

Retinal Optic Disc Detection using Speed up Robust Features

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Abstract:

Optic disc is generally used for transfer the signal to the brain, which is yellow ball like structure, Optic disc is the portion where the all blood vessels are grows it mean; it is the center point of blood vessels of the retina. As we know blood vessels is very important part of our retina because, if blood vessels get swell or it get rupture then it will leak the blood or sometimes it will leak the fluid, fluid is gel like substance. The necessity to detect the optic disc is to see whether the blood vessels are normal or not because near the optic disc region vessels get change their pattern and ophthalmologist see this part and come to know, whether the vessels are normal or not, abnormal vessels called as tortuous vessels. Tortuosity stand for changing the vein structure of the vessels, as we know if blood vessels get tortuous then the chances of leaking the blood is more and due to this, Retina get damage, there are some diseases like Microaneurysms, Hammorrhages, Exudates, Cotton Wool Spot and so on. For detecting the optic disc we have used the Image Processing techniques, firstly we have performed the preprocessing operations for enhancing the fundus image and then for detecting the Optic disc we have used Speed up Robust Features. For analyzing these techniques we have taken database from Dr. Neha Deshpande and Dr. Saswade, in this database total twenty eight images are there fourteen were fluorescein angiogram and another fourteen were high resolution fundus images we have work on high resolution fundus images. To observing the result we have develop one GUI with the help of MATLAB 2012a, and used Receiver Operating Characteristic (ROC) curve for evaluate the result and we have got 92.86% sensitivity, 0% specificity and accuracy score is 0.9902.

Introduction:

Optic Disc is very important part of our retina because it helps to transfer the signal to the Brain. It is Yellow ball like structure. Optic Disc is the origin of the retinal blood vessels. As we know if blood vessels get swell or it get rupture then blood get leak from the vessels and it damage the retina or sometimes it will leak the fluid which is gel like substance. Blood vessels get swell or rupture due to the changing their structure, which called Tortuosity or tortuous vessels. Optic disc detection is very important aspect because as know the optic disc is the origin were the blood vessels are grow, and the ophthalmologist concentrating on the nearest area of the optic disc to see whether the blood vessels are normal or not, if blood vessels get tortuous then they come to know that the patient having an early stage of Diabetic Retinopathy. We have design this algorithm for the ophthalmologist to reduce their time for finding the Optic disc. In Diabetic Retinopathy there are certain diseases like Microneurysms, Exudates, Hammorrhages, Cotton Wool Spot etc. Optic disc and Exudates sharing the same properties in some cases even the trained professional are also confused between the Optic disc and the Exudates in some cases. For designing this algorithm we have used the Image processing techniques like firstly we have perform the preprocessing operations on the high resolution fundus images then for detecting the Optic Disc we have used Speed up Robust Features. And to evaluate these techniques we have used the MATLAB 2012a and using this platform we have design on Graphical User Interface for detecting the Optic disc. For result analysis we have taken database from Dr. Neha Deshpande and Dr. Saswade Aurangabd. In this database total twenty eight images are there, fourteen were high resolution fundus images and another fourteen were fluorescein angiogram we have worked on high resolution fundus images which is RGB images. And for result analysis we have calculated the Performance evaluation and Receiver Operating Characteristic (ROC) curve and we have got 92.86% sensitivity, 0% specificity and accuracy score is 0.9902.

Method:

For detecting the Optic Disc we have used some Image Processing techniques like taking the Green channel from the RGB image because it shows high intensity as compare to Red and Blue respectively.

$$g = \frac{G}{(R + G + B)} \quad (1)$$

Here g is a Green channel and R , G and B are Red, Green and Blue respectively.

Then for enhancing the Optic Disc we have used Intensity Transformation function

$$s = T(r) \quad (2)$$

Where T is Transformation and r is Intensity

Then for detecting the Optic Disc we have used the Speed up Robust Features

$$I_{\Sigma}(x, y) = \sum_{i=0}^{i \leq x} \sum_{j=0}^{j \leq y} I(x, y) \quad (3)$$

Given an input image I and a point $(x; y)$ the integral image I_{Σ} is calculated by the sum of the values between the point and the origin. These functions we have used for detecting the Optic Disc.

Result:

For detecting the Retinal Optic Disc we have designed one GUI in MATLAB 2012a, for result analysis we have used Receiver Operating Characteristic (ROC) curve, this algorithm achieves a true positive rate of 92.86%, false positive rate of 0%, and accuracy score of 0.9902. Table 1 shows the performance evaluation.

