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Kernel Convolutional Neural Network Deep Learning Algorithm To Classify LIVER Disease

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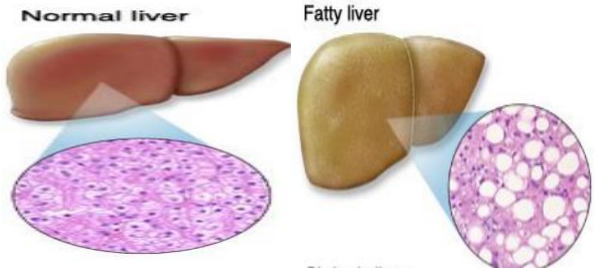
Abstract: ***Now a day, liver disease is common disease due to the bad eating habits among individuals. Some disturbance in the functioning of the liver may cause liver sickness. Liver is responsible for overall functioning of the body. Hence, it becomes necessary to diagnosis the liver disease at an early stage. In advanced world of technology, various methods has been been developed to diagnosis and detect the disease includes data mining. This is novel concept to determine the data by extracting features and recognize indications of liver disease by medical experts. The existing technique has implemented optimize the rules released from Boosted classification with a genetic algorithm, to enhance the LDD (Liver Disease Diagnosis) interval of time and accuracy level. Hence, GA is utilized for enhancing and enhancing directions of another method. In this research work, defines a novel method ECNN (Enhanced CNN) of LDD and enable medical specialists to recognize sign of disease and optimization is done for maximum period, decrease the death rate. Clustering and Feature extraction phase to extract the unique feature based on Kernel method and divide the data into a group or cluster-based using FCM algorithm. Implement CNN method to predict or detect the liver disease to improve the performance and classification of rules set. The proposed method has implemented to achieve better performance and compared with existing methods. The simulation tool used in this research works MATLAB 2016a and calculates the performance is Accuracy achieved 96 % ad existing GA accuracy rate 92.9 % achieved in our work.***

Keywords:- LDD (liver Disease Diagnosis), CNN (Convolutional Neural Network), KPCA (Kernel Principal Component Analysis) and FCM (Fuzzy C-means Clustering) method.

I. INTRODUCTION

With the advancement of the technology, the eating habits of the humans have been changes that result into the liver disorder disease that became the main cause of the various other types of the diseases [1]. Currently, due to the change in the lifestyle of the people, bad eating habits, depression, smoking and maybe other reasons has threatened the world with everyday life disease or Disease of evolution which is Liver Disease[2][3]. The liver part is the second major inner organ of the body that is responsible for the metabolic function of the body. The liver plays a main role in the production of the protein in the body and filtration of the blood throughout the body and converts the nutrients that are absorbed in the digestive glands. The other main function of the liver is the removal of the toxins from the body and from the blood. The liver is the biggest gland of the body that weighs around 3lb and its color is reddish brown [4]. The four lobes of the liver are of imbalanced mass and form. The liver is placed adjacent to diaphragm and large blood vessels carry the blood towards the liver [5]. The circulation of the blood passes through the liver so it is abnormally responsible for accessing the cancer cells. The disorder in the liver becomes a major issue around the world. The main cause of the liver disease is viral hepatitis that increases liver disease among the people. The automatic record of the patients is stored in the health data and different techniques are applied [6][7]. On the basis of the various methods, association, collection and clustering are done. In connection based approach, the reoccurrence method is applied and after that classification allocates the information to the object and prediction of the definite class is recognized. In classification based approach, the data set is divided into different cells [9]. In different stages, the disease is recognized in different steps [10].



(i) (ii)

Fig 1(i) Normal Liver and (ii) Fatty Liver [7]

The sickness of the liver may cause abnormal function of the liver due to liver disease. The liver may be damaged due to abnormal function in the body and the liver disease is the hepatic disease. The disturbance liver function may be due to the change in the metabolism rate of the body [7]. The main types of Liver Disease are:-

i) Fatty Liver: - This is the condition when triglyceride fat is acquired by the liver cells. Liver of the person may be fatty who consume a high amount of alcohol or maybe to those who never had alcohol.

ii) Hepatitis- The straight interaction with the diseased fluid may cause this problem.

iii) Cirrhosis: - This is the most communal type of liver disease that may be caused due to the significant injury of the cells. The liver becomes contract and rubbery and there may be excessive loss of the liver cells [8].

