Detection of Diabetic Retinopathy on Retinal Images using Support Vector Machine

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Abstract

Diabetic retinopathy is a complication of diabetes that is caused by changes in the blood vessel of the retina and it is one of the leading cause of blindness in the developed world. This project is fully focused on automatic detection of diabetic retinopathy using Support vector machine algorithm. The input of this project is an retinal image and it is given to the preprocessing stage for removal of noise. The preprocessed image is applied to the feature extraction process.In the process of feature extraction HOG and SURF features are to be extracted from the given image.The extracted image is given to the SVM classifier. The classifier will detect whether the image contains diabetic retinopathy or not.

Keywords - *SVM,DR,HOG,SURF*

I. INTRODUCTION

Diabetic retinopathy is one of the severe eye disease occurred for long term diabetes patient. There are various factors affecting the disease like age of diabetes, poor control, pregnancy but Researches shows that progression to vision impairment can be slowed or averted if DR is detected in early stage of the disease. One can see large no. of population suffering from the disease but still testing is done manually by trained professionals in real life which is quite time taking and lengthy process and usually due to miscommunication and delayed results eventually leads to delayed treatment and ignorance.

PRP is advised for patients with vitreous hemorrhage and areas of neovascularization or in patients with large amounts of neovascularization of the optic nerve. It can also be considered in patients with severe NPDR to prevent progression to PDR. Macular edema should be treated once it becomes clinically significant

This paper contain section1.Literature survey 2:architecture diagram 3: methodology 4: experimental result and its analysis 5: conclusion and future work.

II.LITERATURE SURVEY

Abdilah et.al [3] Focuses the texture features that are required for the classification of Diabetic retinopathy .The texture features used in this study is local binary pattern because it has better data representation. The Neighbor mean local binary pattern centre value is derived average color intensity value in local area, this will make the transition between pixels & other when there is a big difference between values. Support vector machine and k-nearest neighbor classifier is used for the classification of images .The advantage of this paper is center value of NM-LBP is more accurate for the detection of diabetic retinopathy .The limitation of this paper is an unbalanced data &miss categorization of lesion characteristics. Bhagyashri [8] focused the detection of diabetic retinopathy disease level emphasizes on determination of two types of diabetic retinopathy: Hemorrhages and Exudates. These are extracted using fundus images of patients and is applied to the stage of preprocessing. The median filter is used to remove the noise from the image. Then the texture features are to be extracted using gray level cooccurence matrix. GLCM features are calculated for various segmented fundus image after it is given to the SVM classifier. The advantage of this paper is to remove impulse noise without give the blur edge of an image. The limitation of this paper is texture features is not possible to classify images accurately. Costa & Camphilo [4] describe a methodology for diabetic retinopathy detection from eye fundus images using a generalization of the BOVW model . The bag of visual words model extract local features from the image and learns a visual dictionary according to the classified feature images and to create a mid level representation of image. In the feature extraction step we have to extract dense & sparse features for the detection of diabetic retinopathy. Sparse level use the SURF features to be extracted for the process. The bag of visual words has the advantages of jointly learning the classification model and it reduce back propagation error. The disadvantage of this paper is few no of visual node doesn't classifying the feature vector accurately.

