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ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

An ISO 3297: 2007 Certified Organization *Vol. 5, Special Issue 6, July 2016*

4th National Conference on Design Innovations for 3Cs "Compute-Communicate-Control"

Organized by

Dept. of ECE, MVJ College of Engineering, Bangalore-560067, India

An Adaptive Threshold Algorithm Based Optic Disc and Cup Segmentation in retinal Fundus Images

Chetan Tulasigeri[1], Dr. M Irulappan[2]

PG Student [DEC], Dept. of ECE, MVJ Engineering College, MVJ, Bangalore, India[1]

Professor, Dept. of ECE, MVJ Engineering College, MVJ, Bangalore, India[2]

ABSTRACT*:* Glaucoma is optic neuropathy characterized by recognizable changes in the structure of optic disc and retinal fibre structure. It is also defined as the loss of vision and optic nerve cupping of the optic disc. The cup to disc ratio is mainly used to calculate the glaucoma disease, if it is crossing normal region so it's called glaucoma.
In this model Adaptive thresholding algorithm is used for cup to disc segmentation. Adaptive thresholding is a type of thresholding, it is based on spatial variations in the illumination. The proposed methodology to segment the optic disc and cup from a fundus image is accurate and efficient. The common challenge in glaucoma detection is the accurate segmentation of optic disc which can be affected due to presence of peri-papillary atrophy (PPA). However, the thresholding I mainly applied for the brighter pixels. In Proposed method adaptive thresholding algorithm is implemented with efficient hardware architecture for hardware implementation. Hardware objective are being validated on FPGA to meet the hardware objective like speed, power and area.

KEYWORDS*:* Glaucoma, Disc, Cup, fundus image Processing, segmentation, mask.

I. INTRODUCTION

Glaucoma is a stage where there is a damage of the optic nerve which occurs gradually. It occurs when there is high pressure within the eyes. It is probably hereditary and identified during the later stage of life. People were suffering from glaucoma and it will be starting to lose the peripheral vision slowly then patient cannot see any partials on the viewing sides. The patient will be feeling that they are seeing objects across a tunnel. Gradually, the central vision is started to cause the entire part of vision capacity. Glaucoma is an optic neuropathy which has property of distinctive changes in the optic nerve head and visual field. If damage to the optic nerve continues, glaucoma has causing the permanent loss of vision in eye portion. If not medicated, glaucoma should effect all humans for the permanent blindness within some years and it is not showing any symptoms and pain before it's effected to the humans but one glaucoma was effected automatically the pressure of the eye is increased.
Glaucoma is the most effected disease in the world, it is most leading in US, America country having this disease more than three millions peoples are suffering from glaucoma. The inside retinal fundus image of the eye, the liquid which is continuously producing and it is drain away a fluid is called aqueous humor. This type of fresh aqueous is continuously produced by cells which is present inside the retinal eye and it is continuously producing an equal amount of aqueous and it would be exit through drainage way. In this case it doesn't get proper drains away from this liquid, it is stored inside retinal eye only that case pressure of the liquid damages the eye. The effect of liquid pressure is damages the retinal nerve fibers and this nerve is main part of the eye, which is caused permanent blindness if this pressure goes at the extreme portion in the eye. The glaucoma is called as the silent thief of sight because it is not showing any significant damages to the eye before the problem is happened. The glaucoma is the one of the no painful disease and if it is reaches at the higher pressure, it is have a permeant blindness of the person.

II. SYSTEM MODEL

A retinal fundus image, which is an image and it mainly consist of the interior surface of the eye, these interior is consisting of retina, optic nerve head, macula, fovea and blood vessels. In this retinal image the disc region is called as

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the optic disc, it is entry point for the all blood vessels that supply the retina and it is the circular region in our retina. The optic cup is the brighter region in the fundus image and it is the visual region of the eye, if the normal person the cup is not affected anything, once the cup is affected to the retina that time the glaucoma is happening to the person. Once the person was suffering from the glaucoma, the person start to lose their visible capacity but if the person didn't have any pain for the person, at the end point only the person knew about this disease and it is the one of the disadvantage of the disease, glaucoma is find out by the taking the optic disc and cup ratio. If the normal human is have cup to disc ratio is 0.3 and if the above ratio its reaches so it's called as the glaucoma stages. The complete block diagram of the proposed system model is shown in Fig.1.