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iv) Liver Cancer:- The high amount of viral hepatitis may lead to the risk of the liver and cancer spread from the other parts of the organs towards the liver. In existing work described optimization and classification technique of liver infection analysis to help clinicians and patients in searching the infection signs or indications and mitigate a long-term of disease finding and avoid death rate.

In the previous method will reduce the protocols released form Boosted C5.0 classification technique with the evolutionary method, to maximize the diagnosis interval of time and accuracy rate. Using an EA (Evolutionary Algorithm) for producing protocols, the GA (Genetic Algorithm) is used for enhanced accuracy rate. It shows that the existing method has enhanced presentation and evaluation with additional methods in data mining. In existing methods performance of the accuracy is 93%.

In research work, has been implemented a novel method to improve the accuracy rate and false detection rate and other parameters. The chief goal of the planned strategy is studying the various prediction algorithms in the Diagnosis of Liver Disease (used a dataset from the UCI database which is about the liver patient in one of the Indian hospitals in 2012). Developed pre-processing and feature extraction phase to extract the unique feature based on Kernel method and divide the data into a group or cluster-based using FCM algorithm. Implement CNN method to predict or detect the liver disease to improve the performance and classification of rules set. Evaluation and comparison based on the performance parameters and also find the accuracy, Specificity and sensitivity, Precision, and Time consumption of the developed approach.

Section I defined about the introduction, types of livers, methods and material, existing work and proposal model. II section defined all about the surveyed of the various paper and conclusion regarding LDD. Section III and IV defined that the Research Proposal and experimental results. In this section elaborated that the performance metrics, methods and dataset description. Section V conclusion and Future scope described in Liver Disease Detection.

II. RELATED WORK

Wu, C. C. and Lee, W. L et al., 2013[11] proposed research on the evolution of the feature based system for the selection of the dominant multiple features for the characterization of the liver disease. The extraction of the grey scale matrices, resolution of the feature vector and energy feature vector for the selection of the features based on the evolution-based algorithm. The selection of the features that is not dependent for the compilation of the feature subset. The features of the various subsets have free of charge data by combining the subsets vector. Fused feature subset is divided into a subset of feature subset for the classification of the ultrasonic images of the liver nerves. Liver cells are classified into three types are hematoma liver, cirrhosis, and normal liver. The experimental approach based on the determination of the accuracy of the single feature subsets. **Ribeiro, R. T and Marinho, R. T et al., 2014[12]** presented research on the local and the global-based system using a computer-aided system. In this research, the Bayes element is calculated using textual features that are extracted from the liver parenchyma. The main approach is selecting the various features by recognition of the final value. In this research, the multi-wavelengths are determined using the decomposition of the final value for the feature extraction of the retinal blood vessels. The binary classification of the ultrasound images recognized using the Bayes values. The fundus images of the retinal blood vessels were implemented using the system aided diagnosis. In this research, the fundus images of the retinal blood vessels are detected using the Bayes Factor. **Trivia is, E and Manikis, G. C. et al., 2018[13]** proposed research on the 3-dimensional convolutional layer and another set of the layer and software layer. The MRI scanning was done on the basis of the training and the testing of the network. The main approach was on the classification of liver cancer disease in the 3-dimensional convolutional neural networks. The classification method based on the significant data of the desired approach with the same value of the data set. In this research, the 3-dimensional convolutional neural networks were proposed for the removal of the classified issue based on the unique clinical data set. **Ma'aitah, M. K. S and Abiyev, R et al., 2017[14**] demonstrated about the designing of the sickness of the liver using a fuzzy based neural network system. The neural and the fuzzy network used for the discovery of recognition of the liver sickness. In this research, extraction of the data set of the liver using the machine learning approach. The proposed method in this research describes the exact and high rated data about the out-dated diagnostic model. **Insha Arshad et al., 2018 [15]** defined that the recognition and prediction of LD (Liver Disease) using DM (Data Mining) methods. It will decide a method for the database and then the protocol will be created. After deciding the protocols, it will utilize different DMAs to examine and check the database to recognize the LD. The information was composed from the UCI repository site and training domain developed. It consists of seven dissimilar attributes having 345 instances. In this database different classes of BTs (Blood Tests) are taken into consideration which is directly connected to LD that may arise due to excessive alcohol consumption along with the frequency of the data. Depend on the kind of liver disease detected, the prognosis might be optional. **Sumedh Sontakke et al., 2017 [16]** defined the main objective to enhance the disease prediction and exploring with two methods of identification patient parameters and genome expression. Surveyed also described the computational method that can be used in the aforementioned research methodology and list domains. It implements techniques to enhance the effectiveness of these methods. Studied lots of papers and find [17] the conclusion and described that the existing techniques Boosted C5.0 classification and Evolutionary Genetic algorithm methods to evaluate the performance metrics and enhance the diagnosis interval of time and accuracy rate. So instead of using GA for generating rules with three operators such as (i) Selection (ii) Crossover and (iii) Mutation, the GA is used to improving and reducing the rules of other methods.

