National Conference on Research Challenges and Opportunities in Digital and Cyber Forensics
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2020 IJSRCSEIT | Volume 4 | Issue 11 | ISSN : 2456-3307 (www.ijsrcseit.com)

Detection of Glaucoma by Optic Disc and Optic Cup Segmentation

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ABSTRACT

Glaucoma is viewed as one of the perilous ongoing eye pathologies which lead to vision misfortune much of the time far and wide. The appropriate finding is needed at the perfect time bombing that will prompt irreversible harm for the optic nerve accordingly causing visual impairment. By the assessment of the optic nerve in an optic cup (OC) and optic plate (OD) proportion, there are more opportunities to discover glaucoma. The manual division is finished by looking at the size, shape, and structure of the optics cup just like a plate. Be that as it may, it is a dreary and time taking cycle. Henceforth an easy to use mechanized framework for the optic plate and optic cup extraction is proposed in this paper for the recognition of glaucoma. This paper clarifies a novel and more basic completely computerized confinement just as division of OD and OC by utilizing the Modified Fuzzy C implies calculation.

Keywords : Glaucoma, Optic Disc, Optic Cup, automated localization

I. INTRODUCTION

There are a few eye pathologies on the planet. Glaucoma is one such eye pathology that is ordered utilizing raised intraocular pressure, slow vision misfortune that outcomes in vision misfortune forever making a record to second replenishing explanation behind visual deficiency in the works[1]. Glaucoma is an ongoing neurodegenerative non-reversible eye illness where the neuroretinal nerve which associates the cerebrum and eye is harmed continuously. Early identification of glaucoma is extremely fundamental for sparing a patient's vision. PC helped calculations are commonly utilized for the recognition of glaucoma by figuring the cup to plate proportion for the shaded fundus retinal pictures. Cup to Disk (CDR) is shifted with patients having great eyes and patients with unusual eyes (Glaucoma influenced eye). Generally, the patient with Glaucoma has the cup to circle proportion high and it continues expanding. RGB fundus pictures are gotten utilizing both Fundus cameras just as Optical Coherence Tomography (OCT). Fig .1 shows the vision of an individual with Glaucoma and typical vision. This work principally centers around robotized divided screening glaucoma utilizing Cup to Disk Ratio (CDR) from the retinal fundus pictures.

Fig.1 Glaucoma vision and normal vision

RELATED WORKS

In the previous, not many years, various investigations have talked about the issue of the division of optic plates. A technique for optic circle confinement, non straight sifting, and vigilant edge discovery with Hough change was proposed by Chrastek et al. [2]. Welfer et al. [3] gave a procedure which depends on versatile morphological preparation. Mendels et al. [3] recommended dynamic forms driven methodology by a creative outer determined field called inclination vector stream. Pixel grouping approach is given by Muramatsu et al [5] sections optic circle by bunching and arranging picture pixels as an optic plate or, in all likelihood foundation pixels. Later Fuzzy c implies and fake neural organizations are utilized for playing out the extraction. Joshi et al[6] proposed district-based dynamic form models by utilizing measurable data recovered from the foundation and closer view areas for limiting energy work. A Hough change-based round layout is proposed by Lowell et al [7]. Numerous goals sliding window band channel (SBF) is applied for OD division [8]. Our principal point is to outline a mechanized framework for fragmenting optic plate and optic cup and to compute CDR for the recognition of Glaucoma.

II. PROPOSED METHOD

The block diagram of the proposed method is illustrated in the fig .2

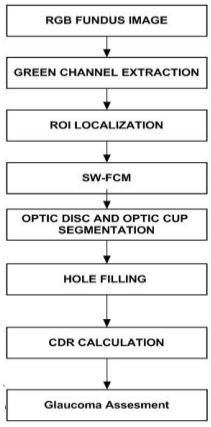


Fig.2 Flow diagram of proposed method

B. Green Channel Extraction

Fundus image consists of Red , Green and Blue components. Of the three shades, the green channel components display the highest vessel backdrop contrast in retinal images of the RGB representation. Red channel will be saturated easily whereas blue channel offers very poor dynamic range as illustrated in figure 3.

