

A Survey on Diabetic Retinopathy Detection Techniques Using Image Processing

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Abstract- In modern era Diabetes Retinopathy has become a common eye disease in most of the developed countries. An advanced symptom of Diabetes Retinopathy is DME(diabetic macular edema).Retina damage is due to diabetes which lead to complete or partial vision loss. So we have needed to identify earlier DME. In this paper we have done a survey on different technique use for identify the macular edama. In primary stage exudate are indicate. It is classified into two parts: Exudates and Nonexudates. Severity of disease is based on gradation of exudates and also location of exudates. These techniques are helpful to ophthalmologist. For determine severity of disease and proper treatment apply to patient and that is only eliminate disease or decrease severity of disease. Many ideas have been published so far for the detection of exudates.

Index Terms- Diabetes Retinopathy, Hard Exudates, Soft Exudates, Neural network, DME(Diabetic macular edama).

I. INTRODUCTION

Diabetic retinopathy is caused by high blood sugar levels damaging the networks of tiny blood vessels that provide blood to the retina[1]. DR is the result of vascular retinal changes increase by diabetes can create a total loss of vision. For prevented of loss of vision need to detect the disease in early stage but Diabetes macular edama generally not to detect easily. Now a day this disease is seen in all age between 32-69 years aged people. We have to generate some techniques to find out EDM. For identification of EDM in earlier we have to find out exudates which is classify into two types: Hard Exudates and Soft Exudates.

Hard exudates:

Hard exudates are small white or yellowish white deposits with sharp margins. Generally hard exudates appears as oily, shiny or lustrous. It is deposits on the outer layer of the retina and interior to the retinal vessels. It is generally set as pointing forms, concurrent patches, sheets, or in ring from crescent surrounding zeros of retinal edema or group of micro aneurysms. Exudates are deposited near the optic.



Fig: hard exudates[2]

Soft exudates:

Cotton wool spots near the retinal view is indicating sever stage of DR. Cotton wool created by the retinal pre capillary arterioles pumping blood to the nerve fiber layer blocked and associatively the local nerve fiber axons get enlarged.



Fig: soft exudates[2]

Diabetic retinopathy has classified into four major stages:

Moderate Non proliferative Retinopathy, the disease is progresses in some blood vessels that nourish the retina are blocked. In Severe Non proliferative Retinopathy, Many blood vessels are blocked and depriving several areas of the retina with their blood supply. In Proliferative Retinopathy advanced stage, the signals sent by the retina for nourishment triggers the growth of new blood vessels. And These new blood vessels are abnormal. They grow along the retina and along the surface of the clear and vitreous gel that fills the inside of the eye. If they are leak into blood then severe vision loss and also even blindness can result.

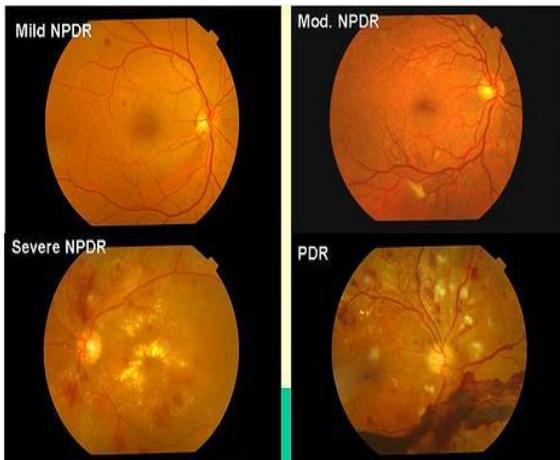


Fig: stages of diabetic retinopathy[1]

II. SURVEY OF METHOD

In [3] Meysam Tavakoli presented a novel and different algorithm for automatic detection of MAs in fluorescein angiography (FA) fundus images. And it's based on Radon transform (RT) and multi-overlapping windows. Remove the background for pre-processing applied Top-hat transformation and averaging filter. And then after pre-processing, the whole image is divided into sub-images. Optic nerve head (ONH) and vessel tree both are detected and masked by applying RT in each sub-image. After defined sensitivity and specificity of 94% and 75%. M. Usman Akram, Shehzad Khalid, Shoab A.Khan [4] define a three-stage system for early detection of Mas using filter banks. In this system extracts all

possible candidate regions for Mas present in the retinal fundus. For this purpose, a region is defined depending upon certain properties for, i.e. shape, color, intensity and statistics. And it's also formed to classify a candidate region as MA or non-MA. The true MA regions are selected and classified using a hybrid classifier. And hybrid classifier is a weighted combination of multivariate m-Medias, GMM and SVM. The system has achieved higher accuracy. This is better than previously published methods.

In [5] Cemal Kose is also developed an approach called inverse segmentation method for detect DR. Here define a direct segmentation techniques gives poor results in some of the cases. The inverse segmentation method and dynamic thresholding both methods are used to segmented separately. In this system define performance is like over 95% in detection of the optic disc (OD), and 90% in segmentation of the DR. so that, here the method is provides high segmentation and measurement accuracy. But in some cases, the image lighting artifacts also affect segmentation performance negatively.

In [6] Anderson Rocha is represented approach for identifying red and bright lesions in DR images without pre- or post-processing. This approach required for pinpointing the location of each lesion to allow the specialist and to evaluate the image for diagnosis. Fundus images are classified based on the presence or absence of these poi as normal or DR-related pathology.

