

Liver Disease Prediction and Health Guidance Using Supervised Machine Learning

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ABSTRACT: Liver disease is one of the major health problems affecting millions of people worldwide. Early detection is important because liver diseases often show very few symptoms in the beginning stages. If not identified early, they can lead to serious complications and affect a person's overall health.

This project proposes a Liver Disease Prediction and Health Guidance System using Machine Learning. The system analyzes patient health information such as age, gender, bilirubin levels, protein levels, and other medical parameters to predict whether a person is at risk of liver disease.

The system uses machine learning algorithms to classify patients into Low Risk, Medium Risk, and High Risk categories. Along with prediction results, the system also provides personalized health guidance and preventive suggestions. This helps patients understand their health condition and encourages early medical consultation.

The proposed system aims to improve early diagnosis, reduce health risks, and support doctors in making better decisions.

KEYWORDS: Liver Disease, Machine Learning, Health Guidance, Prediction System, Healthcare, Decision Support System

I. INTRODUCTION

The liver is one of the most important organs in the human body. It performs several vital functions such as removing toxins, producing proteins, storing nutrients, and helping in digestion.

Liver diseases can occur due to alcohol consumption, viral infections, unhealthy lifestyle habits, obesity, and certain medications. Common liver diseases include fatty liver, hepatitis, cirrhosis, and liver failure.

Many people are unaware of liver problems until the disease becomes severe. Therefore, early detection is very important. Machine Learning provides an effective solution by analyzing patient data and identifying disease patterns quickly and accurately.

This project develops a Liver Disease Prediction and Health Guidance System that predicts the possibility of liver disease and provides useful health recommendations based on the patient's condition.

II. Literature Survey:

2.1 Liver Disease Prediction Systems

Several researchers have developed machine learning models for predicting liver disease using patient health records. These systems analyze medical parameters and identify patterns associated with liver-related conditions.

2.2 Machine Learning in Healthcare

Machine Learning has become an important technology in the healthcare sector. It helps in disease

prediction, medical diagnosis, patient monitoring, and decision support by analyzing large volumes of healthcare data.

2.3 Risk Assessment Systems

Risk assessment systems help identify individuals who are more likely to develop a disease. Early risk prediction allows patients to take preventive measures and seek medical attention before complications arise.

2.4 Health Guidance Systems

Modern healthcare applications not only predict diseases but also provide personalized recommendations related to diet, exercise, and lifestyle improvements. Such guidance helps users maintain better health and reduce disease risks.

III. System Analysis And Design

3.1 Existing System

Most existing liver disease diagnosis systems depend on laboratory tests and manual evaluation by healthcare professionals. Doctors analyze patient reports and symptoms before making a diagnosis.

Limitations of Existing System

- Time-consuming diagnosis process
- Chances of human error
- Limited support for early prediction
- No personalized health recommendations
- Difficult to analyze large amounts of patient data

3.2 Proposed System

The proposed system uses supervised machine learning algorithms to predict liver disease risk automatically.

The system supports:

- Liver disease prediction using medical data
- Early risk assessment
- Personalized health recommendations
- Diet and lifestyle suggestions
- User-friendly healthcare assistance

Advantages of Proposed System

- Supports early disease detection
- Improves prediction accuracy
- Reduces manual effort
- Provides personalized healthcare guidance
- Helps doctors and patients make informed decisions
- Encourages preventive healthcare practices
- Reduces dependency on unreliable symptom searches

3.3 System Architecture

The proposed Liver Disease Prediction and Health Guidance System is designed using multiple modules that work together to predict liver disease and provide health recommendations.

1. User Interface Module

Allows users to enter health information and view prediction results in a simple and understandable format.

2. Data Collection Module

Collects patient information such as age, gender, bilirubin levels, protein levels, liver enzyme values, and medical history.

3. Data Preprocessing Module

Cleans and prepares the collected data by handling missing values and removing unwanted information.

4. Machine Learning Module

Trains and tests machine learning models using patient datasets.

5. Prediction Module

Predicts whether the patient is at risk of liver disease based on the trained model.

6. Health Guidance Module

Provides personalized recommendations including healthy diet plans, exercise suggestions, and preventive healthcare measures.

7. Database Module

Stores patient information and prediction results securely.



Fig. 1. System Architecture of Liver Disease Prediction and Health Guidance System

4.2 Data Preprocessing

Raw medical data may contain missing values, duplicate records, or inconsistent information. Therefore, preprocessing is performed to improve data quality.

- Removing missing values
- Eliminating duplicate records
- Data normalization
- Data formatting and cleaning

4.3 Feature Selection

Not all collected attributes contribute equally to disease prediction. In this stage, important features that have a strong impact on liver disease are selected

Examples include:

- Bilirubin Levels
- Liver Enzymes
- Protein Levels
- Albumin Ratio

IV. PROPOSED METHODOLOGY

The proposed methodology explains how the system processes patient data and generates prediction results.

