

IMAGE SEGMENTATION IDENTIFICATION FOR EXUDATE DETECTION USING DIABETIC RETINOPATHY

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Abstract— From the observation of past 10 years medical report, about 30% of patients with diabetic acquired great hazard of eye disease. Severe stage of diabetics may cause damage in retina blood vessels. The affected blood vessel further may produce loss of blood and another lymphatic. The swelling on retinal tissue leads to Diabetic Retinopathy (DR). Serious stage of DR leads to blindness. Early detection is essential for the prevention of blindness. Automatic detection is carried by various techniques such as pre-processing, feature extraction, exudates segmentation and classification of exudates are performed using different approaches. This paper describes various method and algorithm implemented for the early detection of Diabetic Retinopathy (DR).

Keywords— Diabetic Retinopathy (DR); Hard Exudates; Fundus Images; Support Vector Machine (SVM)

1. INTRODUCTION

Diabetic Retinopathy (DR) occurs due to serious infection on eye. The high blood sugar level could affect the blood vessel in eye retina. Abnormal swelling or leakage on blood vessel may steal your vision. The symptoms of DR are burry vision, amplify the number of floaters, weak night vision. Proliferative diabetic retinopathy (PDR) and non- Proliferative diabetic retinopathy (NPDR) are the two phases in Diabetic Retinopathy (DR). In NDPDR, vision loss is due to macular edema. PDR occurs when new blood vessel develops on the retina. Yellow flecks formed by lipid causes outflow of blood from injured capillaries leads to Hard Exudates. Yellow flecks appear between temporal vascular arcades. Affected patients are referred to ophthalmologist. Hard exudates are a life- threatening and vision- threatening disorder. Computer Aided Diagnosis (CAD) identifies the macular disease with elevated accuracy. CAD minimize the clinical level of incertitude based on various diseases. It improves the early identification of retinal disease, maintain patient health condition reports, record treatment method in every stage, store all digital retinal images and diagnosis of diabetic retinopathy (DR) databases are sustained. CAD are used to improve superiority and convenience of medical service.

2. LITERATURE REVIEW

Diabetics Retinopathy is an eye disease affect the retina of the diabetic patient. The severe stage may lead to blindness. In this paper they proposed Gradient Vector Flow Snake algorithm and region growing segmentation algorithm for exudates detection and separate non-exudates like optic disc, blood vessels, and blood clots into two phases respectively. [1] In early stage, the Diabetic Retinopathy is identified by the process of regular screening. Using GVF algorithm undergoes pre-processing. Remove and mask optic disc, blood vessel and blood clot using Region growing segmentation algorithm and finally Gabor filter applied to the image text segmentation are used to detect exudates and reduce the complexity with less

expensive. [2] About 850 text images are used. Here they obtained the efficiency of about 87%. In future, few more text feature has been introduced to increase the efficiency [3]. The early stage of Diabetic Retinopathy is a hard Exudates. It is identified by using Novel method. In this paper hard exudates are characterized by using Stationary Wavelet Transform (SWT) and Gray Level Co-occurrence Matrix (GLCM). Classification are performed by an optimized support vector machine (SVM) along with Gaussian radial basis function. About 50 hard exudates data set are implemented. [3] Using classification accuracy of 84%, sensitivity of 88% and specificity of 80 % are obtained this paper, diabetic retinopathy is diagnosed by using digital retinal images obtained by fundus camera. Large scale screening is performed by using computer Aided Diagnosis (CAD). CAD reduces the classification error. plays a vital role in early diagnosis of DR. In this paper they proposed a novel method and automated lesion detection scheme to perform vessel extraction and optic disc removal, pre-processing, candidate lesion detection and post-processing. [4] The dark lesions are depurating from the indisposed brightness by implementing Curvelet based edge enhancement. [5] The most favorable designed wideband bandpass filter is used to contradict between the bright lesions and the background. [6] The thresholds of segmenting the candidate regions are obtained from the highest values of the fuzzy function parameter, by using Differential Evolution algorithm. The roguishly observed candidate pixels are performed by Morphology based post-processing. [7] This method increases the performance with the accuracy of 9.1% and brute force. Here, the performance of red lesion is display as dark patches and identical from background due to weak brightness. [8] Microaneurysms dot like structure are missed out and hence required improvement in the dark lesions. Time optimization is also requiring. In this paper, the detection of non-proliferative diabetic retinopathy (NPDR) is determined by using the effective fundus color image analysis system. This method is classified into two section.

