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Comparison of Classifiers for the Prediction of Liver Cancer Disease

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Abstract *– The detection of liver cancer in its early stages is very difficult. The proposed system collects microscopic images as input from the patients and preprocesses them to extract features. Once the feature extraction stage is completed the classification of the image need to be done on them. The proposed system uses the probabilistic Neural Networks (PNN), K-nearest neighbor (KNN), and Learning Vector Quantization (LVQ) classifiers to classify the images into their respective classes. The classifier system uses the normal approach of classification i.e., a normally two stages one is training and then testing. Each of these classifiers goes through both these stages. Firstly, the training stage involves the system learning on the images and their respective category which is already known from the expert advice. In this way a series of images are given in the form of an input with their actual category. The classifier learns from this and then in the testing phase a new image is given for classification to the system. The system uses the prior knowledge which it has learnt during the training phase to predict the category for the image. The accuracy of each classifier is being calculated to apply the classifier with more accuracy for the prediction of the disease.*

Keywords: *Microscopic Images, Feature Extraction, Probabilistic Neural Networks (PNN), K-nearest neighbor (KNN), and Learning Vector Quantization (LVQ).*

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I. INTRODUCTION

Liver Cancer is the uncontrolled development of unusual cells in the liver. Liver disease has turned into the broadest kind of malignant growth among all kinds of people. With regards to further developing the endurance rate, the main conceivable arrangement is its recognition in beginning phases. The specialist examinations the infinitesimal pictures of the liver and predicts the presence of growth. As the manual detection of cancer takes more time to predict as there are limited number of professionals, we require a computerized technique for support of the decision and reduce time in the prediction of the disease. A few picture handling procedures can be utilized for identification of the sickness [1]. Expectation includes three phases,

- pre-handling stage.
- include extraction stage.
- liver disease cell ID.

Picture handling, with their capacity to comment and get significance from questionable information, can be utilized to separate, and identify designs that are too intricate to possibly be seen by either people or other PC strategies [2]. Along these lines, this aides in foreseeing the presence of cancer in the liver more precisely.

A doctor analyses the microscopic images of the liver and detect the presence of cancer cell in the image [4-5]. But however, in the manual method of detection there are chances of false detection which may be due to the presence of ribs, presence of air in bronchi, and blood vessels etc. so, it is necessary to develop a computerized method to act as a support system for the doctor. Image processing is a most identical concept for developing such a method. when images of patientcare processed by several image processing tools and techniques, the machine specifies whether a cancer nodule is present or not. Various classification techniques can be applied and compared the accuracy of each classifier to apply the classifier with more accuracy [6].

II. MOTIVATION ON PROPOSED WORK

The below points were the motivation of work

1. To classify the disease using several classification techniques.
2. To compute the efficiency of each classifier in detection of disease.
3. Apply the classifier based on the accuracy.
4. To be a supporting system for the doctor in the prediction of disease.

III. LITERATURE SURVEY

Raghesh Krishnan K. et. al, proposed a system for automatic classification liver diseases into carcinoma, cirrhosis, greasy livers, hepatitis, and cystic livers. The authors have used linear, nonlinear and diffusion filters for detailed analysis of ultrasound liver images before feature extraction and then further classification is done by extracting features using support vector machine classifier. Authors have achieved an accuracy of around 92.1 % [7-8].

Minhas F et. al, diagnosed a technique for distinguishing greasy and heterogeneous livers. The expected Region of Interest (ROI) was concentrated by applying textural analyzer to get the factual highlights. For grouping among the two predefined classes a multi class straight SVM was applied. The general exactness of their methodology prompted a precision of 95.4% [9-12].

Balasubramanian D et. al, concocted a programmed arranging framework which ordered liver into harmless classification, threatening class, growth class and ordinary liver class. Around 4 highlights extraction strategies were applied SGLDM, RUNL, TEM and Gabor wavelets procedures. K-implies grouping calculation and BPN calculation were applied for characterization. K-implies gave result around 80.75% and BPN 84.6% separately. Execution of BPN is preferred relatively over K-implies calculation [3].

Ahmadian A et. al, have suggested a method for categorizing different liver diseases using Gabor wavelet texture feature extraction method and classified ultrasound liver images into normal type, cirrhotic type, and hepatitis type. Dyadic wavelets transform as well as Gabor wavelet have been applied to extract the features from the images. An accuracy of around 87% was observed in the classification [4].

