A Review of Data-Driven Liver Disease Risk Prediction through Machine Learning Algorithms

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ABSTRACT
Millions of individuals throughout the world suffer from liver disease, which is a major health issue. Early diagnosis and treatment of liver illness can significantly enhance health outcomes and lower medical expenses. Healthcare providers in underdeveloped nations might find this strategy very helpful. A hybrid technique has been introduced to accurately diagnose liver disease. Scalability and prediction have been computed. A new patient's data was used as input, and it was discovered that the model produced good accuracy for detecting livers. In the final section of this work, we conclude that the hybrid strategy is preferable after thoroughly analyzing the available data.

General Terms
Liver Disease, Accuracy, Healthcare

Keywords
Hybrid Approach, Liver Disease, Hybrid Approach, Scalability, Lifestyle, Hepatitis.

1. INTRODUCTION
The liver is an essential organ in the body and is involved in numerous metabolic activities, including the breakdown of nutrients in meals, the production of bile for digestion, the control of blood sugar levels, and the removal of toxins from the blood.

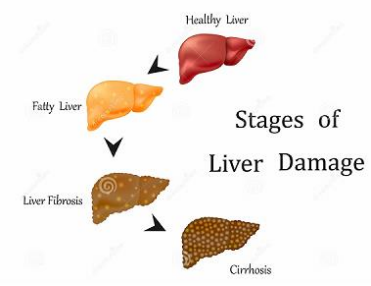

Figure 1: Stages of Liver Disease [12]

Any disorder that impairs the function of the liver and can cause a variety of symptoms and problems is referred to as liver disease. Fatigue, nausea, abdominal pain, jaundice, swelling of the legs and ankles, and easy bruising or bleeding are just a few of the symptoms of liver disease that can vary depending on the kind and severity of the problem. Depending on the underlying reason, treatment options for liver illness may include lifestyle modifications, medication, or surgery. Even when liver tissue has only somewhat been damaged, liver disease is exceedingly difficult to diagnose in its early stages, making it challenging for many medical expert systems. This results in treatment and drug failure. Early diagnosis is essential to providing the patient with the right care and saving their life. Liver transplantation might be required in specific circumstances. Maintaining a healthy lifestyle, abstaining from excessive alcohol use, and receiving hepatitis A and B vaccinations are all important components of liver disease prevention. Regular visits to the doctor can help identify liver illness early and stop the consequences. Several other less frequent disorders can damage the liver in addition to the types of liver disease that were previously listed. To stop the course of liver disease and lower the risk of consequences, regular monitoring and follow-up with a healthcare professional are crucial. Alcoholic liver disease can develop as a result of excessive alcohol intake, which can be detrimental to the liver. Alcohol-related liver disease can range in severity from mild to severe and can worsen over time, causing cirrhosis, liver failure, and a higher chance of developing liver cancer. Alcohol is processed in the liver after consumption. Acetaldehyde, a hazardous byproduct of alcohol metabolism that can harm liver cells, is produced by the liver. Repeated alcohol usage over time can damage the liver and impair its function by causing hepatic inflammation and scarring. Abstinence from alcohol and lifestyle modifications, such as better nutrition and weight loss, are required for the treatment of alcoholic liver disease. In extreme situations, hospitalization can be required, and symptoms or problems would need to be managed with medication. To treat end-stage liver disease, liver transplantation may occasionally be required. To stop the advancement of alcoholic liver disease and lower the risk of complications, regular monitoring, and follow-up with a healthcare professional are crucial. Based on symptoms, machine learning algorithms can be very helpful in identifying liver illness. The liver is a crucial organ in the body that produces bile, filters pollutants from the bloodstream, and stores nutrients. An individual's health can be significantly impacted by liver disease, and effective treatment depends on early detection. Creating a classification model is a typical method for using machine learning for the identification of liver disease. This algorithm learns to categorize new patients based on their symptoms after being trained on a dataset of patients with and without liver disease. The model can be built using decision trees, random forests, or support vector machines, among others. In this research, we suggest using machine learning to diagnose liver illness with high accuracy. We gathered data from people with and without liver illness, and we utilized various techniques to automatically extract attributes and categorize the data. Accuracy, sensitivity, and specificity were three performance criteria used to evaluate the proposed machine learning model's potential as an additional tool for medical practitioners to diagnose liver problems.

2. LITERATURE REVIEW
Elias Dritsas et.al (2023): This study demonstrated that the Voting classifier surpasses the other models with accuracy, recall, and F-measure of 80.1 percent, the precision of 80.4 percent, and an AUC of 88.4 percent following SMOTE with 10-fold cross-validation.