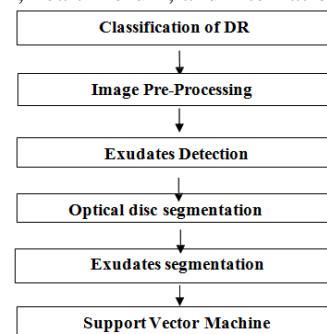
One section includes the segmentation of the retinal pathological element such as blood vessel, optic disc and fovea. The other section includes the detection lesions related to the NPDR (micro-aneurysms, hemorrhages and exudates). The parameter is localization, gray value of retina and types are lesions. In this paper, the resultant segmentation is compared with the ophthalmologists prepared segmentation lesions respectively. This method provides an effective segmentation in minimal time. Photographic aspect of the eye fundus. [9]. In this paper the classification of retina into normal and diabetics are done by feature extraction. By the method of Discrete Wavelet transformation, the color retina images are used to detect exudates. Mathematical morphology method is implemented to deparure the blood vessel, that comfort optic disc and exudates elicitation. These exudates notification is used for further classification. The content on ophthalmologist is minimized by the automatic detection of DR to filter the normal from diabetics. It supports the DR screening. Diabetic Retinopathy is a serious eye disease and its severe stage may lead to blindness. In this paper they introduce an effective and sensitive tool such as fundus camera to capture digital retinal images. Patch level prediction are performed by screening tool using SVM classifier. It partitions the affected area into Hard Exudates and Hemorrhage. The screening tools are split into two parts such as image level prediction and patch level prediction. Image level prediction plot feature using PCA and Patch level prediction uses SVM Hard exudates and hemorrhage prediction. The two different types of datasets are training dataset and tested dataset are used. SVM classifier is implemented on training dataset and is compared with the tested dataset. The performance results using SVM for Hard Exudates are Accuracy 96 %, Sensitivity 94%, Specificity 96% and for Hemorrhage are Accuracy 85 %, Sensitivity 77%, and Specificity 85% respectively. [10]. In this paper extreme machine language are implemented to identify the occurrence of retinal exudates. The appearance of exudates feature is obtained such as Mean, Standard deviation, Centroid and Edge Strength are derived from Luv color space. About 80 images for training and 20 images for testing are implemented. classification is performed by the algorithm such as Naive Bayes (NB), Multilayer Perceptron (MLP) and Extreme Learning Machine (ELM). It undergoes Image preprocessing, Image segmentation, Feature extraction and classification. Preprocessing method such as HSI conversion, Local Contrast Enhancement, Histogram Equalization are applied on the given input retinal images. Further segmentation is performed by using Fuzzy C- means. Finally, classification is carried by NB, MLP, ELM. The accuracy obtained by using Naive Bayes is 82% MLP is 81% and ELM is 90% respectively. Among all, ELM produces a highest accuracy. From the result they identified that the novel method determines the appearance of exudates more convenient. [8]. In Computer Aided Diagnosis (CAD) of Diabetic Retinopathy (DR) exudates detection is prerequisite mission. In this paper, convolution neural network (CNN) of deep machine learning is used. The pixel wise classification is obtained by CNN, provides a minimum computational time. Classification is

performed by the method of deep CNN. In DR diagnosis, automatic detection of exudates is insistent. Automatic detection is performed by three steps such as getting exudates candidates, extracting features and machine learning. The exudates candidate's extraction is performed by morphological operation. Machine learning are implemented to obtain pixel-level feature. In this paper, the accuracy has been enhanced by pixel-level exudates detection. The rate of accuracy can be improved by increasing the datasets such as Messidor and DIARETDB databases and also increase the count of exudates images in training set respectively.

Exudates is the basic symptoms of DR. In this paper, The automatic detection of exudates are attained by the sequence of texture feature and Local Binary Pattern variant (LBP). Classification is done by Artificial Neural Network (ANN). The value of entropy, energy, contrast and correlation-based measures on color components as well as texture features including GLCM and Gabor filtering are should be suggested for the detecting hemorrhage. Comfy arisen with very low intensity values. The aggregation of color and texture illumination are obtained by the consequent feature extraction process [10].

3. METHODOLOGY

Med help forum has different types of hosts they are the doctor's forum, health forum, and international forum.



A. Proposed Method for Classification of DR

In the proposed method, pre- processing step enhances the quality of the image. Further to improve the contrast between exudates and non-exudates regions, shade correction is performed. The second stage involves segmentation of exudates from the green channel image after removal of blood vessels and optic disc. The GLCM features are extracted from the segmented region. Using the extracted feature five classifiers SVM, SCG-BPN, GRN, PNN, and RBF are trained and tested for obtaining the best classifier.

B. Image Pre-Processing

The green band is largely used for identification of exudates, since it gives more information than red and blue bands. The green channel image is filtered by applying a morphological opening as structuring element in order to remove vessel central light reflex, since it may contribute to false detection of exudates. Background homogenization is done using arithmetic mean kernel which smoothens the intensity values uniformly.

C. Exudate Detection

The exudates are segmented by removing blood vessels and optic disc from the green channel image extracted from the fundus image. The process for exudates detection are as follows. Blood vessels are prone to cause bright lesion like appearance during the segmentation of exudates. Hence it is removed in order to reduce false positive and to improve the accuracy of exudates segmentation. Fuzzy C-Means (FCM) clustering algorithm is used to segment the blood vessel since it can retain more information of the dataset.

D. Optical disc segmentation

The segmentation of optic disc is crucial since it is circular in shape with high contrast and is similar to exudates. The optic disc is removed using a circular mask.

E. Exudates segmentation

An entropy filtering is performed on the pre-processed image clearly segments blood vessels, optic disc and exudates. For detecting the exudates, the blood vessels segmented in step 1 and the optic disc obtained in step 2 are subtracted from the filtered image. The features are extracted by pair wise spatial co-occurrences of pixels separated by some angle and distance which are tabulated using the GLCM. The GLCM consist of an NxN matrix, where N is the number of grey levels in the image. The Four GLCM features that are selected as the feature set are correlation, cluster shade, dissimilarity and entropy. Cluster shade [17] is a measure of the skewness of the matrix or lack of symmetry. When the value of cluster shade is higher, the image is not symmetric with respect to the texture value. Dissimilarity [18] is a measure that defines the variation of grey level pairs in an image. It is computed as in(4)

$$\text{Dissimilarity} = \sum_{i,j} |i - j|p(i, j) \quad (4)$$

It is expected that these two measures behave in the same way for the same texture because they calculate the same parameter with different weights. Contrast will always be slightly higher than the dissimilarity value. Dissimilarity ranges from [0, 1] and obtain maximum when the grey level of the reference and neighbor pixel is at the extremes of the possible grey levels in the texture sample. Entropy shows the amount of information of the image that is needed for the image compression. Entropy measures the loss of information in a transmitted image as in equation (5).

$$\text{Entropy} = - \sum_{i,j} p(i, j) * \log(p(i, j)) \quad (5)$$

Generalized Regression Network (GRN), Probabilistic Neural Network (PNN), Radial Basis Network (RBF) are tested and found SVM classifier is more accurate and have high performance.

F. Support Vector Machine

SVMs are efficient learning approaches for training classifiers based on several functions like polynomial functions, radial basis functions, neural networks etc. SVM is a linear classifier that maps the points into the space with separate categories such that they have wider space with a clear gap in between. A hyper-plane is chosen to classify the data [19]. The separating hyper-plane must satisfy the constraints.

$$y_i[(w \cdot x_i) + b] \geq 1 - \xi_i, \xi_i \geq 0 \quad (6)$$

Where w = the weight vector b = the bias

The SVM requires the parameters such as the kernel function and the regularization parameter C . In this work Radial Basis Function (RBF) kernel function is used.

G. Generalized Regression Network

It is a radial basis function that is often used functional approximation. The use of this network is especially due to its ability to the underlying function of the data with only few training data available. The probability density function used in GRN is the normal distribution. Each training sample X_j , is used as the mean of a normal distribution. The distance D_i between the training sample and the point prediction is used as a measure of each training sample.

4. CONCLUSION

From these surveys we analyzed various concept regarding Diabetic Retinopathy (DR) and their corresponding algorithm with methodologies are validate by numerous researchers till today. Diabetic Retinopathy is a serious eye disease for diabetic patients. Study of various techniques and concept provides us a deep knowledge about Diabetic Retinopathy (DR). From the we concluded that the automatic screening system is trained to classify the fundus images. Computer Aided Diagnosis (CAD) determine the different stages of DR. Stages include (normal, mild, moderate and severe). After the removal of optic disc and blood vessels exudates segmentation is carried out by Entropy filter. Texture features are extracted by Grey Level Co-occurrence Matrix (GLCM) and classification are done by SVM. The detection of diabetic retinopathy is done by analyzing presence of exudates in eye fundus images. Our algorithm could mask optic disc and non-exudates like blood vessels and clots. The algorithm is computationally less expensive and complexity is also less. The algorithm has achieved a high efficiency and accuracy.

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