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AN EFFICIENT TECHNIQUES IN DIGITAL IMAGE PROCESSING TO DETECT GLAUCOMA

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ABSTRACT:- *Evaluation of blood vessels in human eye allows earlier detection of eye diseases such as glaucoma and diabetic retinopathy. Digital image processing techniques play a vital role in retinal blood vessel detection. Several image processing methods and filters are in practise to detect and extract the attributes of retinal blood vessels such as length, width, pattern and angles. Automated Digital image processing techniques and methods has to undergo more of improvisation to achieve precise accuracy to the condition of Retinal Vessels especially in cases of Glaucoma and retinopathy; Our project have explained filter, Thresholding Method, Segmentation method, and functional approach to isolate the blood vessels.*

KEYWORDS: **MATLAB, GLAUCOMA, VESSELS SEGMENTATION, FILTERS.**

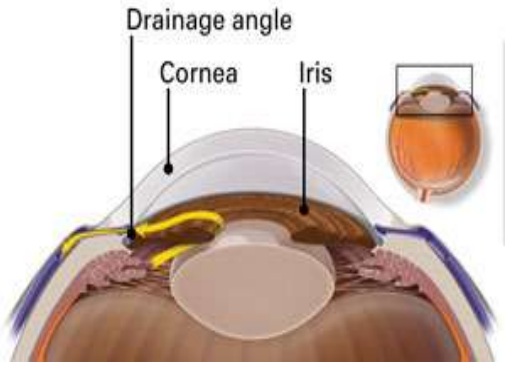
1. INTRODUCTION

Blood vessel segmentation is the basic foundation while developing retinal screening systems, since vessels serve as one of the main retinal landmark features. Proposed Technique to detect the Retina vessels and Exudates from an eye fundus image the morphology of blood vessels in retinal fundus images is an important indicator of diseases like glaucoma, hypertension and diabetic retinopathy. The accuracy of retinal blood vessels segmentation affects the quality of retinal image analysis which is used in diagnosis methods in modern ophthalmology. Contrast enhancement is one of the crucial steps in any of retinal blood vessel segmentation approaches. The reliability of the segmentation depends on the consistency of the contrast over the image. This paper presents an assessment of the suitability of a recently invented spatially adaptive contrast enhancement technique for enhancing retinal fundus images for blood vessel segmentation.

Manual segmentation of the retinal blood vessels is arduous and time-consuming, and making a detailed segmentation can be challenging if the complexity of the vascular network is too high. Thus, automated segmentation is valuable, as it decreases the time and effort required, and in the best-case scenario, an automated algorithm can provide as good or better segmentation results as an expert by manual labeling. For practical applications, it would be better to have algorithms that do not critically depend on configuring many parameters so that also non-experts may utilize this technology with ease. Automated blood vessel segmentation has faced challenges related to low contrast in images, wide range of vessel widths and variety of different structures in retinal images such as retinal image boundaries, optic disc and retinal lesions caused by diseases. Even though, different methods are available for retinal segmentation, there is still space for improvement.

GLAUCOMA

Glaucoma is a disease that damages your eye's optic nerve. It usually happens when fluid builds up in the front part of your eye. That extra fluid increases the pressure in your eye, damaging the optic nerve. The optic nerve is connected to the retina a layer of light-sensitive tissue lining the inside of the eye and is made up of many nerve fibres, like an electric cable is made up of many wires. The optic nerve sends signals from your retina to your brain, where these signals are interpreted as the images you see. In the healthy eye, a clear fluid called aqueous (pronounced AY-kwee-us) humor circulates inside the front portion of your eye.



To maintain a constant healthy eye pressure, your eye continually produces a small amount of aqueous humor while an equal amount of this fluid flows out of your eye. If you have glaucoma, the aqueous humor does not flow out of the eye properly. Fluid pressure in the eye builds up and, over time, causes damage to the optic nerve fibers

RETINAL BLOOD VESSEL

There are two sources of blood supply to the retina: the central retinal artery and the choroidal blood vessels. The choroid receives the greatest blood flow (65-85%) and is vital for the maintainance of the outer retina (particularly the photoreceptors) and the remaining 20-30% flows to the retina through the central retinal artery from the optic nerve head to nourish the inner retinal layers. The central retinal artery has 4 main branches in the human retina. The human retina is a delicate organization of neurons, glia and nourishing blood vessels. In some eye diseases, the retina becomes damaged or compromised, and degenerative changes set in that eventually lead to serious damage to the nerve cells that carry the vital messages about the visual image to the brain. Blood vessel segmentation is the basic foundation while developing retinal screening systems, since vessels serve as one of the main retinal landmark features.

