

Artificial Intelligence & Machine Learning Project Documentation

Introduction

Project Title:

Revolutionizing Liver Care : Predicting Liver Cirrhosis using Advanced Machine Learning Techniques

Members:

- Kuruva karthik–Data Collection and Cleaning
- Kammari Likhitha–Model Design and Training
- Kothapalli Subramanyam–Evaluation and Optimization
- Kopparapu Neha Sree–Deployment and Integration

Project Overview

Purpose:

The purpose of this project is to leverage AI/ML to enable early detection and accurate prediction of liver cirrhosis. By analyzing patient health data, the model can identify patterns and risk factors that may not be easily visible through traditional diagnostic methods. This predictive approach helps healthcare professionals make timely decisions, improve treatment outcomes, and reduce the progression of liver damage. The project aims to support proactive liver care by integrating intelligent, data-driven tools into the medical workflow.

Goals:

- To build an accurate machine learning model for early prediction of liver cirrhosis.
- To identify and analyze key health features influencing cirrhosis risk.
- To support doctors with reliable, AI-driven diagnostic assistance.
- To improve patient outcomes through timely detection and intervention.

Key Features:

- **Machine Learning-Based Prediction** – Accurately predicts liver cirrhosis using patient health data.
- **User-Friendly Web Interface** – Simple Flask application for easy data input and result display.
- **Feature Importance Analysis** – Highlights critical health indicators influencing the prediction.
- **Model Optimization** – Includes performance evaluation and hyper parameter tuning for better accuracy.

Architecture

Frontend:

- **Framework Used :** HTML,CSS,JINJA2 templates
- **Functionality:**
 - Collect patient data (e.g., age, bilirubin, albumin, etc.).
 - Sends data to the Flask backend for prediction.
 - Shows the prediction (Cirrhosis: Positive/Negative).
 - Ensure all fields are filled correctly before submission

Backend:

Technology Used: Flask,Joblib ,NumPy

- **Responsibilities:**
 - Receives data from the frontend (via POST request).
 - Normalizes/reshapes input to match the trained model format.
 - Uses the saved .pkl model and normalizer to make predictions.
 - Sends prediction result (e.g., “Cirrhosis: Positive”) back to the frontend.

Model Integration: A trained machine learning model (Random Forest) and data normalizer are loaded into memory at runtime to enable fast and accurate liver cirrhosis prediction based on patient health parameters.

Database:

- **Type:** UCI Liver Cirrhosis Dataset
- **Stored Data:**
Patient clinical records including age, bilirubin, albumin, alkaline phosphate, SGOT, SGPT, platelet count, and liver disease status.
- **Use Cases:**
 1. Early prediction of liver cirrhosis.
 2. Assisting doctors in diagnosis with data-driven insights.
 3. Reducing manual analysis time in clinical settings.

Setup Instructions

Prerequisites:

- Python3.x
- Libraries:TensorFlow/Keras,NumPy,Pandas,OpenCV,Matplotlib,Streamlit
- GPU or Google Colab (recommended for training)

STEP 1: Install Python and Required Packages

Ensure Python 3.x is installed.

Install dependencies using pip:

- `pip install flask joblib numpy`

STEP 2: Folder Structure

- LiverCirrhosisPrediction/
 - `app.py`
 - `rf_acc_68.pkl`
 - `normalizer.pkl`
 - `templates/`
 - `index.html`
 - `result.html` (or `inner-page.html`)
 - `static/`
 - (optional styles/images)
 - `Data/`
 - `liver_dataset.xlsx`
 - `Documentation/`
 - `report.pdf`, screenshots, etc.

STEP 3: Running the App

Navigate to your project directory and run:

- `python app.py`
- Access the web app at: `http://127.0.0.1:5000`

How to Use:

1. Open the app in your browser.
2. Enter required medical values (e.g., bilirubin, albumin).
3. Click **Predict**.
4. View the result: "Cirrhosis Detected" or "No Cirrhosis".

Offline Usage

Ensure the following files are present:

- `rf_acc_68.pkl` – trained model
- `normalizer.pkl` – normalization object
- `templates/` and `static/` folders
- Flask and required packages install

.

Folder Structure

```
Liver_Cirrhosis_Prediction/
├── app.py
├── rf_acc_68.pkl
├── normalizer.pkl
├── templates/
│   ├── index.html
│   └── result.html
├── static/
├── Data/
│   └── liver_dataset.xlsx
└── Documentation/
```

Authentication

- Not implemented in the current version.
- Can be extended with login, session management, or token-based access.