IV. METHOD

The Proposed technique classifies the Liver into normal and cirrhosis using different classifiers. The Labelled dataset is collected from the JSS Hospital Dangerous the prediction of cancer. Different classifiers are applied, and accuracy has been calculated for each of the classifier to apply more efficient classifier for the prediction. The types of Probabilistic Neural Networks (PNN), K-nearest neighbor (KNN), and Learning Vector Quantization (LVQ) are applied to classify, and accuracy is being calculated. Results have shown that PNN provides better accuracy than KNN and LVQ in *figure 1*.

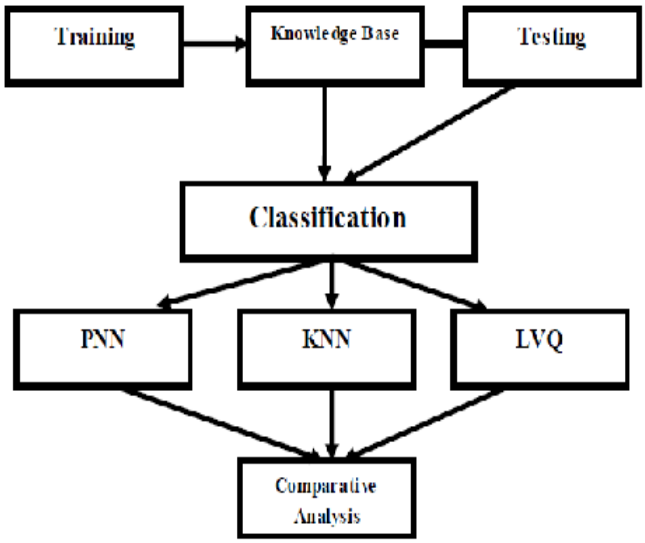

Figure 1 Different Classifier

V. IMPLEMENTATION

Once significant features are generated then classification is easy. In the proposed system three classifiers have been employed to categorize the images into common and cirrhosis liver. The accuracy details of each of these classifiers are given in the table 3. It also gives the details of confusion matrix. The terminology is given below,

Positive (P) = No. of affected (Cirrhosis Livers)
Negative (N) = No. of non-affected (Normal Livers)
True Positive (TP) = No. of affected liver images correctly identified as affected
True Negative (TN) = No. of normal liver images correctly identified as normal
False Positive (FP) =No. of normal liver images incorrectly identified as affected
False Negative (FN) = No. of affected liver images incorrectly identified as normal

From this we can derive the following details,
Sensitivity (TPR) = TP/P
Specificity (TR) = TN/N
Accurateness = (TP+TN)/ (TP+FP+TN+FN)

Table 1 Comparison of accuracy of KNN, PNN, LVQ classifiers using Confusion matrix

Classifier	No of Test images	TP	FP TN	FN	Sensitivity	Specificity	Accuracy	Execution Time
PNN	60	50	10 60	0	0.833	1	91.66%	5.52
KNN	60	60	0 40	20	10	0.66	83.33%	5.69
LVQ	60	50	10 40	20	0.833	0.667	75%	5.61

From the *table 1* it can be observed that PNN classifier shows 91.66% which is a better result comparatively than KNN and LVQ. The proposed system compares the accuracy of all these classifiers. KNN is the next efficient classifier with accuracy of around 83.33% followed by LVQ classifier 75%. There can be improvement in the accuracy results with large data set. As the study is carried out with a small data set of around 22 images still the PNN classifier as it is famous in working on smaller dataset showed better result. Table 3 also gives the execution time of the system with all three classifiers. From these results it can be understood that PNN is a better classifier comparatively for classifying the ultrasound images of liver into typical liver type classification and affected liver classification (here affected category is cirrhotic type).

Table 2 General precision of Category

Classifier	Total test images of Normal Liver	Classified as Normal Liver	Total test images of Cirrhosis Liver	Classified as Cirrhosis Liver	Accuracy
KNN	60	40	60	60	83.33%
PNN	60	60	60	50	91.66%
LVQ	60	40	60	50	75%

It gives the details about the number of images considered for classification and the complete accuracy of categorization. The *table 2* gives information about the correct categorization of ultrasonography liver pictures into typical liver and cirrhosis liver with all three classifiers. It can be observed that out of 6 normal images KNN classifier correctly classified only 4 images as into normal category, PNN correctly categorized all six images of normal liver as normal liver itself similarly LVQ classifier showed similar accuracy as KNN is classification of normal livers. But it can be observed that KNN classifier correctly classified all six images of cirrhosis liver into cirrhosis category where as PNN and LVQ correctly classified 5cirrhosis liver out of six. The table 4 above gives an overview of collective accuracy of these three classifiers.

