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EFFICIENT DETECTION AND IDENTIFICATION OF AUTOMATED PREVALENCE OF GLAUCOMA IN OPTIC DISC BOUNDARY

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Abstract:
Glaucoma is one of the many eye diseases can lead to the blindness if it is not detected and treated in proper time. It is often associated with the increased in the intraocular pressure (IOP) of the fluid (known as aqueous humor) in eye, and it has been nicknamed as the "Silent Thief of Sight". Glaucoma is the second leading cause of blindness in the world. It affects 40% of Blindness in Singapore, more than 3 million peoples living in the United States. Glaucoma is the leading cause of blindness in African – Americans.

Keywords – IOP, Aqueous, Glaucoma.

1. INTRODUCTION

The protective outer layer of the eye is called the sclera. The other components of the eye are regions such as cornea, lens, iris, and retina. Retina is approximately 0.5-mm thick and covers the inner side at the back of the eye. The center of the retina is the optical disc, a circular to oval white area measuring about 3 mm2 (about 1/30of retina area). The mean diameter of the vessels is about 250μm. The early stages of glaucoma will damage the optic nerve without incurring any symptom. The patients are not aware of the

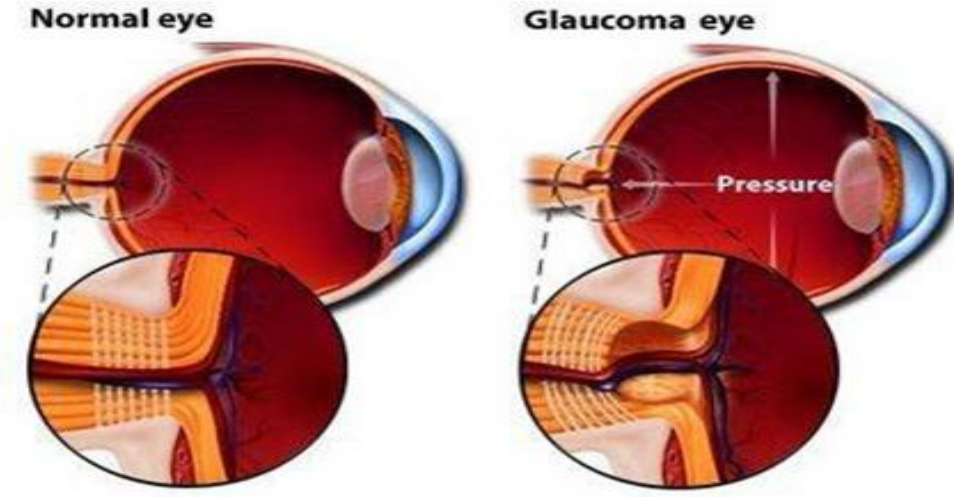

Fig.1. Medical image of normal and affected eye

disease until the advanced stage of disease occurs which makes total blindness. Clinically, the diagnosis of Glaucoma can be done through measurement of CDR. It is defined as the ratio of the vertical height of the optic cup to the vertical height of the optic disc. An increment in the cupping of Optic Nerve Head (ONH) corresponds to the increased ganglion cell death and hence CDR can be used to measure the probability of developing the disease. A CDR value that is greater than 0.65 indicates the high glaucoma risk. The inner eye pressure (IOP) rises because the correct amount of fluid can't drain out of the eye. It's

affecting 70% to 80% of those who suffered from the disorder and accounts for 90% of glaucoma cases in the United States. It is painless and does not have acute attacks. It can develop gradually and go unnoticed, especially if caught early and treated.

2. LITERATURE REVIEW

Optic disc (OD) detection is an important step in developing systems for automated diagnosis of various serious ophthalmic pathologies. This paper presents a new template-based methodology for segmenting the OD from digital retinal images. This methodology uses morphological and edge detection techniques followed by the Circular Hough Transform to obtain a circular OD boundary approximation. It requires a pixel located within the OD as initial information. For this purpose, a location methodology based on a voting-type algorithm is also proposed. The algorithms were evaluated on the 1200 images of the publicly available MESSIDOR database. The location procedure succeeded in 99% of cases, taking an average computational time of 1.67 s. with a standard deviation of 0.14 s. On the other hand, the segmentation algorithm rendered an average common area overlapping between automated segmentations and true OD regions of 86%. The average computational time was 5.69 s with a standard deviation of 0.54 s. Moreover, a discussion on advantages and disadvantages of the models more generally used for OD segmentation is also presented in this paper. A novel OD segmentation method is proposed which integrates the local image information around each point of interest in multidimensional feature space to provide robustness against variations found in and around the OD region. We also propose a novel cup segmentation method which is based on anatomical evidence such as vessel bends at the cup boundary, considered relevant by glaucoma experts. Bends in a vessel are robustly detected using a region of support concept, which automatically selects the right scale for analysis.