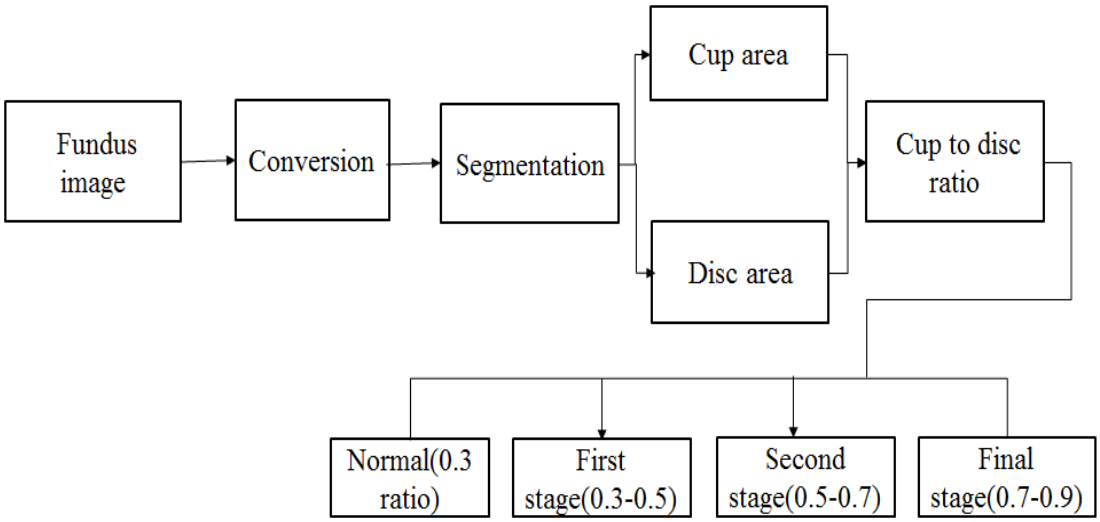

Fig. 1 Proposed block diagram of Glaucoma detection

Considering retinal fundus imageof both normal and glaucoma affected eye images are taken from different local hospitals of different patients and are stored in database of proposed system.The histogram of the fundus retinal images are used to calculate the threshold value for the segmentation the retinal fundus image. The disc and cup is the brightest part in the retinal fundus image and it is used to the converting of grey scale image and some other pre-processing processes are doing in the retinal fundus image to capturing the disc and cup area to calculate the retinal glaucoma, these algorithm is shown in below Fig.2. Here, the process is mainly classifying into the two channels that is red and green channel. According to these channel occupied optic cup and disk is in different channel is shown, in this processes is the purposed of removing information to fundus retinal image by exchanging obtained pixel to the segmentation blocks to applying threshold to deleting the hole information from the red and green channels, after that channel have performing the following operation as shown in the Fig.2.

In the segmentation process is mainly consider the grayscale image to perform the segmentation process. In this process is mainly performing the pre-processing to remove the unwanted information from the original image for further processing. After the pre-processing process have to apply the threshold based on the histogram of that image is taken automatically by the global value. The global threshold value is helped to capturing the brighter pixels in the segmentation process, in this threshold process is passed through the filter to take the accurate pixels of the both cup and disc area, according to this area have to calculate the CDR value, if it is the 0.3 range is the normal condition but if it is reaches above value is called glaucoma affected retinal fundus image and here assigned the stages of the glaucoma is to capable of showing the level of disease as well as the amount of medicine required to cure in a particular duration. It is showing after obtaining the CDR ratio, and in Fig.1 is shown the complete block diagram of the glaucoma detection and segmentation is the main part of the process. In this process only have to decide the stage of glaucoma and according to that process is helped to doctor to about that disease properly for the treatment purpose.

