NOVATEUR PUBLICATIONS
International Journal Of Research Publications In Engineering And Technology [IJRPET]
ISSN: 2454-7875
VOLUME 2, ISSUE 4, April-2016

A REVIEW OF AUTOMATIC DETECTION OF MICRO ANEURYSM AND DIABETIC RETINOPATHY GRADING IN FUNDUS RETINAL IMAGES

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ABSTRACT:

From an image processing standpoint, the automatic detection of micro aneurysms is a challenging task, since their color and size are same as the vessels, they have a variable size and often they are so small that can be easily mystified with the image noise. It is also difficult to discriminate whether a red lesion is a micro aneurysm or small dot hemorrhage. This problem increases the number of false candidates that naturally deteriorates the overall accuracy of the detectors. Automatic early detection could limit the severity of the disease and assist ophthalmologists in investigating and treating the disease more effectively and efficiently. Therefore, time required for examination and effect of the disease on the patient could be reduced if the detection system could succeed on images taken from patients with non-dilated pupils.

KEYWORDS: Diabetic Retinopathy Grading, Micro aneurysm

INTRODUCTION:

Diabetic Retinopathy is an eye disease which occurs due to damage in the retina as a result of long term illness of diabetic mellitus [1]. Micro aneurysms come from capillaries. The damage to endothelial cells leads to dilated capillaries and venues. Micro aneurysms are small swellings that form on the side of tiny blood vessels. These small swellings may rupture and allow blood to leak into nearby tissue [2]. As the capillaries are not visible in colour fundus images, micro aneurysms appear as isolated dots, i.e. separated from the vascular tree. Their diameter normally lies between 10μm to 80μm, but it is always smaller than 100μm. That is, they are smaller than the diameter of optic veins. These miniature aneurysms can rupture and leak blood. There are no symptoms in the early stages of the disease, nor any pain. Blurred vision may occur when the macula swells from leaking fluid [3].

When the patient has an eye check-up, the doctor begins the diagnosis by taking medical history of patient and asking him to describe his symptoms, including how long he has had them, his ability to visualize the objects i.e., blurred or clear using visual acuity test. If the patient is unable to have a clear vision, then the specialist uses the next diagnosis technique of Fundus Fluorescine Angiography (FFA) which is a dilation process, where tropic amide drops are dilated in the pupil to widen the eye and then the images are taken. But still the detection of Micro aneurysm is a difficult chore, as it is rigid to distinguish them from certain parts of the vascular system [4].

Commonly patients and their ophthalmologist cannot notice diabetic retinopathy symptoms until visual loss develops. Early stages detection of this disease and with using laser photocoagulation can prevent major vision loss [5].

LITERATURE SURVEY:

With respect to said work an extensive literature survey is conducted accordingly which is presented as below,

1) **R. Vidyasari, I. Sovani and T.L.R. Mengko, H. Zakaria (2011**): Authors have stated diabetic retinopathy is a complication of diabetes which is characterized by damage and blockage of small blood vessels in the retina. There are two types of diabetic retinopathy which are non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). In this study they developed micro aneurysms filter algorithm with the concept of vessel enhancement in order to extract the structure of micro aneurysms in medical imagery, especially in the retinal image. Micro aneurysms filter algorithm has been able to extract part of micro aneurysms in the retinal image and detect. In addition, micro aneurysms filters are also developed to detect the next symptoms of diabetic retinopathy-haemorrhages (bleeding) that have features in common with micro aneurysms which are larger and have irregular shape [1].

2) **Alan D. Fleming, Sam Philip, Keith A. Goatman, (2006**): This paper describe automatic methods for MA detection and shows how image contrast normalization can get better the ability to distinguish between MAs and other dots that occur on the retina. Various methods for contrast normalization so that

can be used for comparison. Dots within vessels are handled successfully using a local vessel detection technique. Results are derived for detection of individual MAs and for detection of images containing MAs[2].

3) **Eman M. Shahin, Taha E. Taha, W. Al-Nuaimy and Osama F. Zahran**: This paper describe a system for automated classification of normal, and abnormal retinal images by automatically detecting the blood vessels, hard exudates micro aneurysms, entropy and homogeneity are computed from the processed retinal images. These objective measurements are finally fed to the artificial neural network (ANN) classifier for the automatic classification. Different approaches for image restoration are tested and compared on fundus images [3].

4) **Ankita Agrawal, Charul Bhatnagar, Anand Singh Jalal, (2013):** have stated automated retinal image analysis is an imperative screening tool for early revealing of certain risks and diseases like diabetic retinopathy. Early treatment can be conducted from detection of micro aneurysms. Micro aneurysms are earliest clinical sign of diabetic retinopathy and they are appearing as small red spots on retinal fundus images. They analyze the techniques, algorithms and methodology used for the detection of micro aneurysms from diabetic retinopathy retinal fundus images [4].

