Prediction of Early Stage of Fatty Liver Disease in Patients using Logistic Regression and Naive Bayes Algorithm

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***Abstract*—The main objective of the work is to evaluate the accuracy in predicting fatty liver disease at an earlier stage in patients by using the Novel Logistic Regression (LR) algorithm and Naive Bayes (NB) algorithm. The dataset is taken from CHAOS Grand challenge website. It consists of a liver image dataset. The sample size per group is calculated as 16. The pretest power is calculated as 95% alpha value set as 0.05.The Novel Logistic Regression classifier is used to identify fatty liver disease at an early stage in patients and compared with Naive Bayes classifier in terms of accuracy. The Naive Bayes classifier produces 76.9% accuracy in predicting the fatty liver disease at an early stage whereas the Novel Logistic Regression classifier accuracy is 83.3%. The significant value is 0.994. Hence Novel Logistic Regression is better than Naive Bayes. The performance of Novel Logistic Regression is better compared to Naive Bayes in terms of both accuracy and precision.**

***Index Terms*—Novel Logistic Regression, Grand challenge , Naive Bayes , fatty liver disease , earlier stage, Prediction , Machine learning**

I. Introduction

Liver is put in the right upper side of the midsection. Greasy liver sickness known as steatohepatitis, fat form in the liver cells because of unnecessary liquor consumption.If dismissed, it prompts cirrhosis. The obligations taken by the liver in our body are to change over the brought food into energy and eliminate poisons ,squander materials and channel blood ,construct proteins and store nutrients and minerals. Greasy liver infection might not have any manifestations , yet torment in the liver part might happen. The proposed concentrate on utilizes AI devices to foresee liver illness at a beginning phase and find every one of the concealed boundaries from huge clinical datasets. Computerized reasoning is additionally applied in identifying liver illness [24], [40]. A concentrate by [3] utilizes a dataset comprising of blood trial of liver patients to gauge liver sickness at the beginning stage. In the review [31] gives relative examination of sickness development in liver infection patients by utilizing various procedures. The microarray dataset is taken for the characterization of liver sickness at a beginning phase. The concentrate by [22]distinguishes the principle hazard factors for both diabetes and greasy liver infection patients. There are 10 investigation articles distributed in IEEE Xplore and around 1500 articles found by google scientists. The proposed concentrate on utilizes genome articulation and patient boundaries to analyze liver sickness in patients. Beginning phase forecast can decrease the gamble of liver malignant growth [34]. In this concentrate on the expectation of liver infection is finished by carrying out different AI grouping calculations like strategic relapse , arbitrary woods and svm with the assistance of WEKA device [12]. The proposed concentrate on point is to recognize liver infection by utilizing AI approaches to find the best precision of every calculation by utilizing different liver sickness datasets [24], [29]. The proposed concentrate on distinguishes the solid people from liver datasets and predicts the liver illness with great precision results [8]. In this concentrate on the five different order calculations were executed to assess the boundaries exactness, accuracy , review for expectation of liver issue [26], [29]. Our group has broad information and exploration experience that has convert into top notch publications [1], [9]–[11], [13], [15], [16], [20], [25], [28], [30], [33], [38], [39], [41]

In existing writing, expectation of beginning phase greasy

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liver infection in patients was done in light of different boundaries and arrangement of datasets in view of likelihood of events of side effects. The point of this study is to work on the precision in ID of greasy liver illness in the beginning phase utilizing AI algorithms.The objective of the proposed irregular woods calculation is to further develop the exactness utilizing Logistic Regression and Naive Bayes calculations.

II. Material and Methods

The exploration work was done in the Department of Computer Science and Engineering, Saveetha School of Engineering, SIMATS. There are two gatherings engaged with anticipating the exactness of greasy liver illness at a beginning phase. The principal bunch is the current calculation Naive Bayes. Second gathering is the proposed calculation Logistic Regression. Greatest 10 emphasess are acted in each gathering to get the right exactness rate. The dataset is taken from the CHAOS Grand test site. The dataset contains 75 CT examine liver pictures. The CT/MRI pictures of the liver are taken. In the dataset 75% taken as preparing information staying 25% is taken as testing information. . The example size is determined as 16 for every each gathering utilizing Gpower. The pretest power is determined as 95% alpha worth set as 0.05.

