PERSONALIZED HEALTHCARE RECOMMENDATION SYSTEM

PREDICTING HEALTHCARE ACTIONS BASED ON BLOOD DONATION HISTORY

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PROBLEM STATEMENT

- ONE-SIZE-FITS-ALL HEALTH ADVICE IS INEFFECTIVE FOR PERSONALIZED NEEDS
- OBJECTIVE:
  - BUILD A SYSTEM THAT PREDICTS PERSONALIZED HEALTHCARE ACTIONS
  - USE ML ON HEALTH INDICATORS (RECENCY, FREQUENCY, MONETARY, TIME)
  - RECOMMEND: NO ACTION OR REGULAR CHECKUP

DATASET OVERVIEW

- SOURCE: BLOOD DONATION DATASET
- RECORDS: 748 ROWS
- FEATURES:
- RECENCY (DAYS SINCE LAST DONATION)

FREQUENCY (TOTAL DONATIONS):

- MONETARY (BLOOD VOLUME DONATED)
- TIME (MONTHS SINCE FIRST DONATION)
- TARGET COLUMN: CLASS (0: NO ACTION, 1: REGULAR CHECKUP)
- SLIGHT CLASS IMBALANCE: 76% NO, 24% YES

DATA PREPROCESSING & EXPLORATION

- CLEAN DATASET — NO MISSING VALUES
- FEATURE DISTRIBUTIONS ANALYZED VIA HISTOGRAMS, BOXPLOTS, HEATMAPS
- SCALED USING STANDARDSCALER
- SPLIT INTO TRAIN/TEST USING TRAIN_TEST_SPLIT

🧪 TOOL USED: PANDAS, SEABORN, SCIKIT-LEARN

MODEL BUILDING & TUNING

MODELS TRIED:

- LOGISTIC REGRESSION
- RANDOM FOREST
- XGBOOST (BEST PERFORMER)

TUNED XGBOOST USING GRIDSEARCHCV:

- BEST PARAMS: DEPTH=3, LEARNING_RATE=0.1, N_ESTIMATORS=50

ACCURACY ACHIEVED: 79.33%

🧪 TOOL USED: SCIKIT-LEARN, XGBOOST, JOBLIB

MODEL EVALUATION & RECOMMENDATION LOGIC

EVALUATION METRICS:

- ACCURACY, PRECISION, RECALL, F1-SCORE
- ROC CURVE, CONFUSION MATRIX
- CLASS 0 (NO ACTION): HIGH RECALL (0.93)
- CLASS 1 (REGULAR CHECKUP): IMPROVED PRECISION (0.62)

FINALFUNCTION:GENERATE_RECOMMENDATION(PATIENT_DATA)

RETURNS PERSONALIZED ADVICE

```python
# Define recommendation categories based on prediction
commendation_map = {
  0: "No Action",
  1: "Regular Checkup"
```

```python
f generate_recommendation(patient_data):
  # Scale the input patient data using the same scaler
  patient_scaled = scaler.transform(patient_data)

  # Predict using the tuned XGBoost model
  prediction = xgb_best.predict(patient_scaled)[0]

  # Map the prediction to a recommendation
  return recommendation_map.get(prediction, "Unknown")
```

```python
port pandas as pd

# Creating a test input for a single patient (must match feature order: Recency, Frequency, Monetary, Time)
mple_patient = pd.DataFrame({
  'Recency': [2],
  'Frequency': [10],
  'Monetary': [2500],
  'Time': [35]


# Generate recommendation
sult = generate_recommendation(sample_patient)
int("Personalized Recommendation:", result)
```

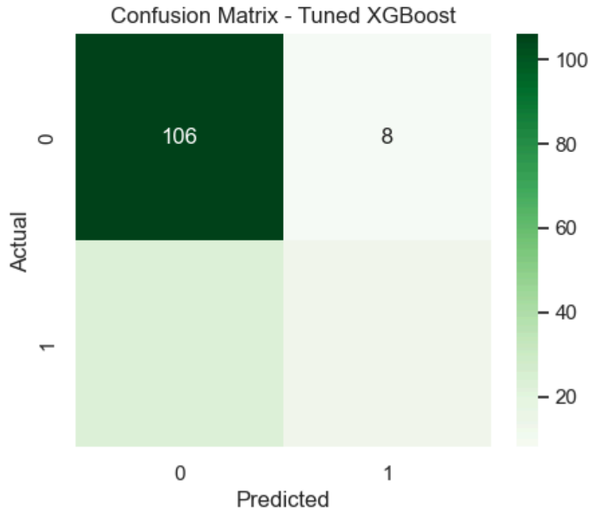
```
rsonalized Recommendation: Regular Checkup
```

```
Confusion Matrix:
 [[106   8]
 [ 23  13]]

Classification Report:
              precision    recall  f1-score   support

           0       0.82      0.93      0.87       114
           1       0.62      0.36      0.46        36

    accuracy                           0.79       150
   macro avg       0.72      0.65      0.66       150
weighted avg       0.77      0.79      0.77       150
```



