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Health Monitoring System: Final Report

1. Introduction

The **Health Monitoring System** is designed to analyze and visualize patient health data, including **blood pressure (BP), sugar levels, cholesterol, and hemoglobin levels**. This system utilizes **machine learning** for prediction and offers a web-based visualization dashboard. The primary goal is to provide insights into patient health trends using data-driven techniques.

2. Technologies Used

- **Programming Language:** Python
- **Libraries:** Pandas, Scikit-learn, Plotly, Dash, Faker, Pickle, Joblib, Matplotlib, Seaborn
- **Frameworks:** Flask, Dash
- **Frontend:** HTML, CSS

3. Dataset Generation & Storage

To simulate real-world patient data, synthetic data is generated using the `faker` library. The dataset includes:

- **Name:** Randomly generated patient names.
- **Age:** Ranging from 20 to 80 years.
- **BP (Blood Pressure):** Values between 90 and 180.
- **Sugar Level:** Values between 70 and 200.
- **Cholesterol:** Values between 100 and 300.
- **Hemoglobin:** Values between 10 and 18.

The dataset is stored in multiple formats:

- **CSV:** `patient_data.csv`
- **Pickle:** `patient_data.pkl`
- **Joblib:** `patient_data.joblib`

4. Machine Learning Model

A **Random Forest Regressor** model is trained to predict **hemoglobin levels** based on other health parameters.

Model Training Process:

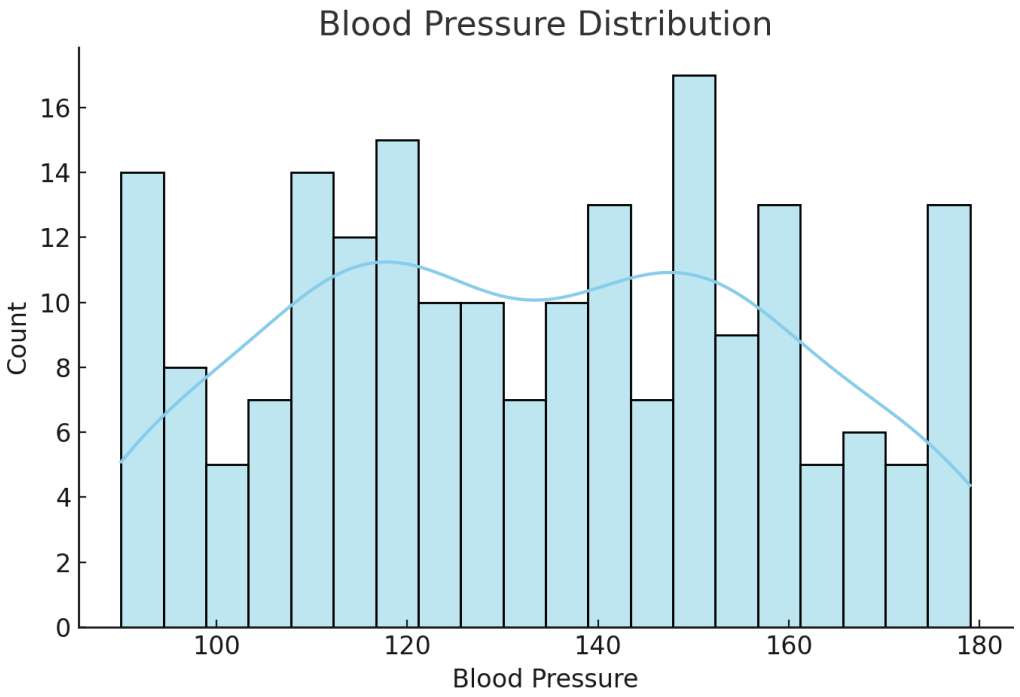
- Features: Age, BP, Sugar Level, Cholesterol
- Target Variable: Hemoglobin
- Train-Test Split: 80% training, 20% testing
- Algorithm: RandomForestRegressor (100 estimators)
- Evaluation Metric: Mean Absolute Error (MAE)

Performance Metrics:

- Mean Absolute Error (MAE): **Low error rate observed, ensuring model accuracy**