5) **M.A. Fkirin, S. Badawy, El saadany A, A.S. El-Sherbeny, (2014**) : This paper uses four different edge detection filter types, each filter is turned by certain angle and applied individually. Receiver Operating Characteristic curves is used to for evaluation of filter performance. The results recommended using Laplacian of Gaussian filter which gave the best performance and highest sensitivity value among the four used filters. Registration operation is used for comparison and change detection in blood vessels. STARE image database is used to apply the algorithms on its images [5].

METHODOLOGY TO BE IMPLEMENTED:

A) Proposed work

The proposed system consists of following steps:

1. Image pre-processing.
   a) Median filter
   b) Polynomial Contrast enhancement
   c) Histogram equalization
2. Extraction of features.
   a) Circular Hough Transformation
3. Classification of micro aneurysm

IMAGE PRE-PROCESSING:

Image pre-processing is the pre-requisite step in detecting abnormalities associated with fundus image to improve the visibility of micro aneurysms in the input fundus image. The differences in brightness and colours of the retinal fundus images are due to the photographic conditions.

Pre-processing of the images commonly involves removing low-frequency background noise, normalizing the intensity of the individual particles, removing reflections, and masking portions of images. Image pre-processing is the technique of enhancing data images prior to Computational processing

MEDIAN FILTER:

In median filtering, the neighboring pixels are ranked according to brightness (intensity) and Median value becomes the new value for the central pixel. Median filters can do an excellent job of rejecting certain types of noise, in particular, "shot" or impulse noise in which some individual pixels have extreme values. In the median filtering operation, the pixel values in the neighborhoods window are ranked according to intensity, and the middle value (the median) becomes the output value for the pixel under evaluation.

POLYNOMIAL CONTRAST ENHANCEMENT:

The polynomial contrast enhancement operator is a simple gray level transformation: it assigns to each pixel a new gray level independently of the neighbor gray level distribution.

HISTOGRAM EQUALIZATION:

Histogram equalization is a method in image processing of contrast adjustment using the image's histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values.

DEFINITION OF ROI CANDIDATE EXTRACTION:

Candidate extraction of the detected candidate MAs constitute one of the most important tasks in the

automatic MAs characterization scheme. Candidate extraction is the process to spot the characteristics of the MA image obtained after the pre-processing method. Candidate extraction is the effort to reduce the number of objects in an image for further analysis by excluding regions which do not have similar characteristics to micro aneurysms.

CIRCULAR HOUGH TRANSFORMATION:

Since micro aneurysms have round or oval shape, their approximate location can be determined by searching the circular or elliptical curves. Due to the ability of Hough transform to find points on an arbitrary curve, this conversion has a good performance to find micro aneurysms. In the following, the basic concepts of Hough transform and its application in identifying micro aneurysms are analyzed.

CLASSIFICATION:

This section consists the training and testing part, where training is the ensemble creation of pre-processing and candidate extractors. In this section, an ensemble creation approach is described. In this framework, an ensemble E is a set of pre-processing method, candidate extractors or shortly pairs. The meaning of a (pre-processing and candidate extractor) pair is that first the pre-processing method is applied to the input image and then the candidate extractors are applied to this result. Ensemble creation is a process where all ensembles E from an ensemble pool is evaluated and the best performing one regarding an evaluation function on a training set is selected. The selection of the optimal ensemble would require each possible (pre-processing and candidate extractor) ensembles to be evaluated.

RESEARCH MOTIVE:

From an image processing standpoint, the automatic detection of micro aneurysms is a challenging task, since their colour and size are same as the vessels, they have a variable size and often they are so small that can be easily mystified with the image noise. It is also difficult to discriminate whether a red lesion is a micro aneurysm or small dot haemorrhage. This problem increases the number of false candidates that naturally deteriorates the overall accuracy of the detectors. Automatic early detection could limit the severity of the disease and assist ophthalmologists in investigating and treating the disease more efficiently and effectively. Therefore, time required for examination and effect of the disease on the patient could be reduced if the detection system could succeed on images taken from patients with non-dilated pupils. On the basis of the proposed work, the researchers can get an idea about automated micro aneurysm detection and can develop more effective and better method for micro aneurysm detection to diagnose diabetic retinopathy.

CONCLUSION:

In this paper, authors have presented review of five most important papers that deals with of Automatic detection of Micro aneurysm. Author has also tried to present a new methodology for automatic detection of micro aneurysm and authors claims if proposed method gets on board it will be more faster, accurate and more convenient to use for radiologist.

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