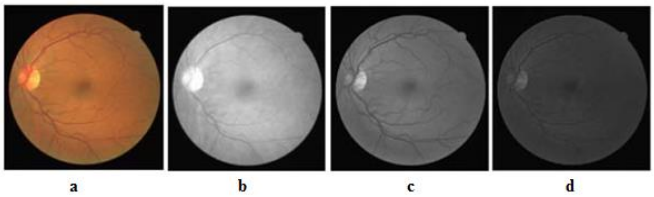


Fig .3 a) Original retinal image, b) red channel, c) green channel, d) blue channel

C.ROI localization

Image localization is done by selecting the region of interest by cropping the image strategically. Here the images are cropped taking OD and OC mask into consideration and masks are obtained as mentioned in [10]. The algorithm considers 15 pixels in addition from the original image surrounded by mask.

D. Spatially weighted Fuzzy C means Clustering (SW-FCM)

The customary Fuzzy C infers that the spatial information on pixels won't be assessed by the grouping calculation and the yield is influenced as an outcome. Consequently, a spatially weighted Fuzzy c implies bunching calculation (SW-FCM). The significant trait of a picture is that pixels in neighbors are profoundly related in the SW-FCM approach. A suitable locale of intrigue (ROI) of measure 255*255 pixels are picked around the greatest point in the green channel of the fundus picture as portrayed before. Since the ROI picture contains the optic circle and optic cup as well as veins. Henceforth veins are taken out so as to acquire better optic division in the fitting locales. Morphological shutting activity utilizing a wavelet change is acquired for lessening the differentiation of the veins. The got

aftereffect of SW-FCM will have groups comparing to optic cup and optic circle and foundation. A circular fitting is useful for the plate locale since the state of the circle mostly round and additionally vertically it is considered as oval plate.

E. CDR Ratio

Once optic disc and optic cup is obtained , a variety of features can be computed. Here we followed clinical caucus to compute the cup to disc ratio (CDR) . A high CDR indicates a high risk of glaucoma. Fig. 4 illustrates the important features of the optic regions.

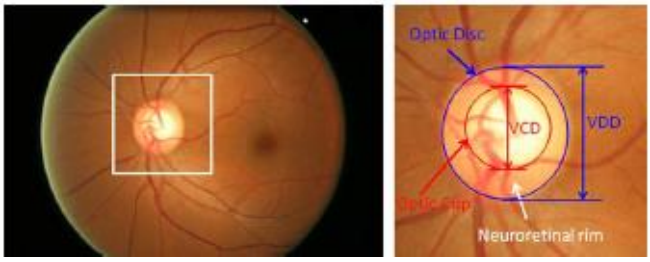


Fig.4 Major structure of optic disc and optic cup (Blue circle is optic disc and red circle is optic cup and region between red and blue is called neuroretinal rim)

Cup to Disc (CDR) ratio is obtained as the ratio between Vertical Cup Diameter (VCD) and the vertical disc diameter(VDD) . The measurement of CDR depends on the segmentation of optic region.

Considering the figure 4

$$CDR = \frac{VCD}{VDD} \text{.....(1)}$$

The calculated CDR is generally used for the detection of glaucoma. When CDR is greater than the threshold (here it is considered as 4) it is considered as glaucomatous else healthy.

III. EXPERIMENTAL RESULTS

The proposed approach is tested using MATLAB7 . Fig 5 shows the a graphical user interface [12] developed for the assessment of glaucoma.Fig. 6 shows output of the the proposed method. Initially the RGB fundus image from database is selected. Image resizing is carried out as a second step of the algorithm. Later Localization is performed by the selection of region of interest. SW-FCM is applied for the segmentation. Optic disc and optic cup segmentation is done using the SW-FCM procedure. Morphological operations are applied for post processing . CDR is calculated as per equation.1 .With the given threshold value glaucoma is diagnosed.

