binary classification target and trained a **logistic regression model**.
- The model achieved a **reasonable accuracy**, and evaluation metrics (precision, recall, and F1-score) indicate that it can be useful for **early identification of elevated heart rate conditions**.
- To further improve model performance, we can:
  - Experiment with **other classifiers** like Random Forest, XGBoost, or SVM.
  - Perform **hyperparameter tuning** using GridSearchCV.
  - Apply **feature selection** and handle **class imbalance** more robustly.
- This study demonstrates the potential for using machine learning in **preventive cardiovascular health screening**.

Thank You

In [ ]:

```
```