RESEARCH PAPER

Risk Analysis of Liver Disease Based on High Cholesterol Food Intake and Alcohol Consumption Using Neural Network Models

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ABSTRACT

Backgrounds/Objectives: Liver disease is a growing global health problem, mainly caused by unhealthy dietary habits and excessive alcohol consumption. High intake of cholesterol-rich foods, such as fatty and processed items, can lead to liver dysfunction, meaning the liver does not function properly. When combined with regular alcohol intake, this significantly increases the risk of serious liver conditions. Early identification of individuals at risk is important for prevention and effective treatment. This study aims to analyze and predict liver disease risk based on high cholesterol food intake and alcohol consumption using Artificial Intelligence techniques.

Methods/Statistical Analysis: This study uses Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN) to classify and predict liver disease risk. The dataset is preprocessed using a median filtering method to remove noise and improve data quality. Important factors considered include cholesterol rich food intake, alcohol consumption frequency, and dietary habits (vegetarian and non-vegetarian). These models are trained to identify patterns and relationships between lifestyle factors and liver health.

Findings: The results show that individuals who frequently consume high-cholesterol foods along with regular alcohol intake have a higher risk of liver dysfunction and disease. The comparison of models indicates that CNN performs better than ANN in terms of accuracy and pattern recognition. The study also finds that reducing cholesterol intake and alcohol consumption can improve liver health and lower risk levels.

Keywords: Liver Disease; Hypercholesterolemia; Alcohol Consumption; Artificial Neural Networks; Convolutional Neural Networks; Risk Prediction

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1. Introduction

Liver disease represents a significant and growing global health burden, largely driven by lifestyle-related risk factors such as high cholesterol intake and excessive alcohol consumption. The liver is a vital organ responsible for metabolism, detoxification, and regulation of biochemical processes essential for human health. However, persistent exposure to unhealthy dietary habits and alcohol can impair liver function, leading to liver dysfunction and progressive diseases such as non-alcoholic fatty liver disease (NAFLD), alcoholic liver disease

(ALD), fibrosis, and cirrhosis (Asrani et al., 2019).

The increasing consumption of cholesterol-rich foods, including processed, fried, and high fat diets, has been strongly associated with fat accumulation in liver tissues. This condition, commonly referred to as NAFLD, is now one of the leading causes of chronic liver disease worldwide (Younossi et al., 2016). In parallel, chronic alcohol intake directly damages liver cells and accelerates inflammation and fibrosis. The combined effect of high cholesterol intake and alcohol consumption significantly increases the risk of severe liver complications, making early risk detection crucial for effective prevention and management (Rehm et al., 2013;).

Recent advancements in Artificial Intelligence (AI) and Machine Learning (ML) have provided innovative approaches for disease prediction and healthcare analytics. These techniques enable the analysis of complex and high-dimensional medical datasets to identify hidden patterns and risk factors. Artificial Neural Networks (ANN) are particularly effective in modeling nonlinear relationships among clinical variables, while Convolutional Neural Networks (CNN) offer superior capabilities in feature extraction and pattern recognition, leading to improved predictive performance (Goodfellow et al., 2016; Esteva et al., 2017).

In this study, ANN and CNN models are employed to analyze liver disease risk based on key lifestyle factors, including high cholesterol food intake and alcohol consumption patterns. Prior to model implementation, the dataset is preprocessed using a median filtering technique to remove noise and enhance data quality. Important variables such as dietary habits (vegetarian and non-vegetarian), cholesterol levels, and alcohol intake frequency are used to train and evaluate the predictive models.

The primary objective of this research is to develop an efficient and reliable predictive framework for early identification of individuals at high risk of liver disease. Additionally, the study compares the performance of ANN and CNN models in terms of accuracy, robustness, and predictive capability. By integrating machine learning techniques with healthcare data analysis, this research aims to support early diagnosis, improve clinical decision-making, and raise awareness about the impact of lifestyle choices on liver health.

2.Related Work

Liver disease has become a major global health problem, especially due to unhealthy lifestyle habits. One of the most common forms is non alcoholic fatty liver disease (NAFLD), which occurs when excess fat builds up in the liver. If not identified early, this condition can develop into serious diseases such as fibrosis, cirrhosis, and liver cancer. Research shows that NAFLD is closely linked to risk factors such as obesity, high cholesterol levels, and poor dietary habits (Younossi et al., 2016; Asrani et al., 2019).