A. Naive Bayes

Input : Liver Image Dataset Output: Selected features , accuracy

1) Load the train_data.mat in matlab environment
2) Split the dataset into training and testing
3) Declaring the XX , YY variables as train data.mat and train_label.mat
4) Fit the Naive Bayes Classifier by using predictors X,Y
5) Train a Naive Bayes Classifier with 12 GLCM features
6) Evaluate the classifier and return accuracy

Gullible Bayes is an AI classifier utilized in arrangement issues. It utilizes Bayes hypothesis to decide the likelihood of a speculation. In this concentrate on the Naive Bayes classifier is utilized to arrange the illness. The liver dataset is stacked . The dataset is split into training(75%) and testing (25%)sets. Here the preparation set is prepared with 12 GLCM highlights. The testing is done on each 15 pictures. Most extreme 10 emphasess acted in every calculation. The test dataset is anticipated in view of the preparation dataset. The Naive Bayes classifier is assessed and the exactness is determined.

B. Logistic Regression

Input : liver image dataset Output : accuracy

1) Load the train_data.mat in matlab environment
2) Split the dataset into training and testing
3) Declaring the XX , YY variables as train data.mat and train_label.mat
4) Fit the Logistic Regression Classifier by using predictors X,Y
5) Train a Logistic Regression Classifier with 12 GLCM features
6) Evaluate the classifier and return accuracy

Calculated Regression is a regulated AI classifier utilized in arrangement and relapse issues. The Sigmoid capacity is utilized to return the anticipated qualities as 0 or 1. The Logistic Regression is carried out to characterize greasy liver sickness prior . The dataset is stacked and splitted into preparing (75%)and testing (25%) sets. The preparation set takes 75 pictures joined with 12 elements and it is prepared. The testing is done on each 15 pictures up to 75. Greatest 10 emphasess are acted in every calculation. The dataset is anticipated in light of the preparation dataset. The Logistic Regression classifier is assessed and the precision is determined. The proposed work was done in MATLAB 2019a. The equipment and programming necessities for carrying out the work incorporates i3 processor, 50GB HDD, 4 GB RAM, Windows OS, RAW C: MATLAB R2019a. At first the dataset is split into two sections : preparing and testing sets. The calculation is executed on both preparation and testing sets. Subsequent to parting the testing set is contrasted with the prepared set with get yield as precision rate. Table 1 shows the examination of exactness and accuracy of Logistic Regression and Naive Bayes for 10 cycles.

The various parameters can be calculated for the analysis as follows:

C. Accuracy

The accuracy that is correctly classified by the classifier.

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} \quad (1)$$

where,
TN=True Positive,
TN = True Negative,
FP = False Positive and
FN = False Negative

D. Precision

Both true positive and false positives how many are actual positives.

$$Precision = \frac{TP}{TP + FP} \quad (2)$$

E. Sensitivity

The test that correctly identifies the disease in patients called True positives.

$$Sensitivity = \frac{TP}{TP + FN} \quad (3)$$

TABLE I

ACCURACY AND PRECISION EXECUTED DURING IMPLEMENTATION OF FATTY LIVER DISEASE PREDICTION AT AN EARLY STAGE USING A TEST DATASET WITH LOGISTIC REGRESSION AND NAIVE BAYES FOR DIFFERENT ITERATIONS.

Iterations	Accuracy of Logistic Regression	Precision of Logistic Regression	Accuracy of Naive Bayes	Precision of Naive Bayes
1	88.6	86.5	79.4	78.8
2	85.2	83.6	75.9	79.6
3	80.7	84.1	76.8	70.4
4	88.0	82.8	73.5	80.1
5	83.9	86.9	78.3	76.9

TABLE II

EXPERIMENTAL ANALYSIS IN MATLAB R2019 FOR ACCURACY, PRECISION, SENSITIVITY, SPECIFICITY FOR LR AND NB. LR SHOWS BETTER ACCURACY (88.6%) AND PRECISION (86.5%) THAN NB.

