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Detection of Abnormalities In Kidney Using Support Vector Machine

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ABSTRACT

Kidney diseases are evolving as a common chronic disease like hypertension, diabetes, and cardiovascular disease. They do not show any significant symptoms at an earlier stage. Therefore, monitoring of kidney diseases at regular interval of time is required to prevent kidney failure. This paper deals with the detection of abnormalities in the kidney using Support vector machine. The support vector machine (SVM) algorithm is used to extract features from medical images and these features are given to the neural network classifier for classification. The performance comparison of SVM is done with different classifiers along with the extracted SVM features to detect the abnormalities. The kidney classes are classified into normal and abnormal kidney with a total of 200 Test images. The efficiency of the classifier is measured in terms of recall, selectivity and accuracy.

Keywords – Support vector machine, Accuracy, K-means cluster algorithm, Neural network classifier.

I. INTRODUCTION

INTRODUCTION

The kidneys play an important role in the excretion system. It helps to maintain blood pressure and fluid balance in the body.

Erythropoietin and renin hormones are produced by kidneys to maintain Oxygen levels and red blood cell production.

There are many possible causes of kidney failure, including diabetes, high blood pressure, and exposure to high levels of medication, extreme dehydration, kidney trauma, or other factors. Kidney disease is classified into five stages. This range from very mild to complete kidney failure. Diabetes and high blood pressure are the most common causes of chronic kidney disease (CKD).At present days, kidney diseases are also becoming as a chronic disease and people do not have awareness on certain diseases like chronic kidney disease (CKD), polycystic kidney disease (PKD), etc. Ten percentages of the world population and 17% of the people in India are affected by CKD. One-third of them are at the final stage of CKD.The two categories of medical images are shown in Figure.1.

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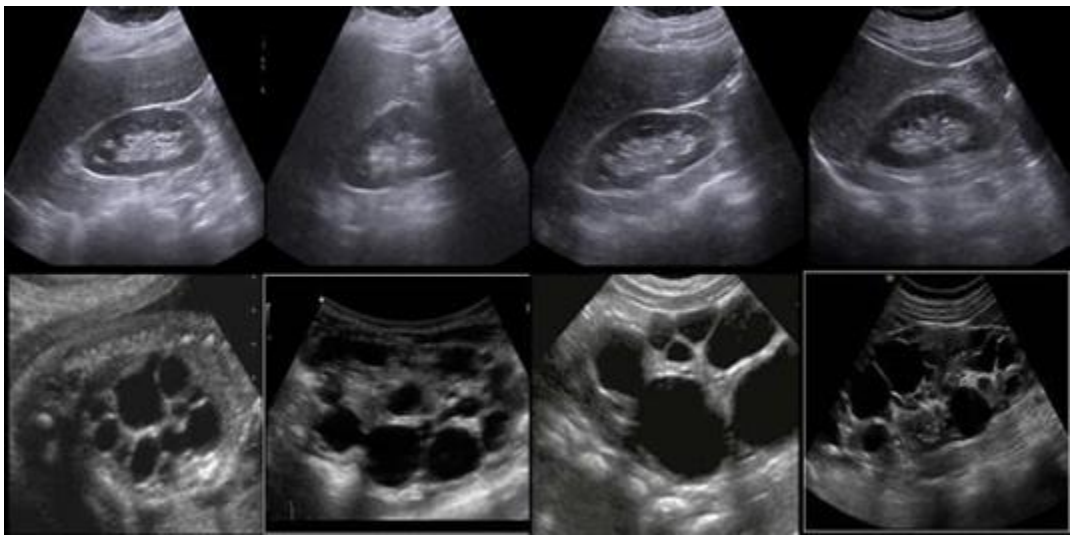


Fig.1.Normal and abnormal US image for kidney

The abnormalities considered in this work are stone and Tumor abnormality. Therefore, this abnormality detection method would help the radiologists in diagnosing the diseases precisely.

