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Design and Development of Glaucoma Detection System

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Abstract: Proposed study aim to provide a fully single handheld system using a raspberry pi, camera and condensing lens. Glaucoma is the major object that cause blindness globally. currently available camera is bulky, not portable and expensive. Taking the benefits of raspberry pi the system own make the modest improvement which could be useful in variety of healthcare organization. The camera and condensing lens is used to obtain superior quality fundus images. The code is programmed in python using OpenCV library functions. The function which we use by OpenCV increase the speed operation and perfectly match the real time process. A set of fundus image is obtained to perform purposed system.
Keywords: Glaucoma, Neuro retinal rim, Optic Disc, Optic Cup, Cup-Disc Ratio, Fundus image.

I. INTRODUCTION

There are various eye disease causing optic nerve damage. Through worldwide glaucoma is awarded as second main reason toward blindness [1]. The patients suffering from glaucoma are quite innocent regarding condition of eye disease unless it has turned to an acute stage, Hence the name “the silent thief of sight”. In any medical treatment, the correct treatment is given only if the diagnosis is correct.

The glaucoma spread so fast that indirectly patient loss their sight within certain time interval. So, we can safe by diseases if we regularly check eye and take proper care [2].

Ophthalmologist check the patient by five general tests to give the final results. The general test include machine like Perimetry, Gonioscope, Tonometry, Ophthalmoscopy, and Tachymetry.

There are number of device through which glaucoma is diagnosed. The proposed system aims to detect glaucoma on real time process by extracting the feature like optic disc, optic cup and CD ratio from fundus image. The image taken here with pi Noir camera and processed image on Open cv platform.

II. LITERATURE REVIEW

A. Detection of Glaucoma Using Neuro retinal Rim

Optic Disc (OD), Optic cup (OC) and Neuroretinal Rim(NRR) are three main feature that are highlighted by author in this paper. Here author used, a computer assisted method for the detection of glaucoma based on the ISNT rule is presented. Applying watershed transformation, the Od and Oc is segmented. After having segmented OD and OC the NRR area is obtained with help of ISNT quadrant. The developed method is applied on four publicly available databases, HRF, Messidor, DRIONS-DB, RIM-ONE and a government hospital database.

B. Data Set for Glaucoma Detection with Annotated cup to disc ratio

The author presents the diagnostic system of computer aided which helped to diagnose glaucoma as early as possible where ratio is small for doctor to patient. Another thing that author analyse is there are huge ratio of CDR which is achieved by collected available dataset. Globally glaucoma led to unawareness and less evaluation of known feature certainty. [3] The author as well provide a dataset for glaucoma. That will be helpful in future to analyse and take other research work easier.

C. An Automatic Glaucoma Screening Algorithm using Cup to-disc ratio and ISNT rule with Support Vector Machine

The author performed Firstly, image segmentation to obtain optic cup, optic disc and rim width. By obtaining OD OC value glaucoma steps regarding classification become easier. As a classifier a Support vector machine is selected. Total three feature are analysed by SVM classifier. The proposed model, at the end we achieve 9 features that extracted from both indicators. Additionally, to minimize false positive and false negative more input feature can added. [4]

D. Feature extraction of retinal fundus images

The author highlights a modern Adaptive Histogram method to gain the features. The freedom of this method is, it picks up the boundary of the optic disk by focusing individual pixel detail. The present method shows the OD boundary in a well-set manner for both normal and abnormal classes without any effective constraint on the result. This method is capable to divide the OD perfectly, evident from the OD area and Centroid. The decided value is appreciable and comparable to the standardized methods achievable in literature. [5]

E. General Disadvantage

Following below are some general point which are found on every paper:

1) The device used for glaucoma analysis are too bulky in nature.
2) Cost effective: both the hardware part and software part are expensive.
3) The examiner room for patient are fixed.
4) Dependent on another machine too.
5) Algorithm that are used presently can be more automated and adjustable according to condition.

III.PROPOSED METHOD

The proposed idea mainly consists of three different stages. The retinal image capturing(ROI), the optic disk and optic cup segmentation and CDR ratio. For glaucoma, the feature of optic disc and optic cup are classified by super pixel classification. Further for pre-processing on fundus image filtration, thresholding is done. By achieving optic cup and disc value, the CDR is calculated. Following below are the flow of proposed idea.