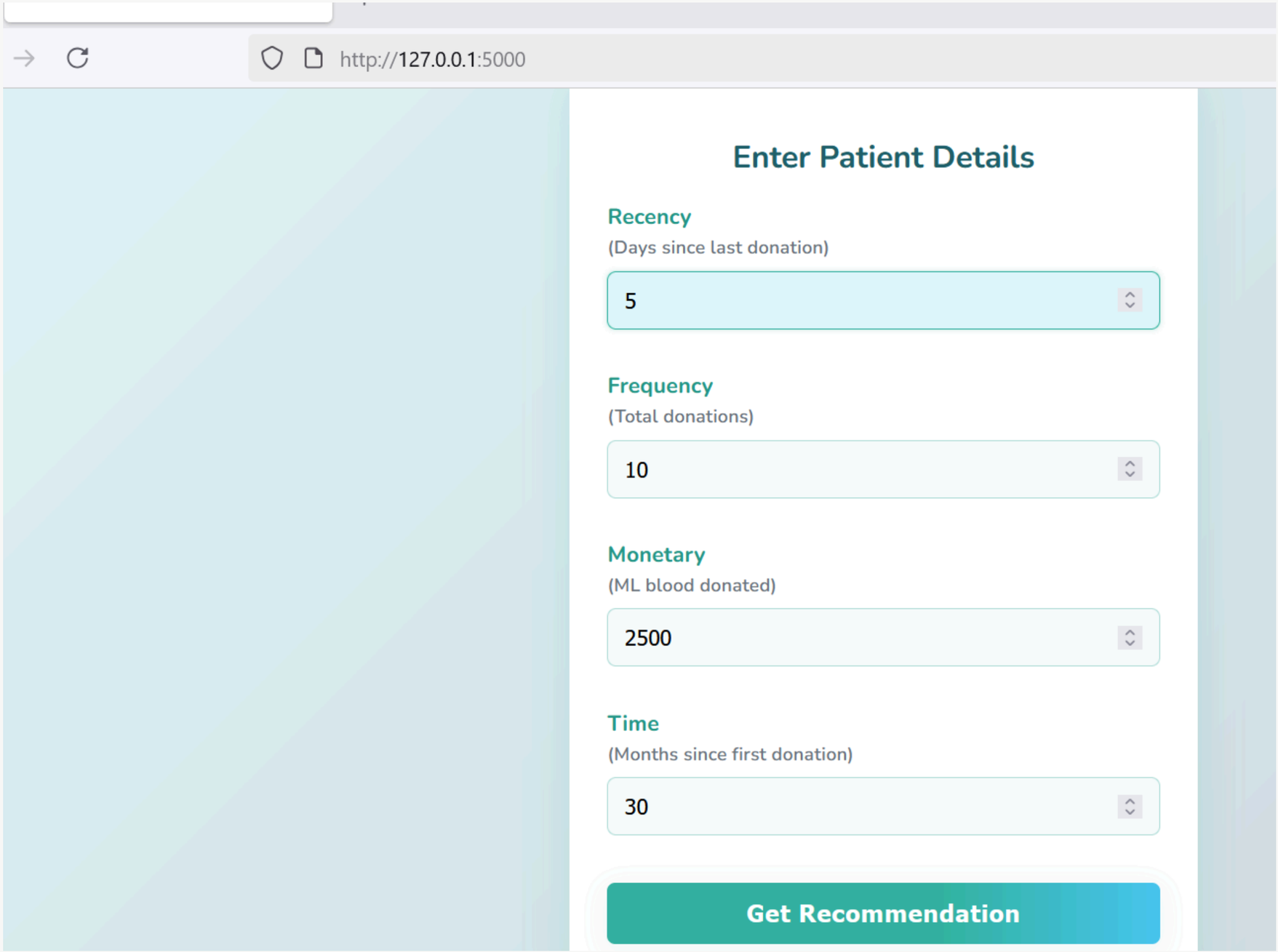
WEB APP & OUTPUT DEMO

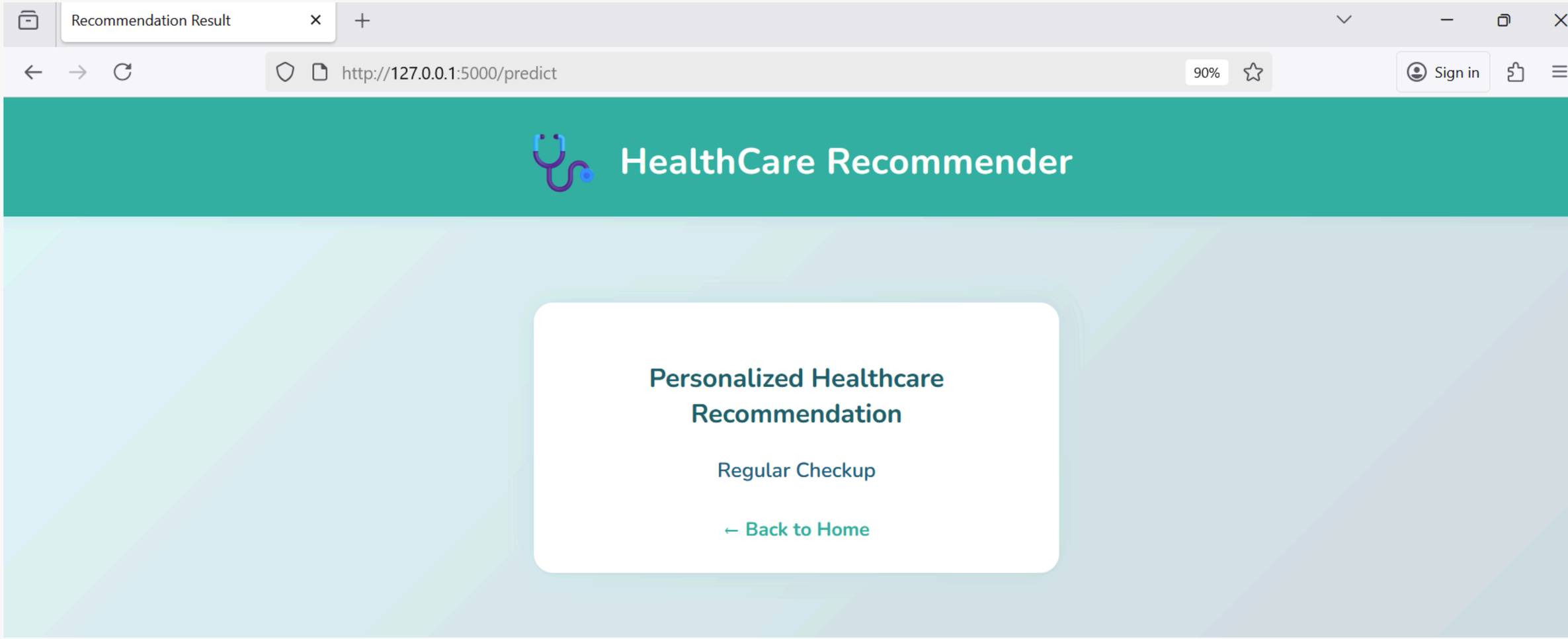
FLASK WEB APP BUILT WITH:

- HTML FOR USER INPUT
- FLASK BACKEND FOR PREDICTION
- USERS ENTER PATIENT DETAILS, RECEIVE INSTANT HEALTHCARE ADVICE

OUTPUT:

- 0 → "NO ACTION"
- 1 → "REGULAR CHECKUP"


http://127.0.0.1:5000
Enter Patient Details
Recency
(Days since last donation)
5
Frequency
(Total donations)
10
Monetary
(ML blood donated)
2500
Time
(Months since first donation)
30
Get Recommendation


Recommendation Result
http://127.0.0.1:5000/predict
90%
Sign in
HealthCare Recommender
Personalized Healthcare Recommendation
Regular Checkup
← Back to Home

CONCLUSION & FUTURE WORK

- Successfully created a healthcare recommendation system
- Model performs well (Accuracy: 79.33%) with actionable results

Future Enhancements:

- Multi-class classification (e.g., Medication, Lifestyle Change)
- Use real-world patient records (EHRs, IoT devices)
- Deploy to the cloud (Render, Railway, Replit)

THANK YOU