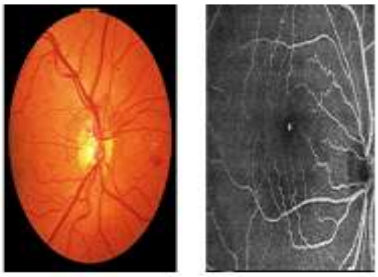


Image processing Techniques in retinal blood vessel

ADVANTAGES

- Improving the Segmentation accuracy
- Efficient Quality

2. RELATED WORK

The retinal blood vessels is an important indicator for diagnosis of several clinical disorders of eye. In this paper an automated method for blood vessel extraction has been presented. In the first stage, the extracted green channel image is enhanced using contrast limited adaptive histogram equalization (CLAHE) and 2D Gabor wavelet. Then the enhanced image is segmented using morphological reconstruction and hysteresis thresholding. A final segmented image is obtained by the application of a two stage post-processing phase. The performance of the proposed method is evaluated and tested on the CHASE_DB1 by reaching an average accuracy of 0.950 [1]. Machine Learning techniques have been useful in almost every field of concern. Data Mining, a branch of Machine Learning is one of the most extensively used techniques. The ever-increasing demands in the field of medicine are being addressed by computational approaches in which Big Data analysis, image processing and data mining are on top priority. These techniques have been exploited in the domain of ophthalmology for better retinal fundus image analysis. Blood vessels, one of the most significant retinal anatomical structures are analysed for diagnosis of many diseases like retinopathy, occlusion and many other vision threatening diseases. Vessel segmentation can also be a pre-processing step for segmentation of other retinal structures like optic disc, fovea, microneurysms, etc. In this paper, blood vessel segmentation is attempted through image processing and data mining techniques. The retinal blood vessels were segmented through color space conversion and color channel extraction, image pre-processing, Gabor filtering, image postprocessing, feature construction through application of principal component analysis, k-means clustering and first level classification using Naïve–Bayes classification algorithm and second level classification using C4.5 enhanced with bagging techniques [2]. The morphology of blood vessels in retinal fundus images is an important indicator of diseases like glaucoma, hypertension and diabetic retinopathy. The accuracy of retinal blood vessels segmentation affects the quality of retinal image analysis which is used in diagnosis methods in modern ophthalmology. Contrast enhancement is one of the crucial steps in any of retinal blood vessel segmentation approaches. The reliability of the segmentation depends on the consistency of the contrast over the image. This paper presents an assessment of the suitability of a recently invented spatially adaptive contrast enhancement technique for enhancing retinal fundus images for blood vessel segmentation. The enhancement technique was integrated with a variant of Tyler Coye algorithm, which has been improved with Hough line transformation based vessel reconstruction method. The proposed approach was evaluated on two public datasets STARE and DRIVE. The assessment was done by comparing the segmentation performance with five widely used contrast enhancement techniques based on wavelet transform, contrast limited histogram equalization, local normalization, linear un-sharp masking and contourlet transform [3]. Despite the continuous advances in local stereo matching for years, most efforts are on developing robust cost computation and aggregation methods. Little attention has been seriously paid to the disparity refinement. In this work, we study weighted median filtering for disparity refinement. We discover that with this refinement, even the simple box filter aggregation achieves comparable accuracy with various sophisticated aggregation methods (with the same refinement). This is due to the nice weighted median filtering properties of removing outlier error while respecting edges/structures. This reveals that the previously overlooked refinement can be at least as crucial as aggregation. We also develop the first constant time algorithm for the previously time-consuming weighted median filter. This makes the simple combination “box aggregation + weighted median” an attractive solution in practice for both speed

and accuracy. As a byproduct, the fast weighted median filtering unleashes its potential in other applications that were hampered by high complexities. We show its superiority in various applications such as depth upsampling, clip-art JPEG artifact removal, and image stylization [4]. In general morphology, the problem of representing – and visualising – more than three dimensions is overcome by placing the variables in columns beside each other, their value ranges listed below them. This is called a morphological field. A particular constructed morphotype (called a field configuration) is designated by selecting a single value from each variable.

