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A Study on Fatty Liver Prediction and Its Current Research Direction

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Abstract
Liver helps with digestion, energy storage, and toxin removal. In recent years, liver disease has become one of the most common diseases with a high mortality rate. Both alcoholics and non-alcoholics are affected by liver disease, which is considered a public health problem. In the case of non-alcoholics, the main problem is the fatty liver disease, which is caused by the alcohol problem. Worldwide, Hepatitis B and Non-Alcoholic Fatty Liver Disease (NAFLD) are the most common and well-known liver diseases. Cirrhosis of the liver results from these disorders over time. It is extremely dangerous to have chronic liver disease without medical attention. It is essential for the physician to diagnose liver disease early in order to accurately predict the numerous liver disorders that exist. It is very difficult to detect liver disease at an early stage. It is because symptoms of the disease do not manifest until later stages of the illness. The paper discusses the current standard methods to assess hepatic steatosis including liver biopsies and CT/MR imaging techniques, which are expensive and/or have associated health risks, and also discusses future research directions in this field.
KEY WORDS: *NAFLD, Cirrhosis, CT/MR, Hepatitis B, Fatty Liver.*

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I. Introduction:

Among all the life-boosting functions, the liver performs a number of important functions. The liver is the second largest organ in the body and makes bile, a chemical that removes toxins from the body and aids digestion. As well as converting nutrients into energy, it also assembles proteins and iron for the body. Energy will be produced by nutrients. Blood clotting substances are produced by the liver. Infections can be fought by generating immune factors and removing bacteria and poisons from the blood. Furthermore, fatty liver disease (FLD) is known to have high mortality rates and morbidity rates. For the past ten years, biopsy has been the gold standard for assessing liver fat infiltration. Hepatocellular carcinoma and non-cholesteric cirrhosis are the terminal effects of FLD. Ultrasonography can provide a more accurate diagnosis of FLDs, but its accuracy is highly dependent on the operator.

Fatty liver disease is characterized by the following symptoms and indicators:

1. Abdominal pain and development of male breasts
2. An abdominal fluid buildup called ascites
3. Underskin blood vessel clusters
4. Urine that is dark
5. Simple bruises or bleeding
6. Itching skin

Symptoms may include loss of appetite, nausea, pale stool, edema (swelling) of the legs, fatigue, and yellowing of the skin and eyes.

Excessive weight gain, type 2 diabetes, insulin resistance, metabolic syndrome, high blood fat levels, particularly triglycerides, negative pharmacological side effects, specific infections, including hepatitis C, and unique inherited conditions can all contribute to fatty liver disease. The risk of developing fatty liver disease is increased by heavy drinking, exposure to certain toxins, genetics, obesity, obstructive sleep apnea, advanced age, PCOS, pregnancy, starvation, Wilson disease, hypobetalipoproteinemia, smoking, and medications such as

methotrexate (Trexall), tamoxifen (Nolvadex), and amiodarone (Pacerone). Data analysis is a technique that can be used to find patterns to predict a range of outcomes. This is called machine learning (ML). A machine learning model that identifies illnesses in real-time will greatly improve healthcare decisions.

Fig: 1 Fatty Liver Disease

Chronic liver diseases can cause liver scarring called cirrhosis. Affecting approximately 122 million people worldwide, non-alcoholic fatty liver disease (NAFLD) is the most common form. It affects 24% of the American population and 36% of those in the Middle East and South America. The causes of liver disease range from viruses to alcohol consumption to obesity. The cause of hepatitis B,C and A is viruses, while obesity is the cause of NAFLD. An obese or overweight individual, someone with type 2 diabetes or someone with metallic syndrome can be diagnosed with NAFLD, a disorder characterized by fat deposits in the liver. The pathologist will remove a small part of the liver and evaluate it for signs of disease in some individuals who need a liver biopsy. Imaging tests are also available for detecting this disease, such as ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI). Hepatitis B is an infectious disease caused by HBV (a hepatitis B virus). Many times, it is misdiagnosed, resulting in chronic hepatitis B and cancer of the liver. The hepatitis B virus spreads from mother to child after birth, through sexual activity, and through contact with infected blood and bodily fluids [2].

In order to evaluate the proposed approach, we used an image database of steatosis. As a result, this study suggests a color correction method that is statistically more trustworthy. This database contains several photographs with high accuracy. A cellular automata has previously been used to complete the labeling process for pixels in the Grow Cut. Photographs of any size can be segmented using this software, which is effective for both color and grayscale images. There are a few labels for each automata cell, such as 'object', 'background', and 'empty', in the binary segmentation example. Rather than having users enter seed tags, the grow cut algorithm produces seed tags automatically, reducing interaction time and improving segmentation accuracy. By automatically splitting steatosis images into healthy and unhealthy parts, the Grow Cut algorithm can segment images of steatosis[3].

