Revolutionizing Liver Care

Final Report

Team ID : LTVIP2025TMID45221

Team Size : 4

Team Leader : Chilukuri Subramanya Manikanta

Team member : Chinta Poojitha

Team member : Atmakuri Navya Sree Sai Lakshmi

Team member : Chodisetti Manoj Durga Bhaskar

1. INTRODUCTION

1.1 Project Overview

Liver cirrhosis is a life-threatening condition characterized by irreversible liver scarring and gradual liver dysfunction. This project introduces a machine learning-based web application that enables early detection and prognosis of liver cirrhosis. It uses clinical input data to generate predictive insights that support proactive medical interventions.

1.2 Purpose

The primary objective is to leverage machine learning techniques to predict the likelihood of liver cirrhosis in individuals, facilitating timely clinical responses and improving healthcare outcomes. The model is deployed via a Flask web application to make the tool easily accessible for clinical or educational purposes.

---

2. IDEATION PHASE

2.1 Problem Statement

Detecting liver cirrhosis early is vital yet challenging due to its slow and often asymptomatic progression. This project aims to build a predictive model that accurately classifies patients at risk based on clinical data inputs.

2.2 Empathy Map Canvas

- **Think & Feel:** Patients worry about disease progression and life expectancy.
- **Hear:** From doctors—lifestyle changes, frequent monitoring.
- **See:** Increasing hospital visits, medications.
- **Say & Do:** Seek affordable and quick diagnosis.
- **Pain:** Late diagnosis, lack of awareness.
- **Gain:** Early detection, better outcomes.

2.3 Brainstorming

- Which algorithms offer better interpretability for doctors?
- What features are most correlated with cirrhosis?
- How can we make the application user-friendly for both patients and clinicians?

---

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

1. User opens the web interface.
2. Inputs relevant clinical parameters
3. Clicks "Predict" to see cirrhosis risk result.
4. Receives suggestion on next steps.

3.2 Solution Requirement

- Dataset with liver parameters
- Machine learning model (Random Forest, XGBoost, etc.)
- Flask-based web UI
- CSS and JS for styling

3.3 Data Flow Diagram

[User Input] → [Flask Web UI] → [Preprocessing] → [ML Model] → [Prediction Output] → [UI Display]

3.4 Technology Stack

- Python, Pandas, NumPy, Scikit-learn, XGBoost
- Flask (Web Framework)
- HTML/CSS/JS for UI
- Jupyter Notebooks (for model training)

---

4. PROJECT DESIGN

4.1 Problem Solution Fit

Patients often lack affordable and accessible diagnostic tools. Our web-based ML solution bridges that gap by offering fast and scalable risk prediction.

4.2 Proposed Solution

Build and deploy a trained predictive model through a user-friendly web application. Integrate `rf_acc_68.pkl` and `normalizer.pkl` for live predictions.

4.3 Solution Architecture

[Frontend: HTML/CSS] ↔ [Flask Backend: app.py] ↔ [Model: rf_acc_68.pkl + normalizer.pkl]

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Phase	Timeline
Data Collection & Prep	Week 1
EDA & Visualization	Week 2
Model Building	Week 3
Hyperparameter Tuning	Week 4
Web UI & Integration	Week 5
Testing & Deployment	Week 6
Documentation & Demo	Week 7

---

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

Models tested: Decision Tree, KNN, Random Forest, XGBoost.\ Metrics used: Accuracy, Precision, Recall, F1-score, ROC-AUC.\ Best accuracy achieved: **68% (Random Forest)**.\ Post hyperparameter tuning: **Performance improved marginally**.

---

7. RESULTS

7.1 Output Screenshots

Include screenshots of:

- Input form
- Prediction result display
- Backend console logs (optional)

---

8. ADVANTAGES & DISADVANTAGES

Advantages

- Early risk identification
- Reduces clinical burden
- Scalable via web interface
- Open-source, customizable

Disadvantages

- Limited dataset generalizability
- Model interpretability can be improved
- No real-time medical validation

---

9. CONCLUSION

This project demonstrates the feasibility of machine learning in the domain of hepatology for cirrhosis risk prediction. The model and its integration into a Flask web app create a practical tool for supporting clinical decision-making.

---

10. FUTURE SCOPE

- Integrate more patient features (e.g., lifestyle, history)
- Use explainable AI (SHAP, LIME) for interpretability
- Incorporate real-time clinical feedback
- Deploy on cloud for broader access

---

11. APPENDIX

- **Dataset Link:** [https://www.kaggle.com/datasets/bhavanipriya222/liver-cirrhosis-prediction]
- **GitHub & Project Demo Link:** [https://github.com/chintaPoojitha03012005/Smart-bridge---live