

OPTIC DISC LOCATION IN DIGITAL FUNDUS IMAGES

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ABSTRACT

Optic Disc (OD) location plays an important role in automatic diagnosis of diabetic retinopathy. Medical image analysis and processing has great significance in the field of medicine, especially in non-invasive treatment and clinical study. Changes in optic disc shape and area may indicate disease processes, particularly glaucoma, and accurate identification of the disk boundary may be used to quantify changes. In this paper we are presenting the preprocessing step which will be beneficial further to calculate the cup to boundary ratio of optic disc. This paper presents technique for finding location of optic disc from digital retinal image. The optic disc pixel (ODP) should first determine for further processing. The optic disc pixel (ODP) can be further used for finding location of optic disc. Three methodologies for finding optic disc pixel and finally one voting algorithm for final optic disc pixel are presented in this paper.

Keywords - Low Pass Filter Method, Maximum Difference Method, Maximum Variance Method, Optic Disc Pixel (ODP)

I INTRODUCTION

Diabetic retinopathy (DR) is a chronic disease which nowadays constitutes the primary cause of blindness in people of working age in the developed world.[1].computer diagnosis is called for to allow detection of early signs of diabetic million patients with diabetes every year.Retinopathy in The benefits that a system for automatically detect early signs of this disease would provide have been widely studied and assessed positively by experts [2]. It is caused by damage in blood vessels in retina. This is important for find the optic disc pixel from given retinal fundus image. The aim of this work is to finding location of optic disc in retinal image. It needs as initial information the coordinates of a pixel located within the OD. A simple but reliable and very fast OD location methodology is also proposed to obtain the required OD pixel.

OD segmentation is also relevant for automated diagnosis of other ophthalmic pathologies. One of them and maybe the most noteworthy is Glaucoma. It is the second most common Cause of blindness worldwide.

Glaucoma is identified by recognizing the changes in shape, color, or depth that it Produces in the OD. Thus, its

segmentation and analysis can be used to detect evidence of Glaucoma automatically.

A computer-aided fundus image analysis could provide an immediate detection and characterization of retinal features prior to specialist inspection. With the increasing size and number of medical images of eye, the use of computers in facilitating their processing and analysis has become necessary. Optic disc or optic nerve head is the point of exit for ganglion cell axons leaving the eye. The optic disc represents the beginning of optic nerve and is the point where the axons of retinal ganglion cells come together. A bio microscopic exam can give an indication of health of optic nerve.

Nowadays in human being the eye problems occurred in a huge amount. In which blindness comes due to optic disc. So detection optic disc is a very important research in medical science. Optic disc (OD) detection is an important step in developing systems for automated diagnosis of various serious ophthalmic pathologies. This paper presents a new methodology for finding the ODP from digital retinal images. 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. From this or by using this algorithm we will detect the exact location of the Optic Disc

Optic disc is a bright area on the right side of the eye where the blood vessels converges Foracchia *et al.* [4] It is circular area in the black of eye where the optic nerve connect to the retina called as optic disc .Generally optic disc are orange to pink in colour .Optic disc is no light sensitive spot formed in the eye that spot also called as a blind spot. In color fundus images, the OD usually appears as a bright yellowish region, although this feature may also experience significant variations.

II. OVERVIEW OF STATE OF ART

First of all we have to find the ODP in retinal fundus image. With regard to location methods, [5] located the center of the OD using the vasculature origin. They determined where all the vessels converged by means of a voting-type algorithm called fuzzy convergence. Another method that uses the convergence of the vessels to detect the OD center . The four main vessels originating from the OD were geometrically modeled using two parabolas, and the OD position was located as their common vertex. Inspired by previous works, Youssif *et al.* [6]. The OD center location was identified using the variance of intensity produced by the blood vessels within the OD. Hoover and Goldbaum [5]. Finding the OD can be used to decrease false positives in the detection of regions of retinal exudates [7]. These injuries are a diagnostic key to grading the risk of macular edema. An OD location method using three-independent location methods and a voting procedure is presented in . Finally, a method for locating the OD using template matching techniques is presented in. While in used the Hough transform to detect the circular shape of the OD, in a complex optimization procedure is used.