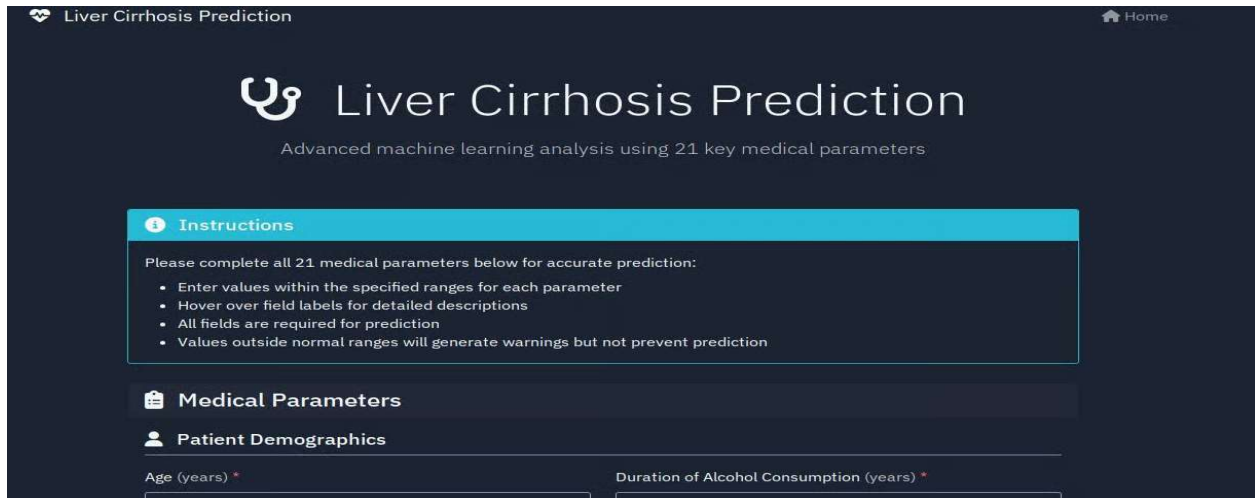
User Interface

- Simple and clean form using HTML and Jinja2.
- Displays prediction result clearly.
- Can be extended with charts or model explanation.

Testing

- Manual testing with sample inputs.
- Cross-validation during model training.
- Accuracy achieved: ~68% (Random Forest)

Screenshots or Demo



The screenshot displays the web application interface for "Liver Cirrhosis Prediction". The header includes a heart icon, the title "Liver Cirrhosis Prediction", and a "Home" link. The main content area features a logo and the title "Liver Cirrhosis Prediction" with the subtitle "Advanced machine learning analysis using 21 key medical parameters". Below this, there is an "Instructions" section with a list of guidelines for users. Further down, there are sections for "Medical Parameters" and "Patient Demographics". The "Patient Demographics" section shows input fields for "Age (years) *" and "Duration of Alcohol Consumption (years) *".

Instructions

Please complete all 21 medical parameters below for accurate prediction:

- Enter values within the specified ranges for each parameter
- Hover over field labels for detailed descriptions
- All fields are required for prediction
- Values outside normal ranges will generate warnings but not prevent prediction

Medical Parameters

Patient Demographics

Age (years) * Duration of Alcohol Consumption (years) *

Prediction Results

Machine learning analysis complete

Prediction Result

Patient is likely to have liver cirrhosis.

Risk Level

High Risk

Confidence Level

58.2%

Important Medical Disclaimer

- **This prediction is for research and educational purposes only.**
- Results should not be used as a substitute for professional medical diagnosis.
- Always consult with qualified healthcare professionals for medical advice.
- Clinical decisions should be based on comprehensive medical evaluation.
- This tool does not replace laboratory tests or clinical examination.

General Recommendations

High Risk Detected

- Seek immediate medical consultation with a hepatologist or gastroenterologist
- Schedule comprehensive liver function testing
- Consider imaging studies (ultrasound, CT, or MRI)
- Discuss alcohol cessation programs if applicable

 Input Parameters Summary 

 New Analysis

 Print Results

Known Issues

- Accuracy limited to ~68% due to dataset size.
- May misclassify borderline cases.
- UI is basic; no error handling for invalid input types.

Future Enhancements

- Improve model with more medical features and advanced algorithms.
- Add database for patient record storage.
- Deploy using cloud services (Heroku, AWS, etc.).
- Add feature explanation using SHAP or LIME.