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RESEARCH ARTICLE

DETECTION AND DIAGNOSIS OF BLOOD VESSEL IN RETINAL DISEASES

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ABSTRACT

Retinal images is an methodology for diabetic retinopathy detection and analysis. The detection of blood vessels from the retinal images is a exhausting process. In this work a new algorithm to detect the blood vessels effectively has been proposed. Proposed system consists of three stages-first is preprocessing of retinal image to separate the green channel, second stage thresholding, third stage image masking, forth stage morphological processing. Initially enhancement of the image is using thresholding and changes of the variation. Since the blood vessels are distributed in different directions, morphology operate with multidirectional structuring elements are used to extract the blood vessel from the retinal images. Morphological operator by reconstruction using structure elements eliminates the ridges not belonging to the vessel. Finally applying median filter on the connected components all of images.

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INTRODUCTION

To implement a computer system for the manual detection of important anatomical structures in digital fundus retinal images such as blood vessels, Optic Disc and macula. Blood vessel tracking provides a map of the retinal vessel of the eye, from which a source frame may be derived that can ease the process of positioning other fundus objects and lesions with favour to a essential "coordinate systems" (Jeyasri *et al*., 2013). An automated segmentation and inspection of retinal blood vessel features such as diameter, color and as well as the optic disc morphology allows ophthalmologist and eye care specialists to complete mass vision screening exams for early detection of retinal diseases and treatment evaluation (Gray-level grouping). This could avoid and reduce vision impairments; age related diseases and many cardiovascular diseases as well as reducing the cost of the screening. Extracting the retinal blood vessels is done in some cases by physician manually, which is difficult and time consuming and is followed by high mistakes due to much dependence on the physician's skill level. The extraction of the blood vessels from the retinal images requires using algorithm and instruments which reduce the dependency on the function and defeat the error factors. In order lessen the cost of these screenings, modern image processing techniques are used to freely detect the existence of abnormalities in the retinal images acquired during the screenings.

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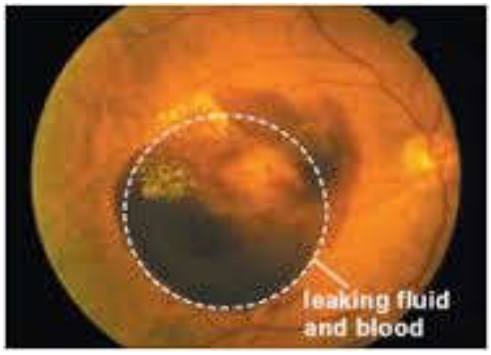
Exudates are a major index of diabetic retinopathy that can possibly be quantified automatically. The purpose of the work is to define and evaluate a machine learning-based, automated system to detect exudates in digital color fundus photographs, for early diagnosis of diabetic retinopathy.



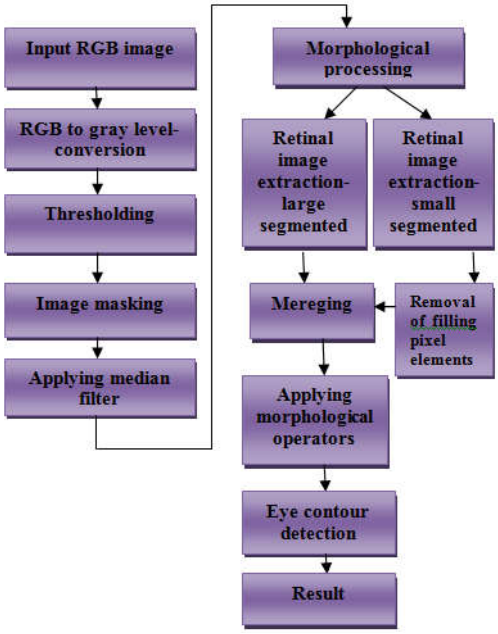
Diabetic Retinopathy (DR) is the micro-vascular changes that cause measurable in the display of the retinal blood vessels. It provides information on retinal blood vessel morphology that can be measured to normal expected blood vessel diameters and which can detect fine blood vessel anomalies that characterize the blood vessel pathology. Gray-level grouping is a general and powerful technique, which can be conveniently applied to a broad variety of low-contrast images and exceed conventional contrast enhancement techniques. Currently, there is an increasing a medical systems that can screen a large

number of people for sight threatening diseases, such as diabetic retinopathy (Sangmesh Biradar, 2015). The segmenting method is used to enhace retinal image and blood vessels are distributed in different directions, morphology processing with multi-directional structuring of filling pixel elements are used to extract the blood vessel from the retinal images (Manpreet Kaur, 2015).