III. RESEARCH METHODOLOGY

In this section, defines the proposed work in liver disease prediction and improve the performance metrics and reduce the failure errors. In this research work, a novel method using kernel Convolutional Neural Network is a deep learning method to classify the liver disease patients. The research methodology explanation in stepwise:-

Step 1 Dataset: Firstly, we search the dataset in liver disease from the UCI machine repository site. Upload the dataset form the excel sheet and shown in table format in the graphical user interface.

Step 2 Pre-processing: The pre-process the data based on the algorithm is easy unsupervised learning algorithm that resolve the clustering issues. The process categorise data in to groups of constant value.

Step 3 Feature Extraction Algorithm: the feature extraction approach to identify the unique features of the liver disease numeric dataset. We extract the component based features.

To start with, the dataset is separated into a preparation informational collection and test informational index. The preparation dataset is being sustained into the calculations. The calculations gain from this dataset. Afterward, in the test dataset, every one of the column with the exception of the last one are sustained in the calculations. The last column is the genuine result. The calculation with the info information frames its very own segment. It can do as such in light of the fact that it has taken in the example from the preparation dataset

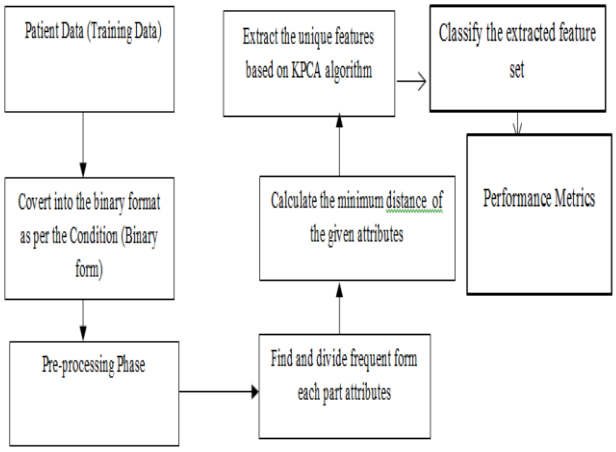


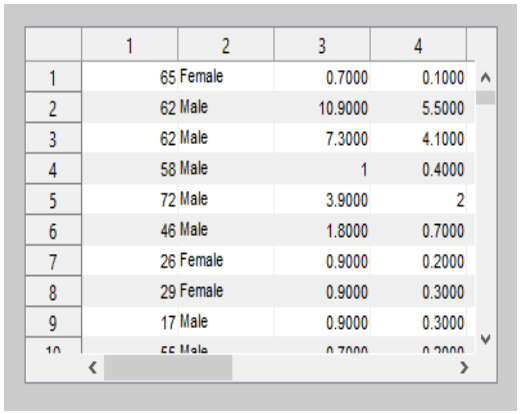
Fig 2 Proposed Flow Chart

Step 4: Classification using CNN method: - ConvNets are intended for technical data that are accessible in the state of various clusters, possibly shading a texture data made out of 3-second exhibits containing constituent powers inside the 3 shading channels. A few data modalities are inside the sort of numerous exhibits:- 1D for signs and successions, together with dialect; second for pictures or sound spectrograms; and 3D for video or meter pictures. There are four key thoughts behind convents that benefit as much as possible from the properties of common signs: local associations, shared weights, pooling and furthermore the utilization of the many layers.

Step 5: Performance Metrics: To evaluate the performance parameters like accuracy, Precision, Time consumption and Recall etc.

