International Journal of Innovative Technologies
WWW.IJITECH.ORG
ISSN 2321-8665
Volume.06, Issue.01,
January-June, 2018,
Pages:0399-0402

Automatic Diabetic Retinopathy Detection using Gabor Filter with Local Entropy Thresholding

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Abstract: The major complication of diabetic patients is Diabetic retinopathy, which leads to vision loss. The disease Diabetic retinopathy (DR) detection, low resolution retinal image makes more difficult to analysis for ophthalmologist. Identification and detection of blood vessels in retina is helpful for ophthalmologists to diagnosis larger populations in very less time. Blood vessels detection is a complex task in retinal image analysis. Blood vessels detection is very complicated with the presence of bright and dark tissues in retinal images. Here, an algorithm is proposed to segment blood vessels in both normal and abnormal retinal images of diabetic patients based on their image features. In the process, the negative impact of bright tissues of retinal images is decreased by using clustering segmentation by image processing methods. Then, for ignoring dark issues a multi-scale line operator is utilized to detect vessels while ignoring some of the dark tissues, which have intensity structures, differs from the line-shaped vessels in the retina. The algorithm involves Gabor enhancing filter with local entropy thresholding for blood vessels extraction under different normal or abnormal conditions. The Gabor filter has main parts as frequency. This Gabor filter frequency and orientation are set to match that of a part of blood vessels to be enhanced in a second channel of an input image. Analysis of blood vessels pixels are classified by local entropy thresholding technique in this method. The working of the below mentioned algorithm is analyzed by MATLAB software with DRIVE database.

Keywords: K-Means Segmentation, Linear Structure, Perceptive Transform, Retina Image, Retinal Vessel Segmentation, Retinal Image, Blood Vessels, Diabetic Retinopathy, Vessels Extraction, Gabor Filter, Local Entropy Thresholding.

I. INTRODUCTION

Blood vessels damaged from diabetic retinopathy can cause vision loss. Diabetic retinopathy is a leading cause of adult blindness, and screening can reduce the incidence. Retinal images are noise and low contrast poses significant Challenges to the segmentation of blood vessels. Many Segmentation algorithms, have been presented To provide either automated or semi-automated detection of Blood vessels. Automated diagnosis may also aid decision making for optometrists. The greatest emphasis in automated diagnosis has unsurprisingly been given to the detection of diabetic retinopathy. Computer based analysis for automated extraction of blood vessels in retinal images will help ophthalmologists screen larger populations for vessel abnormalities. A wide variety of approaches have been proposed for retina blood vessels segmentation. Many image processing methods proposed for retinal vessels extraction. In this literature is based on Gabor filter with local entropy thresholding. Gabor filter methods often produce false. Positive detections when retinal image abnormal condition thresholding. Gabor filter methods often produce false positive detections when retinal image abnormal condition. Image preprocessing is an early stage activity in image processing that is used to prepare an input image for analysis to increase its usefulness. Image preprocessing includes image enhancement, restoration, and registration. Image enhancement accepts a digital image as input and produces an enhanced image as an output; in this context, enhanced means better in some respects. This includes improving the contrast, removing geometric distortion, smoothing the edges, or altering the image to facilitate the interpretation of its information content. In image restoration, the degradation is removed from the image to produce a picture that resembles the original undegraded picture. In image registration, the effects of sensor movements are removed from the image or to combine different pictures received by different sensors of the same field.

II. EXISTING SYSTEM

Applications of ultraviolet "light" are varied. They include lithography, industrial inspection, microscopy, lasers, biological imaging, and astronomical observations. We illustrate imaging in this band with examples from microscopy and astronomy. Ultraviolet light is used in fluorescence microscopy, one of the fastest growing areas of microscopy. Fluorescence is a phenomenon discovered in the middle of the nineteenth century, when it was first observed that the mineral fluorspar fluoresces when ultraviolet light is directed upon it. The ultraviolet light itself is not visible, but when a photon of ultraviolet radiation collides with an electron in an atom of a fluorescent material, it elevates the electron to a higher energy level. Subsequently, the excited electron relaxes to a lower level and emits light in the form of a lower-energy photon in the visible (red) light region. The

basic task of the fluorescence microscope is to use an excitation light to irradiate a prepared specimen and then to separate the much weaker radiating fluorescent light from the brighter excitation light. Thus, only the emission light reaches the eye or other detector. The resulting fluorescing areas shine against a dark background with sufficient contrast to permit detection as shown in Fig.1. The darker the background of the nonfluorescing material, the more efficient the instrument. Fluorescence microscopy is an excellent method for studying materials that can be made to fluoresce, either in their natural form (primary fluorescence) or when treated with chemicals capable of fluorescing (secondary fluorescence).

