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Detection of Optic Cup Disc using Morphological Pixel Classification Technique

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Abstract

Retinal image segmentation is important for diagnosing various issues happens in eye. Retinal image segment is one among the crucial problems as a result of this image contains terribly little nerves and a few artifacts present in it. This paper proposes associate automatic morphological segmentation technique to vary the illustration of a picture into one thing that's additional significant and easier to research the interested object. There are many ways that shall perform segmentation, however it's tough to adapt simply and observe the terribly little nerves accurately. To resolve this drawback, this paper associate flexible automatic morphological segmentation and region growing technique that may be applied to any form of retinal pictures that is strictly diagnosed even with the little changes that occur within the image. This projected technique is predicated in a very model of morph perform that applies the morphological watershed operator to a grey scale image. Morphological phase technique is employed to phase the image and choosing the particular image objects, cutting the article to found the basis nerves. Once employing a morphological operation to show the fundamental components among a picture, it's typically helpful to extract and analyze specific info regarding those image components. This proposed segmentation performs region growing for a given image region among the array that are connected to neighboring region pixels which fall among provided constraints.

Keywords: Optic Disc, Cup, Morphological, Segmentation.

Introduction

Retina is a light sensitive tissue lining the inner surface of the eye. The optics of the eye creates an image of the visual world on the retina, which serves much the same function as the film in a camera. Light striking the retina initiates a cascade of chemical and electrical events that ultimately trigger nerve impulses. These are sent to various visual centers of the brain through the fibers of the optic nerve. A digital image is composed of a grid of pixels and stored as an array. A single pixel represents a value of either light intensity or color. Images are processed to obtain information beyond what is apparent given the image's initial pixel values. This paper proposes an automatic morphological segmentation method to change the representation of an image into something that is more meaningful and easier to analyze any type of medical images. Segmentation involves separating an image into regions corresponding to objects. The goal of image segmentation is to cluster pixels into salient image regions, i.e., regions corresponding to individual surfaces, objects, or natural parts of objects. This approach was extended to a fully automatic and complete segmentation method by using the pixels with the smallest gradient length. The not yet segmented image region as a seed point. After segmentation, the infected region is identified by comparing the values of original image with the values of reference image. Then the diagnosed part is enhanced for region growing. Region growing is a simple region-based image segmentation method. It is also classified as a pixel-based image segmentation method, since it involves the selection of initial points. This approach to segmentation examines neighboring pixels of initial "seed points" and determines whether the pixel neighbors should be added to the region.

Automatic optic disc detection

Structuring Element

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Morphological operations apply a structuring element or morphological mask to an image. A structuring element that is applied to an image must be 2 dimensional, having the same number of dimensions as the array to which it is applied. A morphological operation passes the structuring element, of an empirically determined size and shape, over an image. The operation compares the structuring element to the underlying image and generates an output pixel based upon the function of the morphological operation. The size and shape of the structuring element determines what is extracted or deleted from an image. In general, smaller structuring elements preserve finer details within an image than larger elements. Morphological operations can be applied to either binary or grayscale images. When applied to a binary image, the operation returns pixels that are either black, having a logical value of 0, or white, having a logical value of 1. Each image pixel and its neighboring pixels are compared against the structuring element to determine the pixel's value in the output image. With grayscale images, pixel values are determined by taking a neighborhood minimum or neighborhood maximum value. The structuring element provides the definition of the shape of the neighborhood.

Morphological Segmentation

The morphological gradient operator function applies to a grayscale image. Morphological gradient is the subtraction of an eroded version of the original image from a dilated version of the original image. The utilization of a brand new grey-scale image is projected. Specifically, it's calculated by means that of PCA as a result of this sort of study maximizes the separation of the various objects that compose a image so the structures of the tissue layer area unit higher appreciated. The primary laptop is that the most important therefore, outlined is chosen because the input image of the strategy bestowed during this paper. It should be stressed that to confirm that contains the foremost structural distinction and data of the initial RGB channels, it ought to be verified that the most important Eigen price represents a minimum of a ninetieth of the entire add of Eigen values. In spite of this case isn't usually within the consulted databases, if the most important Eigen price represents but ninetieth, the elements whose add of Eigen values get the ninetieth should be processed in parallel.

