Analyzing the Severity of the Diabetic Retinopathy and Its Corresponding Treatment

Neelapala Anil Kumar, **Mehar Niranjan Pakki**

Abstract:- ***Diabetic-related eye disease is a major cause of blindness in the world. It is a complication of diabetes which can also affect various parts of the body. When the small blood vessels have a high level of glucose in the retina, the vision will be blurred and can cause blindness eventually, which is known as diabetic retinopathy. Regular screening is essential to detect the early stages of diabetic retinopathy for timely treatment and to avoid further deterioration of vision. This project aims to detect the presence of abnormalities in the retina such as the structure of blood vessels, micro aneurysms and exudates using image processing techniques by automating the detection of Diabetic retinopathy (DR). This Process is achieved by the fundus images using morphological processing techniques to extract features such as blood vessels, micro aneurysms and exudates and then we calculate the area of each extracted feature. Depending on the area of each feature we classify the severity of the disease. Then finally by knowing the severity of the disease corresponding treatment measures can be analyzed. It will surely help to reduce the risk and increase efficiency for ophthalmologists.***

Keywords:- Blood Vessels, De-noising, Diabetic Retinopathy, Disease Severity, Enhancement, Exudates, Fundus Camera, Micro-aneurysms, Morphological Operations, Segmentation, Treatment.

I. INTRODUCTION

Diabetic retinopathy (DR) is one of the complications resulted from prolonged diabetic condition usually after ten to fifteen years of having diabetes. In the case of DR, the high glucose level or hyperglycemia causes damage to the tiny blood vessels inside the retina. DR affects about 60% of patients having diabetes for 15 years or more and a percentage of these are at risk of developing blindness discussed in [2]. Despite these intimidating statistics, research indicates that at least 90% of these new cases could be reduced if there was proper and vigilant treatment and monitoring of the eyes [3]. Laser photocoagulation is an example of surgical method that can reduce the risk of blindness in people who have proliferative retinopathy [4]. However, it is of vital importance for diabetic patients to have regular eye checkups. Current examination methods use to detect and grade retinopathy include ophthalmoscope (indirect and direct) James L. Kinyoun et al [5], photography (fundus images) and fluorescein angiography.

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The objective of this project is to implement an automated detection of diabetic retinopathy (DR) using digital fundus images. By using MATLAB to extract and detect the features such as blood vessels, micro-aneurysms and exudates which will determine classifications: normal or abnormal (DR) eye. An early detection of diabetic retinopathy enables medication or laser therapy to be performed to prevent or delay visual loss.

II. ALGORITHM DESIGN

The automated disease identification system is not a single process. This system consists of various modules the success rate of each and every step is highly important to ensure the overall high accurate outputs. The rest of the work is organized as follows (a) Read the input image from Fundus camera, (b) Image Pre-Processing, (c) Anatomical Structure Extraction, (d) Feature Extraction, (e) Disease Severity, and (f) Corresponding. All these techniques are explained in the following sections.

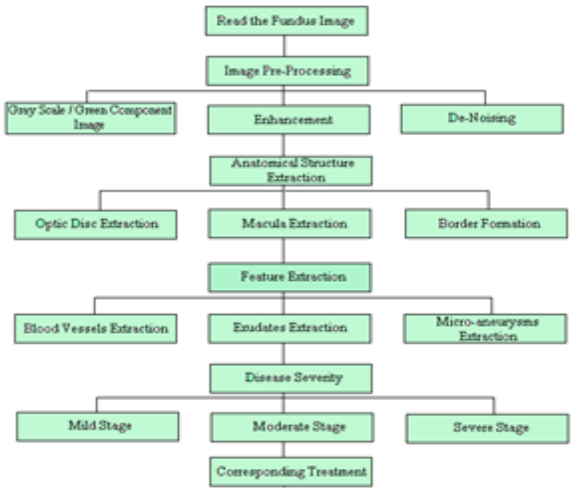


Fig. Algorithm Design

III. IMAGE PRE-PROCESSING

The preliminary step in automated retinal pathology diagnosis is image preprocessing. This includes various techniques such as contrast enhancement, gray/green component, image de-noising etc. Initially we convert the RGB image into gray color image/green channel image Salvatelli A. (2007) et al [6] to further process the image. Then Image enhancement techniques are designed to improve the quality of an image as perceived by human being. Adaptive Histogram equalization is a constant enhancement technique which provides a sophisticated method for modifying the dynamic range and contrast of an image by altering that image such that its intensity histogram has a desired

shape Andrea Anzalone (2008) et al [7]. The median filter is a non linear digital filter technique often used to remove noise from images or other signals. We use "bwareaopen" also to remove the small area of pixels considered to be noise after applying morphological operations.

