International Journal of Power Control Signal and Computation(IJPCSC)
Vol 8. No.1 – Jan-March 2016 Pp.123-128

available at : www.ijcns.com
ISSN: 0976-268X

IMAGE PROCESSING ANALYSIS ON RETINAL BLOOD VESSEL FOR DETECTING GLAUCOMA AFFECTED HUMAN EYE USING MORPHOLOGICAL PROCESS

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ABSTRACT— In recent days glaucoma related problems are tremendously increased in a stratergical manner. Hence it is to be considered as a serious threat in biomedical problem among human beings. proper arrangement of retinal vessel provides information about the retinal abnormalities. This process help to find cause several retinal diseases. The assessment of blood vessel is used to find eye diseases such as diabetic retinopathy, glaucoma and hypertension. Digital image processing methods play a vital role in retinal blood vessel detection. Various image processing techniques and filters are in practice to detect and get the attributes of retinal blood vessels like length, width, patterns and angles. Automated digital image processing methods to undergo more of improvisation to achieve precise accuracy to learn the condition of retinal vessels especially in case of glaucoma and retinopathy. In existing technique the blood vessel detection points are not clearly indicated and also Junction points are not always detected. This paper deals with identifying retinal diseases by image processing technique using morphological algorithms. Morphological algorithm is applied to include the image in order to achieve the retinal image defect. Morphological filters are a collection of non-linear process related to the shape or morphology of features in an image. The advantage is that it tracks the vessels efficiently and also attenuates the noise to improve contrast. So the result of the given method provides good accuracy.

KEYWORDS—Retina blood vessels, digital image processing, morphological process.

I. INTRODUCTION

Retinal views consider all the issues that affect body vasculature. The human eye is a visual region of the human body in which the vascular condition can be directly observed and solved. The analysis of vascular characteristics like vascular width, branching angle, vessels tortuosity and fractal dimensions are most important performance structural parameters that are implemented in identication, treatment and assessment of various ophthalmologic diseases. Blood vessel division is the essential way to identify the retinal diseases. Blood vessel division involves segmenting the blood vessels into many number of parts[1].

The vision of the human are troubled by some retinal diseases like diabetic retinopathy, hypertension and glaucoma. These diseases can be treated by examing the retinal vessels conditions caliber, color and tortuosity. Division and analysis of retinal vessels will assign the diagnosis and treatment of retinopathy, hypertension and glaucoma. Automatic extraction of the retinal vasculature can insist to the doctors in the insertion

of screening programs for retinopathy[2]. The extraction of the retinal vessel involves in the segmentation of vasculature and identifying the distinct vessels. The aim of the division is to simplify and change the identification of an image into something that is easier to analyse. It is used to locate object and boundaries. Image division is the process of assisting a label to certain pixel in an image such that pixel with the same label share every characteristics.

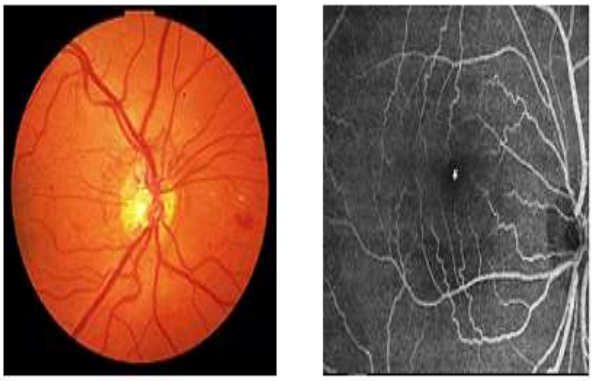

Fig.1 Image of Retinal blood vessel

The result of the image division is a set of segment that collectively cover the whole image. Each of the pixel in a place are same with respect to some characteristics property such as color, intensity, or texture, division of retinal vasculature from the retinal image are implemented in various medicine disciplines such as disease identification or image registration[3]. There are some of the methods in retinal image such as region growing, thresholding and morphological techniques neural network based on statistical classification based methods and hierarchical methods.