Table 1. Performance Evaluation

Test Result	Present	Absent
Positive	True Positive (TP)	False Positive (FP)
Negative	False Negative (FN)	True Negative (TN)

$$Sensitivity = \frac{TP}{TP + FN}$$

$$Specificity = \frac{TN}{TN + FP}$$

Experimental Work:

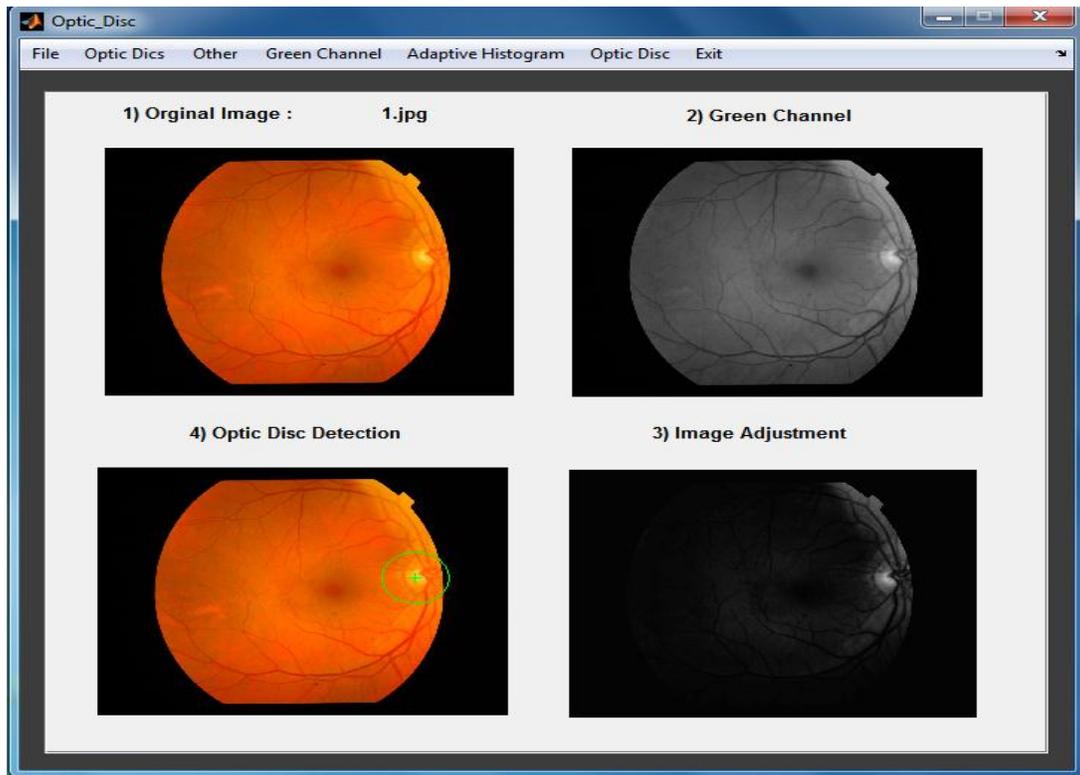


Figure 1: GUI for detection of Optic Disc

ROC Curve for $y = 0.01\ln(x) + 1$
Area under curve = 0.9902

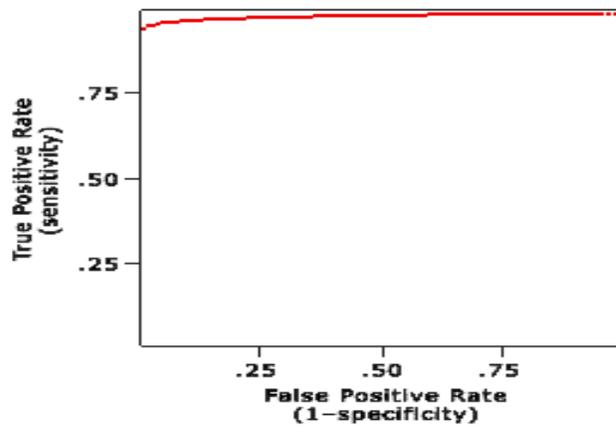


Figure 2: ROC curve

Discussion:

For detecting the optic disc we have used image processing techniques like we have taken green channel from the rgb image because green channel show high intensity as compare to red and blue respectively. Then for enhancing the optic disc we have used intensity transformation function and lastly for detecting the Optic Disc we have used Speed up Robust Feature, for evaluation this techniques we have taken database from Dr. Neha Deshpande and Dr. Saswade Aurangabad. And for designing the GUI for Optic Disc detection we have used MATLAB 2012a and for result analysis we have used performance evaluation and receiver operating characteristic curve. And this algorithm got 92.86% sensitivity, 0% specificity and accuracy score is 0.9902.

Conclusion:

In this algorithm we have used Image processing techniques for detecting the Optic Disc of the retinal images, for performing these techniques we have used database from Dr. Neha Deshpande and Dr. Saswade, and this algorithm achieves a true positive rate of 92.86%, false positive rate of 0%, and accuracy score of 0.9902.

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