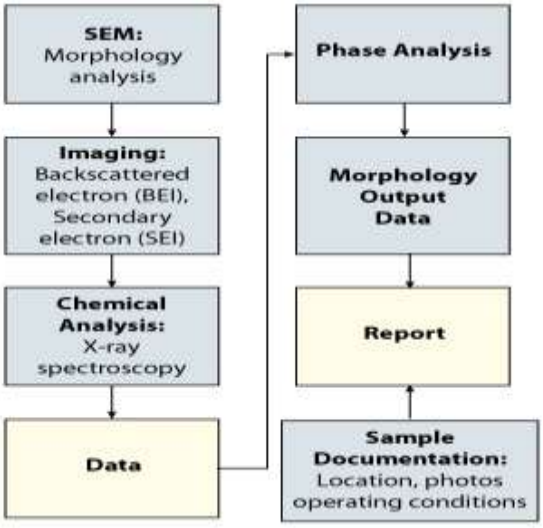


FIG.1 FLOWCHART OF MORPHOLOGY

BASICS MORPHOLOGICAL ALGORITHM

- Extract image components that are useful in the representation and description of shape
- Boundary extraction
- Region filling
- Extract of connected components.

3. PROPOSED WORK

Blood vessel segmentation algorithm is the basic foundation while developing retinal screening systems, since vessels serve as one of the main retinal landmark features. This project proposes an automated method for identification of blood vessels in color images of the retina. For every image pixel, a feature vector is computed that utilizes properties of scale and orientation selective Gaussian filters. The extracted features are then classified using generative Gaussian mixture model.

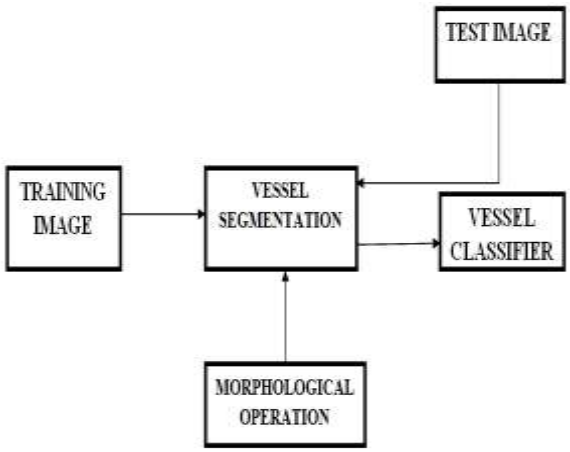


FIG.2 BLOCK DIAGRAM

VESSEL SEGMENTATION

To validate the segmentation process, the code find the percentage of blood vessel pixels that are being correctly classified as a blood vessel, denoted as Percentage of background pixels that are being correctly classified as background. However, to recognize a person using retina it is necessary to capture image of retina and segment blood vessel to match its structure with stored blood vessel image in database. Segmentation algorithm is to extract complex structure of blood vessel from retina image.

Along with segmentation we are using morphological operations and filter technique. The morphological may be defined using three main criteria: speed, Accuracy and flexibility.

GAUSSIAN FILTER

The filter approach is a widely used template-based method this method usually uses a linear structural element that has a Gaussian cross-profile section, extruded or rotated into identify the cross profile of the blood vessels. The resulted image is finally threshold to produce a binary segmentation of the image. The basic filters, section, morphological filters are defined as increasing idempotent operators, and their laws of composition 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.

GAUSSIAN MIXTURE MODEL

Gaussian mixture model is a multivariate distribution that consists of multivariate Gaussian distribution components. Each component is defined by its mean and covariance. The mixture is defined by a vector of mixing proportions, where each mixing proportion represents

the fraction of the occupier described by a corresponding component. A color image could be considered as the result from Gaussian mixture model (GMM) to which several Gaussian random variables contribute.

ALGORITHM FLOW

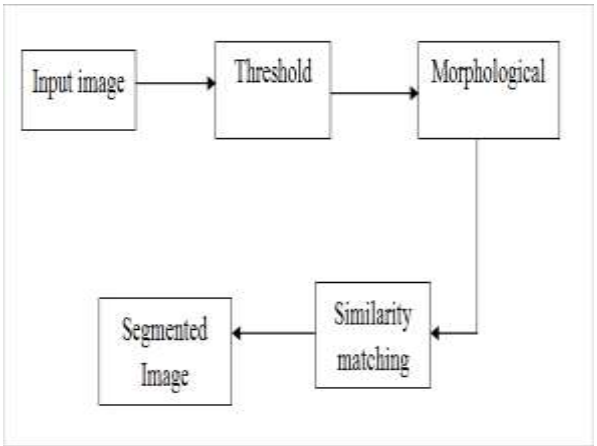


FIG.3 SEGMENTATION FLOW

Step 1: Read Image

Step 2: Resize image for easier computation

Step 3: Convert matrix to intensity image

Step 4: Computes the complement of the image

Step 5: Converts the intensity image to double precision

Step 6: Applying Morphological operations

Step 7: Hysteresis thresholding

Step 8: Segmentation Result

Step 9: Classification

SENSITIVITY

Sensitivity gives the percentage of pixels correctly classified as vessels by the method.