Initially, the appearance of the blood vessels are enhanced and back-ground noise is suppressed with the set of real component of a complex Gabor filters. Then the vessel pixels are detected in the vessel enhanced image using entropic thresholding based on gray level co-occurrence matrix as it takes into account the spatial distribution of gray levels and preserving the spatial structures. Also detection process becomes much more complicated in presence of lesions and other pathological changes affect the retinal images. [4]. Its processed on images of retina with the help of digital image processing (DIP) tool in which images are detected and then processed. At last we describe the problem of detecting edges in images as a diabetic retinopathy (DR), macular degeneration and glaucoma. The edge detection problem can be separated into three stages: filtering; detection; and tracing and images separated with the application of different algorithm based on local pixel characteristics which can control the degree of Gaussian smoothing.

Filtered images are then applied to a simple edge detection algorithm which evaluates the edge fuzzy association value for each pixel; based on local image characteristics. One drawback to these approaches is their dependence upon methods for locating the starting points, which must always be either at the optic nerve or at subsequently detected branch points [2]. **F**irst step involves in the extraction of the retina vascular tree using the graph cut technique. The blood vessel information is then used to estimate the location of the optic disk. The optic disk segmentation is performed using two alternative methods. The markov random field (MRF) image reconstruction method segments the optic disk by removing vessels from the optic disk region, and the compensation factor method segments the optic disk using the prior local intensity knowledge of the vessels. Drawback of this approach tracking methods detect first initial vessel seed points, and then track the rest of the vessel pixels through the image by measuring the continuity proprieties of the blood vessel [5]. Morphological Process and clustering method used morphological and clustering algorithm proposes a method for the retinal ima0000ge analysis through efficient detection of exudates and recognizes the retina to be normal or abnormal. The contrast image is enhanced by curvelet transform. Hence, morphology operators are applied to the enhanced image in order to find the retinal image ridge [6].

II. METHODS OF GLAUCOMA DETECTION

Glaucoma is inferred by a numerous different eye diseases in many produce increased pressure within the eye. This enormous pressure is due to backup of fluid in the eye. In time, it implicits damage to the optic nerve. In early inventory, diagnosis and treatment its helps to overcome prevention of your vision. There are several types of glaucoma as follows, Primary open angle glaucoma involves mainly at the age of 50 group. These are no symptoms increased with primary open angle

glaucoma. The pressure in the eye slowly increases and cornea adapts without swelling. It is painless and the patient does not recognize vision lost at the last stage of the diseases. Normal tension glaucoma, also referred as low-tension glaucoma, is characterized by progressive optic nerve damage and visual field loss with a statistically normal intraocular pressure. Acute glaucoma same as POAG, where the IOP increases slowly, in acute angle-closure, it increases suddenly of the pressure rises high enough, the pain may become so deep that it can cause vomiting.

The eye returns red, cornea swells and clouds and patient sees haloes and lights may increases blessed vision. In Pigmentory glaucoma , Near sighted patients are more afflicted. The anatomy of the eyes of these patients plays a vital role in glaucoma. Exfoliation syndrome this exfoliation material is erased off the lens by movement of the iris and at same moment, pigment is erased off the iris. Both pigment and exfoliation material clogs the trabecular meshwork, including to 10 elevation, sometimes to increased levels. Trauma related glaucoma all in the eye, chemical even or increasing injury, mechanical disturbance or physical change with drainage process of eye.

Diagnoses techniques of glaucoma involve the following method. The tonometer is the measurement of pressure inside the eye by using an instrument called tonometer. Numbering drops may be used to the eye for the text. A tonometer measures pressures inside the eye to find and diagnoise glaucoma. The visual field test is an vital measure of extend damage of nerve in high IOP. In computerized visual field testing, place our chin on stand that is seen in computeresed screen. In opthalmoscopy, eye doctor can look immediately into pupil at optic nerve. Its colors and appearance can signify whether or not damage from glaucoma in present and extensive. Visual acuity test involves the eye chart test measures how well we see various distances. This test measures the peripheral (side vision).It helps the eye care professional tell if we has lost peripheral vision,a sign of glaucoma.

