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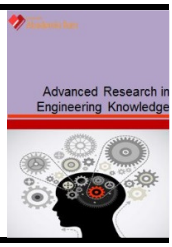

Microaneurysm (MA) Detection on Retinal Image: A Review

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ABSTRACT

In term of medical dictionary, Microaneurysm (MA) is a saccular enlargement of the venous end of a retinal capillary associated especially with diabetic retinopathy. Ma normally caused by Any form of vascular disease or high blood pressure may contribute to a retinal microaneurysm, however, the most common cause is diabetes mellitus. MA can be diagnosed using A dilated retinal examination will reveal the microaneurysm, and further tests such as a fluorescein angiogram, which is special pictures of the eye, will help determine the origin and severity of the underlying diagnosis causing them. In this paper, a few selected MA detection was discussed based on methodology and result performance. Hopefully, implications of this review can give a new direction to a researcher in order to propose a better MA detection.

Keywords:
Microaneurysm, Detection, Retinal, Image, Review

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1. Introduction

Malaysia is 4th highest in Asia with diabetes. Who have diabetes for 20 years or more can affect up to 80 percent of all patients [1,2]. Early treatment can reduce diabetic retinal disease. 90 percent of patients receiving early treatment can avoid being blind. The person who has longer diabetes can be higher his or her developing diabetic retinopathy. Microaneurysm is the earliest sign of Diabetic Retinopathy that appears as a small red dot on the surface of the retinal [3,4]. The problem is increasing in its scale, with diabetes having been identified as a significant growing global public health problem. There are several solutions to overcome these problems. One of the solutions is to develop automated Microaneurysm detection systems, it is still a challenging problem.

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2. Literature Review

The improving microaneurysm detection using an optimally selected subset of candidate extractors and preprocessing methods was proposed by Antal and András [5]. The goal of the investigation was conducted to explore overcome the difficulty by taking advantage of the diversity of candidate extractors by using different preprocessing methods within one framework. Converge of differing applicant yields can prompt a higher number of genuine identifications, while the expanding number of false location can be limited at a later stage. This article shows a comprehensive survey of these examinations and recommends a heading for future improvements. In this study, preprocessing methods is to differentiate improvement procedure by Walter and Klein [6] brings about a grayscale image with a smooth foundation, and underscores MA like items was investigated. In light of the outcomes, the vessel evacuation and extrapolation technique intend to lessen the number of false positives caused by the comparative appearance of vessel sections and microaneurysms. The outcomes exhibited here may encourage changes in the structure to discover an accumulation of preprocessing methods and candidate extractors which beats the individual calculations in the quantity of effectively perceived microaneurysms.

In a different studied, Haloi [7] proposed microaneurysm detection using deep neural Networks. In this study, propose a novel microaneurysm (MA) detection for early diabetic retinopathy screening using color fundus images was analyze. This article gives numerically investigation of the MA ordinarily the principal injuries to show up as a marker of diabetic retinopathy, the exact location of MA is important for treatment Every pixel of the image is delegated either MA or non-MA utilizing a deep neural network with dropout preparing methodology utilizing max out actuation work. No preprocessing step or manual element extraction is required. Considerable enhancements over standard MA identification technique in view of the pipeline of preprocessing, highlight extraction, characterization took after by post handling is accomplished. An exploratory examination was directed to investigate exhibited a deep learning based computer helped framework for microaneurysm identification. The deep network comprises of 5 layers including softmax yield layer and dropout preparing with max out initiation work is utilized to enhance accuracy. In contrast with another current technique, this framework does not require extra veins extraction step, preprocessing and include outline.

In 2015, Jayaseelan [8] found differences suggesting that early detection of microaneurysms based on removed blood vessel analysis. The identification of microaneurysms in retinal fundus images includes the best possible choice of green sub-band channel of retinal fundus picture light smoothing of retinal fundus picture by bicubic interpolation blood vessel recognition was broke down. Rotational cross-sectional profile investigation on the local most extreme pixels fixated on territorial greatest pixels and the pinnacle different properties are estimated. This article gives numerically investigation of the factual parameters mean standard deviation, the coefficient of a variety of list of capabilities are ascertained. The microaneurysm competitors are evaluated by examination of dispersion from the estimations of mean and standard deviation with the preparation set acquired from different datasets.

By the same objective, the automatic detection of microaneurysms in retinal fundus images was investigate by Phil [9]. The method use for the automatic detection of MAs in eye fundus images. In this study, the method consists of four main steps: preprocessing, candidate extraction, feature extraction and classification was analyzed. This project was investigation was conducted to explore proposed method has been evaluated on two open databases: ROC and E-Optha. The method is image preprocessing retinal fundus images are often nonuniform light, poor complexity and noise images. Smoothing due to the little size of MAs, it is critical to reducing the effect of noise. To start

with preprocessing steps are applied to enhance the information images for candidate extraction and feature extraction. A step of CLAHE enhancement is applied. The enhancement method of CLAHE has a decent performance in making MA more visible while suppressing noises and areas for future research are recommended. The preliminary candidate pixels are extracted by applying peak detection on each profile. The region developing is adopted to develop preliminary candidate pixels back to unique pathology shape, in which, the dynamic change is applied to acquire the ideal threshold.