VI. RESULTS & DISCUSSIONS

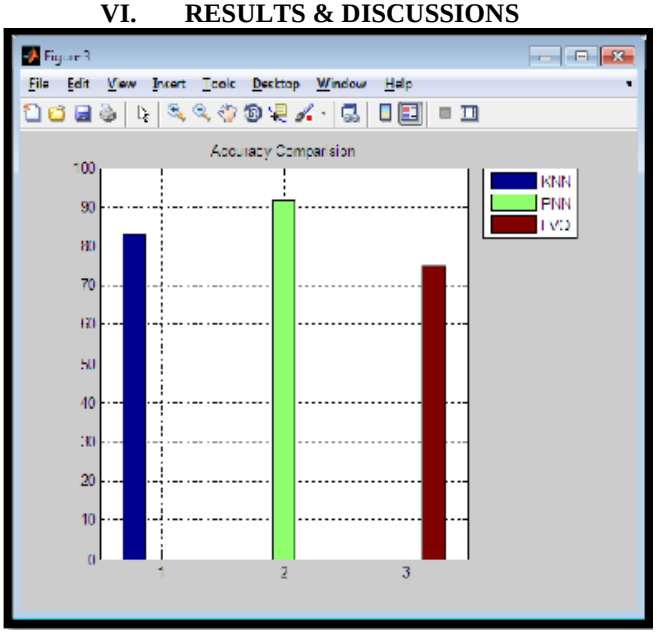

Figure 2 Execution time comparison of classifiers

Figure 2 shows the Receiver Operating characteristic (ROC) curve of the proposed system. As it is known that ROC is an important used in the field of diagnosis of some disease into normal and affected. ROC curve gives the details regarding the sensitivity and specificity that is True Positive Rate and False Positive Rate. The ROC arc gives the information about the how correct a particular parameter is grouped under normal and affected category.

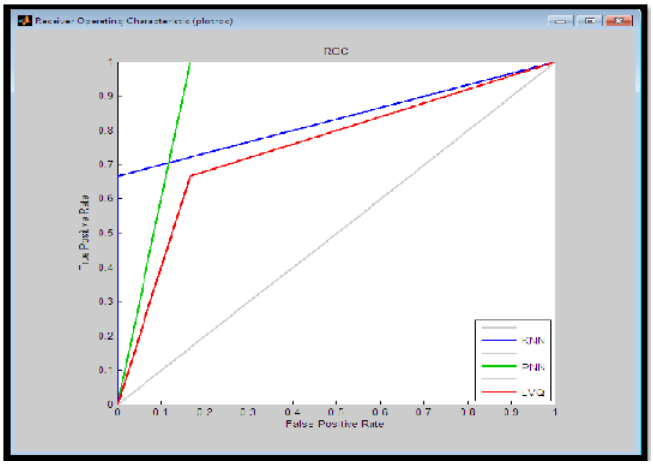

Figure 3 ROC with all three classifiers

Figure 3 gives details about the accuracy of individual classifiers namely PNN, LVQ and KNN. From the screenshot it is easy to make out that ROC of PNN classifier is better comparatively.

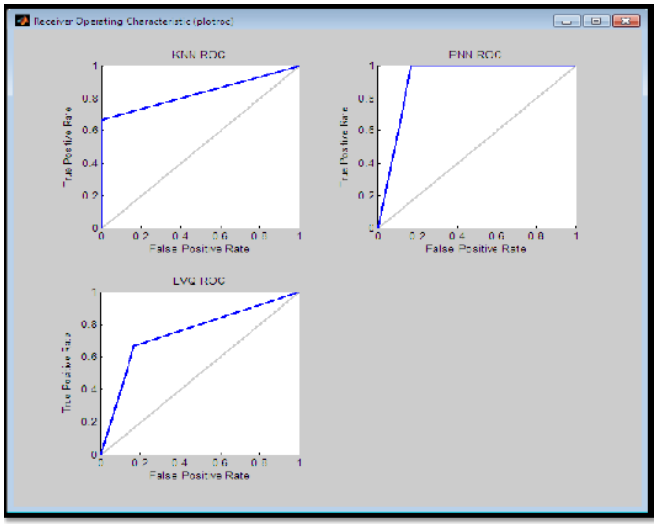

Figure 4 Combined ROC comparison of PNN, KNN, LVQ

VII. CONCLUSION

Classification of liver is done with help of three classifiers such as KNN, PNN and LVQ. All three classifiers are applied to understand the efficient classifier. The study found that PNN classifier showed good accuracy comparatively with KNN and LVQ. The accuracy of each classifier is KNN 83.33%, PNN 91.6% and LVQ 75%. From the study it was observed that application of more classifiers would help us to understand the efficiency of classifiers rather than applying only one classifier

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