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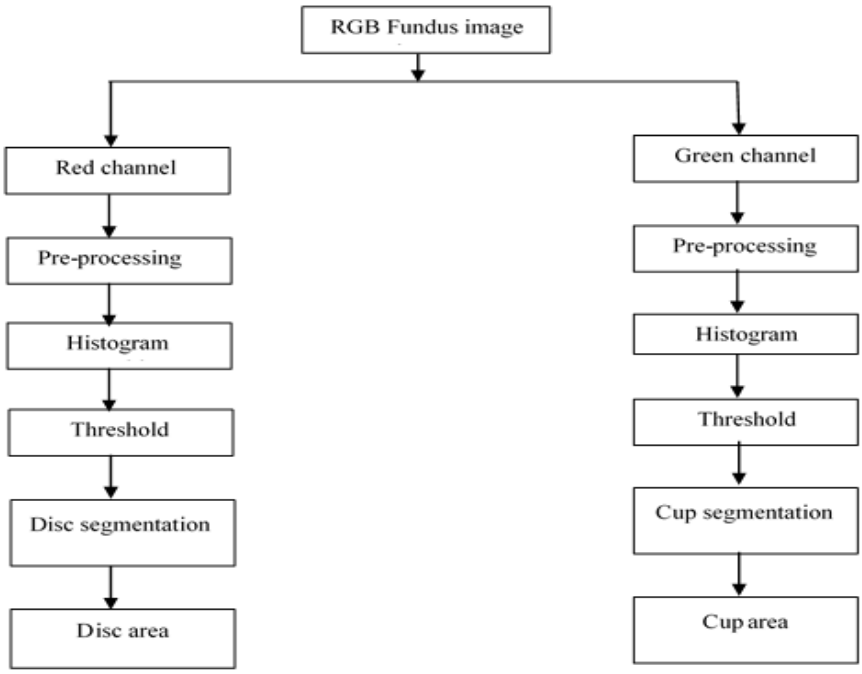

Fig. 2 Flowchart for the segmentation of optic disc and cup

III.RESULT AND DISCUSSION

The funds retinal eye images are took for performing the experimentation were taken from the different local hospital. Here, number of fundus eye samples are used for performing the segmentation process to calculate the CDR ratio. The image is consist of JPEG format and in the form of pixel value, it can took for the fundus camera and it takes only the inside portion of the retinal eye. The main process of this experimental process is to identifying the glaucoma disease present in the human. According to the above process we can getting the output for each process, these process is explaining here step by step in the next part. In the fig 3 (a) & (b), it shows the original fundus image and it is cropped by 256×256 pixel for the further process and it is converted into the grayscale image.

Fig. 3 (a) Fundus retinal image (b) grayscale image

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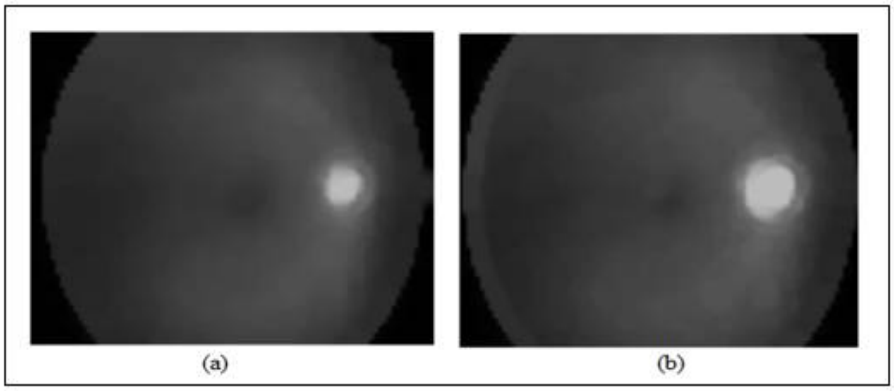

Fig. 4 (a) Pre-processing image (b) Morphological process

In the fig 4. (a) it shows the pre-processing output, here seen that, mainly considering the grayscale image to perform the pre-processing process, in this process mainly removing the unnecessary information of the grayscale image, and getting only the brighter pixel value is shown.