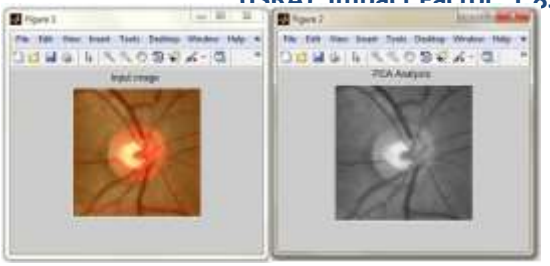

Fig 1. Input Image and Preprocessing output

B.Image Enhancement

The non uniform illumination of this gray image is additionally corrected and its distinction is enhanced through a neighborhood transformation. The Morphological top hat function applies the top-hat operator to a grayscale image. The top-hat operator is implemented by first applying the opening operator to the original image, then subtracting the result from the original image. Applying the top-hat operator provides a result that shows the bright peaks within the image.

Fig 2. Image Enhancement

Gradient Magnitude

Gradient magnitude edges to be loci of "maximal" gradient magnitude. One way of defining these maximal curves is as the boundaries of watershed regions everything on one side "flows" downhill to one side and everything on the other flows to the other side. Thus, as you cross from one watershed region to another, you've had to cross over some local ridge curve. Unfortunately, this definition of a ridge isn't based on purely local properties but instead requires building the regions first. So, a common technique for segmentation is to use *gradient watershed regions*. First build a gradient magnitude image, then find the watershed regions in this image. One way to find watersheds is to think of filling them from the bottom up and finding where different pools merge.

The image gradient is to find edge strength and direction at location (x,y) of image, and defines as the vector.

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$$\nabla f \equiv \text{grad}(f) \equiv \begin{bmatrix} g_x \\ g_y \end{bmatrix} = \begin{bmatrix} \frac{\partial f}{\partial x} \\ \frac{\partial f}{\partial y} \end{bmatrix}$$

The magnitude (length) of vector ∇f, denoted as M(x,y)

$$\text{mag}(\nabla f) = \sqrt{g_x + g_y}$$

The direction of the gradient vector is given by the angle

$$\alpha(x, y) = \tan^{-1}\left[\frac{g_y}{g_x}\right] \quad (0.1)$$

The direction of an edge at an arbitrary point (x,y) is orthogonal to the direction. We are dealing with digital quantities, so a digital approximation of the partial derivatives over a neighborhood about a point is required.

D.Region Discrimination

The discrimination between significant and non significant regions relies on the typical intensity of the region. The worth of every region are going to be adequate being the quantity of pixels of the corresponding region represents the image wherever the intensity of every region is adequate. The value of the threshold is being and also the mean and also the variance of the residue of the close-hole operator. Using, hit-or-miss transform is an operation that detects a given configuration in a binary image, using the morphological erosion operator and a pair of disjoint structuring elements. The result of the hit-or-miss transform is the set of positions, where the first structuring element fits in the foreground of the input image, and the second structuring element misses it completely. A structuring element is a simple, pre-defined shape, represented as a binary image, used to probe another binary image, in morphological operations such as erosion, dilation, opening, and closing.

