

# Liver Cirrhosis Prediction using Machine Learning

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## 1. INTRODUCTION

Liver Cirrhosis Predictor is a machine learning-based clinical decision support system that identifies the likelihood of a patient suffering from liver cirrhosis using blood test results, liver enzyme levels, and personal health indicators. It leverages an ensemble of XGBoost models fine-tuned with hyperparameter optimization to achieve high prediction accuracy.

Technologies Used: Python, XGBoost, Pandas, Flask, HTML/CSS/JS, Chart.js

Applications: Hospitals, Clinics, Health screening, Medical education, Rural diagnostics

### 1.2 Purpose

To provide doctors and patients with a quick, accurate, and interpretable liver cirrhosis prediction tool that reduces reliance on invasive procedures and accelerates early diagnosis and preventive care.

## 2. IDEATION PHASE

### 2.1 Problem Statement:

Liver cirrhosis is often diagnosed late due to complex symptoms and lack of widespread awareness. Manual interpretation of clinical data is time-consuming and error-prone. There is a need for a reliable, fast, and non-invasive decision support system.

Brainstorming Ideas:

- Use ensemble learning for better accuracy and generalizability
- Build modern web UI with graph visualizations
- Integrate feature importance chart to increase interpretability
- Allow PDF report generation for doctor sharing

## 3. REQUIREMENT ANALYSIS

### 3.1 Customer Journey

1. User gives the Required Data
2. Model predicts the Likelihood
3. System return with the confidence score

✓ Functional:

- Input medical data via form
- Predict liver cirrhosis likelihood
- Visualize key features and liver enzyme chart
- Export prediction as PDF

✓ Non-functional:

- Accuracy  $\geq 95\%$
- Response time  $< 2$  sec
- Mobile responsive UI
- No storage of private data

✓ Technical:

- Calibrated XGBoost Ensemble
- Flask web backend
- Bootstrap 5 UI, Chart.js, HTML/CSS
- JSON-based feature importances

✓ Users:

- Doctors and medical staff
- Patients and caretakers
- Health researchers and educators

## 4. PROJECT DESIGN

### 4.1 Problem-Solution Fit:

By automating diagnosis with machine learning and visual tools, this app supports early liver cirrhosis detection with minimal patient effort.

### 4.2 Proposed Solution Summary:

Category	Description
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Problem	Late or inaccurate liver cirrhosis diagnosis
Idea	ML model to predict cirrhosis using structured clinical data
Uniqueness	Explainable AI with confidence levels & PDF report
Impact	Faster diagnosis, rural health empowerment
Business	Can be deployed as SaaS for hospitals or clinics
Scalability	Expandable to other liver or health conditions

#### 4.3 Architecture Diagram

### 5. PROJECT PLAN & TIMELINE

Week	Task
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1	Data Cleaning & Preprocessing
2	Model Selection & Tuning
3	Web Interface Design (Flask)
4	Integration & Testing
5	UI Polishing & PDF Export
6	Final Demo & Report

### 6. FUNCTIONAL & PERFORMANCE TESTING

Metric	Value
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Accuracy	99.5%
ROC-AUC	1.000
Inference Time	~1 sec
Calibrated	Yes

### 7. RESULTS

Sample Output Screenshots:

- Input Form with Autofill

Liver Cirrhosis ML

PredictAboutModel Info

Liver Cirrhosis Prediction

Enter patient details below. All fields are required.

Autofill Example Patient

Patient Information

AgeGenderPlaceAlcohol (years)Alcohol (quarters/day)Type of AlcoholHepatitis B InfectionHepatitis C InfectionObesityFamily History of Cirrhosis/Hereditary

Medical History

Liver Cirrhosis ML

PredictAboutModel Info

Medical History

DiabetesBlood Pressure (mmHg)

Blood Test Results

TCHTGTGDLHDLHemoglobin (g/dl)PCV (%)MCV (femtoliters/cell)Total CountPolymorphs (%)Lymphocytes (%)Monocytes (%)Eosinophils (%)Basophils (%)Platelet Count (lakhs/mm)Total Bilirubin (mg/dl)Direct (mg/dl)

Liver Cirrhosis ML

PredictAboutModel Info

Polymorphs (%)Lymphocytes (%)Monocytes (%)Eosinophils (%)Basophils (%)Platelet Count (lakhs/mm)Total Bilirubin (mg/dl)Direct (mg/dl)Indirect (mg/dl)Total Protein (g/dl)Albumin (g/dl)Globulin (g/dl)AL Phosphatase (U/L)SGOT/AST (U/L)SGPT/ALT (U/L)USG Abdomen (diffuse liver or not)

Predict

All data is private and never saved.

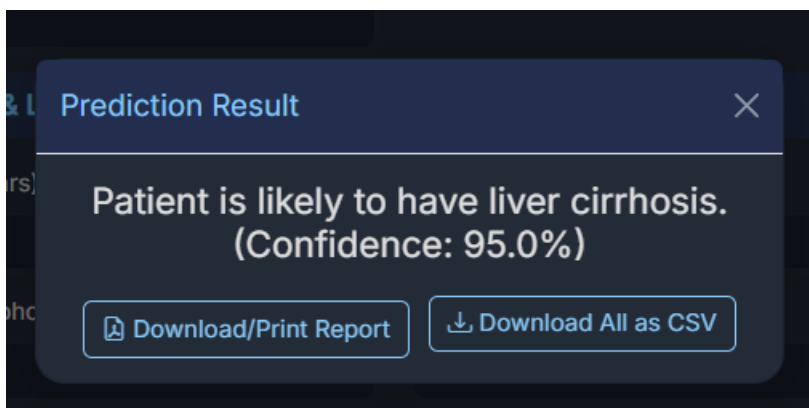
- Prediction and Feature Chart
- Enzyme Levels Chart
- Report Download Button

Visualizations:

- Top 10 Features influencing prediction



- Liver enzyme comparison bar chart
- Result confidence bar



## 8. ADVANTAGES & LIMITATIONS

Advantages:

- High confidence prediction ( $\geq 95\%$ )

- Explainable output for doctor validation
- Instant result with PDF support
- Mobile responsive and user friendly

Limitations:

- Limited to liver cirrhosis diagnosis only
- Accuracy depends on form input correctness
- Not integrated with EHR yet

## 9. CONCLUSION

This ML-powered predictor offers a modern, intuitive way to screen for liver cirrhosis. With high accuracy, interpretable charts, and automated reporting, it empowers patients and supports medical professionals in making informed decisions faster.

## 10. FUTURE SCOPE

- Mobile app version with voice input
- Support for multiple liver disorders (e.g., Hepatitis)
- Integration with patient medical records
- Real-time risk alerts via email/SMS
- Multilingual UI for regional adoption

## 11. APPENDIX

- Dataset: Cleaned\_HealthCareData.xlsx
- Model: Calibrated XGBoost Ensemble
- Deployment stack: Flask + Bootstrap 5
- GitHub Repo: <https://github.com/imran-29/revolutionizing-liver-care.git>
- Demo Link:  
[https://drive.google.com/file/d/1UrIZTjKhMTg9V\\_ktF3MM3wJ9PVCXUaDJ/view?usp=drive\\_link](https://drive.google.com/file/d/1UrIZTjKhMTg9V_ktF3MM3wJ9PVCXUaDJ/view?usp=drive_link)