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RETINAL FUNDUS IMAGE SEGMENTATION USING WATERSHED ALGORITHM

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Abstract –*Automated optic disk (OD) detection plays a very important role in developing a pc assisted system for eye diseases. The examination of eye disease by ophthalmologists is limiting factor. In this paper, a technique for Optic Disk detection based on structured learning that belongs to a supervised method to avoid creating assumptions. The proposed technique utilizes the edge information of the fundus image to detect the Optic Disk and identifies the presence of cancer. The Sobel edge detector to capture the edge information and segmentation using watershed algorithm. Then circle Hough transform is carried out to approximate the boundary of Optic Disk by a circle.*

Key Words: **Fundus image, Optic Disk, Edge Detection, Watershed Segmentation, Hough Transform.**

1. INTRODUCTION

Nowadays, some of the most common causes of visual impairment and blindness are diabetic retinopathy, glaucoma, hypertension and macular degeneration. These eye diseases manifest themselves in the retina and all of these diseases can be detected through a direct and regular ophthalmologic examination. Medical image analysis and processing has a great significance in the field of medicine, especially in non-invasive treatment and clinical study. Normally fundus images are manually graded by specially trained clinicians in a time-consuming and resource intensive process. However, several factors, like population growth, aging, are contributing to the risk of the patients with these diseases that makes the quantity of ophthalmologists required for analysis by interrogatory becomes a limiting issue. As a result, a pc assisted diagnosing system which can significantly reduce the burden on the ophthalmologists and may alleviate the inter and intra observer variability is desired.

Retinal fundus image segmentation is a fundamental step in retinal image analysis and the follow-up ophthalmic diagnostics. In the process, OD detection plays a very important role, that has attracted intensive attention from clinicians and researchers. OD detection is commonly a key step for the detection of different anatomical structures. As a example, the OD location helps to prevent false positive detection of exudates incurred by diabetic retinopathy, since each OD and exudates are formed by bright regions within the fundus image. To sight these problematic veins that may be done with the segmentation of blood vessels in retinal digital pictures.

The retina is a extremely organized structure with the ability to begin the process of visual information before the knowledge is transmitted through the optic nerve to the visual cortex. Layered structure that permits the perform to look restrictions in optical disk function or functional impairment on a layer or cluster of cells. However, the perception of colour, contrast, depth, and form happen within the cortex. OD is one of the most vital from indicator medicine pathology. Image segmentation is a important step in image analysis. Segmentation separates an image into its element components or objects. Here segmentation is critical to separate the optic disc area with blood vessels that exist in the area of the optic disk at the time was not considered in the segmentation of blood vessels.

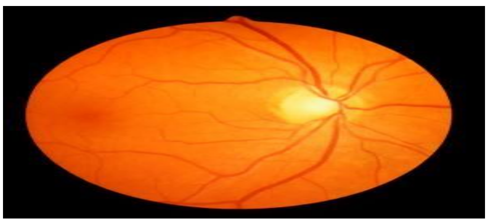

Fig-1: Retinal fundus image

2. RELATED WORK

Due to its clinical importance, fundus image segmentation has received ample attention over the years. Existing work can be roughly divided into two categories based on whether an annotated training set is required on unsupervised and supervised methods. Supervised methods learn their models based on a set of training examples, while unsupervised methods do not require a training set. Regarding unsupervised methods in retinal vessel segmentation, Hessian-based techniques have been proposed to utilize the second order derivatives to characterize the foreground boundaries, or to incorporate the eigenvalues to facilitate the delineation of vascular structures.

Hui Gao and Oksam Chae proposed active contour tracking algorithms which used single level set method and coupled level set method. The single level set technique tracking was used for root segmentation and handled the complex image conditions as well as the root branching problem. The coupled level set technique tracking was developed for crown segmentation that separated the touching teeth and created the virtual common boundaries between them. Furthermore, the variation level set technique was improved in many aspects: gradient direction was introduced into the amount set framework to prevent catching the encompassing object boundaries; additionally to the shape prior, intensity prior was introduced to produce adaptive shrinking or expanding forces in order to deal with the topological changes.

Primary segmentation exploitation the spiral scanning technique was performed by Dirk Smeets et al. Additionally speed image was obtained by statistical pixel classification algorithm with supervised learning. An initialization for the level set algorithm was obtained using spiral scanning technique and also the speed image guides the propagation of the level set. Anusha Achuthan proposed an approach for region segmentation in CT images which contained regions demonstrating the characteristics of intra- region intensity variations and having high similarity in intensity distributions with the adjacent regions. Yunjie Chen et al. proposed a variational level set method, in which bias field estimation was done before quantitative analysis of magnetic resonance (MR) images for images with intensity inhomogeneities. The objective function defined first, clustered image pixel in small region and the cluster center then estimated the bias within the small region. The objective function were integrated over the complete domain with local Gaussian distribution of fitting energy and analyzed the information.