4.1 Data Collection

The first step is collecting patient health data from medical datasets or user input. The collected information includes

- Age
- Gender
- Bilirubin Levels
- Liver Enzyme Levels (ALT, AST, ALP)
- Protein Levels
- Albumin Levels
- Medical History

This data serves as the input for the prediction system.

4.4 Model Training

The prepared dataset is used to train different supervised machine learning algorithms.

The algorithms used are:

- Logistic Regression
- Random Forest
- Support Vector Machine
- K-Nearest Neighbors
- Decision Tree
- Gradient Boosting

V. IMPLEMENTATION

5.1 Technologies Used

The Liver Disease Prediction and Health Guidance

System is developed using modern software technologies and machine learning techniques.

Technologies Used

- Python – Main programming language
- React – Frontend development
- Flask – Backend framework
- MySQL / SQLite – Used for storing patient records and prediction results
- Pandas & NumPy – Used for data processing and analysis
- Scikit-learn – Used for implementing machine learning algorithms
- Matplotlib & Seaborn – Used for data visualization and result analysis

These technologies work together to build an efficient and user-friendly prediction system.

5.2 Modules

User Interface Module

This module is the main part where users interact with the system.

Users can enter their health details and view the prediction results in a simple and easy-to-understand format.

Data Collection Module

This module gathers all the necessary health information required for liver disease prediction.

Data Preparation Module

Before making predictions, the collected data is checked and organized properly. This helps the system work more accurately.

Disease Prediction Module

This is the core module of the system. It uses machine learning techniques to analyze patient data and predict the possibility of liver disease.

Risk Classification Module

After prediction, the system classifies the patient based on the level of risk.

Health Guidance Module

This module provides useful suggestions to help users maintain better liver health.

Database Module

This module safely stores patient information and prediction results for future reference.

VI. RESULTS AND ANALYSIS

The system was tested using liver disease datasets containing patient medical information.

The machine learning models successfully identified disease patterns and generated accurate prediction results.

Random Forest and Gradient Boosting algorithms provided higher prediction accuracy compared to other models.

The health recommendation module generated useful dietary and lifestyle suggestions based on prediction outcomes.

Overall, the system demonstrated effective performance in supporting early liver disease detection and healthcare awareness.

Liver Cirrhosis Predictor

AI-powered stage prediction with patient summary and personalized follow-up guidance

Clinical Status

Patient Status: Active

Age (Years): 34

Sex: Female (F)

Ascites (Fluid buildup): No (N)

Edema: No Edema (N)

Basic Laboratory Data

Bilirubin Count: 0.5
Normal Range: 0.1 - 1.2 mg/dL

Albumin Count: 3.4
Normal Range: 3.5 - 5.0 g/dL

Total Protein Count: 3.1
Normal Range: 6.0 - 8.0 g/dL

Advanced Laboratory Data

Cholesterol: 180
Normal Range: < 200 mg/dL

Copper: 35
Normal Range: 10 - 100 mg/dL

Alkaline Phosphatase (ALP/Phos): 110
Normal Range: 44 - 147 U/L

GGT (AST): 30
Normal Range: 0 - 40 U/L

Triglycerides: 120
Normal Range: < 150 mg/dL

Platelets: 300
Normal Range: 150 - 450 x10⁹/L

Predict Cirrhosis Stage

Predict Cirrhosis Stage

AI Stage Prediction Results

Most likely stage: Stage 1 with 84% confidence.

Stage 1: 84%

Stage 2: 14%

Stage 3: 2%

Stage 4: 0%

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Submitted Patient Inputs

CLINICAL STATUS	
Patient Status	Active
Age	34
Sex	F
Ascites	N
Edema	N

BASIC LABORATORY DATA	
Bilirubin	0.5
Albumin	3.4
Protein	3.1

ADVANCED LABORATORY DATA	
Cholesterol	180
Copper	35
ALP/Phos	110
GGT	30
Triglycerides	120
Platelets	300

Health Guidance

The model suggests a milder stage pattern. This usually calls for follow-up, healthy liver habits, and regular review of symptoms and lab values.

- Schedule a routine review with a doctor or liver specialist to confirm the result with clinical examination and tests.
- Avoid alcohol and avoid taking non-prescribed medicines or supplements without medical advice.
- Maintain balanced meals and hydration unless a clinician has already given specific fluid or diet restrictions.

This is a screening-style prediction, not a medical diagnosis. Always confirm with a qualified healthcare professional.

VII. CONCLUSION

The Liver Disease Prediction and Health Guidance System successfully combines machine learning techniques with healthcare assistance to provide early prediction of liver disease risk. The system helps users understand their health condition, encourages preventive healthcare practices, and supports better medical decision-making. By providing prediction results along with personalized health recommendations, the platform improves healthcare awareness and promotes healthier lifestyles.

VIII. REFERENCES

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