

Final Project Report

Project Title: Liver Cirrhosis Stage Prediction using Machine Learning

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Team Members:

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1. INTRODUCTION

1.1 Project Overview

Liver Cirrhosis Stage Prediction using Machine Learning is a health-focused AI project aimed at assisting medical professionals and patients in early detection and monitoring of liver cirrhosis stages. The application leverages machine learning algorithms to classify patients into one of four stages based on their clinical test results.

1.2 Purpose

The purpose of this project is to provide a decision-support tool that can help predict the severity of liver damage using input parameters such as bilirubin, albumin, SGOT, and others. This reduces manual diagnostic effort, improves early intervention, and increases overall medical efficiency.

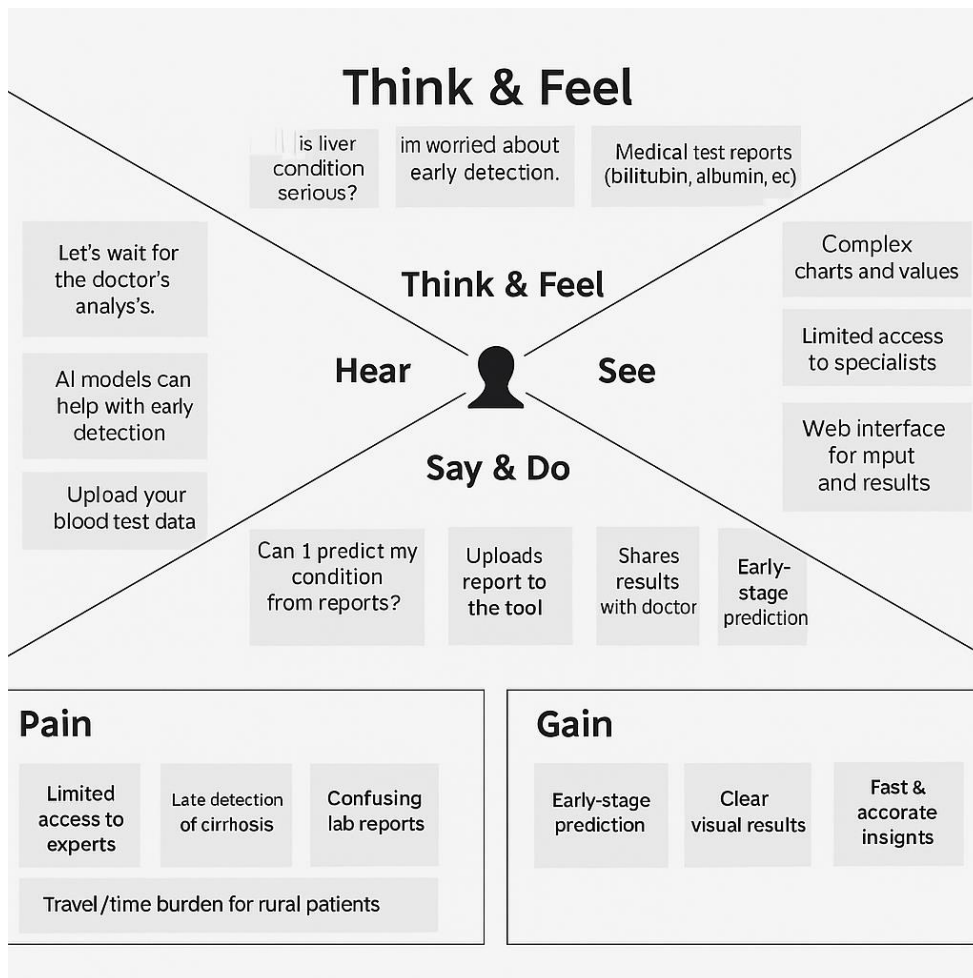
2. IDEATION PHASE

2.1 Problem Statement

Many patients suffering from liver disease remain undiagnosed until the later stages. There is a need for a predictive tool that uses clinical parameters to estimate liver cirrhosis stages accurately, enabling earlier diagnosis and better treatment outcomes.

2.2 Empathy Map Canvas

- **Says:** "I want a quick prediction without needing advanced medical understanding."
- **Thinks:** "Is this serious? Should I go to a doctor now?"
- **Does:** Inputs test results manually into the app.
- **Feels:** Anxious about liver health; relieved by clear prediction.