Fig 3. Region Discrimination and Watershed

Optic Cup DETECTION

In this section, the optic cup region is segmentation is to analyze the image shapes and selecting specific image objects. Detecting the cup boundary from 2-D anatomical structure pictures while not depth data may be a difficult task as depth is that the primary indicator for the cup boundary.The structuring element used in the hit-and-miss is a slight extension to the type that has been introduced for erosion and dilation, in that it can contain both foreground and background pixels, rather than just foreground pixels, *i.e.* both ones and zeros. Note that the simpler type of structuring element used with erosion and dilation is often *depicted* containing both ones and zeros as well, but in that case the zeros really stand for `don't care's', and are just used to fill out the structuring element to a convenient shaped kernel, usually a square

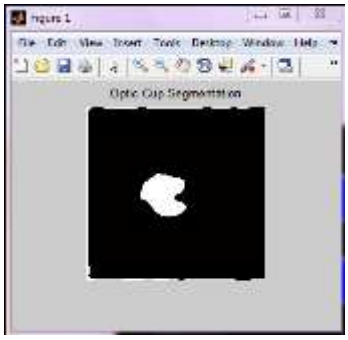

Fig 4. Optic Cup Segmentation

Analyzing Image Shapes

After using a morphological operation to expose the basic elements within an image, it is often useful to then extract and analyze specific information about those image elements. The following method uses the label region function procedure to identify and extract information about specific image objects. The Region function labels all of the regions within a binary image, giving each region a unique index number. The Region function consecutively labels all of the regions, or blobs, of a

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bi-level image with a unique region index. This process is sometimes called "blob coloring". A region is a set of non-zero pixels within a neighborhood around the pixel under examination. The argument for Label Region is an n-dimensional bi-level integer type array only zero and non-zero values are considered. Statistics on each of the regions may be easily calculated using the histogram function.

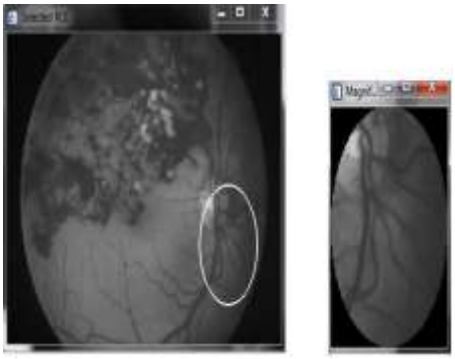

Fig 5. Analyzing Image Shape

B.Cup to Disc ratio

Detect of optic disc and cup, the CDR is computed for eye disease screening. The computed CDR is used for glaucoma screening. Glaucoma is detected by calculating Cup to disc ratio. Glaucoma is present when CDR value is greater than equal to 0.8. No Glaucoma is present in the provided image, when CDR value is less than 0.8.

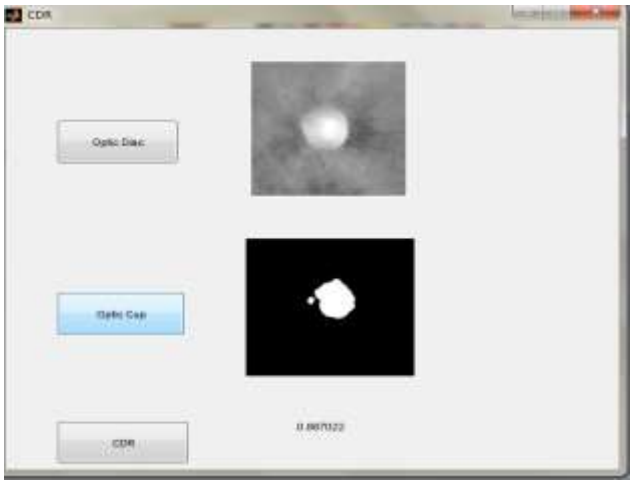

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Fig 6. Cup Disc Ratio Calculation

Conclusion

This paper projected automatic technique of morphological pixel segmentation to found the tiny nerves within the retinal image simply and accurately. During this paper the accessible classifications of strategies was reviewed also as a classified for applying this techniques to decreasing human intervention in optic disk extraction. There square measure several Extraction algorithms which will be universally accustomed solve several issues. Easily and quickly screen the Glaucoma region in an retinal image .This technique is employed to discover the abnormal object from the image very fastly. Our approach detects the centre and limits of the objects quickly and faithfully to all retinal images.

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