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DETECTION OF SEVERITY OF OPTICAL NERVE HEAD DAMAGE USING OCT IMAGES

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Abstract: One of the major sensory organ of a human body is eye. Optic Nerve is the part of the eye that carries visual information from eye to brain which is located at the very back of the eye. It is a part of an eye that gets injured when eye pressure rises, if left untreated the patient may lose vision. This work aims at developing a system which will recognize the presence of Optical Nerve Head damage, identifies the area of damage and finally the percentage of damage in the nerve head by utilizing the OCT image of an eye of a person. The main reason for using OCT images is that these images give us in depth information about the eye, when compared to other methods.

Index Terms **– Optic Nerve, Optical Nerve Head damage, Optical Coherence Tomography, Glaucoma.**

I. INTRODUCTION

An eye has Retina, lens, and iris. The retina is the sensory part of the eye and has layers of photoreceptors, nerves, and supporting cells. The important ones include the photoreceptor layer, which is found further out, and the ganglion nerve layer which lies most inward. For light to reach the photoreceptor it must pass through many layers. After, it reaches the photoreceptors the visual signal propagates back up to the ganglion nerves. These ganglion nerves, in turn, course along the surface of the retina toward the optic disk and form the optic nerve running to the brain. Glaucoma is eye disease which is the second most common cause of blindness worldwide. The characteristic of glaucoma is high eye pressure, loss of vision gradually which can cause blindness and damage to the structure of retina. The damages which may occur are structural form changes of the Optic Nerve Head (ONH) and Retinal Nerve Fiber Layer (RNFL) thickness. Quantitative analysis of RNFL via image processing of "Optical coherence tomography(OCT)" images plays a major role in its early detection. The project plays a major role in the field of medical science in early detection of Glaucoma and one can avoid loss of vision by taking preventive measures. An Optical Nerve is the part of the eye that carries visual information from eye to brain which is located at the very back of the eye. It is a part of an eye that gets injured when eye pressure rises, if left untreated the patient may lose vision. In Optic Nerve there is a small crater like depression seen at the front of ONH. This depression is known as cup. Its diameter is less than diameter of Optic Nerve. The nerve head look like a cup on a disc. The method implemented in this project mainly deals with finding the area of the damage and percentage of damaged area. The methodology implemented in this project is using different MATLAB image processing functions like a Gaussian filter, RGB to gray scale conversion, gray scale to binary image conversion and then identifying lesion in the image. This work aims to develop a system which will recognize the presence of ONH damage by the changes in the OCT image of an eye of a person and automatically quantify the defect using image processing techniques which aid in the diagnosis of glaucoma disease.

II. THE DETECTION OF DAMAGE IN THE IMAGE

The aim of the work is to analyze the damage to optical nerve head by using optical coherence tomography images. With developing effective algorithm, we determined the damage part in eye by using image processing tool. Various methods are implemented to analyze thickness which are pre-processing, noise removing methods and filtering process as shown in flow diagram.

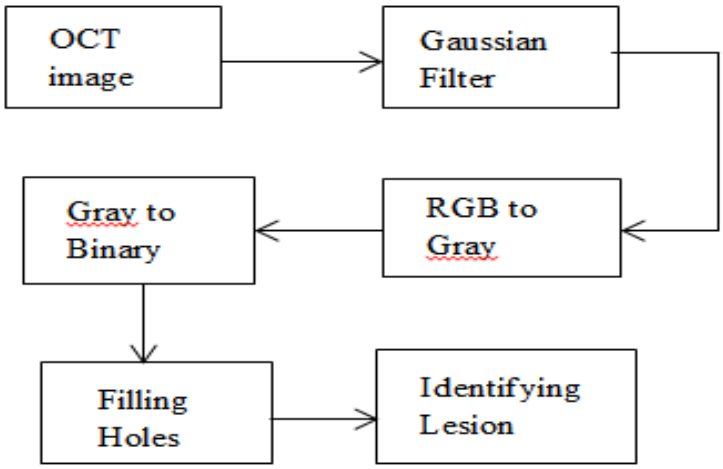

Figure2.1: Detection of damage in the image

OCT is an established medical imaging technique that uses light to capture micrometer-resolution, three-dimensional images from within optical media. Gaussian filtering is more effective at smoothing images. Identifying lesion means detecting the damage from results.