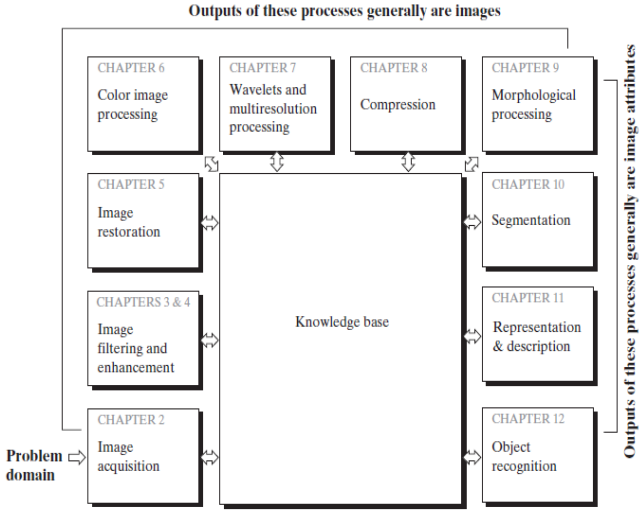

Fig.1. Fundamental steps.

III. PROPOSED SYSTEM

Blood vessels damaged from diabetic retinopathy can cause vision loss. Diabetic retinopathy is a leading cause of adult blindness, and screening can reduce the incidence. Retinal images are noise and low contrast poses significant Challenges to the segmentation of blood vessels. Many Segmentation algorithms have been presented. To provide either automated or semi-automated detection of Blood vessels. Automated diagnosis may also aid decision making for optometrists as shown in Fig.2.

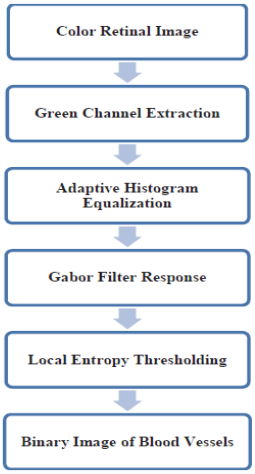

Fig.2. Proposed Methodology.

The greatest emphasis in automated diagnosis has unsurprisingly been given to the detection of diabetic retinopathy. Computer based analysis for automated extraction of blood vessels in retinal images will help ophthalmologists screen larger populations for vessel abnormalities. A wide variety of approaches have been proposed for retina blood vessels segmentation. Many image processing methods proposed for retinal vessels extraction. In this literature is based on Gabor filter with local entropy thresholding. Gabor filter methods often produce false. Positive detections when retinal image abnormal condition thresholding. Gabor filter methods often produce false positive detections when retinal image abnormal condition. The proposed method uses the following steps shown in

- Green Channel Extraction,
- Adaptive Histogram Equalization
- Gabor Filter Response
- Local Entropy Threshold
- Binary Conversion

Fig.3. Typical retinal image.

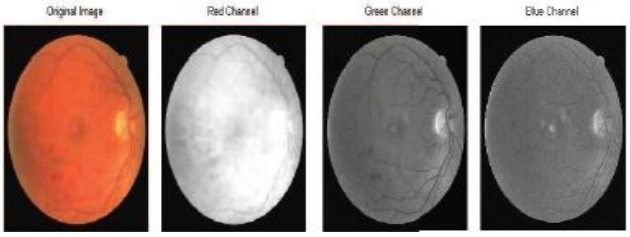

Fig.4. extraction of channels.

A. Pre-processing

Preprocessing is a technique of image enhancement. It improves the quality of an image. Preprocessing is used to enhance the contrast in find us image. Low contrast cause very hard to extract the fundus. So that from color retinal images we are extracting green channel which is having high contrast. Then adaptive histogram is used to improve the contrast of green channel.

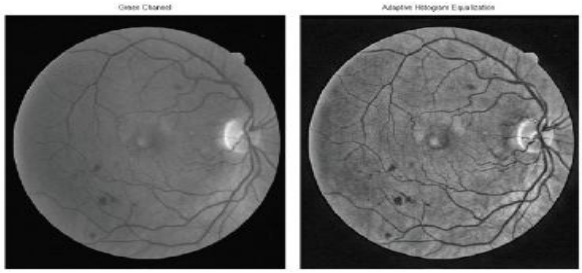

Fig.5. Green Channel of the Original Image (left) and Equalization Image (right).

B. Gabor Filter

Gabor filters are used for texture analysis. Sinusoidal modulated gabor filter kernels are used in this analysis. Gabor filters are band pass filters which are used in image processing for feature extraction, texture analysis, and stereo disparity estimation. The impulse response of these filters is created by multiplying a Gaussian envelope function with a complex oscillation. Gabor showed that these elementary functions minimize the space (time)-uncertainty product. By extending these functions to two dimensions it is possible to create filters which are selective for orientation .Under certain conditions the phase of the response of Gabor filters is approximately linear. This property is exploited by stereo approaches which use the phase-difference of the left and right filter responses to estimate the disparity in the stereo images. It was shown by several researchers that the profile of simple-cell receptive fields in the mammalian cortex can by described by oriented two-dimensional Gabor functions.