There are more liver diseases than ever before because of sedentary lifestyles and a lack of physical activity. Urban areas, particularly metropolitan areas, have become more susceptible to liver disease, but rural areas are still able to control the intensity. To make a living, humans must be able to predict liver disease. Human life is automatically disrupted when the liver is injured since it is the largest internal organ. It is possible to diagnose fatty liver, cirrhosis, liver cancer, hepatitis, liver tumor, and other liver diseases in humans. Drinking alcohol, using drugs, eating pickles, and eating food is contributing to the rise in disease. There are millions of deaths caused by liver diseases every year. There are many diseases that can affect the liver. When alcohol is consumed for an extended period of time, it affects the liver's metabolism, resulting in negative effects. There can be problems associated with hemochromatosis, a liver disorder. Using genetic algorithms, significant features will be identified, and these features will be used to train different classification models like Naive Bayes, KNNs, Support Vector Machines (SVM), and Logistic Regression. The outcome will tell us if a person is at risk for liver disease, and if so, which disease it is. Can liver disease be classified as minor or major? If so, what precautions should be taken?

This initiative is expected to produce the following key outcomes:
1) Classification of liver diseases.
2) Specific symptom warnings
3) Lower liver-related fatalities
4) Increased medical detection of liver disease [4]

Around 18% of the 2 million liver diseases worldwide occur in India, which is a significant number. There are many practical limitations in India when it comes to timely diagnosis and detection of liver diseases. Statistics show that liver diseases are a major cause of death and an increasing burden on health care resources. Early detection and treatment of liver illnesses can prevent liver disease's lethality. Acute and chronic liver diseases are the two main types. It is possible to acquire acute hepatitis C from hepatitis C if it is not treated. Untreated acute hepatitis causes chronic liver problems. There are four types of chronic liver diseases: liver fibrosis, liver cirrhosis, hepatocellular carcinoma, and liver cancer. Over the last few years, artificial intelligence has become increasingly popular for identifying illnesses. A lack of learning enables the use of substantial medical data in a timely and accurate manner to assist in automating disease detection. It has been found that machine learning algorithms can be improved and validated with further research, which may have a big impact on the care of patients with liver diseases [5].

II. Literature Review:

S.No	Title	Year	Methods Used	Characteristics	Algorithms	Objective	Conclusion
1	Multiparametric ultrasound imaging for early detection of nonalcoholic fatty liver disease	2020	1. Preparation of animals 2. Image capture with mpUS 3. Analysis of histology 4. Measurement of performance	Developed a new mp US method that uses SWE parameters to measure liver viscoelasticity, CEUS to measure liver vascularity, and H-scan US to measure tissue microstructure	1.From the beamformed in-phase quadrature, tissue displacements were estimated using a 2D algorithm 2 . US scatterers were classified using the newer H-scan format	Introducing a surrogate biomarker comparable to liver biopsy using multiparametric ultrasound imaging (mpUS) for assessing NALFD	A detailed comparison between mpUS data classification accuracy and histological measurements.
2	Modification of ultrasound image reconstruction method for adversarial attacks on deep learning models for fatty liver disease classification	2020	1. Collection of data 2. Reconstruction of images 3. Neural networks 4. Attacks by adversaries	It is possible to mount adversarial attacks using modified US image reconstruction methods	1. In order to classify liver US images, we use transfer learning. 2. In order to find a perturbation in the space of image reconstruction parameters, we apply zeroth order optimization (ZOO)	Specifically targeted at ultrasound (US) imaging, we devise an adversarial attack. Radio-frequency signals are used to reconstruct US images.	A ZOO technique is used to study different machine learning models' robustness
3	Analysis of high frequency ultrasound data to identify advanced hepatic steatosis and fibrosis using machine learning algorithms	2021	1. Processing of Data 2. Schemas of annotation 3. Models of machine learning 4. Strategies for evaluating machine learning	Various Machine Learning algorithms can be used to detect liver fibrosis and liver steatosis noninvasively using one-dimensional ultrasound radio-frequency signals	Machine that boosts gradients	In order to diagnose liver disease non-invasively, transient elastography is often utilized. However, the associated equipment is complex and expensive.	A better performance would likely result from diversifying the database with more clinical data