III. EXPERIMENTAL RESULTS

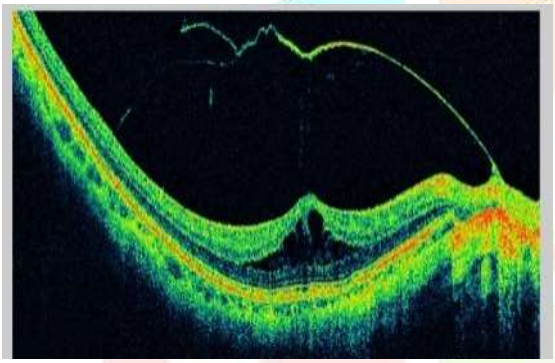

Figure3.1:Oct original image

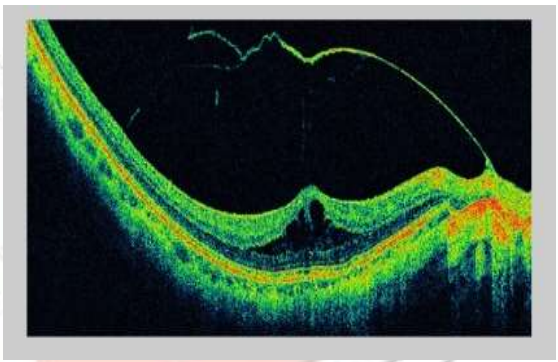

Figure3.2: Indexed image

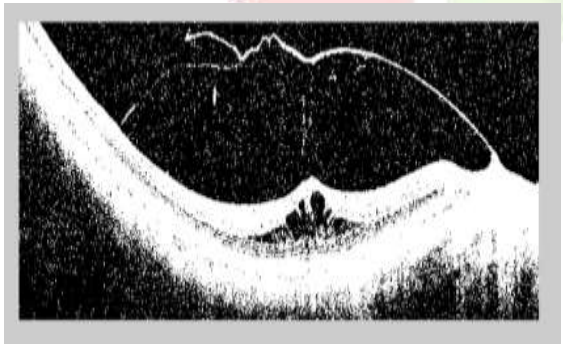

Figure3.3: Gray Scale Image

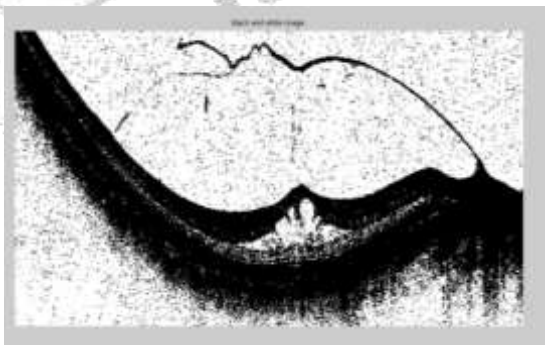

Figure3.4: Inverted Gray Scale Image

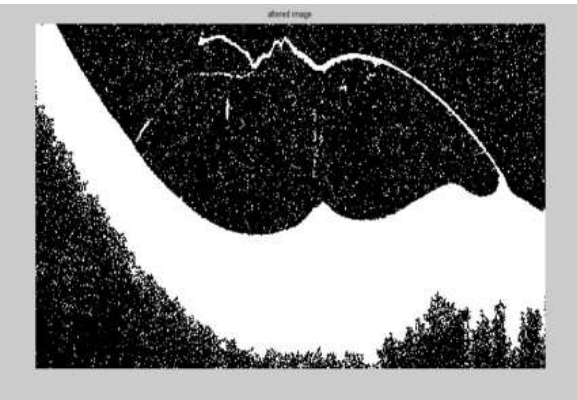

Figure3.5: Altered Image

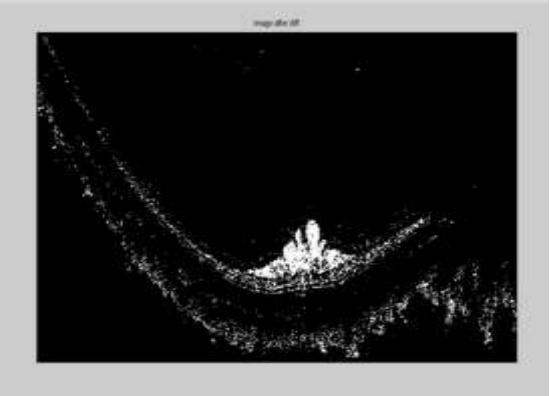

Figure3.6: Image after Diffusion

Figure3.7: Image after filling Holes

Figure3.8: Final Image

Initially we are given an OCT image which is in RGB format then Gaussian filter is applied to smooth the OCT image and now the filtered image is converted into gray scale image. The Gray scale image consists of pixel values ranging from 0 to 255. The resultant grey scale is converted into a binary image i.e.; if the pixel value is greater than threshold value the pixel is assigned value 0(black), if pixel value is lower than the threshold value the pixel is assigned value 1(white). Now the binary image is negated let say the image as 'x'. Now subtract the previously obtained binary image and x let say the resultant image as y. The image y consists of the lesion along with the other distortions to eliminate this distortion remove all the smaller closed figures to achieve this fill all the holes which have less than 20 pixels. Now the image obtained finally is the exact lesion i.e.; the damage part of the optic nerve is in white color, divide total area of the image with total number of pixels in the target image to find out the area under each pixel let say the area under each pixel is 'A'. Now to identify the area of damaged part multiply 'A' with total number of white pixels and the result is the total area which is in white color (lesion) regarding square mm.

IV. CONCLUSIONS & FUTURE SCOPE

We would like to conclude that it is an efficient and accurate technique for automatic detection of ONH problem. In this research, glaucoma diseased is detected by using the area of the damaged part in the optic nerve. The color features extraction is applied on samples that are contained the healthy eye of human and the diseased eye of the human.

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