Diet plays an important role in maintaining liver health. High consumption of cholesterol-rich foods, such as fried, fatty, and processed items, leads to fat accumulation in the liver and causes metabolic imbalance. This condition results in liver dysfunction, where the liver cannot perform its normal functions effectively. In addition, excessive alcohol consumption is a major cause of liver damage. Alcohol directly affects liver cells, leading to inflammation and long-term complications. Studies indicate that the combined effect of high cholesterol intake and regular alcohol consumption significantly increases the risk of liver disease (Rehm et al., 2013).

Traditional methods used to diagnose liver disease, such as liver biopsy and imaging techniques, are often invasive, expensive, and

not suitable for early detection in large populations. Therefore, there is a growing need for simple, accurate, and non-invasive methods to predict liver disease at an early stage. In this context, Artificial Intelligence (AI) and Machine Learning (ML) techniques have become important tools in healthcare. These methods can analyze large amounts of medical data and identify patterns that help in disease prediction (He et al., 2022).

Several machine learning algorithms have been used to predict liver disease. Techniques such as Support Vector Machine (SVM), Random Forest, and decision tree models have shown good performance in identifying risk factors and classifying disease conditions. These models can process complex datasets and provide accurate results, making them useful in medical diagnosis (Razmpour et al., 2023).

Deep learning models, especially Artificial Neural Networks (ANN), are highly effective in analyzing complex relationships between multiple factors. ANN models can process inputs such as cholesterol levels, alcohol consumption, and dietary habits to predict liver disease risk. In addition, Convolutional Neural Networks (CNN) are widely used for feature extraction and pattern recognition, which improves prediction accuracy. Research studies show that CNN models often perform better than traditional machine learning methods in complex classification tasks (Goodfellow et al., 2016; Ülger & Delik, 2023).

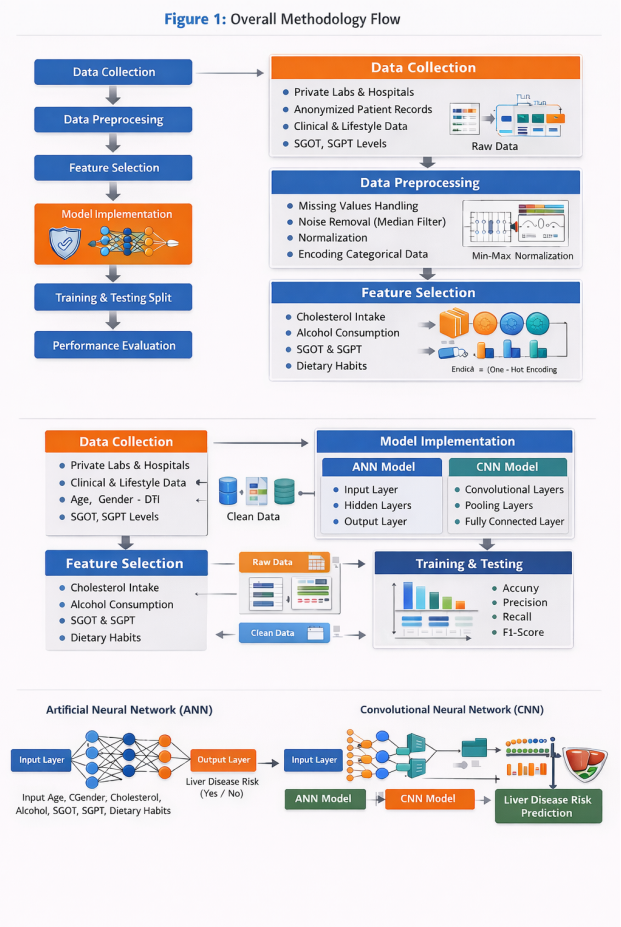
Although many studies have focused on clinical and laboratory data, fewer studies have considered the combined impact of lifestyle factors such as high cholesterol food intake and alcohol consumption. This creates a research gap in understanding how these factors together influence liver disease risk. Therefore, this study focuses on applying ANN and CNN models to analyze the combined effect of these lifestyle factors and to improve early prediction of liver disease. Organization of the article The remainder of this paper is organized as follows. **1** presents the Introduction and explains the background and objectives of the study. **2** provides the Literature Review of existing research. **4** describes the Methodology, including data preprocessing and the implementation of ANN and CNN models. **5** presents the Results and Discussion, focusing on model performance and risk analysis. **6** concludes the study with key findings and future research directions.

