Detection of Severity in Diabetic Retinopathy

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Abstract— Automated early detection of exudates in retinal images is a challenging task. With the global diabetic population increasing at an alarming rate, there is need for development of automated systems for detection of exudates. In several patients, the only visible symptoms of Diabetic retinopathy are Exudates. The main obstacle in exudates detection is extreme variability of color and contrast in retinal images that depends on the degree of pigmentation, size of the pupil and illumination. The aim of this project is to automate the system to detect and grade the severity of Diabetic retinopathy. Diabetic patients who have had diabetes for more than five years are likely to develop some form of Diabetic Retinopathy. Only regular screening can result in early detection and effective management of Diabetic Retinopathy. Patients should get their both eyes screened at least once in a year. These screening programs generate large number of images and processing of which is time consuming process. Automated diabetic Retinopathy can save time and reduce the workload of ophthalmologists. Developing strategies for screening large population for early detection of Diabetic Retinopathy is engaging attention of several groups in India. Automated grading is less costly and of similar effectiveness, it is likely to be considered a cost effective alternative to manual grading.

Key words: Opthomologist, DiabeticRetinopathy, Pigmentation, Screening

I. INTRODUCTION

Diabetic Retinopathy is damage to the retina that occurs with long term diabetes. Diabetic Retinopathy(DR) is a major cause of blindness in people with diabetes. According to World Health Organization (WHO) more than 75 percent of patients who are affected by diabetes for more than 20 years will develop some form of DR. Detection of exudates is to decide healthy or diseased eye. Exudates are key indicators of Diabetic Retinopathy. For Diabetic Retinopathy detection and treatment, mass screening is done on a regular basis. These programs produce enormous amount of images. Manual detection of abnormalities and severity checking is time consuming and is error prone. The time and work load of ophthalmologists can be considerably reduced with the development of an automated system for this purpose.

A. Retinal Image (Image Processing)

The abnormal formation of the retina due to the disease attack of blood vessels in the retina of the eye shown in the retina of the eye shown in below figure.

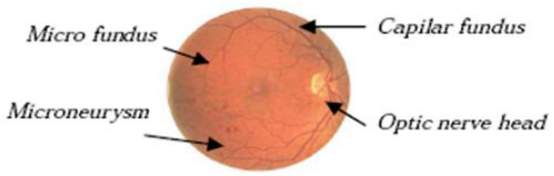

Fig 1a: Abnormal formations of the retina due to diabetic retinopathy

In the framework of computer assisted diagnosis of diabetic retinopathy, a new algorithm for detection of exudates is presented and discussed. The presence of exudates within the macular region is a main hallmark of diabetic macular edema and allows its detection with a high sensitivity. Hence, detection of exudates is an important diagnostic task, in which computer assistance may play a major role. Exudates are found using their high grey level variation, and their contours are determined by means of morphological reconstruction techniques. The detection of the optic disc is indispensable for this approach. We detect the optic disc by means of morphological filtering techniques and the watershed transformation. The algorithm has been tested on a small image data base and compared with the performance of a human grader. The proposed problem is to design a Machine Vision System that detects the severity of diabetic retinopathy. After the detection of exudates, the proposed system asses the severity of the DR and grades the image as mild, moderate or severe DR. enhancing the retinal image by preprocessing it using suitable filters such as Gabor filter, Median filter, Gaussian filter. From enhanced retinal image anatomical features and exudates are detected using k-means or fuzzy c means algorithm.

II. PROCEDURE OF DETECTING DIABETIC RETINOPATHY

The proposed system functions in two stages. The first stage comprises of receiving the retinal image as input, processing it and checking the quality of image. The second stage comprises of finding severity of DR by eliminating noise with the help of SVM classifier.

This system, determines the quality of retinal image for further processing. It not only determines the presence of diabetic retinopathy but also grades the severity of diabetic retinopathy as Mild, Moderate and Severe.

The system shall be able to,

1) Perform quality analysis on the input image and either accept image for further processing or reject the image.
2) Detect the region of macula.
3) Detect the region of exudates in the retinal image.
4) Grade the severity of DR based on the location of the exudates detected as mild, moderate or severe.

A. Quality Analysis

The system shall be able to perform quality analysis of image. User selects image to perform quality analysis of the image to either accept image for further processing or reject the image.

Exception Scenario The quality of image will not be analyzed when user selects quality analysis menu. Quality analysis of image should be performed.

Data flow Diagram for Quality Analysis.