4	Automated Detection of Liver Steatosis in Ultrasound Images Using Convolutional Neural Networks	**2021**	1.Hepatorenal Index (HI) 2. Gray-Level Co-occurrence Matrix method (GLCM) 3.Inception Resnet 4.Dataset Description	CNN-based approach for classifying hepatic steatosis type in B-mode ultrasound images i	Grey-Level Co-occurrence Matrix (GLCM) algorithm	A Convolutional Neural Network (CNN)-based strategy to classifying malignant and benign fatty livers from ultrasound images is presented in this research	we'll work on a better version of the residual networks and apply volterra filtering n images before training to improve medical image analysis even more
5	Ultrasound liver steatosis diagnosis using deep convolutional neural networks	**2021**	1.Data Set 2.Neural Network Based Feature	Transfer learning approach with Inception-ResNe v2 was used for feature extraction and a SVM algorithm was used for classification	1.SVM	find a non-invasive, cost-effective and wide available method for hepatic steatosis diagnosis that can replace the standard invasive procedure. The solution proposed is to use ultrasound images and deep convolutional neural networks.	we plan to implement the splitting for the dataset using a leave-one-out patient approach. In the current work, even if randomized is used for splitting, there might had been images from the same patient in the testing batch
6	A Substitution of Convolutional Layers by FFT Layers -A Low Computational Cost Version	**2021**	1.Role of Convolutional Layers in CNNs 2.Fast Fourier Transform 3.Dataset Description 4.Substituting CNN Layers with FFT Layers	we proposed a Fourier transform approach to optimize the convolution operations in the CNNs to save the image classification time.	Convolution	We present a CNN-based technique that replaces the convolution layers with Fast Fourier Transform (FFT) layers. Instead of using the kernel to convolution each pixel in a huge ultrasound image, which has a processing overhead of O(n2).T	Our results showed that Fourier layers is more feasible for the medical image classification to improve speed. For future work we will explore more on improving the performance of this model.
7	Classification of Liver Diseases in CT scan Images based on Support Vector Machine and Texture Analysis	**2021**	1.Image Acquisation 2.Pre Processing 3.Segmentation using Active Contour method 4.Feature	serves as the second opinion to physicians in disease diagnosis. In this study, we have developed a	Genetic	Aim of designing this system is classification of healthy and three	Texture analysis based on co-occurrence matrix is used to

			Extraction using Grey-Level Co-occurrence Matrix (GLCM) 5.Analysis of different liver Diseases 6.Classification using Support Vector Machine (SVM)	Computer aided diagnostics (CAD) system which extracts the liver from computed tomography images and detects the abnormality present in it		liver diseases: Hepatic Cyst, Hepatic Abscess and Hepatocellular Carcinoma. T	extract features and to train SVM classifier
8	A New Machine Learning Based Complementary Approach for Screening of NAFLD Hepatic Steatosis	**2021**	1.Data Extraction 2.Data Analysis 3.Model Training	ocuses on machine learning-based intelligent model development using liver functionality and physiological parameters for Hepatic Steatosis (Non-alcoholic Fatty Liver) screening	1.Linear 2.Quadratic 3.Gaussian	Investigate the association of HS (NAFL) with liver functionality and physiological parameters using a population dataset (NHANES)	Our current and future work involves developing and identifying advanced models for NAFLD screening. In parallel, we are testing the developed models on different population datasets
9	Early Detection of Liver Steatosis using Multiparametric Ultrasound Imaging	**2021**	1.Magnetic Resonance Elastography(MRE) 2.magnetic resonance 3.Animal Preparation 4.Multiparametric US Imaging 5.Histological Analysis 6.Performance MEasure imaging-derived proton density fat fraction (MRI-PDFF)	we confirm the repeatability of this previous study's findings, and obtain histology information at an earlier ime point of NAFLD progression to provide a gold standard measure of steatosis.		use of mpUS imaging for the detection of early liver steatosis.	This preclinical study further evaluated the use of in vivo mpUS measurements for the detection of NAFLD. When liver steatosis was the only dominate feature as confirmed by ex vivo analysis of liver tissue samples, RSS estimates using H-scan US imaging were the most sensitive to early changes
10	Image processing tool for detection of liver disease	**2021**	1.Materials	consists of the processing of microscopic images of the liver, in order to know the type of pathology that the user presents, at the time of	Image Processing Algorithm	image processing liver tool to obtain the result previously mentioned with a high accuracy of	This study describes, implements, and evaluates a method of pathology clasificatio n of the