Related Work

Blood vessel detection

Blood vessel detection in an essential step in medical diagnosis of fundus images as it aids in the diagnosis of macular diseases. Other applications of retinal vasculature extraction include the treatment of age related macular degeneration, filling algorithms and personal identification in security application (Sangmesh Biradar, 2015). Vessels appear darker than the background and width is always smaller than a certain value, they are piecewise hold only approximately. Due to the presence of noise, the vessels are regularly disconnected, and not each pixel on a vessel appears darker than the background. The vessel line appear often unsharp (Larsen, 2003). Diabetic retinopathy is influenced particularly by the disorders in the blood vessels which are very thin and weak. quantitative analysis of retinal blood vessel images in terms of length, width, curve and turns branching pattern, can provide new intuitive understanding of the truth about vessels provide valuable information for diagnosis and study the stage of disease (Anu *et al.,* 2015). With the advent of computing techniques, the automated segmentation and analysis is to support the ophthalmologist in the clinical decision making process. The blood vessel detection module is create to track the borders of a vessel sequentially. The proposed system consists of three stages-first is preprocessing of retinal image to separate the green channel extraction and second stage is thresholding and third stage image masking is blood vessel analysis using morphological operations and SVM Classifier (Manpreet Kaur, 2015). The proposed system for blood vessel segmentation are:



Green channel extraction

The retinal image is taken in the RGB form. The green channel of the RGB space is extracted and chosen for detection of blood vessels, because it appear most contrasted in this channel. So first step is to separate this channel to a new image (Manpreet Kaur, 2015).

Thresholding

- Thresholding is the easiest method of image segmentation. From a grayscale image, thresholding can be used to create images.
- Grey-level histogram corresponds to an image, f(x,y) composed of light objects on dark background in the way of objects and background pixels have grey level grouped into two dominant modes (Nishu Bansal and Maitreyee Dutta, 2013). Extract the objects from the background is to chosen a threshold (T) that separates these modes. Any point x, y. for which f(x, y) > T is called an object point, otherwise called background point (Dr Ravi Subban).

Image Masking

Image masking enables a developer to create images with irregular shapes dynamically. Masking is define as Region of Interest processing. In terms of enhancement, masking is used primarily to isolate an area for processing. This is done to focus that area and differentiate it from the rest of the images.

Morphological Processing

Morphology is a process used for extracting image components that are useful in the representation and description of a shape, such as boundaries and skeletons. The important morphological operations used for edge detection are Open-in. The value of pixels added or removed from the objects in an image depends on the size and shape of the structuring element used to process the image. Morphology is a broad set of image processing operations that process images based on shapes. Morphological operations execute a structuring element to an input image, creating an output image of the same size. The block execute an erosion operation followed by a dilation operation using a predefined neighborhood or structuring element. A structuring element is a matrix subsist of only 0's and 1's that can have any arbitrary shape and size. In the morphological dilation and erosion operations, the case of any given pixel in the output image is determined by applying a test to the corresponding pixel and its neighbors in the input image. The rule used to process the pixels defines the operation as a open. To the green component extracted eye image, morphological open operator is apply.

Median Filtering

The median filter is a nonlinear filter, which has lower impulsive distortions in an image and without too much distortion to the edges of such an image. It is an useful method that of suppressing isolated noise without blurring sharp edges. Median filtering operation change a pixel by the median of all pixels in the neighborhood of small sliding window. It gives better results than the neighborhood averaging in the case where noise is of impulsive nature. The advantage of a median

filter is very robust and has the capability to filter only outliers and is thus an excellent choice for the removal of salt and pepper noise and parallel scanning artifacts (Dr Ravi Subban). After applying the morphological open operation to the eye image, the median filter is tested yielding the pre processed image.

Detecting Edge

Edges characterize boundaries are areas with strong intensity contrasts, a jump in intensity from one pixel to the next. Detecting an edge in an image and reduces the amount of data and filters out useless information, while preserving the structural properties in an image (Gray-level grouping). The canny operator retinal images works in a multi-stage process. First of all the image is polished by Gaussian convolution. Then a simple 2-D first derivative operator is applied to the image to highlight regions of the image with large spatial derivatives (Larsen, 2003). The algorithm then tracks along the top of these edges and sets to zero all pixels that are not actually on the ridge top so as to give a thin line in the output. The canny filter is applied to the preprocessed eye image and the blood vessel is detected.

RESULT AND DISCUSSION

The blood vessel detection and segmentation methodology is applied on images and the segmentation results were compared with their images. To measure the performance of the proposed method for the detection of blood vessels on the fundus image, the proposed blood vessel segmentation method is compared to its corresponding ground truth images (Manpreet Kaur, 2015). The performance of vessel detected image is validated with ground truth images.