C. Local Entropy Threshold

The entropy of a system was proposed by Shannon. Shannon's function is based on the concept that information gained from an event is inversely related to its probability of occurrence. Several researchers have used this concept to image processing problems. They can partition the image into object and background. An efficient entropy-based thresholding algorithm is used to retinal blood vessel detection .This algorithm takes into account the spatial distribution of gray levels, because the image pixel intensities are not independent of each other. According to this, two images with same histograms but different spatial distribution will result in different threshold values. Given image F is a P×Q dimensional matrix, P×Q is the co-occurrence matrix of the image F, this co-occurrence matrix gives an idea about the transition of intensities between adjacent pixels, indicating spatial structural information of an image.

D. Graylevel Co-Occurrence Matrix

A statistical method of examining texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix. (The texture filter functions, described in Texture Analysis cannot provide information about shape, i.e., the spatial relationships of pixels in an image.)It provides the information about contrast, correlation and energy. The gray-level co-occurrence matrix can reveal certain properties about the spatial distribution of the gray levels in the texture image. For example, if most of the entries in the GLCM are concentrated along the diagonal, the texture is coarse with respect to the specified offset. You can also derive several statistical measures from the GLCM. See Derive Statistics from GLCM and Plot Correlation for more information.

IV. RESULTS

This Analysis the software selected to perform the experiment is MATLAB. The Accuracy is calculated by the ratio of the number of correctly classified pixels to the total number of pixels in the image. The sensitivity represents the fraction of pixels correctly classified as vessel pixels, where the false positive defines the fraction of pixels erroneously classified as vessel pixels. The total time required to process a single retinal image is less than 2 seconds. This analysis may be applied to publically available STARE data base.

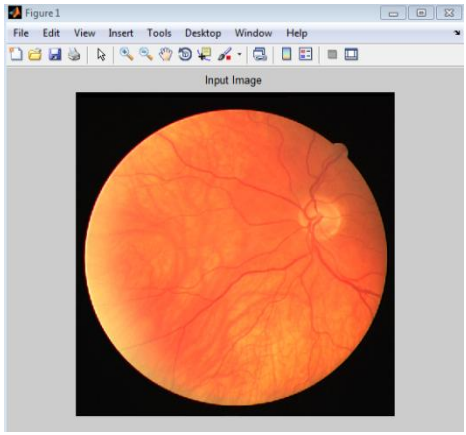

Fig.6.

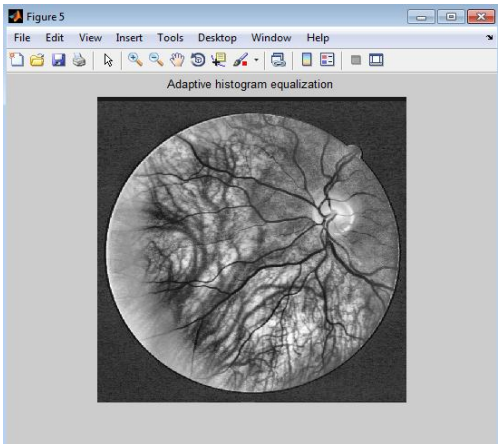

Fig.7.

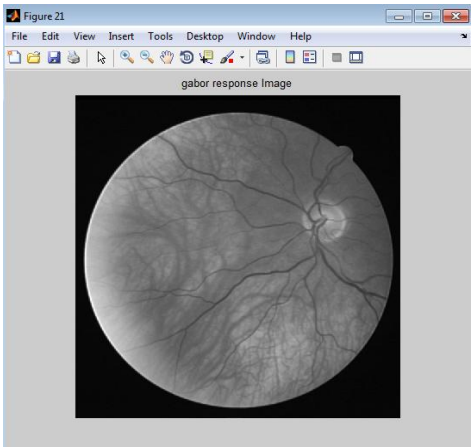

Fig.8.

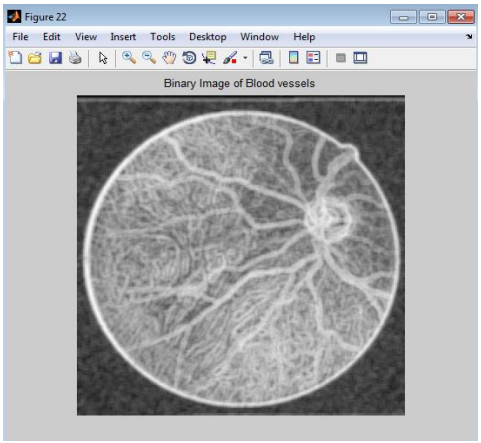

Fig.9.

V. CONCLUSION

This segmentation method is a very suitable application for automatic tool for early Diabetic Retinopathy (DR) detection. This project, first introduce Gabor filter with local entropy thresholding for vessels extraction automatically. This analysis manifested maximum true positive rate and reduce false vessels detection in findus. The execution of the proposed method is assessed by comparing DRIVE database images. This method average accuracy and sensitivity (Se) are calculated. This method can be applied for image registration purpose to track the change in findus for monitoring Diabetic Retinopathy.

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