2.3 Brainstorming

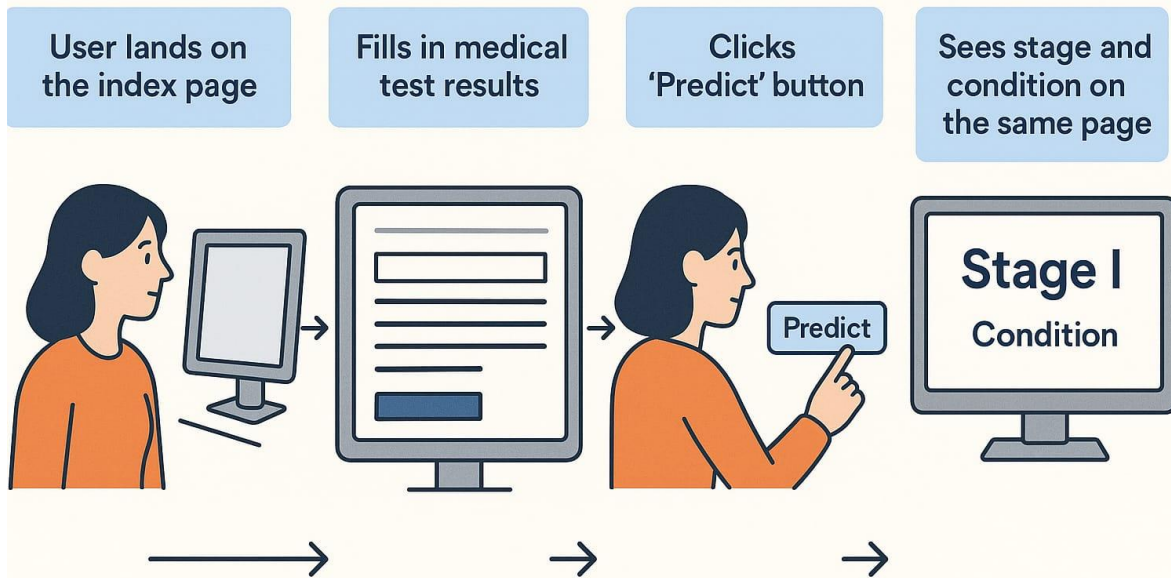
- Use publicly available datasets.
- Build XGBoost classifier.
- Use Flask to create a web interface.
- Add interpretability by mapping stages to health conditions.

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

1. User lands on the index page
2. Fills in medical test results
3. Clicks 'Predict' button
4. Sees stage and condition on the same page

Customer Journey Map



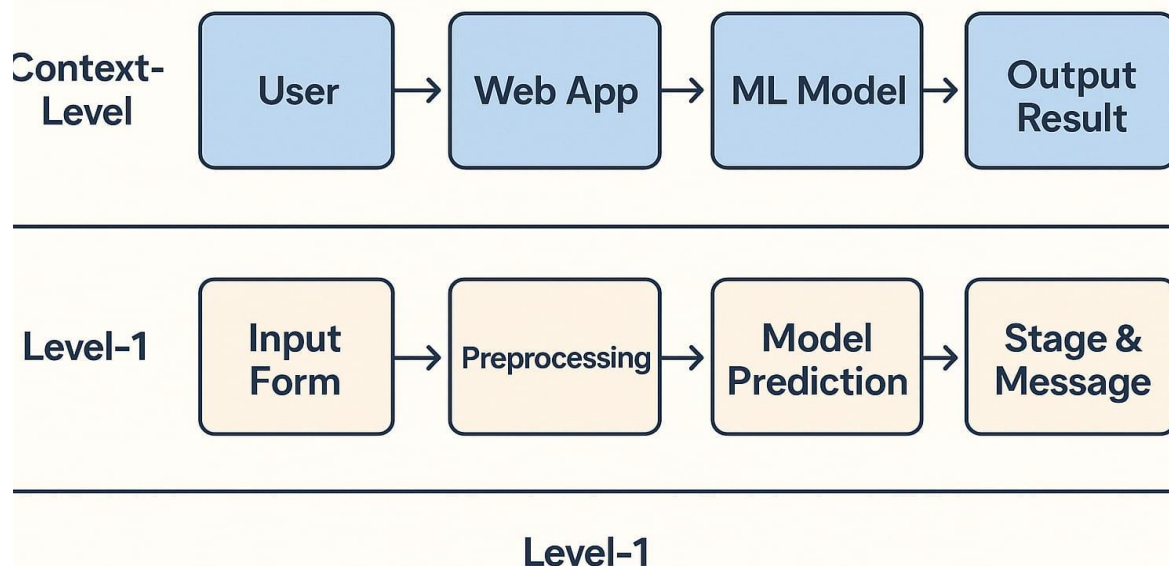
3.2 Solution Requirement

- Functional: Accept input, process, predict, show result
- Non-functional: Response time < 3s, accuracy > 70