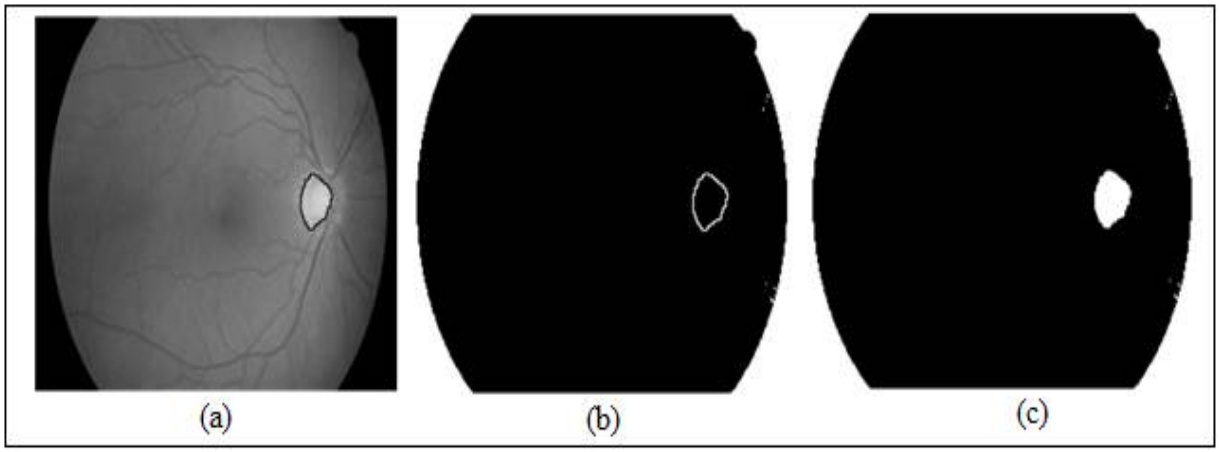

Fig. 5 (a) Pixel condition to marking the cup area (b) Thresholding of the cup area (c) Segmented cup area

In Fig 5. (a). It is showing the marking cup area according to the pixel condition of the fundus image, Fig.5.(b) is showing the applying threshold to the segmented marking area and Fig.5.(c) is showing the complete segmented cup area of the retinal fundus eye.
In Fig 6. (a) Shows the grayscale image of the original retinal fundus image, Fig.6. (b) Shows the pre-processing of the grayscale image, and in this process mainly applying the morphological operation to perform the pre-processing process. In this pre-processing image is passed to the filter for the purpose of the getting the complete segmented disc is the entire area of disc.

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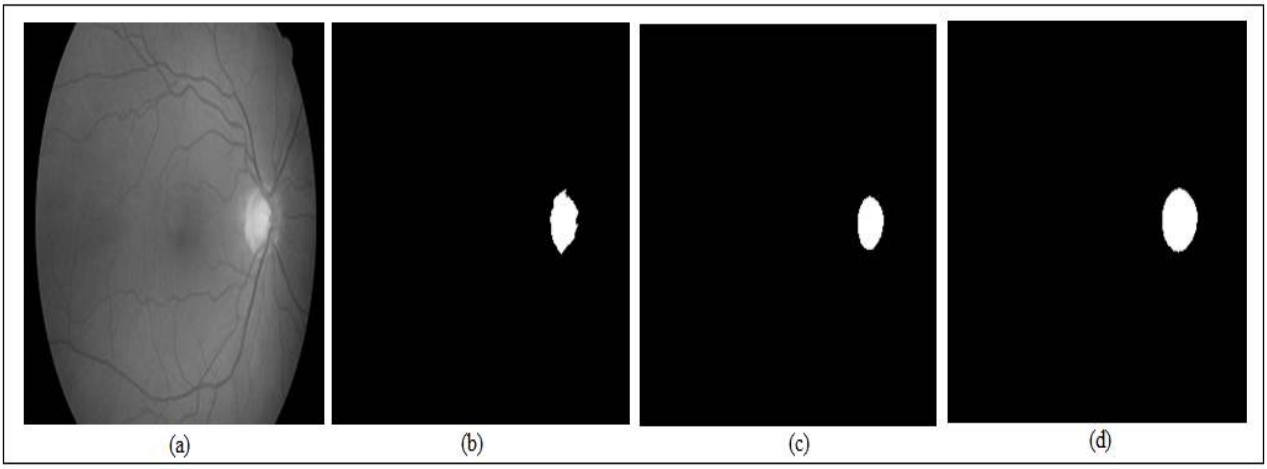

Fig. 6 (a) Grayscale image (b) Pre-processing image (c) Filter output for morphological operation (d) Segmented disc.

VI. CONCLUSION

The proposed methodology is advantage to segment the optic disc and cup from the retinal input funds image, and it is more accurate and efficient by masking this operation is getting exact segmented output. The glaucoma can commonly affected to retinal eye inner portion with the high pressure , to overcome this disease, the system is applying threshold to the brighter pixels, and also using the thresholding algorithm to extract the disc and cup segmentation for the find out the CDR value.

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