III. PROPOSED WORK

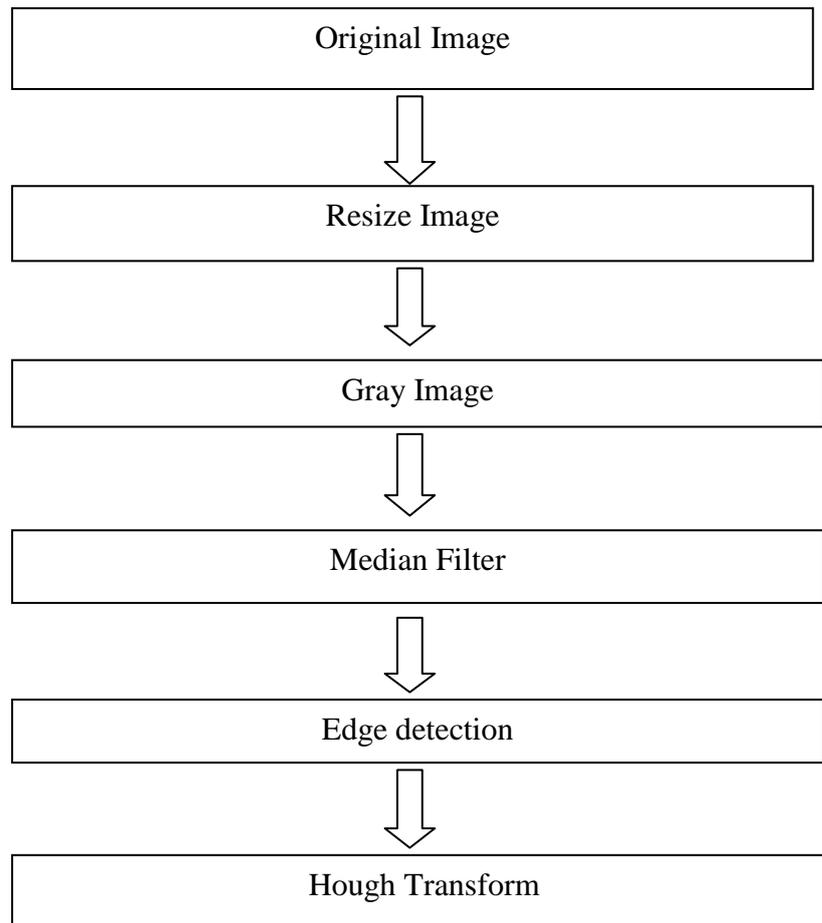


Fig. Proposed Work

IV. MEHODOLOGY USED

The aim of this work is to introduce a new methodology for OD segmentation that obtains a circular boundary approximation. It needs as initial information the coordinates of a pixel located within the OD. To this effect, in order to complement the presented segmentation methodology, a simple but reliable and very fast OD location methodology is also proposed to obtain the required OD pixel. It must be stressed that any other location method could be used for this purpose. All values of parameters, constants and window sizes given in this section refer to retinas of 1046 pixels in diameter. For different image resolutions, all of these values would have to be scaled.

4.1 Optic Disc Location

The location methodology obtains a pixel [called Optic Disc Pixel (ODP)] that belongs to the OD. It comprises three independent detection methods. Each method obtains its own OD candidate pixel. The final ODP is selected by taking into account the three previous candidate pixels and their location with respect to their average point (centroid). For this, a voting procedure comprising the following cases is applied.

- If the three OD candidate pixels are close to the centroid (closer than one-fifth of the image, maximum OD diameter estimation [7] the selected ODP is the centroid.
- If only two candidates are close to the centroid the selected ODP is the average point in these two referred pixels.
- Otherwise, the selected ODP is the candidate pixel obtained

With the most reliable method (performed tests show this is the maximum variance method described below).

The three developed methods work on the green channel of the RGB color space as this is the one that provides the best contrast. This gray scale image will be denoted as I . A description of these methods, by three examples of their application to different eye fundus images, is presented as follows

i) Maximum Difference Method

The OD usually appears as a bright region in eye fundus images. Moreover, the vascular tree formed by the “dark” blood vessels emerges in the disc. In OD the variation in maximum gray level occurs. This maximum is used by this method to select its OD pixel. A median filter

The OD pixel from this method is decided according to the following equation: [1]

$$P_{MDM} = \arg \max_{(i,j)} \left\{ (I_M)_{w}^{MAX}(i,j) - (I_M)_{w}^{MIN}(i,j) \right\}$$

Where I_m denotes the filtered image.