3. SYSTEM FUNCTION

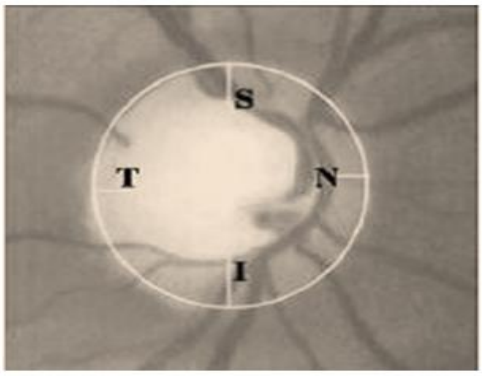

Fig.2. Retinal image of an eye with ISNT rule

Glaucoma is a group of diseases that can damage the eye's optic nerve and result in vision loss and permanent blindness. Some of the key facts about Glaucoma are: a. Leading cause for blindness globally . Though there is no cure, right medication will help further vision deterioration c. It is prone to affect patients of any age According to World Health Organization (WHO), Glaucoma is the second leading

cause of blindness; that contributes to approximately 5.2 million cases of blindness (15% of total blindness cases reported) and can potentially affect ~60 million people in the next decade. An ophthalmologist will diagnose Glaucoma by measuring the CDR (Cup to Disc Ratio) which is the ratio of the vertical height of the optic cup and optic disc. Where there is more ganglion dead cells, which shall reflect in the cup size can be used to measure the possibility of Glaucoma. If the value exceeds 0.65, it indicates for a high risk of Glaucoma and can be then tested using other techniques to confirm the disease. Earlier various methods have been in practice for optic disc detection, however owing to challenges due to poor visibility of optic cup within the optic disc and the nervous architecture surrounding the optic cup boundary challenged the final output. One of the earliest reported methods was based on the discriminatory analysis of color intensity. Variational level set based on pixel intensity was used to globally optimize the obtained cup contour. As per Hatanaka's method that analyzed based on the blood vessel regions that were un-erased affected the profile the contrast of temporal side of the optic disc was high in the blue component image which affected its effectiveness. In another approach by Gopal Datt Joshi, region based active contour method which avoided intensity variations due to vessels.

4. IMAGE PROCESSING

In imaging science, image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Image processing usually refers to digital image processing, but optical and analog image processing also are possible.

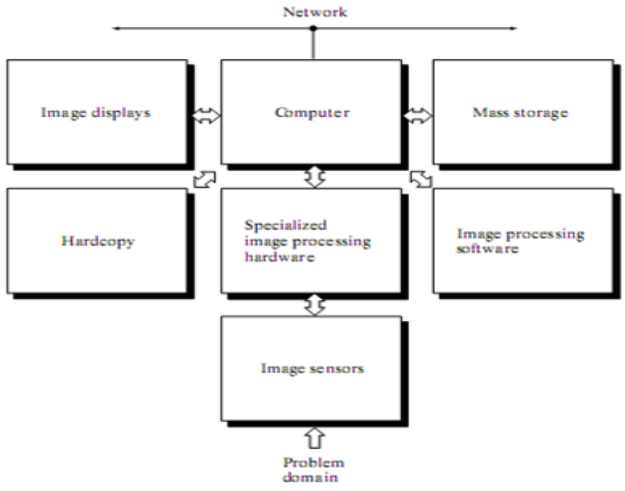

Fig.3.Components of image processing

This article is about general techniques that apply to all of them. The acquisition of images (producing the input image in the first place) is referred to as imaging. An image may be considered to contain sub-images sometimes referred to as regions-of-interest, ROIs, or simply regions. This concept reflects the

fact that images frequently contain collections of objects each of which can be the basis for a region. In a sophisticated image processing system it should be possible to apply specific image processing operations to selected regions. Thus one part of an image (region) might be processed to suppress motion blur while another part might be processed to improve color rendition. Sequence of image processing: Most usually, image processing systems require that the images be available in digitized form, that is, arrays of finite length binary words. For digitization, the given Image is sampled on a discrete grid and each sample or pixel is quantized using a finite number of bits. The digitized image is processed by a computer. To display a digital image, it is first converted into analog signal, which is scanned onto a display.