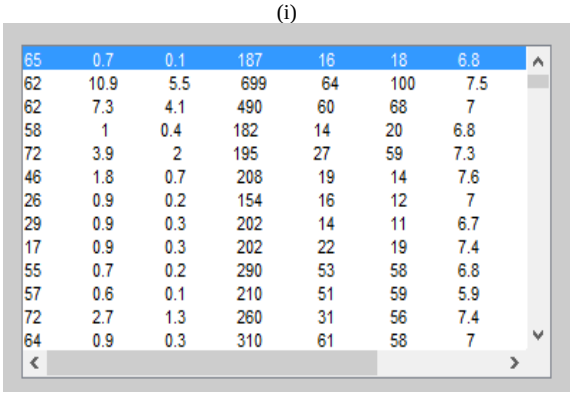
IV. EXPERIMENTAL RESULTS

In this section, defines data about the technology utilised in the implementation and developed of research work, database description to predict and validate the performance metrics and compared with the existing work and algorithms.



	1	2	3	4
1	65	Female	0.7000	0.1000
2	62	Male	10.9000	5.5000
3	62	Male	7.3000	4.1000
4	58	Male	1	0.4000
5	72	Male	3.9000	2
6	46	Male	1.8000	0.7000
7	26	Female	0.9000	0.2000
8	29	Female	0.9000	0.3000
9	17	Male	0.9000	0.3000

(i)



65	0.7	0.1	187	16	18	6.8
62	10.9	5.5	699	64	100	7.5
62	7.3	4.1	490	60	68	7
58	1	0.4	182	14	20	6.8
72	3.9	2	195	27	59	7.3
46	1.8	0.7	208	19	14	7.6
26	0.9	0.2	154	16	12	7
29	0.9	0.3	202	14	11	6.7
17	0.9	0.3	202	22	19	7.4
55	0.7	0.2	290	53	58	6.8
57	0.6	0.1	210	51	59	5.9
72	2.7	1.3	260	31	56	7.4
64	0.9	0.3	310	61	58	7

(ii)

Fig 3.(i) Uploading Dataset (Liver Disease Patients) and (ii) Messy Dataset

Fig 3 (i) defined that the dataset uploading the disease patient's records from the training phase that is upload the .xls and .csv file present in coding folder. In this dataset download the UCI machine learning repository site. 3(ii) defined that pre-processing phase to find the missing values in the given datasets. The graphical representation of LDD (Liver Disease Datasets), all values is integral format. In this phase, upload dataset from the given folder present in collection in number of patients and with parameters like as BP (Blood Pressure), HP and Sugar Level. In this phase, remove the missing values in the main databases (LDD).

Below Fig 4 describe that the Clustering process is a method (FCM) which gives individual regions value of data to denote two or more clusters or groups. In this phase, work by assigned to individual data points (DP) corresponding to each group centre on the normal distance between cluster centre and DP. Additional data is close to the Group centre more is its membership towards the particular CC (Cluster Centre). FCM gives assign the DPs to clusters such that items in the similar cluster are similar possible, while attributes belonging to different clusters.