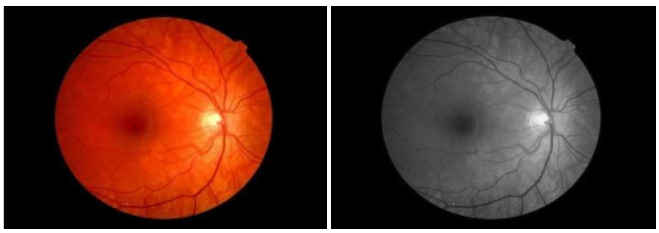


Fig. 1. RGB to grey conversion (a) Retinal image of normal person (b) Image after RGB to grey conversion

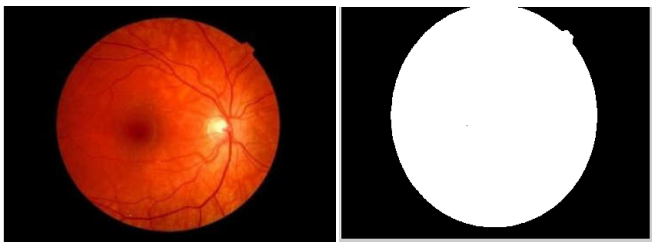


Fig. 2. Binary Conversion (a) Retinal image of normal person (b) Image after applying binary conversion

The testing of blood vessels segmentation was driven in the way of comparing the pixels of manually segmented vessels and algorithm output after the closing operation (Ravi Subban). The performance of the methodology and features are evaluated against several publicly available datasets.

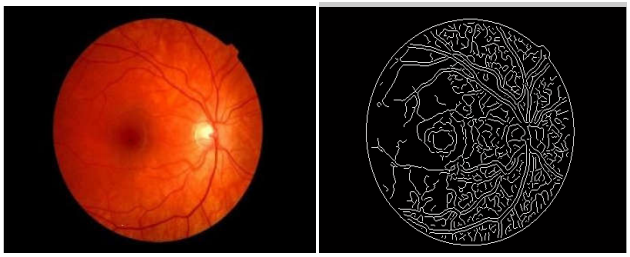
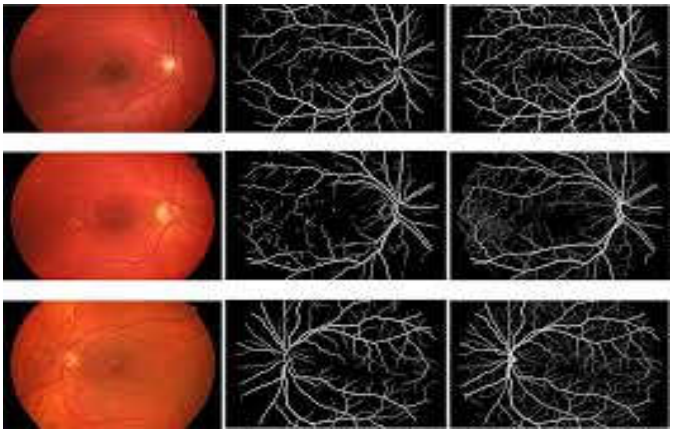


Fig. 3. Blood vessel detection (a) Retinal image of normal person (b) Image after canny edge detection



Machine Learning Algorithm

The machine learning algorithm is as so-called supervised algorithm, and therefore needs a set of annotated lesions to learn how to detect bright lesions (Anu, 2015). For this purpose, DR images originally read as containing bright lesions were selected. All pixels in the images were segmented by retinal specialist as to whether they were (part on) an exudates or background retina.

- The machine learning algorithm is based retinal pixel and lesion classification.
- To perform detection of bright lesions, if any, in a previously unseen image, the following steps were performed.
- Each pixel was classified, resulting in a so-called lesion feasibility map that indicates the probability that a pixel is part of a bright lesion (Manpreet Kaur and Mandeep Kaur, 2015).
- Pixels with high probability were grouped into probable lesion pixel clusters.
- Based on cluster characteristics each feasible lesion pixel cluster was assigned a probability indicating the likelihood that the pixel cluster was a true bright lesion (Nishu Bansal and Maitreyee Dutta, 2013).
- Each bright lesion cluster likely to be a bright lesion was classified as exudates.After finding the exudates to make the user identity, exudates are recoloured as green.

Conclusion

This paper discussed about macula detection on diabetic retinopathy. To implement a anatomical structures in color retinal images and the blood vessel are detected. The detection of blood vessels from the retinal images is a tedious process. In

this task a new algorithm to detect the blood vessels effectively has been proposed. The blood vessels are distributed. morphology processing with multi-directional structuring elements are used to extract the blood vessel from the retinal Images. It presents a method for segmenting is used to enhace retinal image and blood vessels are distributed in various directions, morphology processing with multi-directional structuring elements are used to extract the blood vessel from the retinal images. The purpose of the work is to describe and evaluate a machine learning-based, automated system to detect exudates in digital color fundus images, for early diagnosis of diabetic retinopathy.

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