5. ANALYSIS

We emphasize that this chapter is only an introduction to the basic functionality of MATLAB. There is much more to learn than contained here. Also, you should not feel frustrated if you do not understand everything the first time you read this. Programming requires time to learn and much practice. We will be using MATLAB throughout this course so you will get plenty of time to practice; this is only the start. To get the most out of this chapter you should read the notes with MATLAB open and type each command and write each program as you read this primer.

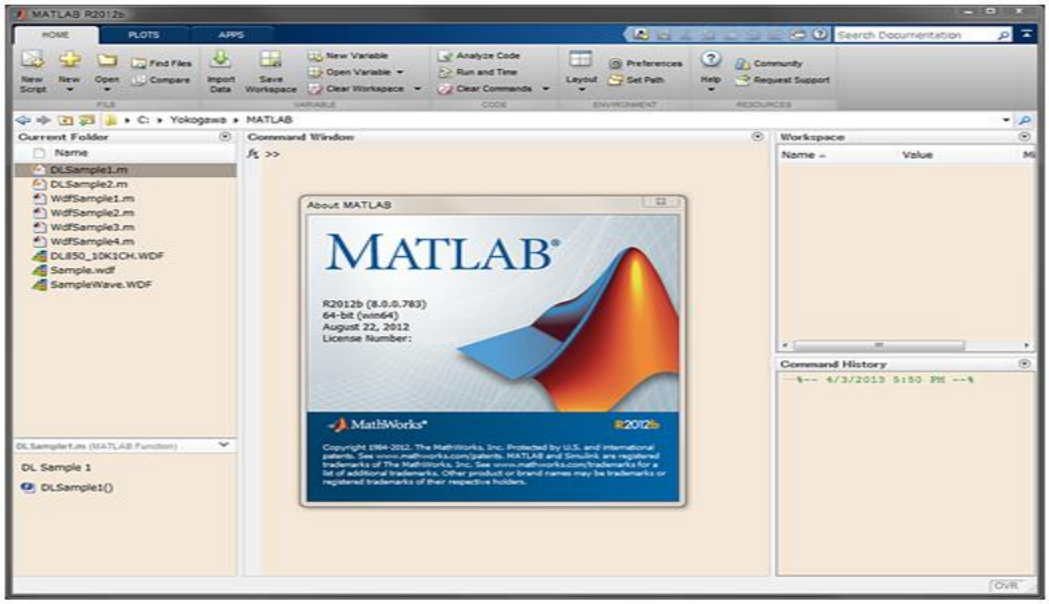

Fig.4.Matlab window

Make some variations so that you understand each command and program. There are problems in the chapter meant to give you practice programming in MATLAB.Depending on your past programming experience these activities may vary in difficulty, it will likely be very challenging for someone who has never programmed in the past. Do not worry about the "deliverables" with each problem. The main objective of the problems is to provide some example applications to give you practice and a chance to explore. This is a comment to describe this command finally; any command presented in this primer has further information via the integrated help manual. To find details of commands that we present, simply type » help command which will provide information on the inputs, outputs, usage, and functionality of

the command. Most commands have a variety of options that may be invoked and these are explained in the help. A listing of commands sorted by functionality can be found by typing help.

CONCLUSION

Software for image processing consists of specialized modules that perform specific tasks. A well-designed package also includes the capability for the user to write code that, as a minimum, utilizes the specialized modules. More sophisticated software packages allow the integration of those modules and general-purpose software commands from at least one computer language. Mass storage capability is a must in image processing applications. An image of size pixels, in which the intensity of each pixel is an 8-bit quantity, requires one megabyte of storage space if the image is not compressed. When dealing with thousands, or even millions, of images, providing adequate storage in an image processing system can be a challenge.

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