				tissue exploration. 2.This paper presents a fast and efficient exploration method to determine the healthy state of the tissue, analyzing the processed image of the sample in digitized analysis.		the results obtained.	liver with the processing of a digital medical image.
11	Development of Bioimpedance based Measuring Systems for Diagnosis of Non-alcoholic Fatty Liver Disease	**2021**	1. Ultrasonography 2.Transient elastography (TE) 3. Computed tomography (CT) 4.Magnetic resonance (MR) 5.Liver biopsy	most important milestones in the development of instruments related to research.	Fourier Transform	due to the limitations of available diagnostic procedures and the current gold standard for diagnosis, the liver biopsy, there is a worldwide demand to develop a non-invasive diagnostic tool and procedure that can detect the disease with high accuracy at an early reversible stage, furthermore is cost-effective, user-friendly, and provides repeatable measurement	Our future development plans include minimalizing measurement time to as short as possible and implementing cloud-based data evaluation
12	A Transfer Learning Approach for the Automatic Detection of Fatty Liver from Ultrasound Images	**2021**	1.Hepatorenal Index 2.Grey level Co-occurrence Matrix	computer aided (CAD) system technique based on transfer learning in which DenseNet-201, a pre-trained neural network is used	CNN	fatty and normal liver classification is done using transfer learning on US images based on DenseNet201; the pre-trained network on ImageNet. This method achieved high performance and it was	The proposed approach will be tried on different datasets to show its robustness and to test its generalization ability.

						validated against other methods based on TL.	
13	A Deep Learning Approach for Classification and Prediction of Cirrhosis Liver Non Alcoholic Fatty Liver Disease NAFLD	**2022**	1.Pre Processing 2.Binary Classification 3.Stages Classification	A new deep learning approach for prediction and classification of cirrhosis liver based on the non alcoholic fatty liver disease. The proposed work consists of different features, deep neural network and Spearman's rank correlation.	1.nearest neighborhood 2. neural network, 3. SVM 4. ensemble learning algorithms	prediction and classification cirrhosis of cirrhosis using deep learning and getting the early warning when getting MRI images. And increase the prediction rates and accuracy.	By comparing multiple datasets and predicting results using real time data and reduce the time complexity.
14	Fatty Liver Diagnosis Using Deep Learning in Ultrasound Image	**2022**	1.Clinical Dataset 2. overall system architecture 3.semantic segmentation network 4.Texture features 5.Performance Evaluation	Asystem for diagnosing fatty liver in a automated method was developed to assist physicians in diagnosis by the method of objective texture analysis.	1.Automatic Algorithm 2.Back Propagation Algorithm	improve the problem of differences in the subjective diagnosis of fatty liver	improve the segmentation model and incorporate more data for verification and consider researching other color space or texuture processing methods.
15	Non-invasive Quantification of Steatosis A New Ultrasound based Model to Predict Fatty Liver Content	**2022**	1.Data acquisition and population 2.Data Processing 3.Multi-parametric model 4.Statistical Analyses	we developed and validated a multiparametric model that combines the US-parameters extracted to predict the liver fat content, using magnetic resonance spectroscopy (MRS) and MRI proton density fat fraction (MRI- PDFF) computed values as a ground truth.	US Based Image Processing Algorithm	To validate and standardize a quantitative US-based score able to predict the MRI-equivalent liver fat content.	It is inexpensive , easy to use and can be used with any US equipment as a tool for fatty liver disease screening and monitoring in patients.
16	An Efficient Liver Disease Prediction based on Deep Convolutional Neural Network using Biopsy Images	**2022**	1.Data Samples 2.CNN Architecture 3.Transfer Learning	The improved CNN model achieved a generalization ability of 96.8 percent on the enhanced picture database, while AlexNet emerged to be the most	1.Superpixel clustering Algorithm 2. Baum-welch algorithm.	to achieve a good generalization capabilities of four histological liver features	This represents an important advance that may contribute to medical assessment with in impartial

				efficient architecture with such a matching efficiency of 96.89 percent. All diagnosis efforts were done on the supplemented image dataset.			distinguishing of diseased components, such as hepatocyte ballooning as well as fat droplets, which are directly to blame for the NAFLD and NASH liver diseases.
17	Predictive analysis on severity of Non-Alcoholic Fatty Liver Disease NAFLD using Machine Learning Algorithms	**2022**	1.Proposed Methodology 2.Predictive Methods	we develop a model that predicts severity of the condition of patients (mild illness or severe illness) based on the NAFLD dataset	1.Predictive Analysis 2.SMOTE 3.SVM 4.Random Forest	Develop efficient Machine Learning (ML) models for the timely prognosis of FLD.	check the performance of the model and validate on a large dataset, and a convolutional neural network is also applied in future work
18	Liver Fat Assessment with Body Shape	**2022**	1.Ridge Regression 2.Deep Neural Network	we use body shapes to assess hepatic steatosis using both traditional linear regression models and a deep neural network	1.Linear Regression (LR) 2. Support Vector Regression (SVR) 3.Gaussian Process Regression (GPR) 4.Lasso Regression (LSR) 5.Ridge Regression (RR) 6. Full Connected Neural Network (FC)	evaluate body shape scan features to predict the degree of hepatic steatosis using both regression and classification approaches	we conclude that the body shape can potentially be an important feature for hepatic steatosis assessment.
19	Simultaneous Imaging of Ultrasonic Backscatter and Attenuation Coefficients for Liver Steatosis Detection in a Murine Animal Model	**2022**	1.Adapted continuous model 2.Optimization-based QUS parameters estimation 3.Liver steatosis assessment	An approach based on Quantitative ultrasound (QUS) and Support Vector Machines (SVM) to detect liver steatosis based on the estimation of backscatter (BSC) and attenuation coefficients (AC) in a murine animal model	1.Conjugate Gradient (CG) 2.SVM	While early diagnosis is the most effective course of action, NAFLD diagnosis procedures are still limited since they are invasive and have a heavy component of subjective.	The results achieved by our proposed method suggest that it is able to perform an accurate detection, and could potentially lead to a tool for diagnosis of NAFLD and analysis of liver damage progression
20	Prediction of Early Stage of Fatty Liver Disease in Patients using Logistic Regression and Naive Bayes Algorithm	**2022**	1.Naive Bayes 2.Logistic Regression 3.Accuracy 4.Precision	The proposed concentrate on point is to recognize liver infection by	1.Naive Bayes 2.Logistic Regression	To evaluate the accuracy in predicting fatty liver	it is reasoned that inside the restrictions

			5.Senstivity 6.Specificity	utilizing AI approaches to find the best precision of every calculation by utilizing different liver sickness datasets		disease at an earlier stage in patients by using the Novel Logistic Regression (LR) algorithm and Naive Bayes (NB) algorithm	of the examinatio n, the outcomes address that the Novel Logistic Regression calculation gives better exactness and accuracy rates in anticipating greasy liver infection at a beginning phase contrasted with Naive Bayes calculation.
21	Intelligent MRI Liver Images based Cirrhosis Disease Identification using Modified Learning Principle	**2022**	1.Normal 2.Steatosis 3.Steatohepatitis 4.Cirrhosis	considers the problem of Non-Alcoholic Fatty Liver Disease (NAFLD) prediction using machine learning methodology. The propose methodology of LBDPL	1.LEARNING BASED DISEASE PREDICTION LOGIC 2.Logistic Regression (LR) Classifier 3.Support Vector Machine (SVM) 4. k-Nearest Neighbor algorithm (kNN)	make predictions about liver illness using an intelligent learning technique called Learning based Disease Prediction Logic (LBDPL)	In future the proposed algorithm is enhanced by means of adding some deep learning principles such as Convolutio nal Neural Network and so on to improve the timing efficiency as well as the deep learning principles eliminate the complex nature of convention al algorithms in nature
22	A Hybrid Approach for Prediction and Stage Wise Classification of Liver Failure	**2022**	1.Ensemble Learning 2.Conventional Neural Network (CNN) 3.Brief Neural Network (BNN)	Deep learning based techniques for prediction and classification using fatty liver	1.SVM	predict and stage wise classify of liver failure	In future, different real features and initial other symptoms of liver failure also considered for future work.
23	Diagnosis of Liver Disease Induced by Hepatitis Virus Using Machine Learning Methods	**2022**	1.Dataset 2.PreProcessing 3.Logistic Regression Model 4.Accuracy	we have analyzed the outcomes of various device studying algorithms which are trained	1.Decision Tree Algorithm 2.Random Forest 3. K – Nearest Neighbor Classifier 4.Support Vector Machine	Examine the accuracies of several Machine Learning algorithms such as	The Support Vector Machine model achieves 91.48%