Lee et al. (2022): Using clinical and radiological data, a machine learning approach to predicting liver cancer recurrence: The recurrence of liver cancer is predicted using clinical and radiological data in this study, which was reported in the journal Clinical Radiology. The authors conclude that their approach is reliable and could aid physicians in making more informed decisions on patient care.

Ikeda et al. (2022): Lenvatinib treatment for advanced hepatocellular carcinoma patients: a machine learning approach for predicting overall survival The construction of a machine learning model for predicting overall survival in patients with advanced hepatocellular carcinoma who are treated with lenvatinib is described in this research, which was published in the journal Cancer Medicine. The authors discover that their model is precise and might aid clinicians in individualized treatment choices.

Gao et al. (2021): Using machine learning to predict patients with hepatocellular carcinoma's prognosis following liver transplantation This study, which was published in the journal BMC Cancer, employs machine learning algorithms to forecast how long HCC patients would live after receiving a liver transplant. The authors discover that their model is more precise than conventional statistical approaches, which could aid clinicians in making wiser judgments on patient care.

Narwaria et al. (2021): A systematic evaluation of machine learning in liver cancer surgery The application of machine learning algorithms in liver cancer surgery is examined in this research, which was published in the journal HPB. The results of surgical planning can be improved and guided by machine learning models, according to the authors.

Wang et al. (2020): Creating a machine learning model to predict hepatocellular carcinoma early recurrence following curative resection: The creation of a machine learning model for anticipating the early recurrence of HCC following curative resection is described in this article, which was published in the journal Scientific Reports. The authors discover that their model performs better than conventional prognostic models and could aid clinicians in identifying patients at high risk.

Lee et al. (2020): A systematic study and meta-analysis of machine learning techniques for the prediction of hepatocellular carcinoma recurrence following liver transplantation This article examines the application of machine learning algorithms for predicting the recurrence of hepatocellular carcinoma (HCC) following liver transplantation. It was published in the journal BMC Medical Informatics and Decision Making. The authors conclude that machine learning algorithms are useful for anticipating HCC recurrence and might enhance patient outcomes.

3. PROS AND CONS OF EXISTING RESEARCH PAPERS

Table 1: Pros and Cons of Existing Liver Disease Detection

Author	Year	Pros	Cons
Elias Dritsas et.al	2023	Early Detection	Generalizability, Implementation
Lee et al.	2022	Personalized treatment decisions	Generalizability, Interpretability
Ikeda et al.	2022	Personalized treatment decisions	ethical implications of the predictions.
Gao et al	2022	An improved patient care, Accurate predictions	Limited generalizability
Narwaria et al	2021	Improved surgical decision-making, Better outcomes	Limited practical implementation, Interpretability
Wang et al	2020	An improved patient care, Accurate predictions	Limited generalizability, Interpretability.
Lee et al	2020	Improved patient outcomes, Accurate predictions	Limited interpretability, Practical implementation.

4. COMPARISON OF EXISTING MACHINE LEARNING TECHNIQUE

Table 2: Comparison of plant leaf disease detection Algorithms

Algorithm	Accuracy	Specificity (%)	Sensitivity(%)
Decision Tree	high	95%	95.6%
ANN	high	83%	97.13%
SVM	Moderate	-	-
Bayesian Network	Moderate	87.6	67.4
Naïve Bayes	Low	88.3	71.4

5. DATA_DRIVENPATIENT-SPECIFIC CLASSIFICATION

There is a need for a more effective and accurate way to diagnose liver disease because current diagnostic techniques are invasive and expensive. The authors of this study put forth a very good hybrid approach for determining whether a patient has liver disease or is healthy. The combination of the two methods used by the Authors results in greater accuracy and scalability. A large patient dataset could increase power, and it's crucial to make the work complex to beat robustness. Scalability is the primary variable that determines the timing of the prediction in the research that is being proposed.

6. STEPS PERFORMED TO DETECT LIVER DISEASE AND CLASSIFICATION TREE

Understand the various methods and techniques that can be used to use machine learning to solve a variety of problems in the real world. The pre-processing process included feature selection and visualization. Check any patient records that are outliers and cap them as well. Second, the dataset has been divided into sections for training and testing. After pre-processing and splitting the data, a hybrid approach was used on the dataset. Accuracy was calculated, tested, received a prediction, and later verified the scalability.

7. CONCLUSION

We have examined various machine learning algorithms in this review. The hybrid approach ensures greater accuracy because the dataset has been properly pre-processed by filling in missing values, removing duplicate values, and capping outlier values. All the methods reviewed have advantages and disadvantages of their own. If there are more patient records available, the calculations will be more accurate and reliable (large dataset). determining that a hybrid approach is a better way to find liver disease.

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[12] Stage of liver disease collected from dreamstime.com.