2. Related works

Several literatures analyzed the abnormality detection and classification using medical images. Among them some of the works are analyzed here: Akanksha soni [1] have explained a Kidney stone recognition and extract using directional emboss&SVM from CT images. The CT scan pictures have poor contrast and also contain noise; this creates complications for recognizing kidney abnormalities manually. So, there is a must wanted an accurate and intelligent system to foresee the stone automatically; it will be really advantageous for necessary treatment. The prime intention of this effort is to develop an automatic stone detection system from the CT picture. A learning model-Support Vector Machine is a proficient algorithm for classifying stone. It classifies the vector space of stone affected & normal kidneys into two separate districts. Before classifying the stone, the image may refer to some kind of improvements such as histogram equalization and Emboss that directionally calculates the differences in colors. S.shudharson [2] have explained a Abnormalities detection in the renal US image using MSVM Model. The pre- trained convolution neural networks (CNN) are used for automatic feature extraction from renal ultrasound (US) images. The extracted features are given to the ensemble MSVM model. This classifier model is designed by combining MSVM to get a quality classifier. The renal US images dataset is divided into normal and abnormal class. This technique is validated with the total of 2085 images. On the evaluation of classifier based on 4-fold cross validation, average accuracy (ACC), sensitivity and specificity obtained are 89.53%, 90.81%, 88.02%, respectively, which is the highest ACC.

Similarly, Priyanka kokil [3] explained a Abnormality classification in the kidney US image using SVD features. The singular value decomposition (SVD) algorithm is used to extract features from ultrasound images and these features are given to the support vector machine (SVM) classifier for classification. The performance comparison of SVM is done with different classifiers along with the extracted SVD features to detect the abnormalities. The kidney classes are classified into normal and abnormal kidney with a total of 100 ultrasound images. The efficiency of the classifier is measured in terms of recall, selectivity and accuracy.

Pallavi vaish [4] explained a Smart phone based automatic detection of kidney in US image. Developed an Application (APP) for a smartphone to automatically diagnose the kidney in the ultrasound image. With the developed APP, the smartphone can acquire images from any ultrasound scanner, process it and give the diagnostic

result. Automatic abnormality detection of kidney is based on Viola Jones algorithm, texture feature extraction followed by SVM classifier. Stones and cysts are the abnormalities detected using the algorithm. The developed APP resulted with an accuracy of 90.91% in detecting the abnormalities.

3. Proposed Methodology for abnormality detection

The main objective of proposed methodology is kidney classification detection of abnormalities using multiple stages. The block diagram shows the training and testing phase of classifier in detecting the abnormalities.

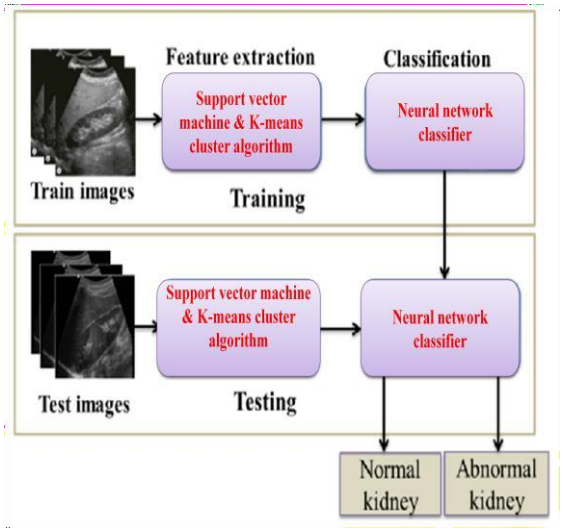


Fig.2.proposed method

A. Feature extraction

In the proposed method, the extraction of features from the training images. These features are used to train the classifier model. The SVM learns features from the training images and perform predictions in the test images for classifying the abnormalities. In the testing phase, the images are completely different from the training phase.

B. Classification

In the classification process, SVM is used and it is choosen based on experimental analysis with set of classifiers. SVM is an optimal classifier and has ability to tackle higher dimensionality problem.

C. Flow diagram of proposed method

The input images are processed for noise removal stage. After the preprocessing stage texture features are extracted from the image.then, these features are given to the neural network classifier to find out the image as a normal or abnormal image.