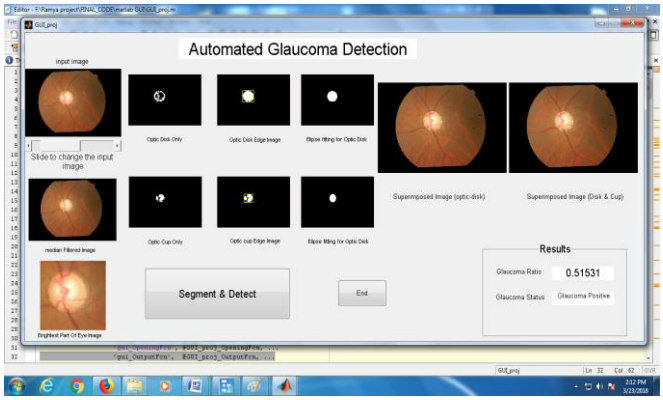
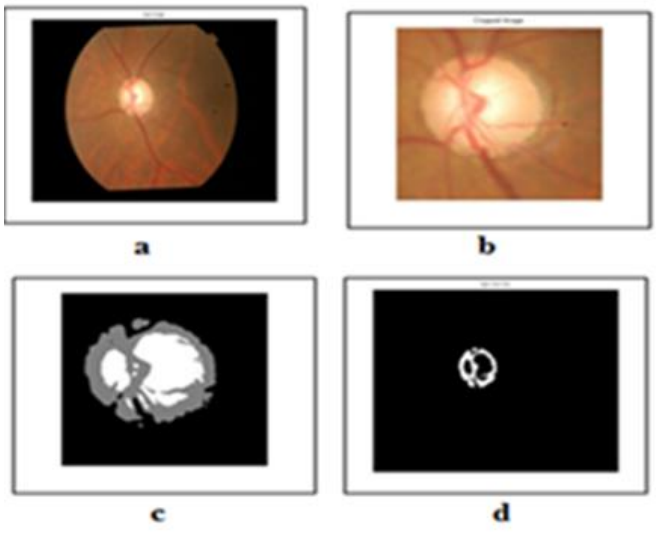


Fig. 6 Graphical User Interface of our proposed method



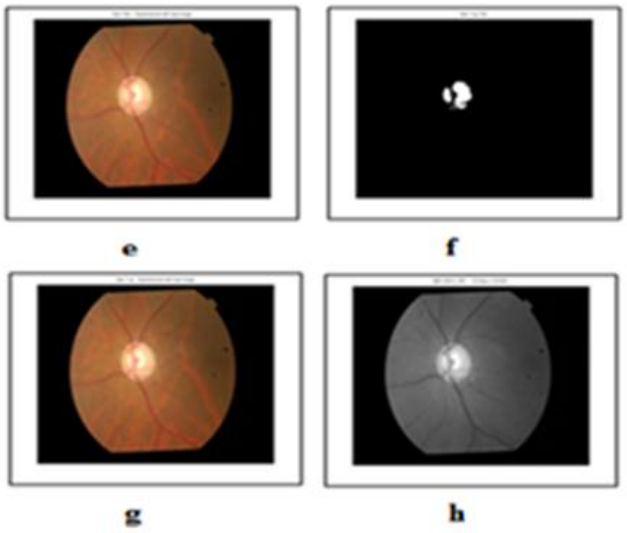


Fig .5 Output by proposed method a. Input Image, b.ROI Selection, c.SW-FCM Applied ,d. Segmented optic disc, e. Optic disc on original image, f. Segmented optic cup, g. Optic disc and optic cup superimposed , h. CDR calculated and Glaucoma detected

IV. CONCLUSION

In this work, we built up a robotized framework for the division of optic circle and optic cup for the location of Glaucoma by computing the cup to plate (CDR) proportion. Additionally, our graphical UI is an easy to understand interface so any individual who is intrigued to distinguish glaucoma can without much of a stretch utilize our framework. As a continuation of this work, we are in the cycle of assessing the proposed technique on different information bases and improve the strategy.

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