Model	Accuracy	Precision	Sensitivity	Specificity
LR	88.6	86.5	86.1	96.6
NB	77.5	79.6	79.1	82.4

F. Specificity

The test that correctly identifies the persons not having disease called True negatives.

$$Specificity = \frac{TN}{TN + FP} \tag{4}$$

III. STATISTICS ANALYSIS

In exploratory examination, the work was assessed genuinely involving Statistical Package for Social Sciences(SPSS). The investigation was done to anticipate Mean, Standard Deviation, and Standard Error Mean. A free factor T test is executed to analyze boundaries on the two gatherings. In the exploration, the free factors were Contrast, Correlation, Energy, Skewness, Kurtosis, Entropy, Homogeneity, Variance. The reliant factors are Accuracy and Precision.

IV. RESULTS

Table 1 shows the Accuracy and Precision of Novel Logistic Regression and Naive Bayes Algorithms for different emphasess. Table 2 shows the different boundaries of the two gatherings . The exactness , accuracy , responsiveness , explicitness has been determined for Novel Logistic Regression and Naive Bayes Algorithms. The exhibition of Novel Logistic Regression gives higher exactness (mean = 88%) and accuracy (mean = 86%) than Naive Bayes . Table 3 addresses the measurable examination of Logistic Regression and Naive Bayes with various test datasets. The mean exactness of the Logistic Regression shows to be higher than the Naive Bayes. Accuracy is likewise high contrasted with Naive Bayes. The exhibition of Logistic Regression is superior to Naive Bayes. Table 4 shows the measurable examination of Significant levels for the two gatherings. There is no Significant distinction among the two gatherings. Figures 1 and 2 show the mean exactness and mean accuracy of Logistic Regression and

TABLE III

STATISTICAL ANALYSIS OF MEAN, STANDARD DEVIATION AND STANDARD ERROR OF PRECISION AND ACCURACY OF LOGISTIC REGRESSION AND NAIVE BAYES ALGORITHMS. THERE IS A STATISTICALLY SIGNIFICANT DIFFERENCE IN ACCURACY AND PRECISION VALUES BETWEEN THE ALGORITHMS. LOGISTIC REGRESSION HAS HIGHER ACCURACY(83.3%) AND PRECISION(82.1%) THAN NAIVE BAYES.

GROUP	N	Mean	Std. Deviation	Std. Error Mean
ACCURACY LR	20	83.3500	4.42808	.99015
NB	20	76.9000	4.20401	.94004
PRECISION LR	20	82.1000	5.21031	1.16506
NB	20	74.6500	3.55816	.79563

TABLE IV

COMPARISON OF THE SIGNIFICANCE LEVEL FOR LOGISTIC REGRESSION AND NAIVE BAYES ALGORITHMS WITH VALUE P <0.05. BOTH LOGISTIC REGRESSION AND NAIVE BAYES HAVE A SIGNIFICANCE LEVEL LESS THAN 0.05 WITH A 95 % CONFIDENCE INTERVAL

3*		Levene's Test for Equality of variances		T- test for Equality of Means						
		2*f	2*Sig	2*t	2*diff	2*Sig. (2-tailed)	2*Mean Difference	Std. Error 2* Difference	95% Confidence interval of the Difference Lower	Upper
2*ACCURACY	Equal variances assumed	.000	.994	4.724	38	.001	6.45000	1.36531	3.68047	9.21953
2*Loss	Equal variances not assumed Equal variances assumed	2.974	.093	4.724 7.281	37.898 38	.001 .001	6.45000 7.45000	1.36531 1.41081	3.6838 4.5939	9.21948 10.30583
	Equal variances not assumed			5.281	33.556	.001	7.45000	1.41081	4.5814	10.31852

Naive Bayes. The measurable examination of two autonomous gatherings shows that Logistic Regression has higher exactness (mean = 83.3%) and accuracy (mean = 82.1%) contrasted with Naive Bayes. The mean blunder of Logistic Regression is lesser than Naive Bayes.