III. MORPHOLOGICAL ALGORITHM AND IMAGE SEGMENTATION

Morphological algorithm is set of image processing operations that analyses the shape inside of the image. It applies a structuring element to the image and output of the image is of same size. The output value of every pixel is determined by the neighboring pixel with respect to the pixel of input image. The size and shape of structuring element affects the number of pixels added or removed from object in a image. Closing operation is defined as dilation followed by erosion. Dilation is an operation that grows or thickens object in binary image. The process and extent of shrinking is controlled by structing elements. Morphological filter redefine as the increasing idempotent operators and their laws of composition the changing sequential filters allow one to bring into groups of operators depending on positive scale parameters. Finally the centre and the toggle mapping change the function under study by comparing it, at each point with few forms of transforms.

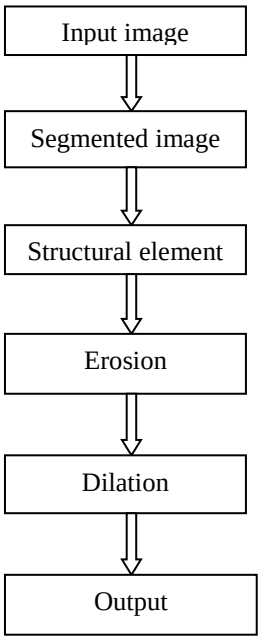

Fig.2 Flow chart for morphologicl process

A morphological filter is a collection of non-linear processed related to the shape or morphology of features in an image. Morphological filters are defined as increasing idempotent operators and their laws of comparison the alternating sequential filters allow one to bring into play families of operators depending on a positive scale parameter. Finally, the center and the toggle mappings modify the function under study by comparing it, at each point, with a few reference transforms.

Morphological algorithm are applied on divided image for softening. It process the image dependant on shape and performance on image using

structuring elements. Dilation and erosion will be used to induce removing the unwanted pixels. The stepwise process of morphological algorithm is represented in Fig.2.

IV. RESULTS AND DISCUSSION

From the simulated result, it can be demonstrated that morphological method will be essential in a wide range of retinal blood vessel assessment and diseases identification using matlab. The processing of the proposed method is of very high accuracy. Morphological based detection on the original retinal images has good performance.True positive (TP) means number of blood vessels correctly detected, false positive (FP) means number of non-blood vessels which are detected wrongly as blood vessels, false negative (FN) means a number of blood vessels that are not detected, true negative (TN) means a number of non-blood vessels which are correctly identified as non-blood vessels.

Accuracy is defined by addition of the true positive and true negative and it is divided by the total number of pixel in the image.

$$\text{Accuracy} = (TP+TN)/(TP+FN+FP+TN) \quad (1)$$

True positive rate (TPR) is calculated as the total number of true positive, divided by the number of blood vessel pixels marked in the ground true image.

$$TPR=TP/(TP+FN) \quad (2)$$

False positive rate (FPR) is calculated as the total number of false positive divided by the number of pixel marked as non vessel in the ground true image.

$$FPR=FP/(FP+TN) \quad (3)$$

Precision or positive predictive value (PPV) is defined as the proportion of the true positives against all the positive results

$$PPV=TP/(TP+FP) \quad (4)$$

Since glaucoma is a retinal disease which leads to loss of vision. By detecting glaucoma in various stages to reduce the risk of blindness. The performance of proposed methodology is analyzed with the following parameters shown in table I.