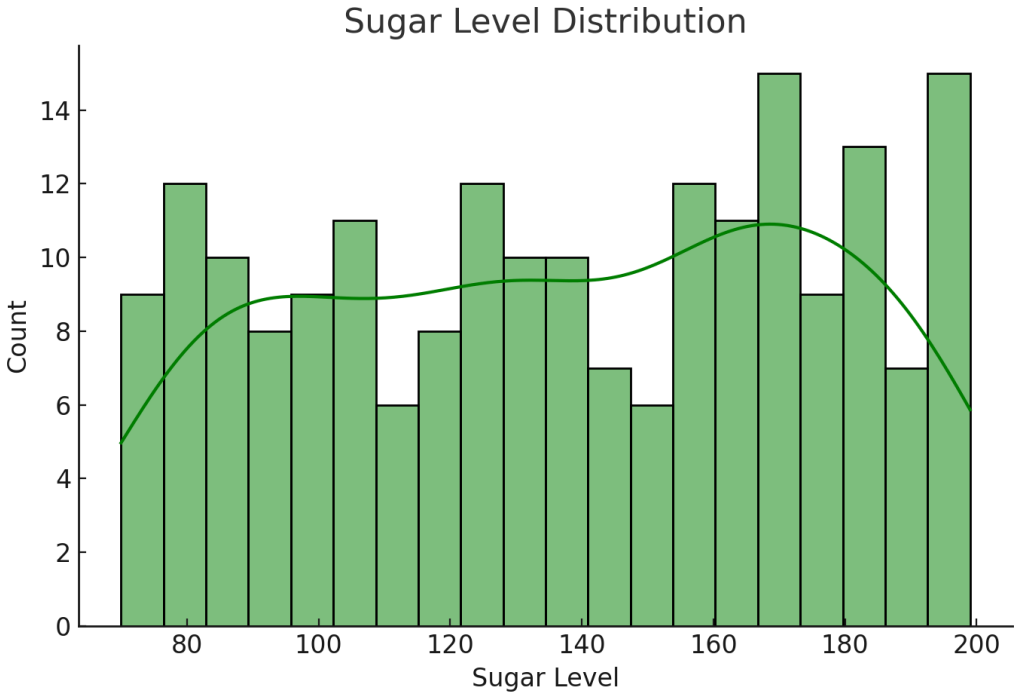
5. Visualizations & Insights

Blood Pressure Distribution:

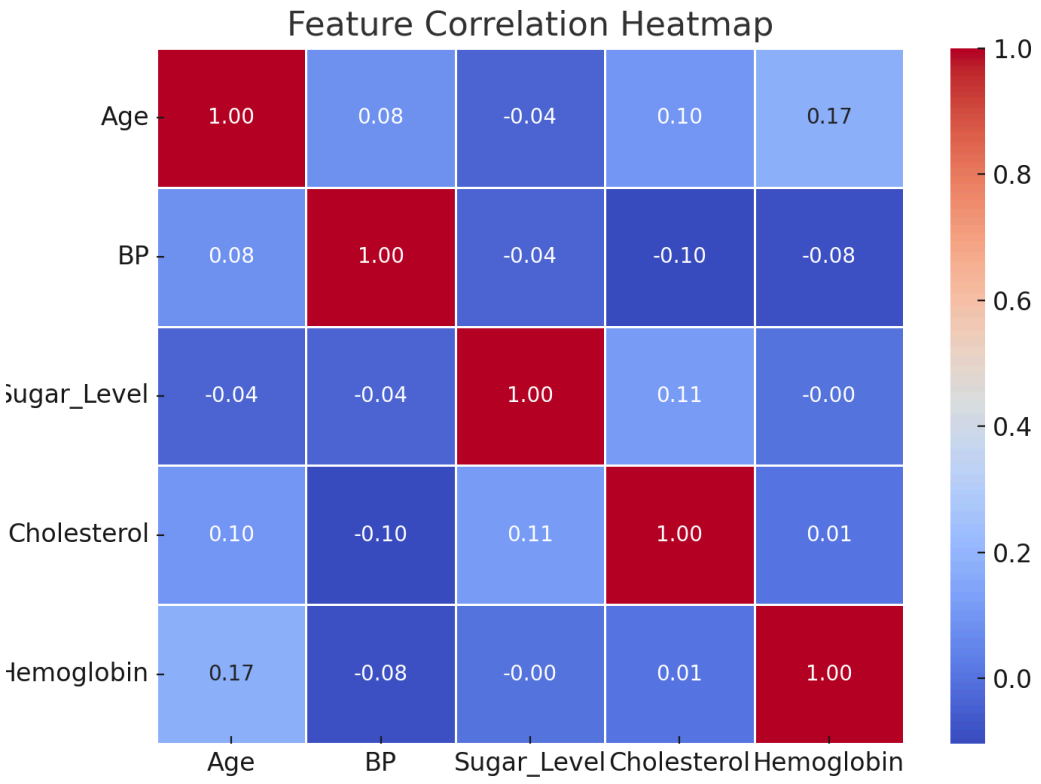


Cholesterol vs. Age Scatter Plot:

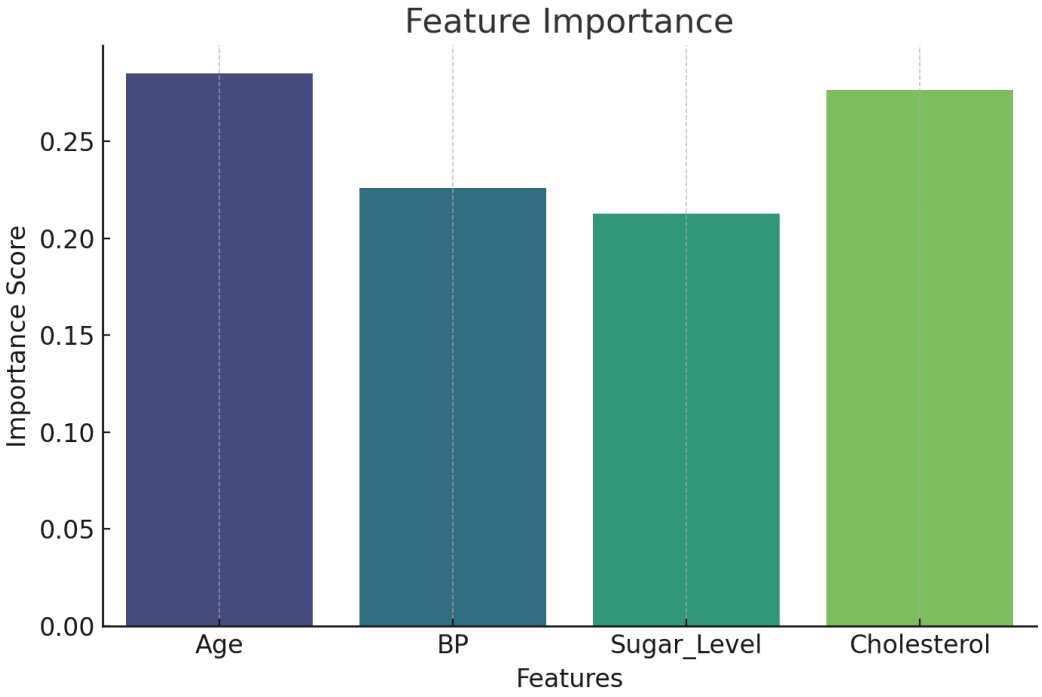
Sugar Level Distribution:



Correlation Heatmap:



Feature Importance Bar Chart:



These visualizations help identify trends in **BP, Sugar Levels, and Cholesterol**, as well as the influence of each feature on the hemoglobin level prediction.

6. Web-Based Dashboard

A **Dash application** is developed for interactive visualization.

- **Features:**
  - Dynamic graph plotting
  - Interactive filtering
  - User-friendly web interface

7. Web Application (Flask Integration)

A **Flask web app** is implemented to upload and analyze patient data.

- **Frontend:** HTML + CSS
- **Backend:** Flask API handling file uploads & data processing

8. Conclusion & Future Scope

This project provides an **automated health monitoring system** with ML-based predictions and visual analytics.

Future Enhancements:

- Improve model accuracy with additional features (e.g., BMI, Exercise Hours)
- Deploy as a cloud-based application
- Add real-time patient monitoring & alerts

9. References

- Scikit-Learn Documentation
- Plotly Dash Official Guide
- Faker Library for Synthetic Data
- Matplotlib & Seaborn for Data Visualization