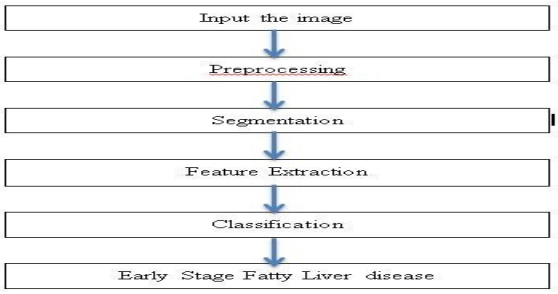

Fig. 1. Framework for prediction of fatty liver disease at an early stage

V. DISCUSSION

Forecast of greasy liver infection at a beginning phase in patients is vital in the medical care industry to lessen the gamble. Test work was done between two gatherings Logistic Regression and Naive Bayes. The execution of Fig 1 was done in MATLAB R2019a, the exactness and accuracy of the Logistic Regression is 88% and 86%, while Naive Bayes precision and accuracy to be 77% and 79%. This portrays that Logistic Regression is superior to Naive Bayes. The various boundaries like awareness, explicitness , TP rate, FP rate, exactness, accuracy are additionally looked at as displayed

in conditions 1-4. From the SPSS diagram, the proposed Logistic Regression classifier is better contrasted and Naive Bayes as far as exactness (83.3%) and accuracy (82.1%). Figure 2 shows the mean mistake of Logistic Regression is superior to Naive Bayes. The 400 patients dataset is taken to perform non alcoholic greasy liver sickness expectation. In this 127 has abrupt weight reduction, the great exercise and treatments can forestall infection. The super significant

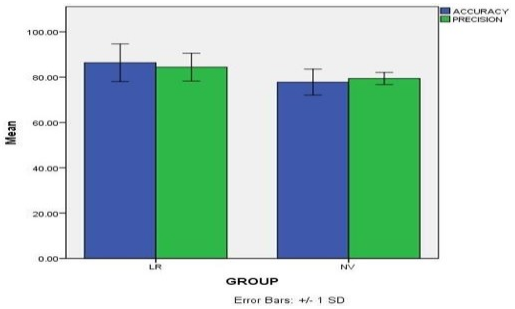

Fig. 2. Bar chart representing the comparison of mean accuracy and mean precision of the early stage of fatty liver disease prediction using Logistic Regression and Naive Bayes algorithms. LR provides better accuracy and precision and more consistent results Xaxis : LR vs NB. Y-axis: Mean Accuracy and Mean Precision ± 1 SD.

variables in anticipating greasy liver illness at a beginning phase are exactness and accuracy. In the exploration did by comparable discoveries, The proposed concentrate on helps the clinical professionals and specialists to break down liver sickness issues precisely . The different boundaries are analyzed and strategic relapse classifiers show better precision in recognizing liver disease(Keerthana et al., no date) . In the investigation of inverse discoveries, The proposed concentrate on utilizes indian liver infection dataset and the proposed calculation svm with crow search calculation get high exactness brings about recognizing the liver illness in patients (Devikanniga, Ramu and Haldorai, 2018) . The precision of the Logistic Regression classifier is fundamentally founded on the preparation and testing dataset size. In our exploratory investigation, the Logistic Regression gives higher exactness and accuracy than Naive Bayes. Henceforth the mean mistake is additionally higher in our proposed work. Our group has broad information and exploration experience that has convert into great distributions [**?**], [2], [4]–[7], [14], [17]–[19], [21], [23], [27], [32], [35]–[37] The specific restrictions in the work are the proposed calculation can't give a superior precision on more modest datasets. Moreover, Logistic Regression mean mistake is higher than Naive Bayes. The future extent of this work should be possible on bigger datasets with various AI procedures to accomplish better exactness rate and less mean blunder.

A. Conclusion

The examination shows that the Accuracy and Precision for anticipating greasy liver illness by utilizing the Novel Logistic Regression calculation gives remarkable execution contrasted with Naive Bayes and mean blunder additionally has all the earmarks of being higher than Naive Bayes. Henceforth it is reasoned that inside the restrictions of the examination, 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.

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