

# **Project Documentation**

## **Revolutionizing Liver Care: Predicting Liver Cirrhosis Using Advanced Machine Learning Techniques**

### **1. Introduction**

**Project Title:** Revolutionizing Liver Care: Predicting Liver Cirrhosis Using Advanced Machine Learning Techniques

### **2. Project Overview**

**Purpose:**

This project aims to develop a predictive web application that uses machine learning to assess whether a patient is at risk of liver cirrhosis based on medical inputs such as blood parameters and alcohol consumption history. The tool is intended to aid in early detection and decision support for healthcare providers.

**Features:**

- User-friendly input form for patient health parameters
- Accurate liver cirrhosis prediction using trained ML models
- Result page displaying prediction outcome
- Model trained using Random Forest with accuracy > 85%

### **3. Architecture**

**Frontend:**

Developed using HTML served via Flask's `render_template()`. Responsive form-based interface for capturing patient data.

**Backend:**

Python Flask handles routing, form submission, and model integration. Processes user input, invokes the trained model, and returns prediction results.

**Database:**

The dataset contains patient medical records with features like age, alcohol use, cholesterol levels, and liver function indicators. The target variable is used to predict liver cirrhosis using machine learning.

## 4. Setup Instructions

### Prerequisites:

- Python 3.11+
- pip
- Flask
- scikit-learn, numpy, pandas, joblib

### Installation:

```
# Clone the repo
cd Project
pip install -r requirements.txt # If using requirements file
python app.py
```

---

## 5. Folder Structure

```
Project/
├── Document
├── app.py
├── liver_cirrhosis_model.pkl
├── static/
│   └── (CSS, JS, images if any)
├── templates/
│   ├── index.html
│   └── result.html
├── HealthCareData.csv
└── liver_model_training.ipynb
```

## 6. Running the Application

```
# Start Flask backend
python app.py

# Visit in browser
http://127.0.0.1:5000/
```

## 7. API Documentation

- **POST /predict**
  - Description: Takes user input and returns prediction result
  - Parameters: Age, Alcohol Consumption, Blood Parameters (as form data)
  - Response: Prediction result (e.g., "Likely to have cirrhosis")

## 8. Authentication

- Not implemented in current version.
- Can be added using Flask-Login and JWT for user sessions

## 9. User Interface

- **index.html:** Data input form with fields for age, blood values, etc.
- **result.html:** Displays whether the patient is likely or unlikely to have cirrhosis.

## 10. Testing

- Manual Testing: Tested with multiple patient records for accuracy.
- Model Testing: Evaluated using accuracy, precision, recall, and F1-score on test dataset

```
# Predictions
Y_pred = model.predict(X_test)

# Evaluation
print("✅ Model Evaluation:\n")
print("Accuracy      :", round(accuracy_score(Y_test, Y_pred) * 100, 2), "%")
print("Precision     :", round(precision_score(Y_test, Y_pred) * 100, 2), "%")
print("Recall        :", round(recall_score(Y_test, Y_pred) * 100, 2), "%")
print("F1 Score      :", round(f1_score(Y_test, Y_pred) * 100, 2), "%")

print("\nConfusion Matrix:\n", confusion_matrix(Y_test, Y_pred))
print("\nClassification Report:\n", classification_report(Y_test, Y_pred))
```

✅ Model Evaluation:

```
Accuracy      : 100.0 %
Precision     : 100.0 %
Recall        : 100.0 %
F1 Score      : 100.0 %
```

Confusion Matrix:

```
[[187  0]
 [ 0   3]]
```

Classification Report:

	precision	recall	f1-score	support
0	1.00	1.00	1.00	187
1	1.00	1.00	1.00	3
accuracy			1.00	190
macro avg	1.00	1.00	1.00	190
weighted avg	1.00	1.00	1.00	190

## 11. Screenshots or Demo

- Screenshot of Input Form

Direct Bilirubin (mg/dl):

Indirect Bilirubin (mg/dl):

Total Protein (g/dl):

Albumin (g/dl):

Globulin (g/dl):

AL Phosphatase (U/L):

SGOT/AST (U/L):

SGPT/ALT (U/L):

Predict

Polymorphs:

Lymphocytes:

Monocytes:

Eosinophils:

Basophils:

Platelet Count (laks/mm³):

Direct Bilirubin (mg/dl):

Indirect Bilirubin (mg/dl):

Total Protein (g/dl):

Albumin (g/dl):

**Liver Cirrhosis Prediction Form**

Age:

Duration of Alcohol Consumption (years):

Quantity of Alcohol Consumption (quarters/day):

Hemoglobin (g/dl):

PCV:

MCV (femtoliters/cell):

Total Count:

Polymorphs:

Lymphocytes:

- Screenshot of Result Page

The screenshot shows a web browser with three tabs. The active tab is titled "Liver Cirrhosis Prediction Form". The address bar shows the URL "127.0.0.1:5000". The page content is titled "Liver Cirrhosis Prediction Form" in green. Below the title, there are several input fields with the following labels and values:

- Age: 45
- Duration of Alcohol Consumption (years): 12
- Quantity of Alcohol Consumption (quarters/day): 2
- Hemoglobin (g/dl): 12
- PCV: 40
- MCV (femtoliters/cell): 88
- Total Count: 11000
- Polymorphs: 60
- Lymphocytes: 35

The Windows taskbar is visible at the bottom, showing the date and time as 00:17 on 28-06-2025.