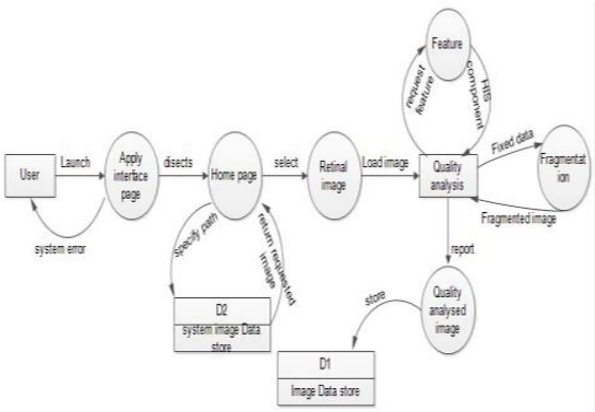

Fig. 2a: Data flow Diagram for Quality Analysis

Description: User launches the system. GUI will be displayed. User specifies the path of retinal image in turn the system load specified image. This image will be pre-processed for enhancement. Pre-processed fund us retinal image should pass the quality analysis test. So, pre-processed image is first sent to entity quality analyzer which will be sent to another process for fragmentation. The fragments These fragments are which refers the trained stored data to judge the quality of image. The output will be either to accept image for further processing or to reject it.

B. Data Flow Diagram for Macula Detection

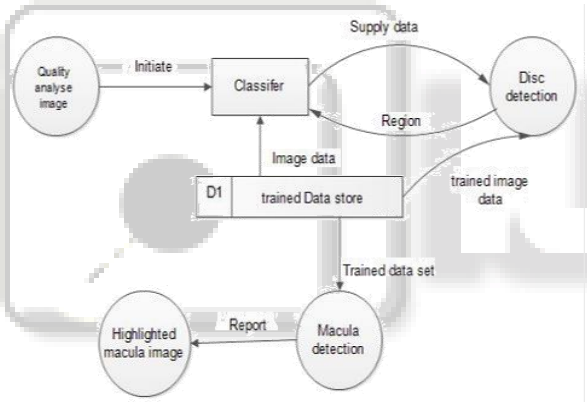

Fig. 2b: Data flow Diagram for Macula Detection

Description: Quality analyzed retinal image is sent to the trained classifier. Classier then refers the stored data. This information is sent to the optic disc detector method to detect the optic disc. Also the same information is sent to macula detector to detect macula region.

C. Data Flow Diagram for Exudates Detection and Grading Severity

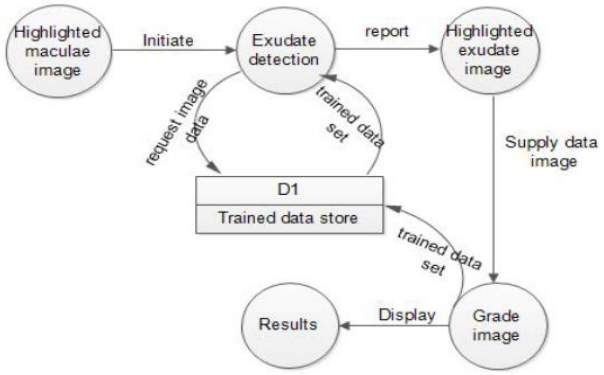

Figure 2c: Data flow Diagram for Exudate detection and grading severity

Description: After detecting optic disk and macula region, the quality analyzed retinal Imaged is sent to the process to detect exudate using the stored trained data. Once the exudates in the image is detected, its been sent for grading the severity. To grade the severity of Diabetic Retinopathy, the process also refers the trained stored data. Then the result is displayed to user.

III. Exceptions

A. Exception During Quality Analysis

- If image chosen to load is black and white then quality cannot be analyzed.
- If reported trained data contains any missing feature then error is thrown.
- If chosen image is of different type format such as .gif then quality.

B. Exception During Maculae Detection

- Too dark image, if on passing quality test can't be helpful for maculae detection.
- If data, which is necessary to detect maculae that is given by training is inappropriate then maculae cannot be detected.

C. Exception During Severity Grading

- Exudates if absent, then the severity cannot be graded.
- For abnormal image grading can be made wrongly as mild, moderate or severe.

IV. Benefits of the System

1) Quality analysis of image.
2) Determining severity of DR is done using SVM classifier for proper analysis.
3) The overall process time efficiency is increased.
4) The training data required for the proposed Machine Vision System is reduced as
5) Compared to the neural network systems.
6) Automated system for analysis of retinal eye.

V. Open Issues and Future Work

- Handling large image database for quality assessment is big issue.
- As an input, image should be of good quality to the exudates detection system, a system cannot reined image to make good quality.
- Grading the image, without considering the microaneureym and maculae region is a big issue.

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