II.ARCHITECTURE DIAGRAM

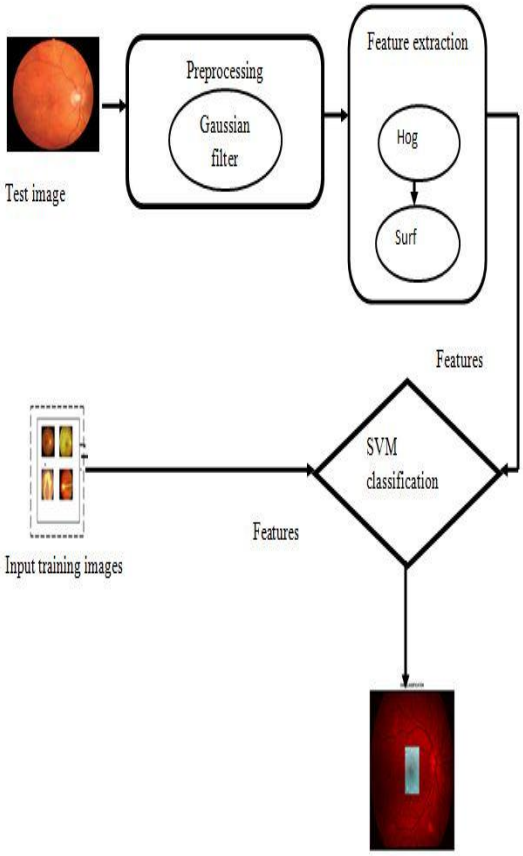

Figure1.1 System architecture

Lot of retinal images are stored in the database for training purpose. The test image is given to the preprocessing stage for the removal of noise. Then the filtered image is given to the feature extraction process.The hog and surf features are extracted from the corresponding image. The extracted feature image is given to the SVM classifier for detecting the location of diabetic retinopathy and it classifies the affected and non affected part of that image.

III.METHODOLOGY

There are three main stages: preprocessing, feature extraction, SVM classification

A. Preprocessing

The main aim of preprocessing is an improvement of the image data that suppress the unwanted distortions or enhances some of the image features important for further processing. The input Retinal image is given from the database to the preprocess stage. In that phase RGB image is converted into gray scale image .The gray scale image contain the clear view of the eye so it converted. In that image noise removal is one of the processes. In that process eliminate the unwanted noise and apply the de noising method and need to apply the low pass Gaussian filter. The need for the noise removal is the Retinal images is to be taken from different scanning machine so the chances of noises in those images will be more ,So to avoid those noise is necessary. Most of the time noise is Gaussian. For the effective segmentation Gaussian noise should be eliminated. The noise removed image is applied for feature extraction.

B. Feature Extraction

Feature extraction is the process of extracting the key features from the images that are useful for the classification process. In this work, the preprocessed images are given to the Histogram of Gradient (HoG) and speeded up robust features(SURF).

The HoG extracts the features of the images that are present over the grid of overlapping rectangular blocks in the search window. The histogram of each block is used to describe the frequency of the gradient directions inside each block. The image is generally described by a set of local histograms. These histograms count the occurrences of the gradient orientation and they become the local parts of the images.

The steps involved in calculating the histogram are:

- Computing the gradients of the image
- Constructing the histogram orientation of each cell
- Normalizing the histograms in each block of the cells

The frames are extracted from the images and then converted to frames first before the features are extracted.

Step 1: Read preprocessed Images from the input image

Step 2: Detect the Feature Points from each frame

Step 3: Extract Feature Descriptors from the required image

Step4: display the strongest points of the extracted feature

1.SURF

SURF is a scale- and rotation-invariant interest point detector and descriptor which is computationally fast, while not sacrificing performance. feature detection and description is performed by utilizing some predetermined integral images. Integral images can be created by Equations(1)

$$s(x,y) = \sum_{i=0}^{x}\sum_{j=0}^{y} I(i,j)$$

C. SVM Classification

SVM is a group of supervised learning tools to perform the data classification and regression. It maps the training samples into various categories. These training samples are taken as points in the feature space whereas the test samples are mapped to a similar feature spaces. It is then classified as belonging to any of the classes. SVM constructs a maximal splitting hyper plane among two classes. Therefore, the classification error is minimized. The input is mapped into a feature space of high dimensionality with linearly no separable data and they can be divided into a hyperplane. Using kernel, this projection in high-dimensional feature space is effectively established. The parameters that are used for the classification are calculated by the SVM learning. The training data is examined by the training process to find the optimal method to classify the images into suitable classes.. The kernel function of the SVM is used to map the data into various feature spaces..Using the non-linear kernel functions, the SVM is used to perform the non-linear classification. SVM is also called as binary classifier, because it takes two values mainly +1 and -1. In two dimensional spaces, a straight line is used to differentiate between two different classes. The equation for the straight line is given by wx+b=0 and so followed by wx+b>0 for positive class and wx+b<0 for negative class and it classify the stages of diabetic retinopathy.

