LIVER DISEASE PREDICTION USING ANFIS (ADAPTIVE NEURO FUZZY INFERENCE SYSTEM) METHOD

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Abstract: Non-invasive assessment of liver disease is major role for understanding to make acure of liver disease stages. We aimed to develop the computer-aided assessment with the help of physical-layer using serum markers, to determine the attributes for identification of liver disease stages. The liver disease dataset contains 416 patients suffering from liver disease and 167 non liver disease patients records collected from Indian liver disease dataset. In Dataset the column is separated into two groups i.e. liver disease and non-liver disease patients with 441 male and 142 female patient records. To avoid the drawbacks of liver biopsy non-invasive method using Machine Learning Techniques was developed recently. In this paper image information is also included in the dataset. For image information, the new algorithm was used i.e. ANFIS (Adaptive Neuro Fuzzy Inference System). In this, concept, an approach has been taken to predict liver grades and what affects its severity. The evaluation of relation between blood test features and visual analysis based on ultra sound images. The result will be displayed in the form of edge detection and it also shows the result whether the patient is suffering from liver disease or not.

Index terms: ANFIS Model, Serum Markers, Ultra sound images, Physical layer.

Introduction: Liver disease is one of the most deadly disease. Liver is the second largest organ of human body. The liver is in reddish color and it is located in gallbladder. The main functionality of liver is to remove the harmful toxics from the blood. If we can’t detect in early stage means it may leads to three types of hepatitis that is A, B and C. The main reason of the liver disease is occurred because excessive alcohol drinking, drugs, pickles etc. If the liver disease in the last stage means we can’t recover it may leads to death. There is only one of the solution is liver transplantation. To overcome this type of situation detection of liver disease in early stage is helpful to recover the patient from liver disease. There are totally four stages of liver diseases i.e. Healthy liver, Fatty liver, Liver Fibrosis, and Cirrhosis.
To avoid such consequences proper treatment is needed for the liver disease. At the stage of the liver fibrosis the functionality of liver stops working and the results will be displayed like no fibrosis, middle stage of fibrosis, last stage of fibrosis may leads to cirrhosis. Some of the symptoms of chronic liver disease is digestion problem, internal bleeding, abdominal pain, dry mouth, yellowish skin color. To avoid such things visiting doctor regularly, regular exercise, maintaining weight must and should to avoid the liver disease conditions. As per the medical existing system liver disease detection is very helpful to the society. Researchers are mainly concentrating alternative of liver biopsy is non-invasive method for the detection of liver disease. Some of the alternatives of liver biopsy is serum markers, Imaging techniques has been that can detect the liver condition.

By using machine learning algorithms is very helpful to identify accuracy and prediction of liver disease. For this machine learning model we need patients serum markers it is not expensive than biopsy moreover for this paper imaging techniques also needed for the prediction of liver disease. In this paper new methodology is the ANFIS(Adaptive Neuro Fuzzy Inference System) model is introduced. For this model image information is also included in the dataset. In previous methodologies four algorithms are used for the comparisons. Now we have to use image information for new algorithm ANFIS model. By using this model it predicts the liver grades and what effects it severity. The evaluation of relationship between blood test features and visual analysis based on ultrasound images done by using Indian liver disease Patient records. First the dataset is used to extract set of rules for predicting the result into clusters of being patient or not. Then the model is extracted into four clusters based on the liver grades. The collected data finds the liver grades just by acquiring the blood test features and ultrasound images. Therefore the liver specialists can gain the information in early stages. This is best diagnosis for liver disease patients.

Materials: In this paper dataset contains 416 patient suffer with liver disease and 167 patients suffer with non-liver disease collected from Andhra Pradesh (India). In this dataset the column is divided into two parts that is patient suffer with liver and non-liver disease. There are 441 male and 142 female patient records. If any patient exceed above 89 means it is listed as 90 age group.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Stages of the liver Disease</th>
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<tbody>
<tr>
<td>Stages</td>
<td>Name of the Liver Stages</td>
</tr>
<tr>
<td>Stage 1</td>
<td>Healthy Liver</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Fatty Liver</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Liver Fibrosis</td>
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<tr>
<td>Stage 4</td>
<td>Cirrhosis</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Attributes of the Liver Disease Dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Attributes</td>
</tr>
<tr>
<td>1</td>
<td>Age</td>
</tr>
</tbody>
</table>

The outcome of this dataset contains Total Billirubin, Direct Billirubin, Alkaline phosphatase are the chemical compounds used to test the patients whether they are used for the treatment or not.
By using these patient records we can find whether the patient is suffering from liver disease or not.