				at the dataset from the UCI Repository to execute binary-elegance categorization of medical information		Linear Regression, Decision Tree, Random Forest, KNN, and SVM	accuracy while ingesting the least amount of processing complexity
24	Liver Disease Prediction using Semi Supervised based Machine Learning Algorithm	**2022**	1.Conventional Method	Employs hybrid SVM and K-Means algorithm-based model to examine the entire patients' liver disease.	1.Hybrid SVM 2.K-Means	Increase the accuracy of liver disease prediction and lower the cost of diagnosis in the medical field	Dedicated to extend the proposed model to handle big data.
25	Effective Machine Learning Techniques to Detect Fatty Liver Disease	**2023**	1.Navie Bayes 2.Support Vector Machine 3.Hybrid of ANN 4. XGBoost	The methods of Naïve Bayes (NB), Support Vector Machine (SVM) and Hybrid of ANN with eXtreme Gradient Boosting (XGBoost) are applied to the dataset to find accuracy, sensitivity,specificity, duration and AUROC.	1.Navie Bayes 2.Random Forest 3. XGBoost	To identify fatty liver disease with specificity, accuracy, and dependability, methods of Naive Bayes (NB), Random Forest (RF), and eXtreme Gradient Boosting with ANN .	Implementing a hybrid ANN,XGBoost approach in the clinical setting could assist doctors in classifying individuals with monitoring, early treatment, and care for fatty liver.
26	Identification and Prediction of Hepatitis B and NAFLD using Machine Learning	**2023**	1.Machine Learning 2.Classification Techniques such as Navie Bayes,Random Forest,Artificial Neural Network,Logistic Regression 3.Linear Regression 4.Decision Tree classifier 5.Gaussian Classifier 6. SVM 7.CNN	The proposed method efficiently identifies or predicts Hepatitis B and NAFLD using the findings of this study, namely the application of machine learning and deep learning neural networks	1.C4.5 2.ID3 3.CART	Create several machine learning and deep learning models for assessing two prominent and well-known liver illnesses, NALFD and Hepatitis B infections	1.Hepatitis B and NAFLD in a more efficient and traditional manner 2. The outcomes of this study will help patients and hospitals to diagnose Hepatitis B by blood tests and NAFLD using ultrasound scanned pictures of the sick liver
27	Detection of Steatosis Disease using Region Based Segmentation of Growcut Algorithm and Comparing with Region Growing Algorithm to Enhance the Accuracy	**2023**	Steatosis Disease Images 1.Image Acquisation 2.PreProcessing 3.Statiscal Analysis	The use of digital image processing to segment the conflict of understanding all distinct parameters is analyzed and formulated.	1.Growcut Algorithm 2.Region Growing Algorithm	Two groups were used in this study; one group referred to the growcut algorithm and the other group to the	growcut algorithm is an effective method for precisely locating and segmenting steatosis disease in

						Region Growing Algorithm	liver pictures.
28	Prediction and Detection of Liver Diseases using Machine Learning	**2023**	Data Mining Tools	1.liver disease classification. 2. Precautions for particular symptoms 3. Reduction in liver disease-related deaths 4. More accurate medical diagnosis of liver disease	1.Support Vector Machine 2.Logistic Regression 3.Naive Bayes 4.K-Nearest Neighbor	Use a classification approach to distinguish between liver disease and healthy individuals, if diseased then further classified into the level of disease and its type	Using a hybrid classifier as a machine learning model, the proposed system to diagnose liver disease that will increase prediction and help users in identify the disease and prescribe further treatment and examinations with more consciousness
29	Multiclass Classification of Liver Diseases using Optimized Machine Learning Classifiers	**2023**	1.Data Acquisation 2.Data PreProcessing 3.Feature Selection 4.Training ML Models 5.Evaluation Parameters	The hepatitis C dataset was utilized to test various machine learning models for prediction of multi class classification of liver diseases	1.Minimum Redundancy Algorithm 2.Maximum Relevance Algorithm	various machine learning algorithms were compared for multiclass classification of liver disease. The proposed research uses the Hepatitis C dataset from the UCI repository for multiclass classification of liver diseases 2.The Synthetic Minority Oversampling Method (SMOTE) was implemented to combat class inequalities Minority Oversampling Method (SMOTE) was implemented to	Future applications of this model could involve larger, real-time datasets and more features, significantly enhancing performance.

						combat class inequalities.	

III. Methodology:

The following algorithms were used to carry out the work

1. Support Vector Machines (SVMs)

In machine learning, support vector machines (SVMs) or support vector networks evaluate data for regression and classification using associated learning algorithms.

2. LR (Logistic Regression)

The categorical dependent variable is predicted using a set of independent factors. Logistic regression predicts the output for a categorical dependent variable. A discrete or categorical value must be obtained as a result. The value can be Yes or No, true or false, etc., but rather than providing an exact value between 0 and 1, it provides probabilistic values in the range of 0 to 1. A Yes or No answer will be presented as the result of the logistic regression.

