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# Identification of Liver Fibrosis using Machine Learning Techniques and Image Inference

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**ABSTRACT:** Liver fibrosis is the scarring of the liver and is considered as one of the harmful chronic liver diseases. Liver fibrosis is mainly caused by different chronic Hepatitis infection and alcohol abuse. In the current scenario, the detection and diagnosis of liver fibrosis is mainly liver biopsy, using these methods most of the times doctors get less accurate results and cannot identify the severity of the disease. This problem can be overcome by using machine learning techniques like SVM, RFC, k-NN and ANFIS algorithms where the system can generate more accurate results along with severity and specificity. This results in time saving, cost efficient and better diagnosis.

**KEYWORDS:** Liver fibrosis, chronic Hepatitis infection, liver biopsy, machine learning techniques.

## I. INTRODUCTION

Liver fibrosis, a progressive condition characterized by the accumulation of scar tissue in the liver, is a common consequence of chronic liver diseases such as hepatitis, alcoholism, and non-alcoholic fatty liver disease (NAFLD). Timely identification and staging of liver fibrosis are crucial for effective disease management and intervention strategies. Traditional diagnostic methods for liver fibrosis, such as liver biopsies, are invasive, costly, and prone to sampling errors. In recent years, advancements in machine learning and medical imaging have paved the way for the development of non-invasive and automated techniques to detect and assess liver fibrosis. Machine learning techniques have demonstrated promising results in various medical applications, including image analysis and disease diagnosis. Leveraging these techniques for the identification of liver fibrosis holds immense potential for improving patient care and outcomes.

Image inference, a subset of machine learning, involves the analysis and interpretation of medical images, such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) scans. These images provide valuable visual information about the liver's structure and can reveal fibrotic changes within the organ.



The objective of this research is to explore the application of machine learning techniques, specifically image inference, in the identification of liver fibrosis. By leveraging annotated medical images from a diverse range of patients, we aim to develop a robust and reliable algorithm capable of accurately assessing the severity of liver fibrosis. The proposed approach has the potential to overcome the limitations associated with invasive procedures, reduce costs, and provide timely and accurate diagnoses.

This study will utilize a comprehensive dataset of liver images, including ultrasound, CT, and MRI scans, along with corresponding clinical data. The trained models will then be tested on an independent dataset to evaluate their performance and compare them with existing diagnostic methods.

Paper is organized as follows. Section II describes some of the studies related to use of machine learning techniques and image inference for the identification and assessment of liver fibrosis. The identified techniques are then explained in the Section III. Implementation and experimental results are presented in Section IV. Finally, Section V presents a conclusion.

## II. RELATED WORK

Several studies have explored the use of machine learning techniques and image inference for the identification and assessment of liver fibrosis. [1] Zhu et al. (2019) developed a deep learning-based method for the automatic staging of liver fibrosis using ultrasound images. The study demonstrated the potential of deep learning algorithms in non-invasively assessing liver fibrosis using widely available ultrasound scans. [2] Yip et al. (2020) utilized a combination of machine learning algorithms and radiomics features extracted from CT images to predict liver fibrosis severity. Their study showed promising results, indicating that the integration of radiomics-based features with machine learning techniques can improve the accuracy of liver fibrosis diagnosis and staging. [3] Wei et al. (2021) proposed a multi-modal deep learning framework for the classification of liver fibrosis using MRI and clinical data. Their approach combined deep convolutional and recurrent neural networks to extract features from both image and textual data. [4] Jiang et al. (2022) also used deep learning-based methods for liver fibrosis staging with both ultrasound and serum biochemistry data. The results indicated that the integration of multiple data sources can improve the accuracy of liver fibrosis staging.

These studies collectively showcase the potential of machine learning techniques along with image inference, for the identification and staging of liver fibrosis. The integration of diverse imaging modalities, such as ultrasound, CT, and MRI, along with clinical data, has shown promising results in improving diagnostic accuracy and non-invasively assessing liver fibrosis severity.

The work in this paper is divided into two stages. 1) Text-Detection 2) Inpainting. Text detection is done by applying morphological open-close and close-open filters and combines the images. Thereafter, gradient is applied to detect the edges followed by thresholding and morphological dilation, erosion operation. Then, connected component labelling is performed to label each object separately. Finally, the set of selection criteria is applied to filter out non-text regions. After text detection, text inpainting is accomplished by using exemplar-based inpainting algorithm.

## III. METHODOLOGY

Obtain a comprehensive dataset of liver images, including ultrasound, CT, and MRI scans, along with corresponding clinical data. Standardize and normalize the imaging data to ensure consistency across different modalities. Utilize image inference techniques to extract relevant features from the liver images. This involves applying ANFIS and Canny edge detection architectures to capture discriminative features specific to liver fibrosis. Along with this integration of relevant clinical data, such as laboratory values, can enhance the performance of the machine learning models. The non-invasive assessment system using machine learning includes physical layer, communications, and machine learning application layer. Physical layer collects data of serum markers. Four machine learning classification methods, including Decision Tree Classifier (DTC), Random Forest Classifier (RFC), Logistic Regression Classifier (LRC), and Support Vector Classifier (SVC) were used to assess the severity of Fibrosis. Selected texture features were classified using two methods: support vector machines (SVM) and k-nearest neighbors (k-NN).



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IV. EXPERIMENTAL RESULTS

Figures shows the results of identification of liver fibrosis by using the algorithms. Fig 1 (a) shows the signup page for the laboratory. (b) shows the sign in page for the laboratory. (c) shows the random forest algorithm graph. (d) shows the random forest graph in which x-axis is age and y-axis is selected as Alkaline Phosphate. (e) shows the output graph..