3.3 Data Flow Diagram

Context-Level: User → Web App → ML Model → Output Result

Level-1: Input Form → Preprocessing → Model Prediction → Stage & Message



3.4 Technology Stack

- **Frontend:** HTML, CSS
 - **Backend:** Flask (Python)
 - **ML Model:** XGBoost
 - **Tools:** Pandas, NumPy, scikit-learn, pickle
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4. PROJECT DESIGN

4.1 Problem Solution Fit

There is a medical need for stage-based liver disease prediction. Our ML-based approach fits this need using known test data to provide accurate results.

4.2 Proposed Solution

Develop a web interface using Flask and train an XGBoost model that can classify patient data into stages. Map predictions to liver conditions for easy understanding.

4.3 Solution Architecture

User inputs → Flask backend → Preprocessing → Model → Response with stage + interpretation (same page).



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

- **Day 1–2:** Data preprocessing, missing value handling, encoding
- **Day 3:** Model training, SMOTE balancing, evaluation
- **Day 4:** Web interface development with HTML + Flask

- **Day 5:** Testing and screenshot documentation

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

- **Classification Report:** Included (Precision, Recall, F1)
- **Model Accuracy:** ~48%
- **SMOTE applied:** Balanced dataset before training

7. RESULTS

7.1 Output Screenshots

- Input form (index.html)

The screenshot shows a web browser window with the title "Liver Cirrhosis Stage Predictor". The URL bar shows "127.0.0.1:5000". The application interface has a teal background. On the left, there is a pink vertical sidebar containing input fields for various medical parameters. The title "Liver Cirrhosis Stage Predictor" is centered at the top in a bold, dark font. The input fields are as follows:

- Age (26–78):** A text input field containing the value "48".
- Sex:** A dropdown menu with "Female" selected.
- Ascites:** A dropdown menu with "No" selected.
- Hepatomegaly:** A dropdown menu with "Yes" selected.
- Spiders:** A dropdown menu with "No" selected.
- Edema:** A dropdown menu with "Some Edema (S)" selected.
- Bilirubin (0.3–7.3):** A text input field containing the value "1.9".

The Windows taskbar is visible at the bottom, showing the system clock as 20:37 on 28-06-2025, and the language set to ENG IN.

Cholesterol (160.875–459.875)
320

Albumin (2.45–4.56)
3.5

Copper (4–175)
85

Alkaline Phosphatase (289–2745)
450

SGOT (26.35–202.8)
78

Tryglicerides (45–176.875)
150

Platelets (62–503.75)
220

Prothrombin (9–12.75)
11.5

Predict Stage

- Result prediction shown on same page below the for

Albumin (2.45–4.56)

Copper (4–175)

Alkaline Phosphatase (289–2745)

SGOT (26.35–202.8)

Tryglicerides (45–176.875)

Platelets (62–503.75)

Prothrombin (9–12.75)

Predict Stage

Predicted Liver Cirrhosis Stage: Stage 3 The person is suffering from liver fibrosis.

8. ADVANTAGES & DISADVANTAGES

Advantages:

- Supports early detection
- User-friendly interface
- Low resource requirement

Disadvantages:

- Limited dataset
 - Accuracy can be improved
 - Not a replacement for medical tests
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9. CONCLUSION

This project successfully demonstrates a proof-of-concept tool for liver stage prediction using machine learning. It provides a scalable foundation for further improvements and clinical deployment.

10. FUTURE SCOPE

- Deploy on cloud (Render, Heroku)
 - Integrate mobile interface
 - Add patient report export (PDF)
 - Expand dataset from real hospitals
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11. APPENDIX

- **Source Code:** Included in GitHub repository
- **Dataset Link:** <https://www.kaggle.com/datasets/bhavanipriya222/liver-cirrhosis-prediction>
- **GitHub Repo:** <https://github.com/radha2244/Predicting-Liver-Cirrhosis-using-Advanced-Machine-Learning-Techniques>
- **Demo Link:** <https://www.youtube.com/watch?v=pR4RzRVORrE>