3. PROPOSED SYSTEM

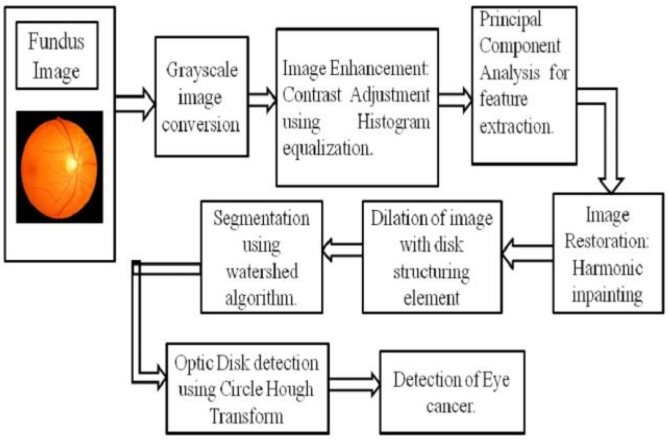

Fig-2: Block diagram of the proposed system

3.1. Image Pre-processing

The Image is created by range of pixels and different major parameters like color and monochrome(sometimes conjointly called black &white image or property). Image is processed and executed by a image process techniques. So image process is that the major a part of signal processing. Grayscale conversion is additionally a significant part of image process. RGB or color information includes a three dimensional property that makes signal process such a lot large and serious to remove this drawbacks grey scale conversion is necessary. Grayscale image are the those pictures wherever color information is missing and every one color information is born-again into grayscale format.

3.2. Image Enhancement

Image enhancement is a technique for adjusting digital images. It can remove noise, sharpen, brighten an image, makes easier to identify key features of the image. Contrast is an important factor in image quality. Contrast of fundus image can be disclosed by its histogram. Histogram Equalization is a method for adjusting image intensities to enhance contrast. Contrast adjustment remaps image intensity values to the complete display range of the data type.

Fig-3: Fundus image to grayscale image

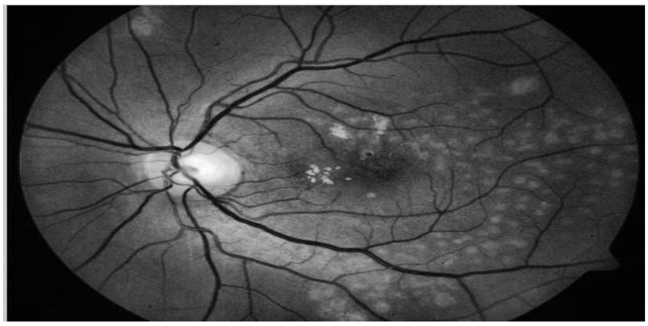

Fig-4: Enhancement of grayscale images using histogram equalization.

3.3. Sobel Edge Detection

Edge detection is an image processing techniques for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for segmentation and data extraction. Common edge detection algorithms such as Sobel, Canny, Prewitt, Roberts, and fuzzy logic methods. Sobel Edge detector is used to capture the edge information.

The Sobel Edge Detector is used to capture the edge information. It works by calculating the gradient of image intensity at every pixel within the image. It finds the direction of the highest increase from light to dark and also the rate of change in that direction. It shows how abruptly or smoothly the image changes at each pixel, and therefore how likely it is that that pixel represents an edge.

The result of applying the Edge Detector to a pixel in a region of constant intensity is a zero vector and a pixel on an edge is a vector that points across the edges from darker to brighter values. The vascular edges on the fundus image are very strong sobel edge operator is applied to detect the Optic Disk edge, many vascular edges are detected besides Optic Disk edge. It utilizes the edge information of the fundus image to detect the Optic Disk.

3.4.Image Segmentation using Watershed algorithm

Image segmentation is the technique of splitting a image into multiple segment. Set of pixels referred to as super pixels. The purpose of segmentation is to decompose the fundus image into Optic Disk. Image segmentation is used to find objects and boundary lines, curves in images. A set of segments that collectively cover the entire image or a set of contours extracted from the image is obtained from segmentation.

Watershed segmentations use the analogy from topography. The watershed transform segmentation finds "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light pixels are high and dark pixels are low.

Segmentation using the watershed transform works efficiently when foreground objects and background location are identified. There are mainly three methods to implement watershed segmentation such as Distance Transform Approach, Gradient method, Marker Controlled Approach. In this work the gradient magnitude uses grayscale fundus image for watershed segmentation. The gradient magnitude image has high pixel and low pixel values along object edges.