The I_m^{MAX} & I_m^{MIN} are the maximum and the minimum values of the pixels in within a window of size 21*21 centered on a pixel (i, j) ...[1]

- 1) Steps for finding ODP in maximum difference method.
 - a) Resize image.
 - b) Filtered by median filter 21*21.
 - c) Thresholding.
 - d) Find $c(i, j)_{max}$ and $c(i, j)_{min}$ matrix.
 - e) Get difference image.
 - f) Locate ODP

ii) Maximum Variance Method

This method is based on the same properties as the previous one. It calculates the statistical variance for every pixel by using a 71 *71 centered window. On the other hand, a set of “bright” pixels is obtained by automatic blue-channel thresholding according to the Otsu method. The OD pixel returned by this method is the maximum variance pixel showing at least 10 “bright” pixels in its neighborhood (established by means of a 101* 101 pixel window). The window sizes selected to compute the variance and to establish the neighborhood criteria, were set with the aim of obtaining the best location performance on a set of 1200 fundus images.

- a) Resize image.
- b) Filtered by median filter 21*21.
- c) Thresholding.
- d) Find standard deviation of image by 21*21 window.
- e) Finding co- ordinates of max value

- f) Taking 10 bright Pixel.
- g) Locate ODP.

The OD pixel returned by this method is the maximum variance pixel showing at least 10 “bright” pixels in its neighborhood

iii) Low-Pass Filter Method

The OD pixel of this method is the maximum gray-level pixel in a low-pass filtered image. Although the OD is usually the brightest area in a retinography, the pixel with the highest gray level could not be located within it. In many cases, this pixel may be inside other small bright regions. In order to smooth out these distractors, the image I is transformed to the frequency domain and filtered by the Gaussian low-pass filter defined[1]

as follows:

- 1) Steps in finding odp using low pass filter.
 - a) Resize image.
 - b) The two-dimensional discrete Fourier transform (DFT).
 - c) FFT shift.
 - d) Use low pass Gaussian filter.
 - e) IFFT shift.
 - f) Locate ODP.

In this method we are using the Gaussian low pass filter for smoothing and filtering with cut of frequency 25Hz.

$$H(u, v) = \exp\left(\frac{-D^2(u, v)}{2D_0^2}\right) \dots\dots[2]$$

Where, $D(u, v)$ is the Euclidean distance between the points (u, v) is origin of the frequency plane, S and D_0 is the cutoff frequency with a value of 25 Hz.

The highest gray-level pixel in the filtered image returned to the spatial domain is the result of this method. Now the result of the final ODP selection process is illustrated by the three examples of application of the methodology. It can be confirmed that although the pixel returned by the maximum difference method is outside the disc, it is discarded and the ODP is successfully selected. Pixels returned by the three methods are close, so the location of the ODP is the location of their cantors are far from their centroid, so the final ODP is the OD pixel found by the maximum variance method.

We implement three methods for finding the location of the optic disc pixel. We also implementing the voting algorithm for find the exact optic disc pixel from the three candidate pixels from three different methods

Voting procedure is useful for selection of appropriate ODP. .Maximum variance methods used to calculates the statistical variance of every pixels.Low pass filter method is used for imsgce smoothing and Maximum difference method is used to select OD pixel.

4.2 ODP

The location methodology obtains a pixel [called Optic Disc Pixel (ODP)] that belongs to the OD. It comprises three independent detection methods. Each method obtains its own OD candidate pixel. The final

ODP is selected by taking into account the three previous candidate pixels and their location with respect to their average point (centroid). For this, a voting procedure comprising the following cases is applied.