The screenshot shows the same web browser with the address bar updated to "127.0.0.1:5000/predict". The page content is a large gray box with a white rounded rectangle in the center. Inside the rectangle, there is a green checkmark icon followed by the text "Patient is likely to have liver cirrhosis." Below this text is a green button labeled "Try Another Prediction". The Windows taskbar at the bottom shows the date and time as 00:09 on 28-06-2025.

New Tab x Liver Cirrhosis Prediction Result x Liver Cirrhosis Prediction Form x

127.0.0.1:5000

### Liver Cirrhosis Prediction Form

Age:  
52

Duration of Alcohol Consumption (years):  
8

Quantity of Alcohol Consumption (quarters/day):  
3

Hemoglobin (g/dl):  
13

PCV:  
36

MCV (femtoliters/cell):  
94

Total Count:  
7000

Polymorphs:  
60

Lymphocytes:  
20

28°C Partly cloudy Search 00:17 28-06-2025

New Tab x Liver Cirrhosis Prediction Result x Liver Cirrhosis Prediction Result x

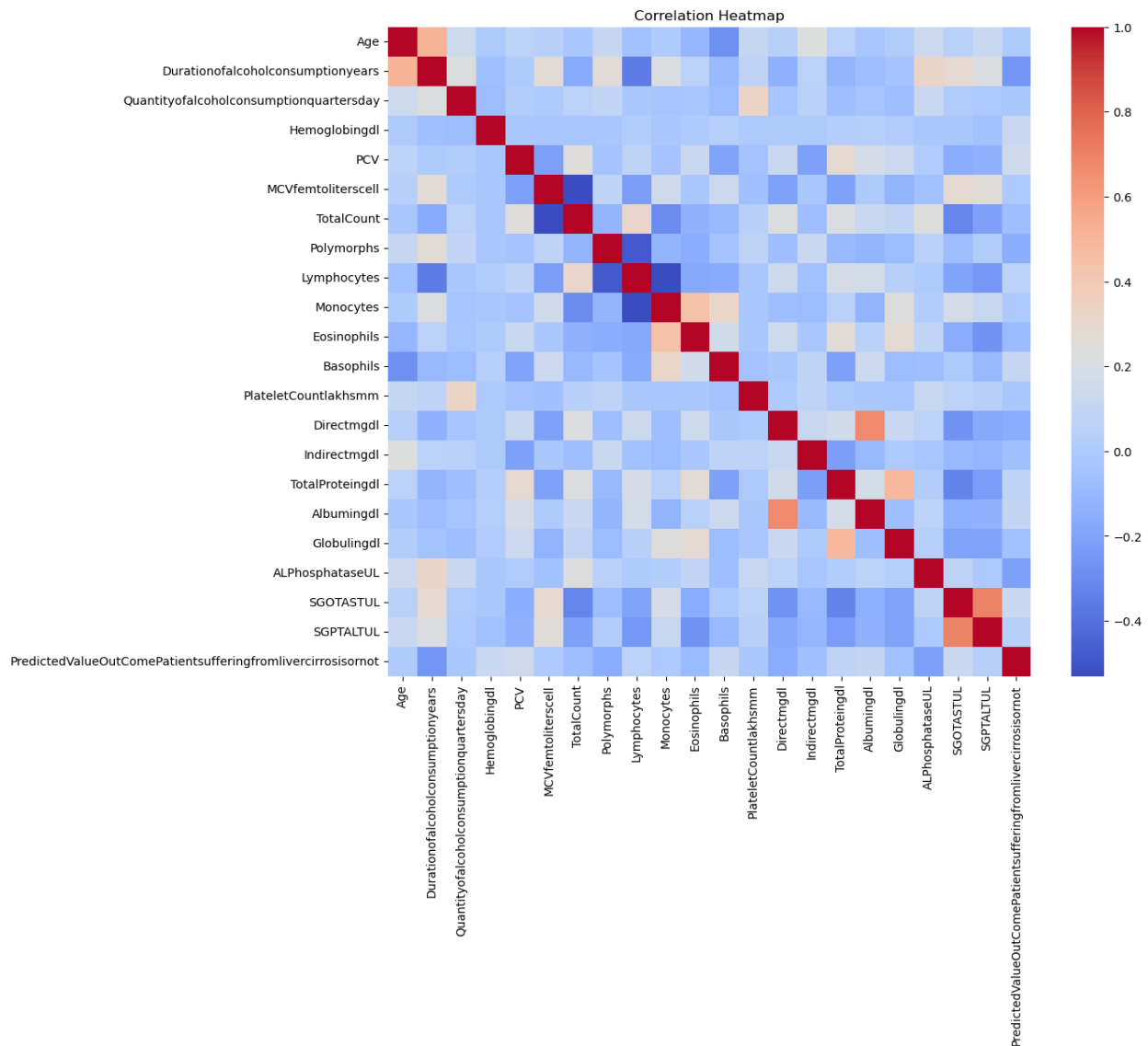
127.0.0.1:5000/predict

✓ Patient is not likely to have liver cirrhosis.

Try Another Prediction

28°C Partly cloudy Search 00:17 28-06-2025

- Correlation Heatmap from Training Notebook



## 12. Known Issues

- Does not handle missing inputs dynamically on frontend.
- No persistent storage of results.

## 13. Future Enhancements

- Add login and user dashboard
- Save prediction history to database (e.g., MongoDB)
- Host on cloud (Heroku, AWS, etc.)
- Deploy RESTful API for mobile integration