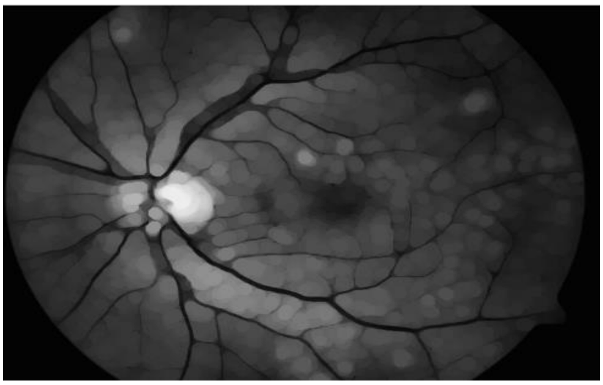

Fig-5: Segmentation using Watershed segmentation.

3.5. Hough Transform

The Hough transform is a method used to identify features of a particular shape within an image. The Hough transform is most typically used for the detection of regular curves such as lines, circles, ellipses, etc. The Circle Hough Transform (CHT) is used for detecting circles. Circle Hough Transform approximate the boundary of Optic Disk from the fundus image. The purpose of this technique is to find the circles in an imperfect image inputs. In the circle, three parameters need to be defined

$$C : (x_{center}, y_{center}, r)$$

Where (x_{center}, y_{center}) define the center position

r is the radius, which permits us to completely define a circle

The inner and outer circle of the Optic Disc is detected. The cancer is detected by area and size. The message box will display whether it is cancerous or non-cancerous with a description of the image.

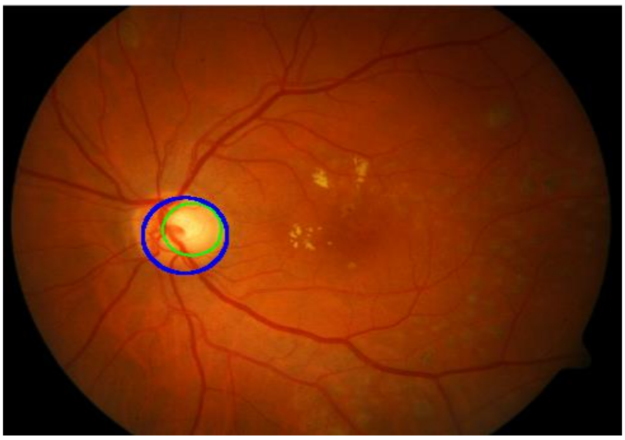

Fig-6: Circular Hough Transform

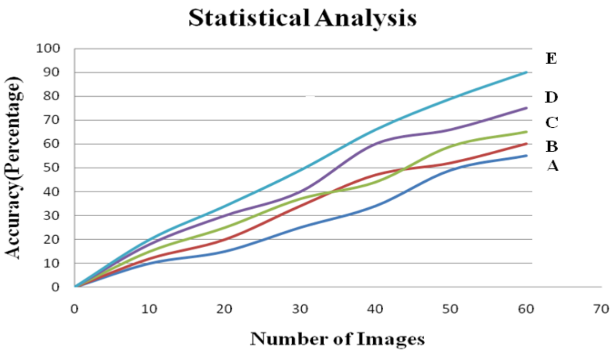

Chart-1: Statistical Analysis

Where **A,B,C,D –**Existing System

E-Proposed System.

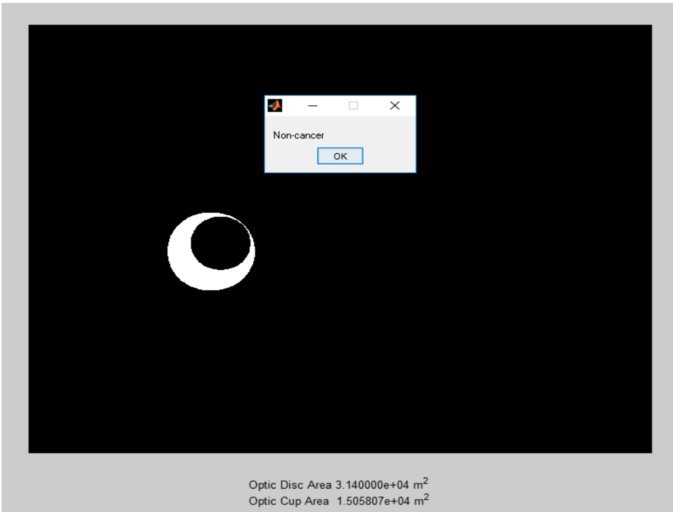

Fig-7: Detection of the eye cancer

4. CONCLUSION

In this work, a computer-assisted Cancer detection system using the Optic disc is detected from Fundus image using the watershed algorithm. The cancer is identified by the area and size of the Optic Disc.

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