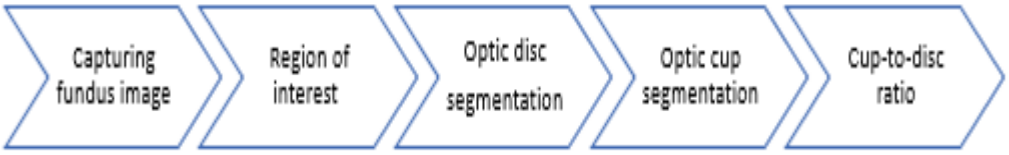


Fig. 1 Block Diagram of proposed idea

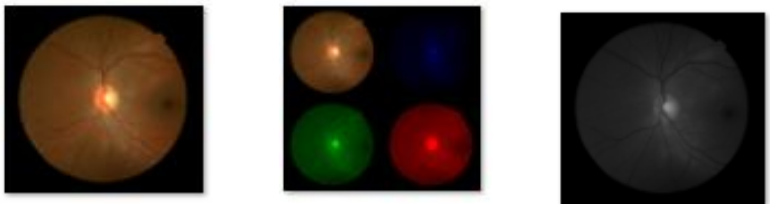
A. Fundus image

Here, fundus image is taken by raspberry pi NoIR camera which have property of8 megapixel. The 20 D lens are used to capture fundus image. The size of image is around 64 kB. Image should be in form of jpeg format.

B. Extraction of ROI

The retinal images have been taken by pi camera. As shown in Figure 2 the separation of three(RGB)channel. The ROI Extraction stage is shown the size of the fundus image is 1504x1000 pixel.

Fig. 2 Extraction stage of ROI



(a) Fundus image (b) RGB separation (c) ROI

Optic disc is the brightest point found in fundus image. Hence G plane contain the brightest point on retinal image. Initially selection of ROI is considered as optic disc. At starting point optic disc entirely know as ROI of fundus image.

C. Optic Disc Segmentation

Optic disc is known as preprocessing steps of image processing. here, Super pixel segmentation is applied to obtain od. It uses simple linear iterative clustering algorithm. There are only K parameter (the number of super pixels) found there. As K value increases, accuracy increases but time required for evaluation also increases. If K value is very small then time required is less but results are poor. Hence tradeoff between those two is achieved and K=100 is used in project. It is iterative process. 10 iterations are used here. Segmentation result is shown in figure 3

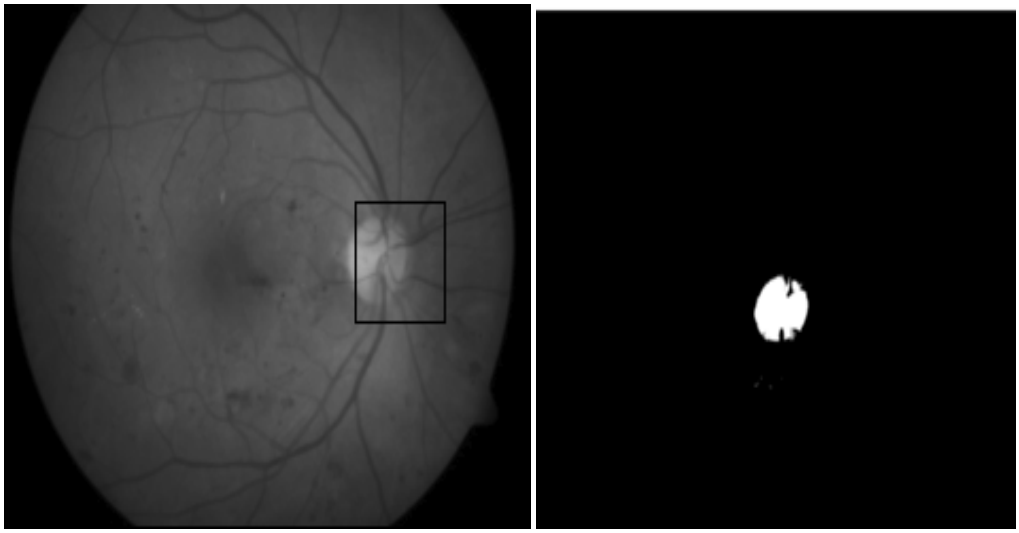


Fig 3 Optic Disc

D. Optic Cup Segmentation

Optic cup segmentation uses thresholding and binarization. during the process the image form a thresholding or binary value as the process is easy. Segmentation is done to obtain a image in two or more part in pixel form. The easiest wat to obtain segmentation for optic cup is otsu thresholding. [10] Here also super pixel segmentation is used. Parameter values are same as disc segmentation. Segmentation result is shown in figure 6.

Fig 4 optic cup segmentation

E. Cup To Disc Ratio

Generally, the diameter of vertical disc to vertical disc diameter ratio is calculated.

Cup-to-disc = VCD/VDD

When computed CDR found bigger than threshold then the condition considers as glaucoma case else normal status is found. Below table show value of CDR of 10 patients.