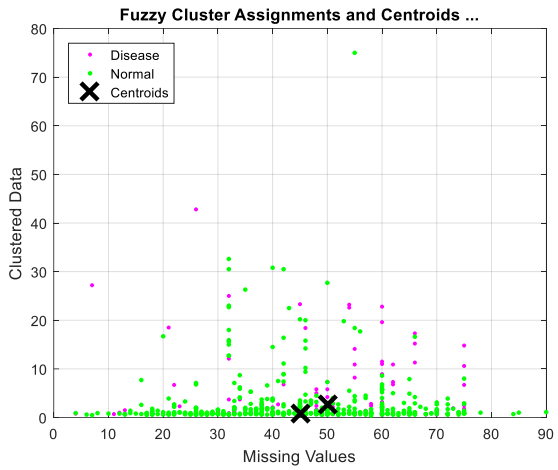


Fig 4 Fuzzy centroid Clustering

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Eigen Values and Vectors : -5.959745e-18
Eigen Values and Vectors : -3.185823e-17
Eigen Values and Vectors : -2.124205e-15
Eigen Values and Vectors : -2.268692e-14
Feature in Latent : 7.923657e+04
Feature Score : 1.990434e+02
Feature Score : -1.990434e+02
Coefficient Features  : 10
```

Fig 5 Feature Extraction using KPCA algorithm

Above figure shows that the KPCA method is dimensional reduction technique that closely regarded to PCA. In DM concerned with searching reasonable designs in large set of data. In this method used to extract and reduce the feature set, seek to solve the issue by optimizing the number of dimensions while retaining most of the information in the database. It becomes simple to extract pattern in remaining data.

Steps in KPCA method :

1. Let l =1.
2. For every information $x_{ii} \in X_{ttr}$; if y^{lr}_{ii} =kotherwise let Z^{lr}_{im}1=+1 otherwise let Z^{lr}_{im}= -1.
3. Next, for assigning the nearest method, use kernel regression (Z^{ll}_{jm},J=1….m_u) to the test group, use novel marks Z^{lm}_{it}=1,….,l_{mtll} as internal value for labelling method.
4. If l $\prec q$, then increase k by 1, and then repeat from step 2,otherwise continue to next step.
5. Foe very information $y_t \varepsilon Y^{ll}_{k}$ .Iiterate through l variable =1,....,q, For first k for which Z^{trr}_{jkk}=1, let Z^{ll}_{jj} =k and go to next information value. If no such l exists, then assume y^{tll}_{jj}=q.

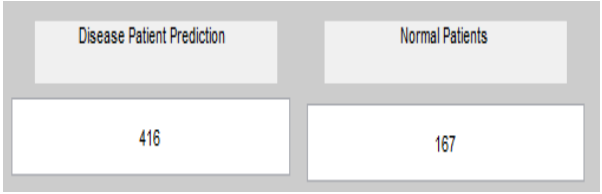
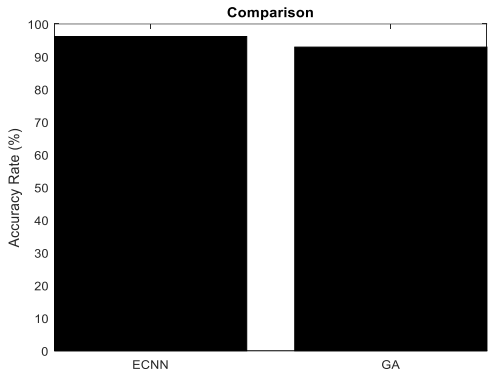
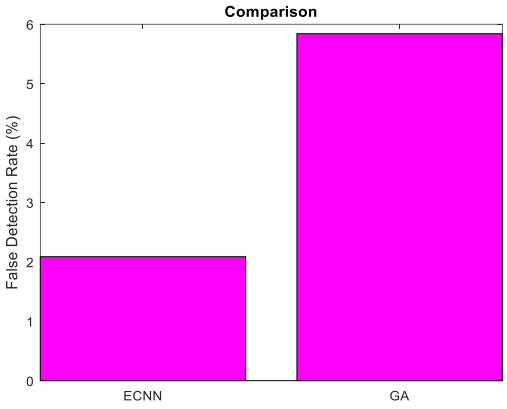


Fig 6 Prediction and Classification

Above figure 6 shows that the classification and prediction process is done by KPCA+CNN method. In this method a move difference consequently acquired and extraction of native features improve presentation to conventional design. CNN are trainable multi-stages arch+ with the given info and yields of each stage comprising of sets of exhibits called highlight maps. In the event that the information is shading map, each component guide is 2-dimensional cluster containing channel of the info information. Liver Disease Prediction and Classification method is predict the data value is Liver Disease Patients Present and Not Present. Prediction Patient Values are: - 416 and Not Prediction Values are :- 167.



(i)



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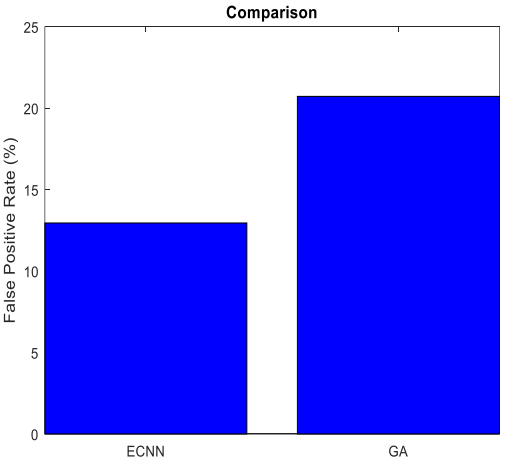
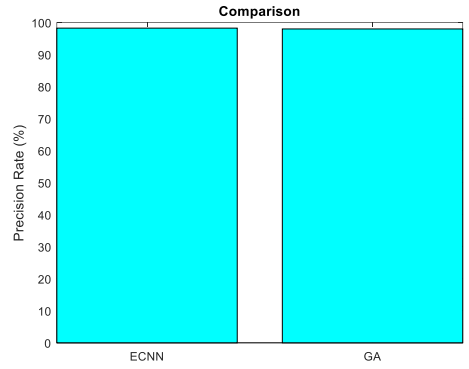


(iii)



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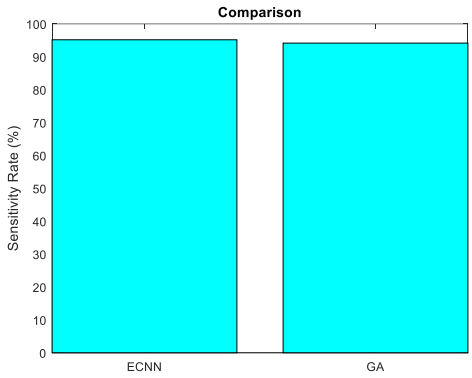

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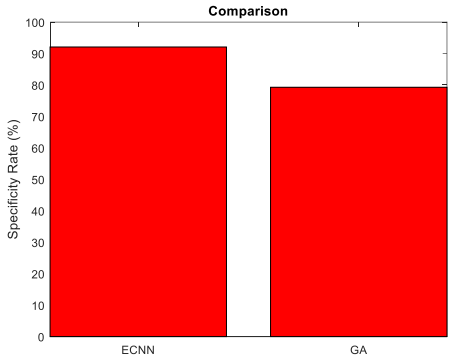

(vi)

Fig 7 Comparison between ECNN proposed method and Existing Boosted and Genetic algorithm