Srivastava *et al*., [10] proposed a detecting retinal microaneurysms and hemorrhages with robustness to the presence of blood vessels. The investigation was conducted to explore detecting two of these lesions, microaneurysms and hemorrhages, which are also known as red lesions. In this study, two problems in identifying red injuries from retinal fundus pictures false location on blood vessels and diverse size of red sores were dissected. The strategies to manage false discoveries on blood vessels, novel channels have been proposed which can recognize red sores and blood vessels. It was discovered that patches are acquired by separating the first picture utilizing a network whose size decides the fixed measure. Distinctive network sizes were utilized and injury recognition comes about for these lattice sizes were joined utilizing Multiple Kernel Learning. The outcome demonstrated that proposed channels distinguished microaneurysms and hemorrhages effectively notwithstanding when these sores were near blood vessels. Moreover, utilizing Multiple Kernel Learning enhanced the outcomes when contrasted with utilizing a lattice of one size as it were. As a conclusion, channels are powerful in the nearness of blood vessels and outperform related works in identifying red sores from retinal fundus pictures. The outcomes exhibited here may encourage changes in the recognition utilizing proposed approach can help in the programmed discovery of diabetic retinal.

The above findings contradict the study by Javidi *et al*., [11]. They examined the vessel segmentation and microaneurysm detection using discriminative dictionary learning and sparse representation. In the proposed the blood vessel segmentation on discriminative dictionary learning (DDL) and sparse representation has been proposed in this paper. An experimental investigation was conducted to explore the semantic concept of the image is yields a strong representation. To extract blood vessel, two separate dictionaries, for vessel and non-vessel, capable of providing reconstructive and discriminative information of the retinal image are learned. In this study, proposed vessel segmentation method is preprocessing and MA candidate extraction was analyzed. To enhance the image contrast and increase its discrimination, color normalization method which proposed by Cree was applied. The color normalization process consists of two steps: intro image correction and histogram adjustment. The former is performed by dividing each color plane of the retinal image by the background, which is approximated by the gross median filtering of the respective color plane. This article provides numerically study of the feature of the Morlet wavelet allows detecting directional features and filtering out the background noise in a single step. Before applying the Morlet wavelet transform to the image, the green plane of the image is inverted, making the vessels brighter than the background. The results reveal that method for MA detection which is similar to our vessel segmentation approach, is proposed. Candidate detection algorithm based on the Morlet wavelet is applied to identify all possible MA candidates

In 2017, a simple hybrid method for fine microaneurysm detection from non-dilated diabetic retinopathy retinal images was discussed Habib *et al*., [12]. The problem of microaneurysm is small sizes, low contrast and additionally closeness with veins. This paper gives numerically investigation of the coarse division utilizing mathematic morphology and naive Bayes classifier. In this examination, preprocessing is the green plane of the first picture shading space is utilized as red lesions, for example, MA and veins have the most astounding contrast with the background in this shading space

was dissect. A middle separating task is connected on a green plane to weaken the commotion before a Contrast Limited Adaptive Histogram Equalization (CLAHE) is connected for contrast upgrade. Others, the automatic classification of bright retinal lesions via deep network features was studied [13]. In this study, the proposed is to extract deep features from the last fully connected layer of, four different, pertained convolutional neural networks were analyzed. These features are then fed into three class diabetic cases for a non-linear classifier. This proposed method of automatically extract deep features was from 4 different CNN models for 3- class retinal classification.

Table 1
Summary of Research Paper

No.	Author	Research focus	Method	Performance
1.	A. Balint and H. Andras [6]	Detection of Microaneurysm	- Walter–Klein (WK) contrast enhancement - Circular Hough-transformation Based	sensitivity = 90%
2.	Haloi [7]	Detection of Microaneurysm	-Deep neural network.	Accuracy = 98.8% sensitivity = 97%
3.	Jayaseelan [8]	Detection of Microaneurysm	- Improved morphology - Naïve bayes classifier	sensitivity = 88%
4.	R. Maher [9]	Detection of Microaneurysm	- Matched filter - Morphological processing	Accuracy = 95.38% sensitivity = 94%
5.	Duan *et al.* [10]	Detection of Microaneurysm	- Frangi Filters - Multiple kernel learning	-
6.	Javidi *et al.* [11]	Detection of Microaneurysm	- discriminative dictionary learning - Gaussian Mixture Model	Accuracy = 95% sensitivity = 75%
7.	Barman *et al.* [12]	Detection of Microaneurysm	- median filtering - mathematical morphology The	sensitivity = 85.68%
8.	Sadek *et al*. [13]	Detection of Microaneurysm	- Deep Network Features	Accuracy = 92%
9.	Malathi *et al*. [14]	Detection of Microaneurysm	- Recursive support vector machine (RSVM)	-

In 2018, a complex algorithm to detect and classify diabetic retinopathy in fundus retina images based on the Recursive Support Vector Machine (RSVM) was proposed by Malathi and R. Nedunchelian [14]. Image preparing procedures are utilized to identify and characterize retinopathy image successfully. In light of the idea of picture preparing, the state of image particles can be broke down in detail. In this investigation, in light of a proposed division calculation titled "Shrinking Edge-Mark," which shows two classes of named areas, including veins and different districts in the retinal

picture. From the removed veins, parameters, for example, the width and length of each vein are ascertained, alongside the cotton fleece district size and shape of the picture. Taking all things together, these four parameters are utilized to recognize the phases of diabetic retinopathy. The width and length are ascertained from the sectioned region by utilizing an essential recipe. The zone of the cotton fleece district is acquired by subtracting the estimation of the zone of the vein locale. In conclusion of review study, a few selected Microaneurysm detection are summarize in Table 1. This table also present the methodology and performance each methods.

3. Conclusion

The microaneurysm (Ma) is a main source blindness in the working popular around the world. Symptoms that can be found by people affected by this illness are difficulty in reading, blurred vision, sudden vision decreases in one eye, looking at the circles of light, seeing dark spots, and flashing light. Improvement of an Automatic microaneurysm (Ma) detection on retinal framework can decrease the work of ophthalmologists in order to determination the disease. In this paper, a comprehensive review on selected microaneurysm detection was discussed. Develop an automatic microaneurysm detection on retinal image need to be improved because it has limitation for certain condition.

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