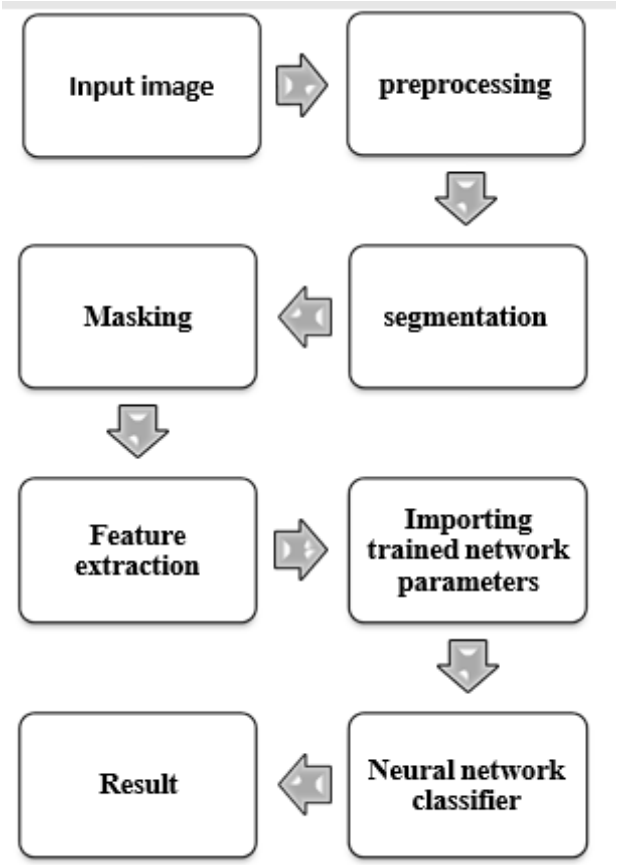


Fig.3.flow of proposed methodology

2.1. Preprocessing

Preprocessing is an imperative procedure of medical pictures because the occurrence of noise is more on Ultrasound picture, CT and MRI. Essentially, the CT pictures are mostly tainted by a speckle noise. Hence, noise removal is a serious procedure in medical ultrasound pictures. In this paper, for noise removal median filter is utilized. Median filter is a non-straight technique used to expel the noise present in the picture. The median is determined by first arranging all the pixel esteems from the window into numerical order, and afterward supplanting the pixel being considered with center pixel value. Middle filter is utilized to evacuate the speckle noise present in the original picture without diminishing the sharpness of the picture.

2.2. Segmentation

The segmentation procedure is a imperative of a images. The noise removal image is segmented by using k-means cluster algorithm.

2.3. Classification

In the supervised learning model, the samples are trained with set of labels. The dataset is represented as f^x(i); ^y(i)g, i = 1;

:::;m, The input and output variables are denoted as $\hat{x}_{(i)}$ and $\hat{y}_{(i)}$.

2.4. Performance measures

The performance measures such as recall, selectivity and accuracy are measured for the SVM classifier. It explains the number of confusions in the classifier while making predictions. The performance of the classifier in both normal and abnormal class is shown in Table I. The confusion matrix helps in analyzing the performance of SVM classifier in each class. The confusion matrix is described as follows:

- Correctly identifies the positive category,
- J- Incorrectly identifies the positive category,
- K- Incorrectly identifies the negative category,
- L- Correctly identifies the negative category.

We have collect 200 samples for testing .The 150 test images result has negative or normal function of kidney. And the 45 test images result is positive or abnormal function of kidney. But 5 test images are incorrectly identifies the positive category**.**

Accuracy = identification of normal and abnormal category / total test images

=(150+45)/200

=97.5 %

Comparison with existing methods

The SVD along with SVM classifier is compared with the existing abnormality detection techniques [10–14] which is

shown in Table.The existing methods uses different feature extraction techniques such as GLCM, gradient, statistical and PCA, etc. In the proposed method, the extracted SVM features are invariant to rotation which is fed into SVM classifier. This classifier learns well to differentiate kidney classes from the SVM features and thereby resulting in better accuracy than the existing methods.

DISCUSSIONS

The abnormality detection method for the kidney medical images is proposed. The proposed method has better classification accuracy than the existing methods features from the kidney ultrasound images are extracted using PCA followed by SVM and KNN as classifiers. This method has achieved 84% and 89% accuracy in classifying the abnormalities. The other feature extraction techniques like GLCM, gradient, statistical features are not efficient in distinguishing the kidney ultrasound images.

