An Ensemble-Based System For Micro-Aneurysm Detection Of Diabetic Retinopathy

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Abstract—At the early stages of diabetic retinopathy, the retinal image of the diabetic person contains abnormalities. To examine the retinal image, modified computerized processing techniques are used to determine the various stages of diabetic retinopathy. This quantitative information can be used by practitioner to plan the treatment of the affected diabetic person. To develop the system which mainly focuses on detecting types of vascular exudates called micro aneurysms. The basic task of the system: detection then further segmentation on the basis of the features and information. The system is capable to test with real image datasets, making the system ready for clinical use.

Index Terms—Diabetic retinopathy(DR), micro aneurysm, Iterative segmentation, GLCM, Euclidean distance classifier.

I. INTRODUCTION

Nowadays due to hectic work lifestyle many diseases are affecting human health. One of them is diabetes, which is increasing day by day and becoming one of the major diseases containing several stages which are difficult to cure and affect permanently. The early detection of diabetes is easy as the human eye is a very sensitive organ which when affected
by diabetes further results in vision loss. The retinal images of the eye are the input to this detection system as the disease prevents the supply of oxygen inside retinal nerve. The classification of diabetes is divided mainly in two stages viz. proliferative diabetic retinopathy and non-proliferative diabetic retinopathy. As per damage of the retinal nerves the non-proliferative follows mild, moderate, severe. There will be

swelling in the small areas of the blood vessels of the retina. Detection of the DR is simple by targeting such areas with help of the image processing techniques.

II. REVIEW OF LITERATURE

The major cause of blindness among the people is diabetic retinopathy. Many various approaches are been proposed till date by various authors to automate and the process of detection of diabetic retinopathy in the fundus images. Here novel method of the detection of diabetic retinopathy is proposed which uses Gaussian intensity feature as an input to a VQ classifier. The basic idea of using this technique for or the fundus image processing is that there are some fixed certain features which are applicable only to diabetic retinopathy. Hence these features are then extracted in terms of diameter of the blood vessels expressed by Sigma and the height of the Gaussian profile across the cross section given by H. this work includes 30 images which were taken as normal and 25 different images which were considered as pathological images. The success
rate for or a successful average Diagnostic performance of 90 percent is achieved in this method. You're the first step in diagnosing the diabetic retinopathy involves the detection of vessels which have the diameter increased or the vessels which have witnessed hemorrhage. hence for the detection of blood vessels in fundus images there are many methods
proposed each method having its own advantages and various disadvantages. to summarize it in short the various methods are segmentation edge detection model based approach for detection of blood vessels using a mathematical model and tracking approach. in this method the training set is used to extract and recognize the features in the testing set that have the same features as in the training vector. vector quantization method is in short known as the VQ classifier method [1]. The
main cause of blindness in today's population is the disease in Diabetic patients known as diabetic retinopathy. The early detection of such diabetic retinopathy will further protect the patient from losing their vision partially or completely. This paper presents a computer assisted diagnosis which is based on the digital processing of retinal images to help the people in detecting the diabetic retinopathy well before hand. The main objective is to automatically classify the grade of non-proliferative diabetic retinopathy at any image of the retina but for that and initial image processing stage will isolate the blood vessels micro aneurysms and the hard exudates in order to extract features which will further be utilized buy a support vector machine to give out the retinopathy grade of each image of the retina which was applied as input to the system. A database of 400 retinal images was tested labelled according to A4 grade scale of non-proliferative diabetic retinopathy. The outcome was obtained with a maximum sensitivity of 95
percent and a predictive capacity or efficiency of 94 percent. Robustness with respect to changes in the parameters of the algorithm has also been evaluated [2]. Retinopathy is the main cause of vision loss of the patients of diabetes and is a diabetic related complication. The major sign of diabetic

retinopathy are the exudates. morphology based method for the early detection of diabetic retinopathy with the help of exudates from color fundus images is presented in this paper. The approach which was applied on fundus images led to satisfactory results which were then compared with the ophthalmologist's hand drawn ground Truths. over here is described and automatic detection of diabetic retinopathy in digital fundus images with a window based recursive region growing segmentation algorithm. hard exudates can be easily detected but the faint exudates cannot be detected. As the primary sign of diabetic retinopathy is exudates if diabetic retinopathy is detected at an early stage then the blindness of
the diabetic patients can be averted as well as prevented. There is a good number of different approaches for the detection of exudates in Diabetic retinopathy. None of these methods are perfect. In this paper they have developed a morphological based system for the early detection of diabetic retinopathy [3]. The most important task for Computer aided diagnosis
of diabetic retinopathy is the exudate detection. This is done to monitor the progress of diabetic retinopathy. This paper or deep convolutional neural network which is known as CNN is used for the achievement of pixel wise exudate identification. This CNN model is first friend with expert labeled
exudates image 50 and then saved as offline classifier. The potential exudate candidate points must be first extracted with morphological ultimate opening algorithm for achievement of pixel level accuracy and reducing the computational time for the Computer aided system. The trained CNN model is given the local region surrounding the candidate points for classification and identification processes. This CNN architecture
which is proposed in this paper leads to do a pixel-wise accuracy of 91.92 percent and sensitivity of 88.85 percent and specificity of 96.00 percent. The Automatic detection of expiry date has been extensively investigated with Different techniques proposed typically the detection of accidents can
be broadly divided into three steps as follows: first getting the exudate candidates, second extracting the features and third: machine learning. Various algorithms have been developed for extracting the exudate candidates including morphological operation based approaches, clustering based approaches and pixel level feature based machine learning [4]. Detection of lesions can be done automatically in the images of retina which can help in early diagnosis and screening of Retinopathy. The
primary sign of Diabetic Retinopathy are exudates. Hence the detection of exudates is the primary requirement of diabetic retinopathy. the most essential part is the detection of optic disc to locate the various number of features in the image of the retina. This paper presents the robust computational efficient approach for the localization of different features of the retinal images. A new constraint for optic disc detection is
proposed in this paper. first the blood vessel is detected and the patches of exudates are then subtracted to get the optic disc. various features such as blood vessel extrudes and optic disc can be detected very accurately using morphological

operations which must be applied appropriately [5]. For the diabetic retinopathy a Computer aided detection and Diagnostic
system has been developed. Fovea, dark lesions, blood vessels network optic disc as well as bright lesions associated with diabetic retinopathy are detected by this system. This diagnosis is affected by the number type and location of the abnormality is relative to the fovea. normal retinal components were detected and this was done as a part of the overall system development. The liaison detection is accomplished through the process of eliminating the normal retinal components. other features like the intensity and the shape also utilized the fovea is detected by utilizing Two main components like the blood vessel network which provides a map of the retina and by remapping the image into probability space. the image
is partitioned into regions first the fovea and second the non-fovea which have various backgrounds. The remaining data is then applied with filtering and statistical adaptive thresholding [6]. Diabetic retinopathy is called or seen as a serious case of diabetes mellitus that may further cause blindness around 10 percent of the recipients with diabetes generate eyesight threatening retinopathy. It is a typical condition in which the
cure is available universally. This cure is very efficient in eliminating lots of vision. Hence the impact of this has been major on the screening of Diabetic retinopathy. Such determination of sight threatening retinopathy is the main motive of this screening programmed. Four lesions viz. Micro aneurysm, hemorrhages, soft and hard exudates are the earlier dominant stages of Diabetic retinopathy. For detection process
of fuck lesions Feature Extraction is a very important attribute. Different types of feature extraction processes are easily available but the disadvantage is that they are limited in their application. Here the Gabor Filter is utilized for detection and difference classification of bright lesions, wavelet transform is mainly used only for detection of Micro aneurysm. This paper uses the AM-FM feature extraction method for to the higher
efficiency and advantages over other methods. This system is applied to detect red lesions she hard exudates. After all this process the automatic classification is done which is based on partial least square for differentiation of pathologies [7]. The complication of diabetes may lead to blindness and may be a big problem for the diabetic patients. They may cause vision loss or complete blindness too. Many lesions come across such as Micro aneurysms, hemorrhage, cotton wool spots and exudates. Such exudates have a tendency to form a ring around the inflicted vessel and look like yellowish white deposits are actual greyish white fluffy edges. These exudates can be easily spotted or visible from the background unlike the cotton wool spots as the edges are very well defined. For lesions detection technique is needed for Segmentation of such cotton wool spots along with exudates from the background. The aim of this paper is to sharpen the edge to make the Segmentation process more easy through ramp with reduction [8].

III. PROPOSED SYSTEM

In this project the retinal image is fed to the image processing system. The retinal color image is also known as fundus images, captured by fundus camera. A block diagram outlining proposed model to figure out the bright and dark lesions from the retinal images.

IV. BLOCK DIAGRAM

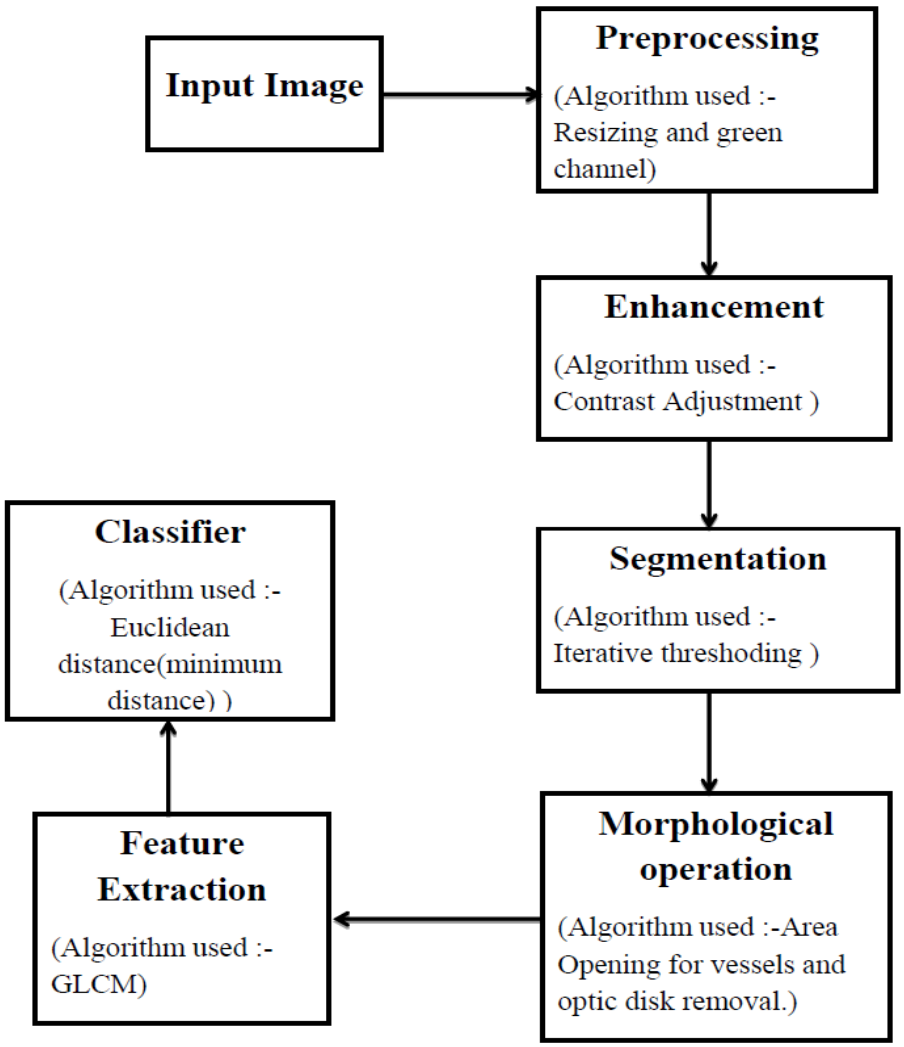

Fig. 1. BLOCK DIAGRAM

V. BLOCK DIAGRAM DISCRIPTION

1) Pre-processing: The image is mainly composed of RGB color model. The extraction of the green channel from the image as the other red and blue are not compatible with color intensities match. Primarily the
image consists of noise, low contrast and non-uniform illumination. Noises arises due to the device used for capturing the images, movement and illumination of the eye. Red colored lesions are more irregular in shapes and their texture characteristics vary. Hence pre-processing of the retinal images is required for

producing better quality in order to detect red lesions. Further the image is resized to the particular width to height ratio.

2) Image Enhancement: Image enhancement involves the contrast enhancement algorithm, histogram equalization, filtering techniques. The original retinal images contain non uniform illumination so it is required to use contrast correction techniques to the green channel that obtain the
bright optic disk.

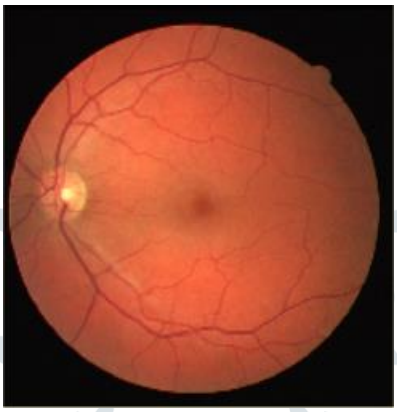

Fig. 2. Input Image

Fig. 3. Green Channel Selection

3) Segmentation: Segmentation is the process in which the digital image divided into multiple segments can say sets of pixel as super pixels. Segmentation process represent the image in new form such that more meaningful and easier to analyze. Segmentation applied on the retinal images used to locate objects and boundaries in images. To assign a label to every pixel in the retinal image such that pixels with the same label can share certain characteristics. In this proposed model, Iterative thresholding algorithm used for the segmentation of the retinal images based on the threshold value to turn the gray scale image into a binary image. The key of this method is to select the threshold value.

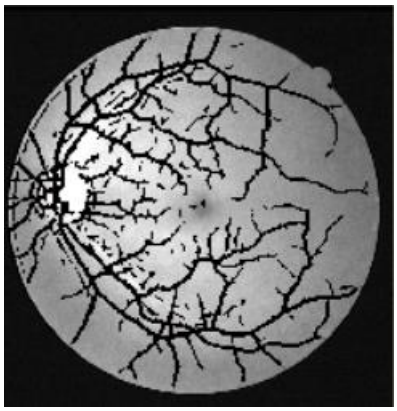

Fig. 4. Removal of Blood Vessels

4) Morphological Operation: Mathematical morphology theory mainly based on the analysis and the processing of geometrical structures. The basic morphological operators are erosion, dilation, opening and closing. An image with pre-defined shape, drawing conclusion on how this shape fits or misses the shapes in the image. This pre-defined probe be the structuring element is itself a binary image. The erosion and dilation operation the retinal gray level image obtained with removed blood vessels and the lesions further integrated with the preprocessed gray level image to obtain only exudates and the background.

5) Features Extraction: Feature extraction initiates from initial set of measured data and builds derived values intended to be informative an non-redundant, facilitating the subsequent learning with generalized steps. In this model, GLCM features are used. Gray Level Co-occurrence
Matrix associated with the texture feature calculations on the image analysis techniques. To compose different combinations of gray levels co-occur in an image. The features are contrast, energy, homogeneity, entropy, mean, standard, Skewness, kurtosis in the spatial domain also encounters the recurring in data in the same continuous time domain introducing wavelets features in frequency domain.

6) Euclidean Classifier: Euclidean classifier is also known as minimum distance classifier is used to classify the image data to classes that minimize the image data and the class in the multi-feature space such that the training images data which are compared with the processed image data so that the distance is defined as an index of similarity so that minimum distance is identical to maximum similarity. Further the retinal image assign to that diabetic class which has nearest featured data.

VI. RESULT AND DISCUSSION

Stages	Contrast	Energy	Homogeneity	Entropy	Deviation	Skewness	Kurtosis
Normal	1.6492	0.7690	0.9705	208.923	160.1803	0.4921	19.0397
Type 1	1.8026	0.7313	0.9678	201.880	160.8974	-0.0962	23.135
Type 2	1.5466	0.7585	0.9724	205.111	154.8297	0.0306	21.0651
Type 3	1.5495	0.7700	0.9723	237.978	181.2877	0.9789	14.55571

Above table shows the calculated values of features belonging to the processed retinal images of the different types of stages of retinopathy.
As gray level channel selection, the enhancement and segmentation are applied to further features calculation according to that previously stored trained images data can compared to the current test image calculated data to assign the class to the nearest feature data using the minimum distance classifier algorithm. The stages of the diabetes can be found with simple proposed model.

VII. CONCLUSION

In automated screening to analyze retinal images before an ophthalmologist does, and only the images that are suspect
for presence diabetic retinopathy are presented to the ophthalmologist. In this paper, a set of exudates candidates are first extracted, calculate the features and the classification based on the Euclidean classifier for the training and test images.

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