3. NB (Naive Bayes)

The Bayes' theorem and naive independence assumptions between factors underlie the naive Bayes classifier family of straight forward statistical "probabilistic classifiers" (see Bayes classifier). These Bayesian network models, which fall into the probabilistic class, are among the simplest, but when coupled with kernel density estimation, they are able to achieve excellent performance.

4. KNN (K-Nearest Neighbor)

With k-NN, all computation is delayed until after the function has been evaluated, and the function is only approximated locally. When different physical units or wildly different sizes are represented in the training data, normalizing them can enhance the accuracy of this distance-based classification technique. By normalizing the training data, which relies on distance for classification, this technique can improve its accuracy significantly if the features represent several physical units or differ dramatically in scale.

IV. Discussions:

The following models were used for research:

1. The acquisition of images

A diagnosis of steatosis requires the acquisition of images. Among the imaging techniques used to diagnose steatosis disease (PET) are ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography. Due to its low cost, non-invasive nature, and security, ultrasound imaging is the most commonly used imaging modality. By using ultrasound imaging, liver fat, fibrosis, and inflammatory indicators can be measured. CT scans provide more accurate details of the liver than ultrasonography when it comes to identifying steatosis. With the help of MRI imaging, you can obtain even more accurate images of the liver, which is commonly used to monitor liver fat changes throughout the lifespan. Using PET imaging, it is possible to detect steatosis, fibrosis, and inflammation. Moreover, GrowCut uses user-defined seed points to find the areas of interest in a picture using an interactive segmentation technique. By pinpointing the regions of the image that are characteristic of steatosis disease, this method can be used to detect the disease with greater accuracy. In order to provide more precise diagnosis and therapy, region-based segmentation can provide greater detail about the illness. As a result of GrowCut, a patient can also find parts of the image that may indicate further illnesses or ailments, helping to complete their diagnosis.

2. The pre-processing step

Using this module, you can convert an RGB image into a grayscale image. It is difficult to distinguish distinct plants by their leaves as the color features do not remain consistent and the environment keeps shifting. Before pre-processing, the resulting RGB-format leaf image will be converted to grayscale to identify distinct plants by their leaves. RGB pixels can be converted into grayscale values using equation .Gray = 0.2989 K + 0.5870 L + 0.1140 * M, where R, G, and B, respectively, represent the color of the pixel. Once the photos have been cleaned up with filters, they can be rendered in grayscale. Using the filter, it is necessary to remove the noise that has deformed the image. Statistics are used to support the analysis. Filters are modeled according to their usual frequency response. In image processing, filtering is a nonlinear approach that is commonly used to remove "salt and pepper" noise. In situations where edge preservation and noise reduction are top priorities, median filters are preferable to convolutional filters.

3. Analysis of statistical data

The analysis was conducted using IBM SPSS version 21. Iterations were conducted with a maximum of 20 samples for both proposed and existing algorithms, and for each iteration, the projected accuracy was recorded. The findings of the iterations were analyzed using an independent sample T-test.

The following tools:

Liver abnormalities can be detected using these tools

1. The UltraSound system
2. The US Doppler
3. The use of contrast-enhanced ultrasonography
4. Infrared elastography

Dataset:

Data on individuals who take drugs and their reasons for taking drugs is included in this dataset.(https://www.kaggle.com/datasets/fedesoriano/cirrhosis-prediction-ataset?resource=download)

V. Conclusion:

A major focus of the paper was to identify liver diseases using a variety of technologies that have been developed in the current research direction. During the course of this paper, we conducted a study on the different types of Support Vector Machines (SVM), Logistic Regressions (LR), Nave Bayes (NB), and K-Nearest Neighbor (KNN) that can be used by the researcher.

References:

[1]. H. M. T Thomas et al., "Hybrid positron emission tomography segmentation of heterogeneous lung tumors using 3D Slicer: improved growcut algorithm with threshold initialization," J Med Imaging (Bellingham), vol. 4, no. 1, p. 011009, Jan. 2017.

[2]. E. Kostopoulou et al., "A custom grow-cut based scheme for 2D-gel image segmentation," Conf. Proc. IEEE Eng. Med. Biol. Soc., vol. 2015, pp. 2407–2410, 2015.