Above figure 7(i) shows that the performance metric compared with the existing one. Clear from table 1 and figure 7 that our kernel PCA with CNN approach with the classification has improved results. They demonstrate the standards of the sensitivity, accuracy rate, and specificity, precision are maximum as compared to existing methods (GA and Boosted C5.0) standards in difference. False Detection and False Positive Rate are error types and they must be reduced. So in proposed work have minimum error rates than boosted C5.0 and Genetic Method. Normally the most significant parameter that in several DM trainings is related is the accuracy rate. It can be seen that the proposed method accuracy rate is maximum as compared to existing methods.

Table 1:- Proposed Performance Parameters

Performance Metrics	ECNN	GA	Boosted Up C5.0
Accuracy Rate (%)	96.172	92.93	81.87
FDR %	2.08	5.84	16.47
FPR %	12.94	20.72	26.07
Precision %`	98.25	98.16	94.55
Sensitivity %	95.172	94.16	83.3
Specificity %	92.08	79.28	73.93

Above table 2 define that compared with existing and proposed method the performance metrics calculated by Accuracy Rate, FDR, FPR, Precision, Sensitivity and Specificity.

V. CONCLUSION AND FUTURE SCOPE

The concluded that research work is presents a deep learning method to classify the rules of LDD (Liver Disease Detection). The new technique uses the CON-NET method to reduce boosted c5.0 and Genetic method which is data mining method and it is used to set the rules for LDD by considering database and its evaluates are consequences and compared with other proposed metrics. It comprehend that methods is an easier and flexible technique but because of various method or rules has been optimized and classify the procedures and amount search the actual characteristics in the Liver Disease Diagnosis (LDD). After that the proposed method has designed and implemented, totally 23 layers created instead of 20 rules are compared statistical metrics such as Accuracy Rate, Precision, FDR, FPR, Sensitivity and Specificity, define that research method has better performance than GA and reduce the error rates and improve the accuracy rate. In proposed method can filter and classify the economic burden by classify the accuracy of diagnosis, which is really helpful path for patients to save money by avoiding the extra analysis for investigation and optimizes the death rate since of altering the wrong diagnosis.

The Future scope , can implement a methods to predict the disease according to the time interval being more fascinating towards the treatment and detection of harmful diseases as the prediction of LD and cancer. It will ease up the process of diagnosis as-well-as save the time, money and death rates. The present methods are capable to search out the sign and symptoms of disease at the beginning phases using filtered Artificial Intelligence methods, so that reduce the death rates.

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