3. Materials and Methods.

This study proposes a systematic approach to predict liver disease risk based on high cholesterol intake and alcohol consumption using Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN). The methodology consists of several stages, including data collection, preprocessing, feature selection, model implementation, and performance evaluation. Initially, the dataset was collected from private diagnostic laboratory centers and private hospitals located in Tamil Nadu, India. The collected data includes anonymized patient records to ensure confidentiality and ethical compliance. The dataset contains both clinical and lifestyle-related attributes such as age, gender, cholesterol levels, alcohol consumption frequency, and dietary habits. In addition, important liver function indicators such as SGOT (Serum Glutamic-Oxaloacetic Transaminase) and SGPT (Serum Glutamic Pyruvic Transaminase) are included. These enzymes are key biomarkers, as elevated levels indicate liver cell damage and dysfunction. In the second stage, data preprocessing was performed to improve data quality and prepare the dataset for analysis. Missing values and inconsistent records were identified and handled

appropriately. A median filtering technique was applied to remove noise and outliers from the dataset, ensuring more reliable input for the models. Furthermore, normalization was carried out to scale all features into a uniform range, which helps improve model convergence. Categorical variables, such as dietary patterns, were converted into numerical values using encoding techniques. After preprocessing, feature selection was conducted to identify the most relevant variables influencing liver disease. Key features such as cholesterol intake, alcohol consumption, SGOT and SGPT levels, and dietary habits were selected, as they directly affect liver function and disease progression. This step reduces data complexity and enhances model performance. In The overall materials and methods adopted in this research are systematically illustrated in Figure 1

Figure 1: Overall Methodology Flow



In the model implementation stage, two machine learning models Artificial Neural Network (ANN) and Convolutional Neural Network (CNN) were developed. The ANN model consists of input, hidden, and output layers and is trained using a backpropagation algorithm. It is capable of capturing complex nonlinear relationships between input features and liver disease risk. The CNN model, although traditionally used for image processing, is adapted in this study to improve feature extraction and pattern recognition in structured data. It includes convolutional layers, pooling layers, and fully connected layers, which enhance classification accuracy. The dataset was then divided into training and testing sets to evaluate the effectiveness of the models. The training set was used to learn patterns, while the testing set was used to validate model performance on unseen data. Standard evaluation metrics, including accuracy, precision, recall, and F1 score, were used to compare the performance of ANN and CNN models. Overall, the proposed methodology provides a clear and efficient framework for analyzing liver disease risk. By combining preprocessing techniques with advanced neural network models, the study enables accurate prediction and supports early detection of liver related health issues.

5.Result and discussion

This section presents the performance evaluation of the proposed models and discusses the findings related to liver disease risk prediction based on high cholesterol intake and alcohol consumption. The Artificial Neural Network (ANN) and Convolutional Neural Network (CNN) models were trained and tested using the preprocessed dataset collected from private laboratories and hospitals in Tamil Nadu. The performance of both models was

evaluated using standard metrics such as accuracy, precision, recall, and F1-score. The results indicate that both ANN and CNN models are effective in predicting liver disease risk. However, the CNN model achieved higher accuracy compared to the ANN model due to its ability to extract deeper patterns and relationships among the input features. The improved feature extraction capability of CNN makes it more suitable for handling complex healthcare data.

Table 1: The show result of two algorithm comparision.