TABLE I. COMPARISON OF PARAMETER ANALYSIS

Methods	TPR	FPR	Accuracy	Precision
Morphological algorithm	0.745	0.02	0.958	0.783
SVM classifier	0.645	0.013	0.671	0.332
Optimized gabor filter with local entropy thresholding	0.445	0.003	0.531	0.433

Fig.3 Input image of glaucoma affected retinal blood vessels

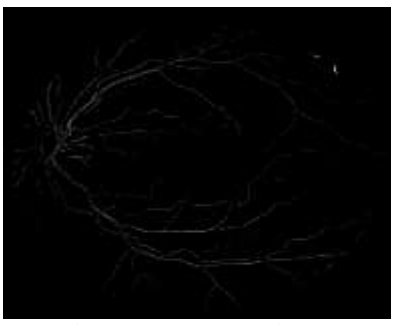

Fig.4 Image of retinal blood vessels after segmentation

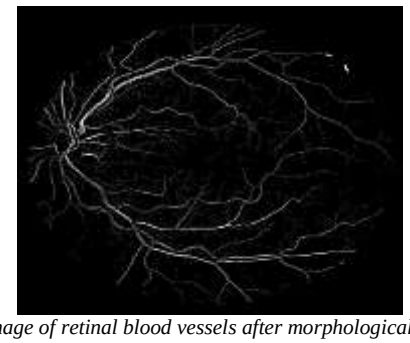

Fig .5 Image of retinal blood vessels after morphological filter

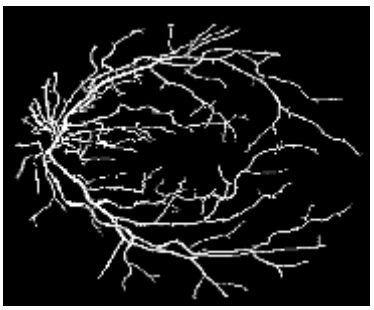

Fig.6 Image of segmented retinal blood vessels

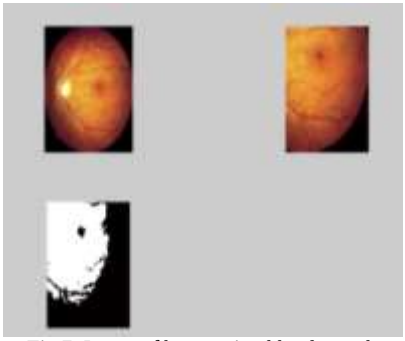

Fig.7 Image of low tension blood vessels

Fig.8 Image of low tension disease identification

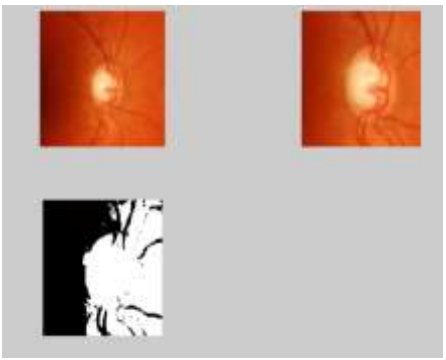

Fig.9 Image of moderate tension blood vessels

Fig.10 Image of moderate tension disease identification

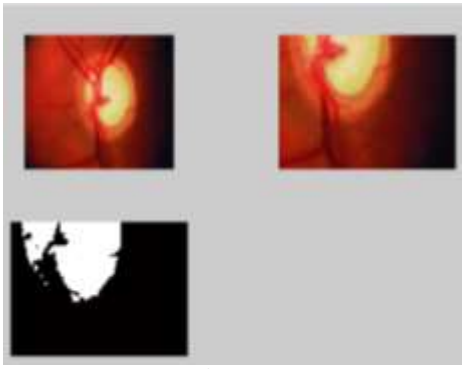

Fig.11 Image of high tension blood vessels

Fig.12 Image of high tension disease identification

V . CONCLUSION

Blood vessel detection in retinal image will help for identification of diseases and also for human recognisation. Here morphological algorithm is used for detecting glaucoma with more accuracy. It provides good accuracy, better contrast enhancement, perfect retinal vessel and perform detection. True Positive refers to the correctly detected blood vessels. False Positive refers to the correctly and wrongly detected non-blood vessel pixels. Precision is defined as the proportion of the true positives against all the positive results. Accuracy is the proportion of true results among the total number of present database was examined. Future work will be replacement of various algorithms for better accuracy.

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