IV.EXPERIMENTAL ANALYSIS

Our proposed project will be implemented with windows8 with i5 processor with the help of mat lab 8.4. We have collected the 40 Retinal images stored in our database and trained our database to ready for determine the Diabetic retinopathy accurately.

In our preprocessing phase load the test image from a testing database. The preprocessed image is given in the figure 4.1

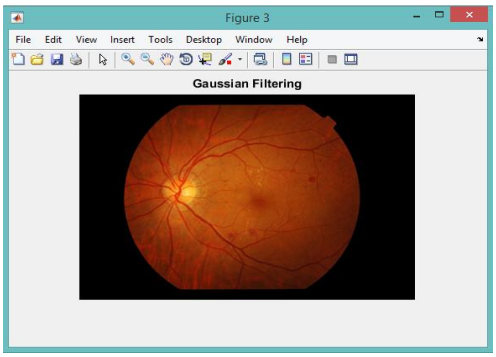

Figure4.1 Preprocessed image

In the first phase, image is preprocessed and the preprocessed image is as input for the next phase Feature extraction process. The extracted hog and surf features are to be shown in figure 4.2 and 4.3

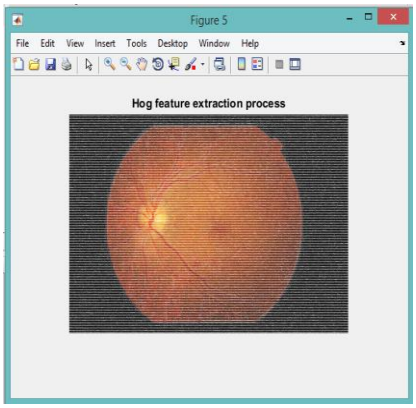

Figure 4.2 HOG image

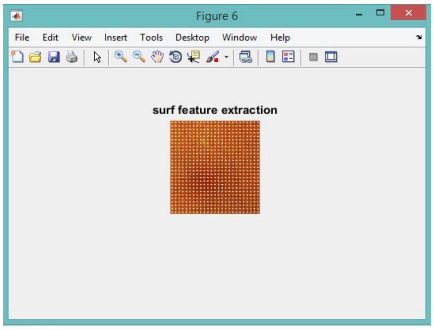

Figure 4.3 SURF image

After the feature extraction process the SVM classifier is used to detect the disease is shown in figure 4.4.

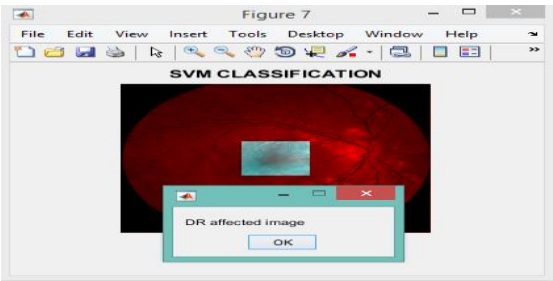

Figure 4.4 SVM classification

V.CONCLUSION

Detection of diabetic retinopathy in retinal image is a challenging one .So we predict the method for detection in three stages. One is to remove the impurities from the image. Another one is to extract the features from the image. Features would be really helpful to identify the disease. In retina the abnormal tissue has to be grown in enormous manner than normal tissue which are categorized under an abnormal image. If the retina contain some normal tissue are categorized under normal image.

Identifying the location of disease can be done using SVM classification. The experimental results have shown that this technique is robust in detecting and bounding the abnormal cells in retinal images despite in homogeneity intensity or the complicate shape of the diabetic retinopathy.

FUTURE WORK

There are a number of things that can be improved upon and added to the system. Improve the filtering process for an image and the feature extraction of retinal tissues are to be collected for identifying the severity level of a disease. Neural networks have shown great promise in this area, and would likely be the main focus for future work. It can analyze the classification part in accurate manner.

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