Model	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
ANN	88.5	87.2	86.9	87.0
CNN	92.3	91.5	90.8	91.1

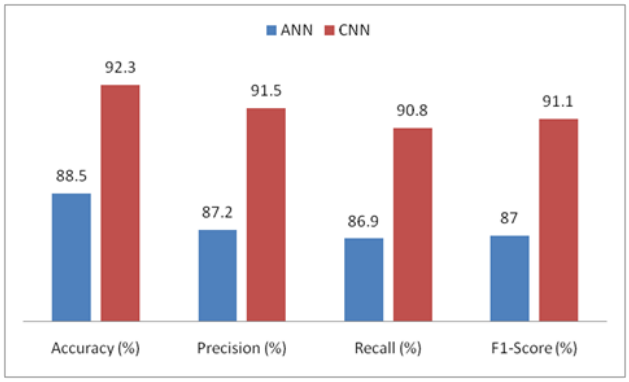


Figure 2: Show the result of two algorithm comparision;

From the results, it is observed that the CNN model outperforms the ANN model in all evaluation metrics. This demonstrates that CNN provides better classification performance and more reliable predictions for liver disease risk. The analysis of input features shows that cholesterol levels, alcohol consumption frequency, and liver enzyme values such as SGOT and SGPT play a significant role in predicting liver disease. Higher values of SGOT and SGPT were strongly associated with increased liver damage, confirming their importance as clinical indicators. In addition, individuals with high cholesterol intake combined with frequent alcohol consumption showed a significantly higher risk of liver dysfunction. The results also highlight the importance of lifestyle factors in liver health. Patients who followed balanced dietary habits and had lower alcohol consumption levels showed reduced risk scores, indicating the possibility of prevention and recovery through lifestyle modification. Overall, the findings demonstrate that the proposed AI based approach is effective for early detection of liver disease risk. The comparison between ANN and CNN models confirms that deep learning techniques, particularly CNN, can provide more accurate and reliable predictions. This approach can support healthcare professionals in decision-making and help in raising awareness about the impact of unhealthy dietary and alcohol consumption habits on liver health.

5. Conclusion

This study focused on predicting liver disease risk using Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN) based on important lifestyle factors such as high cholesterol intake and alcohol consumption. The dataset, collected from private laboratories and hospitals in Tamil Nadu, was carefully processed to improve its quality and ensure reliable analysis. The results show that both ANN and CNN models can effectively identify individuals at risk of liver disease. However, the CNN model performed better, as it was able to capture complex patterns in the data more accurately. Important factors such as cholesterol levels, alcohol consumption, and liver enzymes (SGOT and SGPT) were found to strongly influence liver health and disease risk. This study clearly shows that unhealthy food habits and frequent alcohol intake increase the chances of liver dysfunction. At the same time, adopting a balanced diet and reducing alcohol consumption can help lower the risk and improve overall liver health. In conclusion, the proposed method provides a useful and reliable

approach for early prediction of liver disease. It can support healthcare professionals in identifying high risk individuals and encourage people to make healthier lifestyle choices. Future research can improve this work by using larger datasets and advanced models to achieve even better prediction accuracy.

REFERENCES.

[1] Centers for Disease Control and Prevention. *Adult Obesity Facts*. Centers for Disease Control and Prevention, 2022.

[2] Asrani, S. K., Devarbhavi, H., Eaton, J., & Kamath, P. S. (2019). Burden of liver diseases in the world. Journal of Hepatology, 70(1), 151–171.

[3] Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. Nature, 542(7639), 115–118.

[4] Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.

[5] Rehm, J., Samokhvalov, A. V., & Shield, K. D. (2013). Global burden of alcoholic liver diseases. Journal of Hepatology, 59(1), 160–168.

[6] Asrani, S. K., Devarbhavi, H., Eaton, J., & Kamath, P. S. (2019). Burden of liver diseases in the world. Journal of Hepatology, 70(1), 151–171.

[7] Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.

[8] He, J., Baxter, S. L., Xu, J., Xu, J., Zhou, X., & Zhang, K. (2022). Artificial intelligence in medicine. Nature Medicine, 25(1), 30–36.

[9] Razmpour, F., Daryabeygi-Khotbehsara, R., Soleimani, D., et al. (2023). Machine learning for NAFLD prediction. Scientific Reports, 13, 4942.

[10] Rehm, J., Samokhvalov, A. V., & Shield, K. D. (2013). Alcoholic liver disease burden. Journal of Hepatology, 59(1), 160–168.

[11] Ülger, Y., & Delik, A. (2023). Deep learning in liver disease diagnosis. Nucleosides, Nucleotides and Nucleic Acids, 42(5), 398–406.

[12] Younossi, Z. M., Koenig, A. B., Abdelatif, D., Fazel, Y., Henry, L., & Wymer, M. (2016). Epidemiology of NAFLD. Hepatology, 64(1), 73–84.