[3]. L. R. Hellwig, "Interactive Growcut Multi-Label N-D Segmentation Based Algorithm for SCLERA Segmentation," International Journal for Research in Applied Science and Engineering Technology, vol. 6, no. 4. pp. 4916–4932, 2018. doi: 10.22214/ijraset.2018.4804.

[4]. S. Katsigiannis et al., "Grow-cut based automatic cDNA microarray image segmentation," IEEE Trans. Nanobioscience, vol. 14, no. 1, pp. 138–145, Jan. 2015.

[5]. Y. Nakashima, "Introduction to GrowCut, an Image Segmentation Algorithm Applied to Liquefaction Images," Journal of Geography (Chigaku Zasshi), vol. 126, no. 6. pp. 785–794, 2017. doi: 10.5026/jgeography.126.785.

[6]. F. R.et al, "An adaptive semi-supervised Fuzzy growcut algorithm to segment masses of regions of interest of mammographic images," Applied Soft Computing, vol. 46. pp. 613–628, 2016. doi: 10.1016/j.asoc.2015.11.040.

[7]. G.-Y. Dai et al., "Segmentation of kidneys from computed tomography using 3D fast growcut algorithm," 2013 IEEE International Conference on Image Processing. 2013. doi: 10.1109/icip.2013.6738236.

[8]. T. Ryba et al., "An automatic liver segmentation algorithm based on grow cut and level sets," Pattern Recognition and Image Analysis, vol. 23, no. 4. pp. 502–507, 2013. doi: 10.1134/s1054661813040147.

[9]. National Research Council, Computer Science and Telecommunications Board, and Committee on Virtual Reality Research and Development, Virtual Reality: Scientific and Technological Challenges. National Academies Press, 1995.

[10]. D. Ueno et al., "Automated GrowCut with Multilevel Seed Strength Value for Building Image," Transactions of the Institute of Systems, Control and Information Engineers, vol. 29, no. 6. pp. 266–274, 2016. doi: 10.5687/iscie.29.266.

[11]. C. Ji, J. Yu et al., "Brain tumor segmentation in MR slices using improved growcut algorithm," SPIE Proceedings. 2015. doi: 10.1117/12.2228230.

[12]. J. R. Parker, Algorithms for Image Processing and Computer Vision. John Wiley & Sons, 2010.

[13]. M. Sonka et al., Image Processing, Analysis and Machine Vision. Springer, 2014.

[14]. K.-L. Du et al., Neural Networks and Statistical Learning. Springer Nature, 2019.

[15]. J. Brownlee, Deep Learning for Time Series Forecasting: Predict the Future with MLPs, CNNs and LSTMs in Python. Machine Learning Mastery, 2018.

[16]. H. Jiang et al., "Liver segmentation based on Snakes Model and improved growcut algorithm in abdominal CT image," Comput. Math. Methods Med., vol. 2013, p. 958398, Aug. 2013.

[17]. M. Kamal et al., "Machine Learning and Image Processing Enabled Evolutionary Framework for Brain MRI Analysis for Alzheimer's Disease Detection," Comput. Intell. Neurosci., vol. 2022, p. 5261942, Mar. 2022.

[18]. V. Mousavi et al., "A Two-Step Descriptor-Based Keypoint Filtering Algorithm for Robust Image Matching," IEEE Transactions on Geoscience and Remote Sensing, vol. 60. pp. 1–21, 2022. doi: 10.1109/tgrs.2022.3188931.

[19]. R. T et al., "Hyperspectral Image Classification Model Using Squeeze and Excitation Network with Deep Learning," Comput. Intell. Neurosci., vol. 2022, p. 9430779, Aug. 2022.

[20]. B. T. Geetha et al., "Pigeon Inspired Optimization withEncryption Based Secure Medical Image Management System," Comput. Intell. Neurosci., vol. 2022, p. 2243827, Aug. 2022.

[21]. Y. Alqahtani et al., "Breast Cancer Pathological Image Classification Based on the Multiscale CNN Squeeze Model," Comput. Intell. Neurosci., vol. 2022, p. 7075408, Aug. 2022.

[22]. M. Saravanan et al., "Intelligent Satin Bowerbird Optimizer Based Compression Technique for Remote Sensing Images," Computers, Materials & Continua, vol. 72, no. 2. pp. 2683– 2696, 2022. doi: 10.32604/cmc.2022.025642.

[23]. P. Vasanthkumar et al., "Improved wild horse optimizer with deep learning enabled battery management system for internet of things based hybrid electric vehicles," Sustainable Energy Technologies and Assessments, vol. 52. p. 102281, 2022. doi: 10.1016/j.seta.2022.102281.