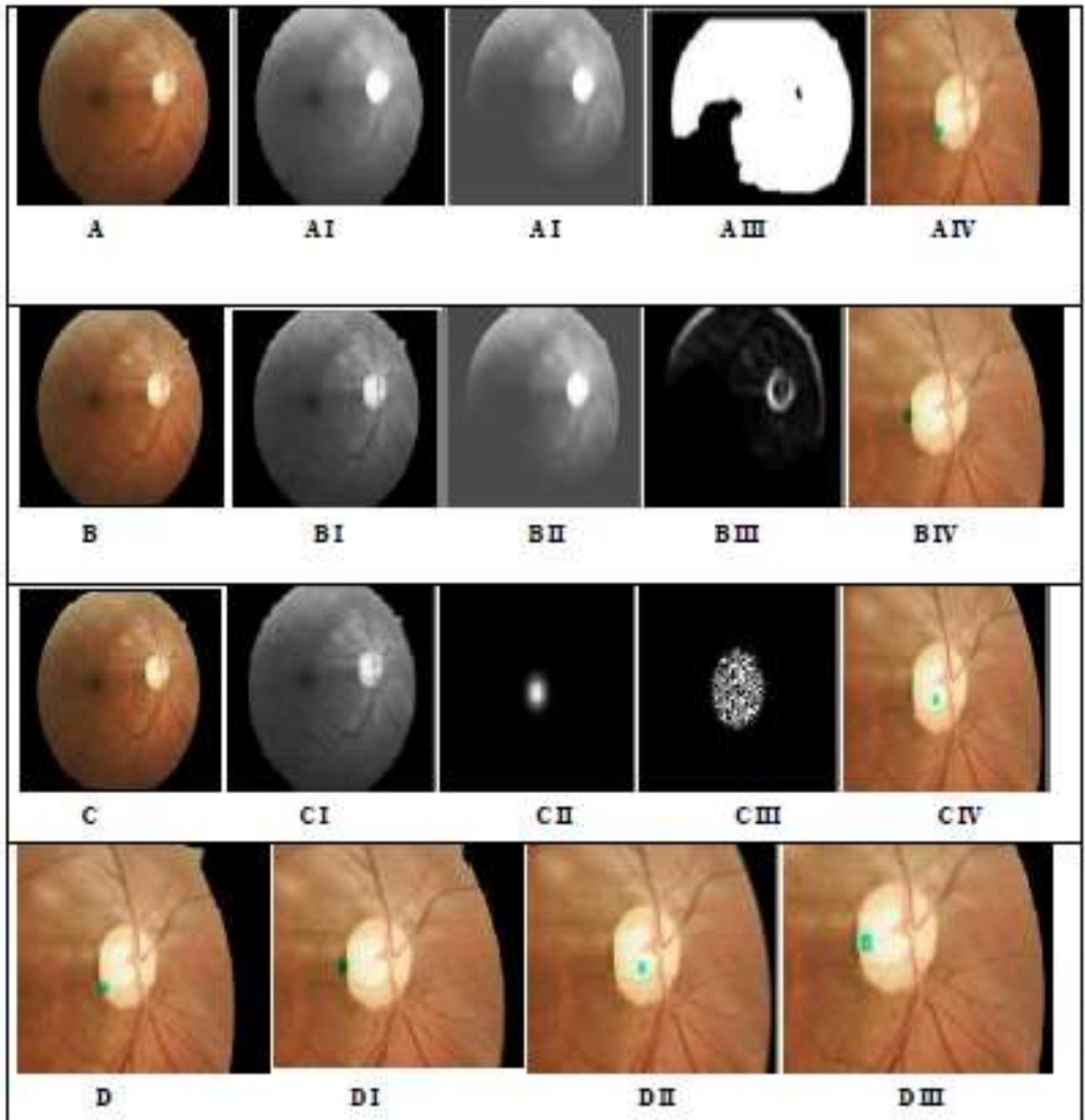


Figure : ODP determination: (A), (B), (C) and (D), original images (A I), (A II),(A III), (A IV) images from maximum difference method,(B I),(B II),(B III),(B IV) images from maximum variance method,(C I),(C II),(C III),(C IV) images from low pass filter method and (D I),(D II),(D III) images from voting procedure

i) Voting Procedure.

The final ODP is selected by taking into account the three previous candidate pixels and their location with respect to their average point (centroid). For this, a voting procedure comprising the following cases is applied.

- If the three OD candidate pixels are close to the centroid (closer than one-fifth of the image, maximum OD diameter estimation. The selected ODP is the centroid.
- If only two candidates are close to the centroid: the selected ODP is the average point in these two referred pixels.[1]
- Otherwise, the selected ODP is the candidate pixel obtained with the most reliable method

In this way the final ODP is locate using the voting process.

V. RESULTS

The result of maximum difference method is 30%. The result given by maximum variance method is 97%. The result percentage observed in low pas filter method is 80%. In this way maximum accuracy can be obtained by using the three methods to find the ODP.

VI. CONCLUSION

In this paper, a computer-assisted retinal image analysis system for the localization of optic disc in color digital fundus images has been presented. This is achieved by means of morphological processing followed by the template based method. The proposed algorithm has segmented the exact boundary of optic disc in retinal images. Overall, morphological pre-processing provided optimized results that were least sensitive to initial conditions and which captured subtle details of the disc boundary. The boundaries of optic disc extracted by this technique can be used by clinical ophthalmologists for clinical use.

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