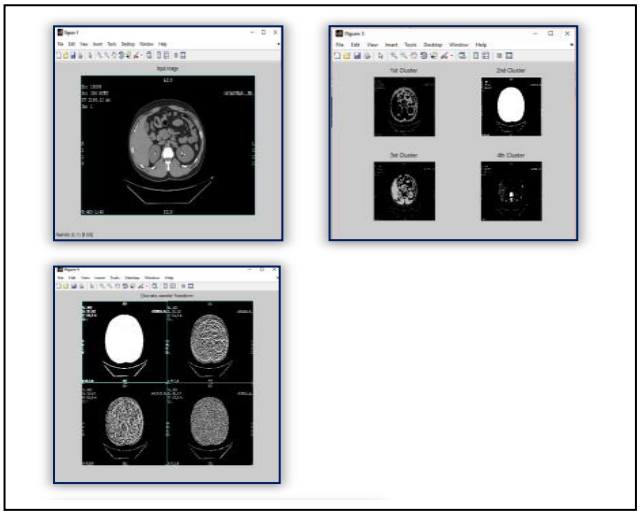
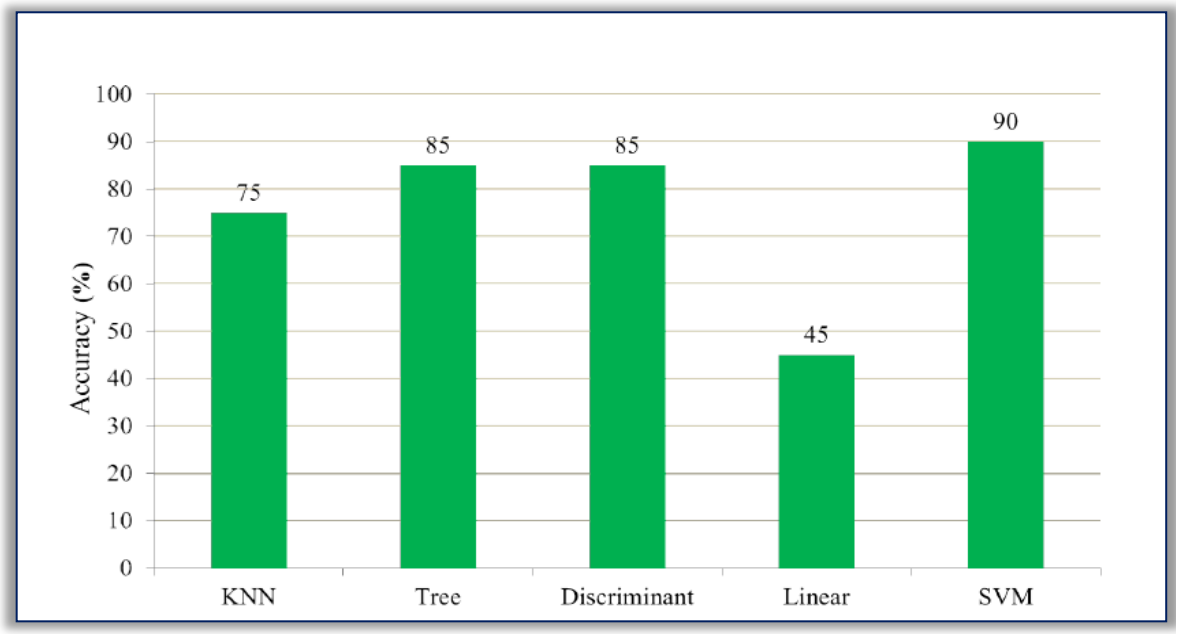


Fig.4.processing the input image



Different classifiers

Fig.5.comparison of different classifier accuracy

Kidney category	Features	Classifiers	Accuracy(%)
Normal,Abnormal	PCA	SVM	84
		KNN	89
Normal, Abnormal	Gradient GLCM	SVM	85.8
Norma,. Abnormal	Stastical GLCM	SVM	85.7
Normal, Abnormal	GLCM Features	ANN	87.5
Normal, Abnormal (proposed)	SVM Features	NN Clasifiers	97.5

CONCLUSION

The SVM & KNN features **are well suited** for the kidney images into normal and abnormal kidney. These features are given to different classifiers and out of which SVM is **high accuracy (97.5%) compared** to existing method. Further this method can be applied in detecting the **abnormalities in other organs.**

II. REFERENCES

[1]. Chaitanya and A. Rajesh kumar, S "Classification of kidney images using particle swarm optimization algorithm and artificial neural networks," International Journal of Innovative Technology and Exploring Engineering, vol. 8, no. 4, pp. 526–530, 2019.

[2]. R.Vasanthselvakumar,M.Balasubramanian, and S. Palanivel, "Pattern analysis of kidney diseases for detection and classification using ultrasound b-mode images," Int J Pure Appl Math, vol. 117, no. 15, pp. 635–653, 2017.

[3]. Sudharson.S, Priyanka Kokil "Abnormality classification in the kidney ultrasound images using singular value decomposition features" 2019 IEEE Conference on Information and Communication Technology (CICT)

[4]. Pallavi vaish "Smart phone based automatic detection of kidney in US image". IEEE Conference 2019

[5]. Akanksha soni " Kidney stone recognition and extract using directional emboss&SVM from CT images" IEEE 2020.