ACCURACY

The receiver operating characteristics, area under ROC and segmentation accuracy is taken as the performance criteria.

FILTER

Based on the results obtained it can be demonstrated that the Gaussian Filter method will be useful in a wide range of retinal blood vessel assessment. It can be concluded that the Gaussian filter provides better results when compared with other filter based methods. Since the scale of the Gaussian filter can be changed, it will be very useful in multi-scale analysis of vessels. For the pixel level classification of vessels entropic threshold provides a fast and better result. The segmented vessels can be used to obtain the control points used in the retinal registration techniques. Based on this method of segmented vessels it is possible to quantify the proliferative diabetic retinopathy. It is hoped that vessel segmentation aids clinicians to detect and monitor the progression of disease, minimize the examination time and helps in the better treatment plan. The segmentation of blood vessels in color retinal images using Gaussian filters has found that the appearance of vessels is highly sensitive in the gray scale image containing only the wavelength of green. Therefore, for segmentation of vessels was performed using only green channel of RGB color image. Gaussian filter, whose application can be found in problems such as, strokes in character recognition and detecting roads in satellite image analysis, were explored to detect and enhance vessel features in retinal image. When compared with the matched filter for detecting line like features, Gaussian filter provided a better result as it has optimal localization in both the frequency and space domains. The Gaussian filter was tuned to a suitable frequency and orientation was able to emphasize vessels along that direction and filtering out background noise and other undesirable structures. Values of all the filter parameter were selected based on the properties of vessels. When filter was aligned along orientation of vessel it produced single peak response along that direction.

4. IMPLEMENTATION

The processing of the proposed method is, which is very high accuracy. The morphological method is applied in input image. Furthermore, MATLAB is an integrated development environment, which can also reduce the time consumption.

FIG.4 RETINA IMAGE

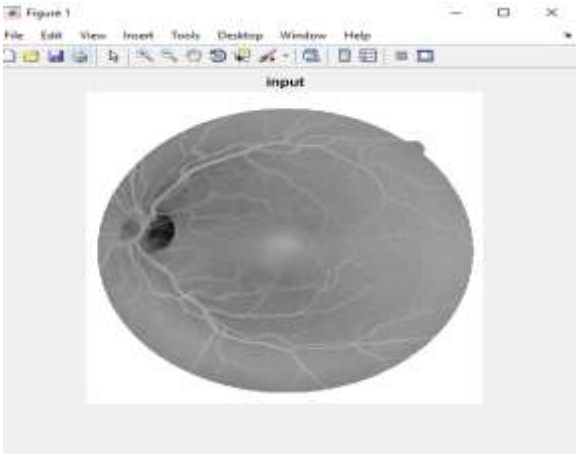


FIG.5 INPUT IMAGE

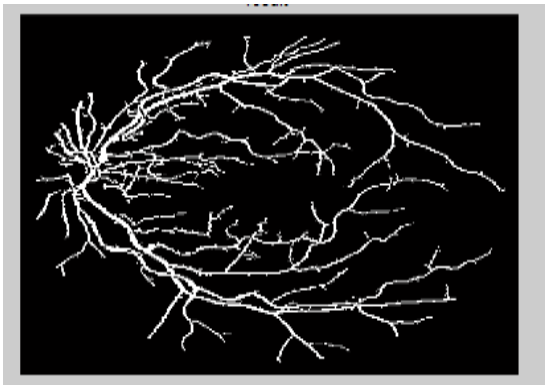


FIG.6 SEGMENTED RESULT IMAGE

5. CONCLUSION:

Fast and efficient computation of Morphological features from frames has become the focus the functionalities of the retina and visual cognitive systems. Here, we are using Morphology method. The resulted enhanced vessels were then subjected to thresholding for vessel pixel classification. It gives clear and good accuracy.

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