TABLE I CDR VALUE ANALYSIS

sr,.no	Fundus image	Cdr value	Class
1	F1	1	Present
2	F2	0.475	Present
3	F3	1	Present
4	F4	0.37	Absent
5	F5	0.91	Present
6	F6	0.69	Present
7	F7	0.33	Absent
8	F8	0.69	Present
9	F9	0.89	Present
10	f10	0.36	Absent

IV. CONCLUSIONS

Proposed method detects whether patient is healthy or is at risk of glaucoma. This imaging technique does not require patient at the time of testing as only retinal image is sufficient. Cup to Disc ratio calculation method for glaucoma detection is superior to earlier methods. This uses super pixel segmentation method to detect disc and cup. This uses simple linear iterative clustering algorithm. Super pixel segmentation has less complexity than pixel-based methods. The only parameter of segmentation is number of super pixels. Increasing this number increases accuracy of correct boundary but time required is more. Hence tradeoff between accuracy and time is achieved. 10 images are used for evaluation

V. ACKNOWLEDGMENT

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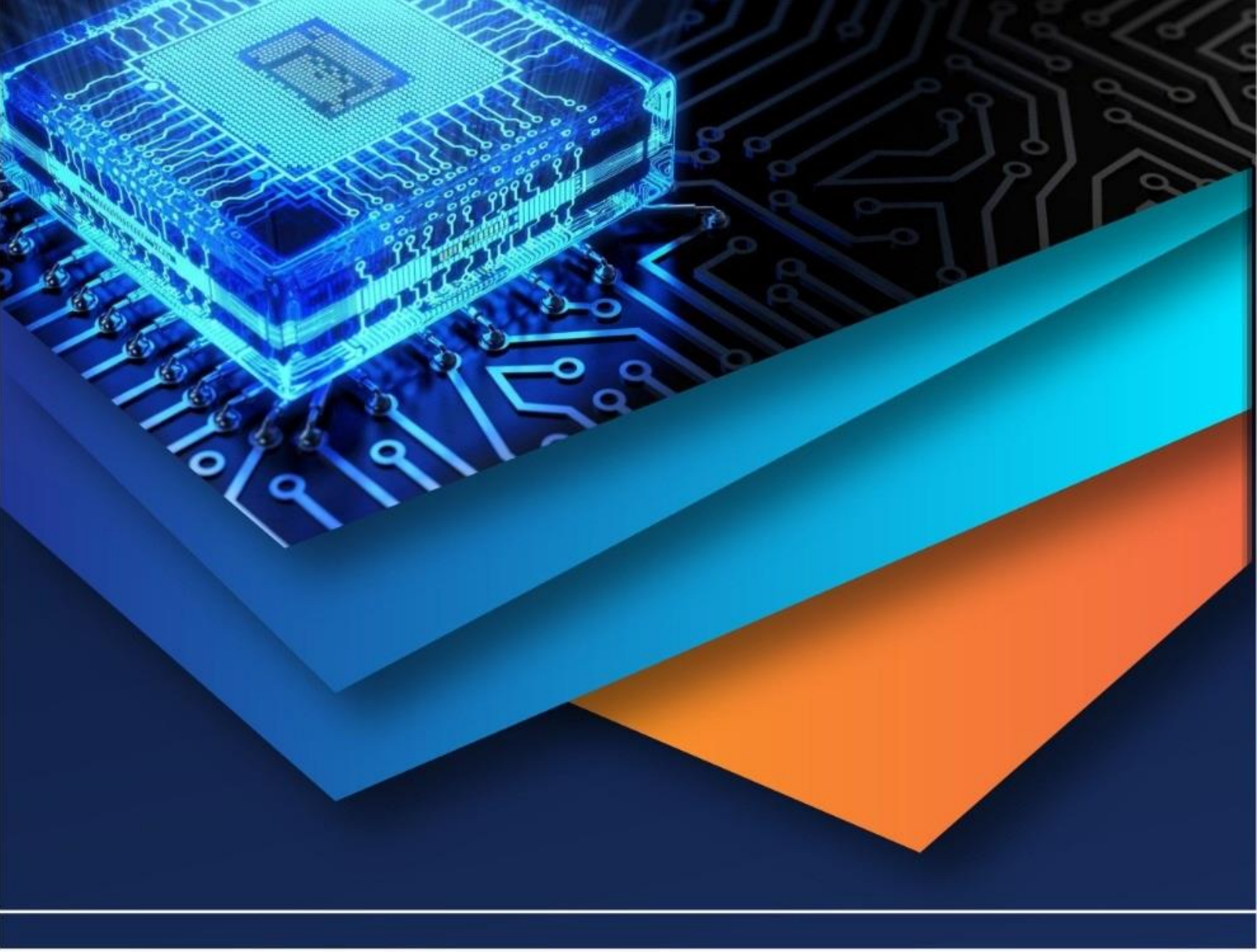

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