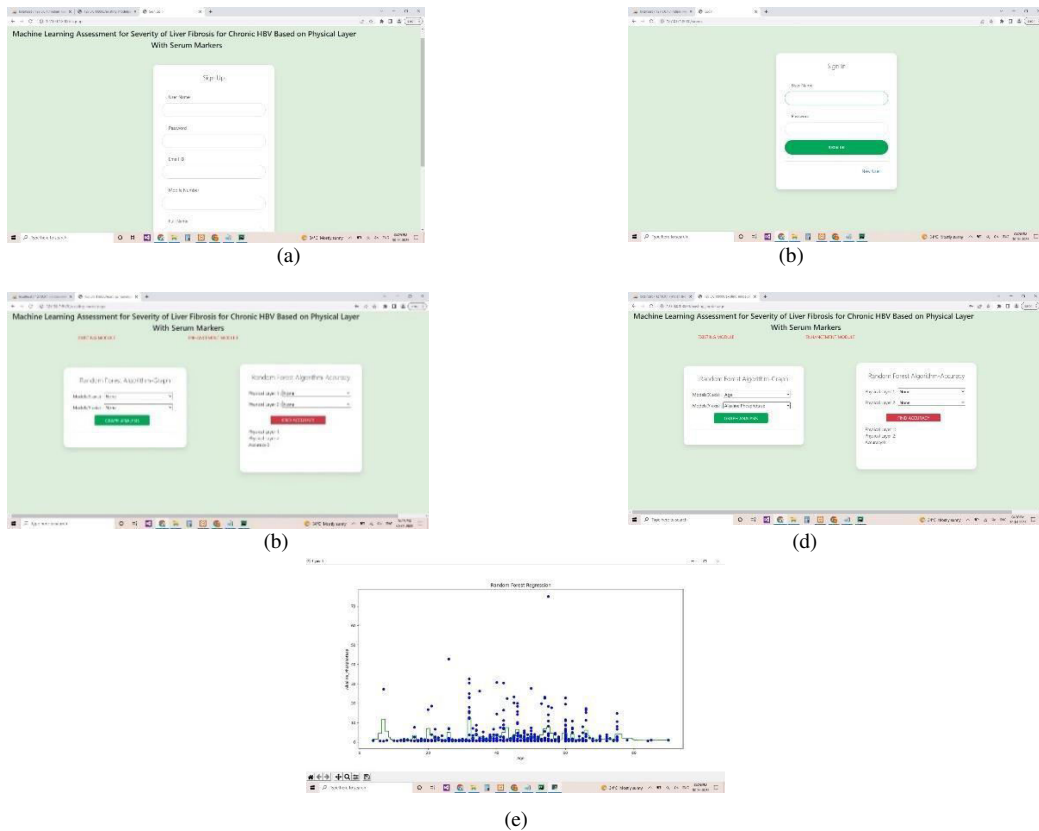
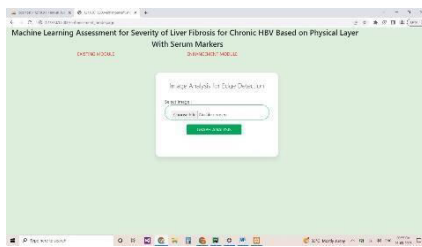


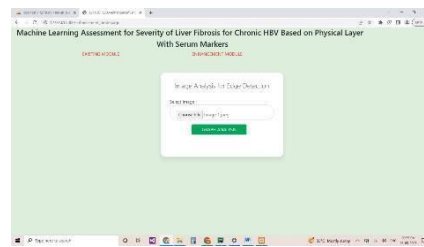
Fig. 2 (a) this shows the page displaying the random forest algorithm accuracy.(b) shows the page displaying the accuracy in which physical layer 1 is selected as Alamine\_Aminotransferase and physical layer 2 is selected as Alamine\_Aminotransferase.



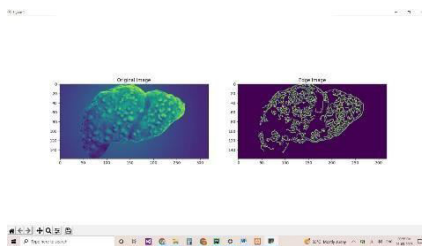
Fig 3(a) shows the main page of enhancement model. (b) shows the image selected. (c) shows the comparison of original image and edge image. (d) shows the dialog box displaying whether the disease is present or not. (e) shows the percentage of severity of disease in the terminal.



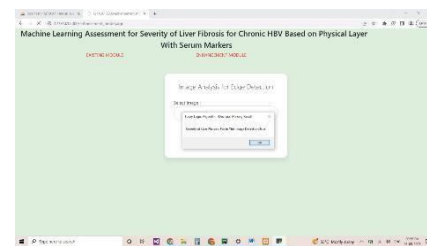
(a)



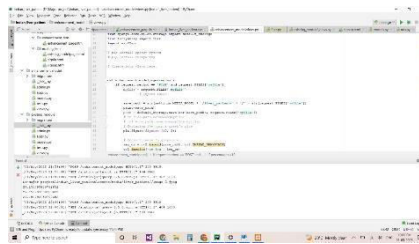
(b)



(c)



(d)



(e)

## V. CONCLUSION

We developed a computer-assisted system to assess severity for liver Fibrosis of chronic HBV. When compared to existing models and other machine learning algorithms, RFC with the 9 indicators has the potential to improve the accuracy in assessing severity for liver Fibrosis. It is noted that the quality of training samples is of crucial importance to the establishment of a classifier. Moreover, future studies, based on a large data-set including serum maker and image information in the physical-layer, are required to improve the diagnostic accuracy and to facilitate its clinical application.

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