In [7] Luca Giancardo is introduced a new methodology for detection of diagnosis of DME using a novel set of features based on colour and automatic lesion segmentation. In this method, DME diagnosis is classification based on the single feature vector generated for each image. The single feature vector is analysis by three types: Exudate probability map, Colour Analysis and Wavelet Analysis.

III. DIFFERENT TECHNIQUE FOR DETECTION OF EXUDATES

There are so many methods for a detection of a diabetic retinopathy. Using several approaches for assessment of diabetic retinopathy. There are following method of detection for DR like Top-Down and Bottom-Up approach, hybrid approach and Neural Network Based Detection, Multiscale

AM-FM method, automatic assessment using color fundus images.

➤ **Top-Down and Bottom-Up Approach in lesion detection**

In retinal areas macular edema lesion are deposited which results to vision loss. Regularly vising of cotton wools or hard exudates in fundus image is damage the preventable eye. Yellow- white lesion with relating different margins and dark lesion consist of hamorrhages exudates.[8] These are not original exudates but degenerative nerve fiber haemorrhage is configured by their color related to the blood vessels. “dot ” and “blot” configuration in the background DR represent hemorrhages. Dark and bright lesion, bottom up and top down approach is applicable for detection to deal with main difficulty in lesions detection. Intensity with local area is used for finding out local contrast enhancement which applied for bright lesion detection, a three-stage and bottom up approach. If local area is high the algorithm does not significantly increase the local contrast and if the local area is small local contrast is increase gradually.

➤ **Neural network based detection**

In the way of biological nervous system such as the brain process information derive as neural network is information processing model. [9]To classifying the retinal exudates using neural network to detect exudates in retinal image are following: MLP(Multi-Layer Perceptron),RBF(Radial basis function) networks and SVMs(Support vector machine).

• **Multi-Layer Perceptron**

MLP is multi-layer feed forward network, A set of output variable and a set of input variable between non-linear function mapping is represent neural network. For approximation pf any function we have enough unit of MLP. Which is signifying single unknown layer provided the activation function of the neurons satisfaction some common constrains.[10] With this consideration one hidden layer with MLP is used, for determine experimentally optimum number of hidden neurons. The drawback of neural network can be formulated in term of the minimize of an error function.

• **Radial basis function**

Universal approximation is Radial basis function and it's model comprises with three layer. First is input layer, second is hidden layer and

third is output layer. Input layer is receive the feature vector and also has many neurons as the length of this vector.[11] Nonlinear transformation from the input space perform by hidden layer. The output layer is nonlinear and supplied the response of the network to the activation pattern. Requirement of hidden neurons in native RBF at available training point is computationally complex and lead for poor generalization ability. Orthogonal least square algorithm is applied to achive this task. Number of radial bases function and optimum spread determine experimentally. The output threshold was set to zero if RFB output is positive for exudate and if RFB output is negative for non-exudates.

• **Support vector machine**

By consideration of previous approaches support vector machine can estimate any function. In radial basis function the input space is mapped into a high dimensional feature space.[12] Then the hyperplan that maximize the margin of separation between classes is contrasted. The point that lie nearest to the decision surface is known as support vectors. It's also effect directly its location. Classification error probably occurs because of the classes are non-separable the optimal hyper plan is minimize it. And Lagrange multipliers method used to solve this problem.

➤ **Hybrid approach**

Pre-processing, post processing and clustering are the three step of hybrid approach. Purpose of this approach is to detect the hard exudates.

• **Pre-processing**

Pre-processing is eliminating unwanted detail from an image. And it makes the image applied for next step. It is initially resize to fix size 256x256 then green channel is extracted. Morphological dilation is applied by using disk shape structuring element.

• **Clustering**

Hard exudate is getting by clustering algorithm once image is dilated. Clustering is perform separately in each feature space, and obtained label are combined in a special manner to a yield exudates segments.

• **Post processing**

Hard exudates are seen normally and optic disc are of same color, brightness and contrast due to

applied clustering algorithm to image dilated. To obtain accurate hard exudates must be remove optic disc from the hard exudates. Circular Hough transform is applied to detect optic disk using clustering algorithm. Once the optic disk is detected it is eliminated and the hard exudates result is obtain.

IV. AN APPROACH FOR EXUDATES SEGMENTATION

exudates are responsible for exudative maculopathy and it is detected using two levels of segmentation for improved accuracy. There are following segmentation of exudates using K-means clustering, naive Byes classifier, fuzzy C-mean clustering

Fuzzy C-mean clustering

Overlapping clustering algorithm is a fuzzy C-mean clustering and it's also use segmentation. Where each point likes a two or more cluster with different degrees of membership. And it's defined by distance of the cluster centre's to the future vector[13].

K-means clustering

K-means clustering algorithm is used in computer vision and its form of image segmentation. The segmentation outcomes are used to help border detection and object recognition .[12]In this algorithm the forming clusters are insufficient the standard Euclidean distance. In addition it's a weighted distance measured utilised pixel coordinates, image texture, and RGB pixel colour.

V. CONCLUSION

An automated DR detection system is a very important for the growing up number of diabetic patients in the world. In this paper a number of algorithms are surveyed and different algorithms are found to give better results as early as exudate detection. After the survey metrics Fuzzy C-Means algorithm is detects exudates more accurately than other algorithms with a sensitivity of 92.08%, specificity and accuracy of 99.87%.

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