IV. ANATOMICAL STRUCTURE EXTRACTION

The second step is the feature extraction technique in which suitable feature set is extracted from the enhanced retinal images. The feature extraction techniques for retinal images are broadly divided into two classes. The first category is the direct method in which the textural features are extracted from the pre-processed. The second category is the indirect method in which various anatomical structures are initially segmented from the preprocessed images and then features are extracted from these anatomical structures. These anatomical structures include macula, border formation and the optical disk.

We extract the anatomical structures like optical disk and macula using morphological opening function Daniel Welfer (2010), Cemal Kose (2008) et al [8, 9]. And using two border detection techniques for effective extraction, we extract the image border by applying morphological dilate and erode then subtracting dilate with erode image.

V. FEATURE EXTRACTION

The third step is to extract the features to detect the required features such as exudates, micro-aneurysms and blood vessels. In this process we use morphological operations such as dilate, erode, opening and closing Dietrich Paulus (2005), Ana Maria Mendonca (2006) et al [10, 11]. After applying these operations we convert image into binary image then using logical operations 'AND' and 'OR', filters like 'colfilt' and segmentation we segment the exudates, micro-aneurysms and blood vessels Jagadish Nayak, Akara Sopharak (2008) et al [12, 13].

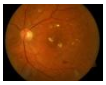
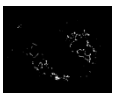
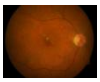
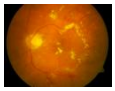
After extracting the features, by using loops we will calculate the area of each feature to know the severity of the disease.

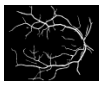
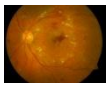
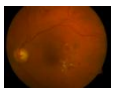
VI. DISEASE SEVERITY & CORRESPONDING TREATMENT

The next step is to know the severity of the disease depending on the area calculated from the above step. Depending on the severity we will categorize the disease into three categories such as Mild, Moderate and Severe by using ANOVA test [14]. And in the final stage depending on the severity of the disease we will give the corresponding treatment to the patient. The treatments for the diabetic retinopathy are Vitrectomy, Scatter laser treatment, Focal laser treatment and Laser photocoagulation Treatments depending upon severity are gathered from Visakhapatnam government eye hospital.

VII. RESULTS

Table (1) The following table shows the Patient's Details and their corresponding Disease and treatment.

S.No.	Patient Name	Patient Phone Number	Patient Input Image	Blood Vessels	Exudates	Micro aneurysms	Disease Severity	Corresponding Treatment
1.	Ganesh	7396069927					Mild	Laser PRP Treatment
2.	Srinu	8885384318					Moderate	Vitrectomy
3.	Mahesh	9700370745					Severe	Laser Photocoagulation
4.	Lalitha	9985536700					Moderate	Vitrectomy
5.	Surya	9908026375					Severe	Laser Photocoagulation

6.	Saraswathi	9908026375					Mild	Laser PRP Treatment
7.	Subbu	8483864467					Severe	Laser Photocoagulation
8.	Lakshmi	7726798340					Moderate	Vitrectomy
9.	Sri Ram	9848693260					Severe	Laser Photocoagulation
10.	Krishna	9497921875					Moderate	Vitrectomy

VIII. CONCLUSION

In summary, a medical system for the automatic diagnosis of the primary sign of Diabetic Retinopathy (DR) has been developed by using effective image processing techniques. In order to detect the severity of DR based upon the area analysis of retinopathy eye and with corresponding preventive measures for various samples of DR eye. The results demonstrate that the system is well suited to complement the screening of DR helping the ophthalmologists in their daily practice.

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