**Stages of Methodology:**

Data Collection

Data Cleaning

Feature Selection

Prediction of Machine Learning and ANFIS (Adaptive Neuro Fuzzy Inference System)

**Data Collection:** The patient data is collected from North East, India, Andhra Pradesh which is related to Indian liver patient records. By using this dataset we can predict and evaluate the algorithms for the purpose of reducing the burden on doctors. In this dataset it contains 417 patients related to liver disease and 168 for who are not suffering for the liver disease. In this dataset the patients age between 11 to 75 suffering from initial stage to final stage. The dataset is divided into two columns that is 1(suffering with liver disease) and 0(not suffering with liver disease). For this project it also needed the image dataset by using that images it predicts the liver condition by using the edge detection.

**Data Cleaning:** In this stage it identifies and corrects the errors to avoid the negativity during predictive model. Data cleaning is mainly used to detecting and repairing errors in data in orderto present a reliable dataset. At the
stage of training data it improves the quality for decision making process. For the data cleaning purpose One-hot encoding is useful to encode the features in the dataset that may be Gender and other one is disease which represents one means the patient is suffering for liver disease.

**Feature Selection:** By using the random forests the important attributes are selected to find the degree of liver stage. By using this random forest according to the nodes it is ranked. Along to random forest ANFIS(Adaptive Neuro Fuzzy Inference System) by using his method it selects an image that is related to all four stages of liver and the results will be displayed in the form of edge detection after forming that edge detection it also displays whether the patient is suffering from liver disease or not.

**Prediction of ANFIS (Adaptive Neuro Fuzzy Inference System) method:** By using this machine learning method we can find the accuracy score by selecting the attributes but by using ANFIS model we can detect the liver damage by edge detection.

**Machine Learning (Random Forest Method):** Random forest is the combination of multiple decision trees used for independent random vector to form vector input. Bagging is used for training purposes for N samples. Therefore the random forest proves that it gives high accurate results in medical diagnosis also.

**ANFIS(Adaptive Neuro Fuzzy Inference System):** In this concept the image information is also included to predict the liver grades and severity of liver. The evaluation is based on relation between the blood test features and visual analysis related to ultrasound images. In this method firstly the dataset is extracted the set of rules for predicting whether the patient or not. Then the model is extracted into four clusters based on the liver disease severity. The collected dataset for the first time determines the grade of the liver disease severity just by acquiring the blood test features and ultrasound images. Therefore the liver specialists can gain the information at the starting stages. So this is the best diagnosis for people who are suffering with liver disorders and it also reduces the cost.

**ANFIS Algorithm (Adaptive Neuro Fuzzy Inference System):** ANFIS is the famous method which combines the ANN(Artificial Neural Network) and Fuzzy Inference Logic for non-linear methods. In fuzzy logic rule it adjust the system for alterations for the exterior environment results the neural network system. For this model it has the learning ability in neural network which has the abilities in the fuzzy logic.

The basic rule for ANFIS model is back propagation and gradient descent it results the signal deviation and from the final node to first node.

**Django:** It is a open-source framework used in web applications. This technology used in backend and it is top most language in web development technology. By using this framework it gives more flexibility, simplicity and scalability. This method is mainly used in HTTP responses after that one web application is created. Moreover it is mainly used for creating the web application and server development process.

By using the Django framework the web application is created. By using this framework the two methods are used here. In existing module random forest algorithm is used and in enhancement module ANFIS method is used. In
existing module we can select the attributes which is related to dataset features and in enhancement module we can select the images. Based on those images we can easily detect the liver condition.

Here in existing module from x-axis and y-axis the different features are selected and the result will be displayed in graph analysis.

After selecting these two features that is belong to liver dataset the accuracy is 0.17% suffering for the liver disease.

**Edge Detection:** By using this edge detection it finds the boundaries of an image. For image segmentation and extracting data edge detection is very useful. This method is used in different areas such as computer vision and image processing, machine vision.

**Results:**

Comparison results of 4 stages liver disease by using Edge Detection
In enhance module we selected an image that is related to four stages of liver and the result will be displayed in the form of edge detection so the doctors can easily identify the stage of the liver by using MRI and X-ray Scanned images.

**Stage 1  Healthy Liver**
Stage 2  Fatty Liver

Stage 3  Liver Fibrosis

Stage 4. Liver Cirrhosis
Conclusion:

In this work, we use serum markers and images that are related to different stages and predict the liver condition by applying ANFIS (Adaptive Neuro Fuzzy Inference System). In ANFIS model, we use edge detection for MRI images to predict the liver stage at a certain point. By this method, doctors can easily predict the disease without any delay. It is helpful to all people who are suffering from liver disease and it can easily diagnose. The results of this paper display the Alanine Aminotransferase at this stage, we can notice with few septa, somewhat it leads to fibrosis (stage 3), Alanine Aminotransferase stage liver leads to high septa which leads to cirrhosis (stage 4). In future work, some other techniques related to machine learning can improve the last two stages (fibrosis and cirrhosis) with more sample population.

References:


