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Automatic Detection Of Diabetic Retinopathy In Retinal Images

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***Abstract**:*

Abstract- Automatic detection of retinal blood vessels and measurement of vessel diameter are very much important for the diagnosis and the treatment of different ocular diseases including diabetic retinopathy (DR), glaucoma and hypertension. In this paper, a novel method is to detect blood vessels in the fundus retinal images. The proposed method consists of three main steps. The first step is pre-processing of retinal image to improve the retinal images by evaluation of several image enhancement techniques. In the second step, the order filter and mean filter is used to enhance the blood vessels. Finally support vector machine algorithm is used for classification. The performance of algorithms is compared and analysed on three publicly available databases (DRIVE, STARE and CHASE_DB) of retinal images using a number of measures, which include accuracy, sensitivity, and specificity

Keywords
Blood Vessel Detection, order filter, mean filter, SVM algorithm

1. Introduction

Diabetes is a disease which occurs when the pancreas does not secrete enough insulin or the body is unable to process it properly. As diabetes progresses, the disease slowly affects the circulatory system including the retina and occurs as a result of long term accumulated damage to the blood vessels, declining the vision of the patient leading to diabetic retinopathy. After 15 years of diabetes about 10% of people become blind and approximately 2% develop severe visual impairment. According to an estimate by WHO, more than 220 million people worldwide have diabetes. It is the sixth largest cause of blindness among the people of working age in India, making it the world's diabetic capital. Retinal images acquired through fundal camera with back mounted digital camera provide useful information about the consequence, nature, and status of the effect of diabetes on the eye. These images assist ophthalmologist to evaluate patients in order to plan different forms of management and monitor the progress more efficiently. Diabetes occurs when the pancreas fails to secrete enough insulin, slowly affecting the retina of the human eye. As it progresses, the vision of a patient starts deteriorating, leading to diabetic retinopathy. In this regard, retinal images acquired through fundal camera aid in analysing the consequences, nature, and status of the effect of diabetes on the eye. The objectives of this study are to (i) detect blood vessel, (ii) identify haemorrhages and (iii) classify different stages of diabetic retinopathy into normal, moderate and non-proliferative diabetic retinopathy (NPDR). The basis of the classification of different stages of diabetic retinopathy is the detection and quantification of blood vessels and haemorrhages present in the retinal image. Retinal vascular is segmented utilising the contrast between the blood vessels and surrounding background. Haemorrhage candidates were detected using density analysis and bounding box techniques. Finally, classification of the different stages of eye disease was done using Random forests technique based on the area and perimeter of the blood vessels and haemorrhages. Accuracy assessment of the classified output revealed that normal cases were classified with 90% accuracy while moderate and severe NPDR cases were 87.5% accurate.

2. Existing System

In existing methodologies, the vessel segmentation has done without eliminating the optic disc. Since the optic disc is the converging point of all the vessels within the retina, elimination of Optic Disc boundary makes some visible blood vessels cross through it. Hence, the boundary of optic disc has to be removed before the vessels are segmented, as it may lead to misdetection of optic disc pixels overlapping with the blood vessels.

3. Proposed System

In this proposed method, (SVM) Support Vector Machine algorithm is used in the stage of disease severity analysis because it gives accurate results rather than other algorithms. The order filter and median filter is used to filter the Salt & Pepper noise and also it used to enhance the blood vessels.

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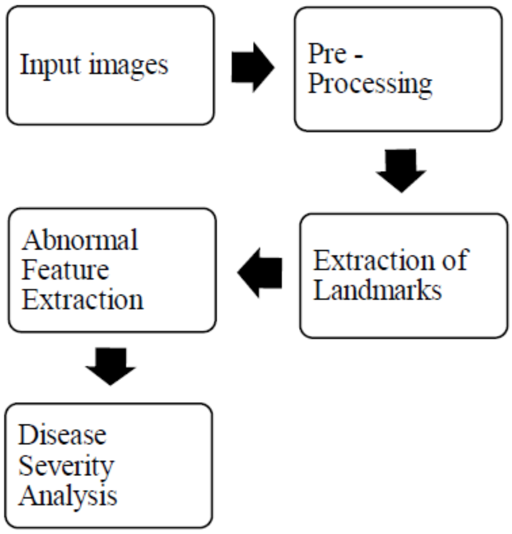

Fig 1. BLOCK DIAGRAM

3.1 INPUT IMAGES

The STARE (Structured Analysis of the Retina) database is used in this paper to analyse the performance of the retinal blood vessel segmentation with respect to ground truth images. This database consists of both normal and abnormal retinal images. STARE database, contains 81 fundus images, 31 images of healthy retinas and 50 images of retinas with disease, and subsequently digitized at 605×700 pixels in resolution, 24 bits per pixel (standard RGB).

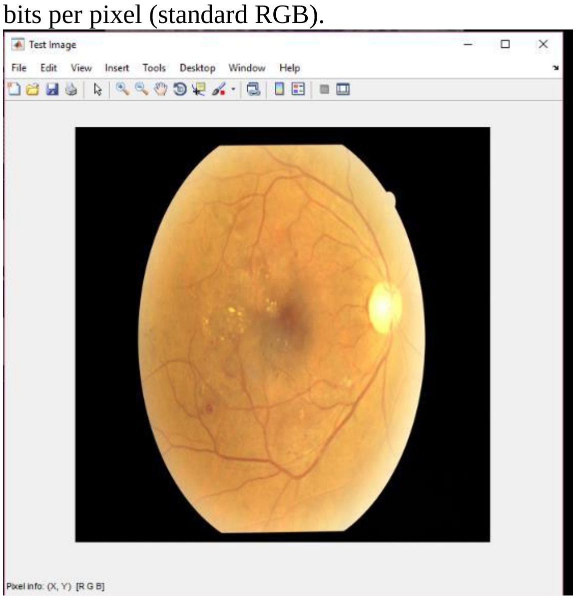

Fig 2. INPUT IMAGE

3.2. Pre-Processing

The aim of pre-processing is an improvement of the image data that supresses unwanted distortion or enhances some image features important for further processing. In this paper, RGB model is used. In this, green channel exhibits the best contrast between the vessels and background while the red and blue ones tend to be more noise. So we work on the grey image from green channel and the retinal blood vessels appear darker in the grey image and invert it to appear the vessels brighter than non-vessel background.

Salt & pepper noise is added in order to represent the the presence of noise

3.3. Filtering

In order to remove the salt and pepper noise by using the suitable filters such as ORDER and MEDIAN filters. The output of the order filter gives better contrast between vessels and background thereby removing the noise more accurately than the other filters. So order filter is used along with median filter. Median filter is used in order to reduce the noise which were leftover by the order filter.

3.4. Feature Extraction

Feature selection is a process where you automatically select those features from the data that contribute most to the prediction variable or output in which you are interested. This paper consists of 3 features (such as Mean, Variance, Standard deviation) in total to consider for the experimentation.

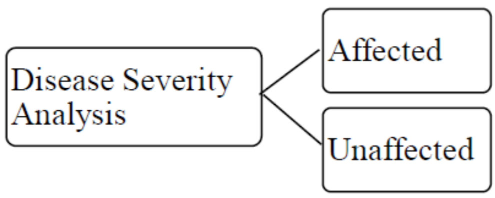

Fig 3. DISEASE SEVERITY ANALYSIS

3.5.Extracted Features

MEAN:

Mean value gives the contribution of individual pixel intensity for the entire image.

$$\mu = \frac{1}{M*N}\sum_{i=1}^{M}\sum_{j=1}^{N} Xij$$

VARIANCE:
Variance is normally used to find how each pixel varies from the neighbouring pixel (or Centre pixel) and is used in classifying into different regions.

$$\sigma^2 = \left[\frac{1}{M * N}\sum_{i=1}^{M}\sum_{j=1}^{N} X^2 ij\right] - \mu^2$$

STANDARD DEVIATION:
The square root of the variance, symbolized by S.

$$\sigma = \sqrt{\left[\frac{1}{M * N}\sum_{i=1}^{M}\sum_{j=1}^{N} X^2 ij\right] - \mu^2}$$

4. Results

Fig 4. RESIZED IMAGE

Fig 5. RESCALED IMAGE

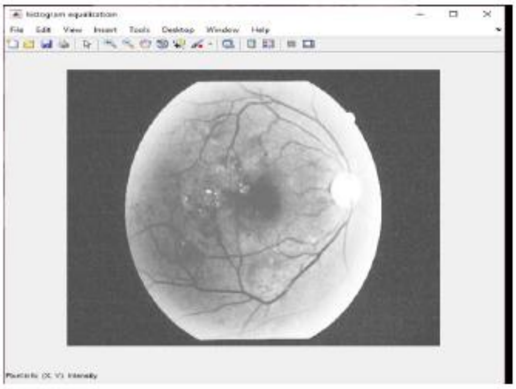

Fig 7. HISTOGRAM EQUALIZATION

Fig 8. GREEN CHANNEL IMAGE

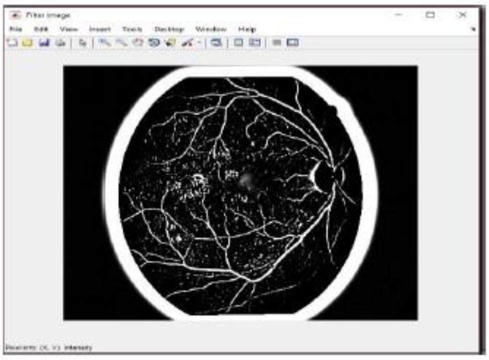

Fig 9. FILTERED IMAGE

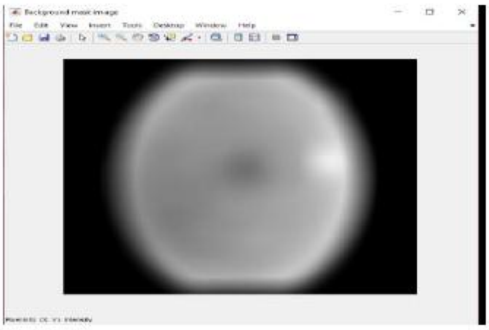

Fig 10. BACKGROUND MASK IMAGE

Fig 11. APPROX. COEFFICIENT IMAGE

5. Conclusions

In this paper, pre-processing and feature extraction of the diabetic retinal fundus image is done for the detection of diabetic retinopathy by using Support Vector Machine (SVM) algorithm. The images were divided into two different datasets, the one was a normal stimulus, and the other was diabetic affected retinal images. The features are extracted from normal and diabetic fundus image datasets. These features are used for identifying a normal and a diabetic fundus images.

6. References

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