DIABETIC RETINOPATHY DETECTION

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Abstract

Retinopathy occurs when blood vessels in the back of the eye, the retina, become damaged. When the blood vessels become damaged they can leak and these leaks can cause dark spots on our vision. The main causes of retinopathy tend to be sustained high blood glucose levels and high blood pressure as well. Detecting DR is a time-consuming and manual process that requires a trained clinician to examine and evaluate digital color fundus photographs of the retina. By the time human readers submit their reviews, often a day or two later, the delayed results lead to lost follow up, miscommunication, and delayed treatment. With color fundus photography as input, the goal of this competition is to push an automated detection system to the limit of what is possible – ideally resulting in models with realistic clinical potential. The winning models will be open sourced to maximize the impact such a model can have on improving DR detection. To achieve this we have executed code on Matlab by using detection methods by performing operations on DRIVE and STARE database as well as designed the Simulink model by which hardware implementation is possible.

Index Terms: Blood vessel extraction, Exudate detection, Classifier, DRIVE & STARE database, Simulink model.

I. INTRODUCTION

Diabetes has become one of the rapidly increasing health threats worldwide. Diabetes occurs when the pancreas fails to secrete enough insulin, slowly affecting the retina of the human eye. As it progresses, the vision of a patient starts deteriorating, leading to diabetic retinopathy. The diabetic retinopathy is a micro vascular complication of diabetes, causing abnormalities in the retina, and in the worst case, blindness. Typically there are no salient symptoms in the early stages of diabetic retinopathy, but their number and severity pre- dominantly increase with time. The diabetic retinopathy typically begins as small changes in the retinal capillaries. There are three stages:

(i) Early stage or non-proliferate diabetic retinopathy (NPDR) or background retinopathy

(ii) Maculopathy

(iii) Progressive or proliferate retinopathy.

II. BLOOD VESSEL EXTRACTION

The extraction of blood vessels from retinal images can be difficult and the two main factors concerned are the improper retinal image contrast and the uneven background illumination during the acquisition process. The improper contrast is because different vessels have different contrast. Therefore, our aim is to propose an algorithm for the extraction of blood vessels automatically from the retinal image. Blood vessels of different thicknesses can be extracted.

Steps are as follows

1. Pre-processing:

Color fundus images often show important lighting variations, poor contrast and noise. In order to reduce these imperfections and generate images more suitable for extracting the pixel features demanded in the classification step.

2. Feature extraction:

The aim of the feature extraction stage is pixel characterization by means of a feature vector, a pixel representation in terms of some quantifiable measurements which may be easily used in the classification stage to decide whether pixels belong to a real blood vessel or not.

3. Classifier:

For our designed system we used nearest neighbor (NN) classifier which classify as blood vessel segmented image and background image at the output.

4. Post-processing:

In post-processing we represent image in gray level by converting matrix and then compare this image with image which we gained at output of pre-processing *i.e.* Homogenized Image H_i.

III. MATH

For classification of the pixels various features of the image need to be extracted. A set of gray-level-based descriptors taking this information into account were derived from homogenized images *I*H considering only a small pixel region centered on the described pixel (i,j). $S^{w}_{i,j}$ stands for the set of coordinates in a sized square window centered on point (i,j). Then, these descriptors can be expressed as

$$f_1(i,j) = H_i(i,j) - \min_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} \quad (1)$$

$$f_2(i,j) = \max_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} - H_i(i,j) \quad (2)$$

$$f_3(i,j) = H_i(i,j) - \operatorname{mean}_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} \quad (3)$$

$$f_4(i,j) = \operatorname{std}_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} \quad (4)$$

$$f_5(i,j) = H_i(s,t) \quad (5)$$

IV. EXUDATE DETECTION

Exudate detection is nothing but the area which affected by DR. As we are providing percentage for DR by finding the area which affected by DR.

Pre-processing:

Fundus Image itself consists of three planes as R plane, G plane, B plane. For extracting feature to detect exudate work with all three plane and extract feature from R plane, G plane, B plane such as minimum, maximum, mean, for that purpose in pre-processing we separate all planes

Feature Extraction:

In feature extraction we extracted feature from R plane, G plane, B plane such as minimum, maximum, mean. These feature formulated in equation (1) to (4) below.

$$f_1(i,j) = H_i(i,j) - \min_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} \quad (1)$$

$$f_2(i,j) = \max_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} - H_i(i,j) \quad (2)$$

$$f_3(i,j) = H_i(i,j) - \operatorname{mean}_{(s,t)\in S^w_{i,j}} \{H_i(s,t)\} \quad (3)$$

$$f_4(i,j) = H_i(s,t) \quad (4)$$

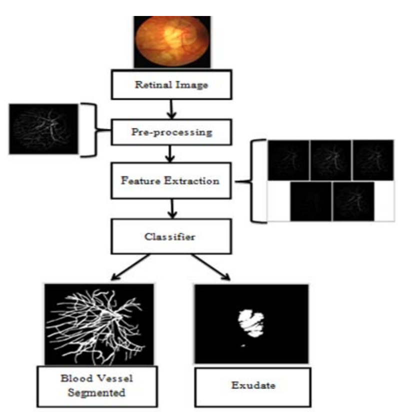
Classifier:

Nearest neighbor (NN) classifier for our system is used to classify image as exudates and background image. In nearest neighbor (NN) classifier we compared feature of sample with feature of training and classify as exudates and background image.

Post Processing:

Post-processing for exudates detection is nothing but finding the area which affected by DR *i.e.* area where blood get spread on eye due to pressure on vessel because lack of insulin. For representation we binaries the image which gets at output of classifier by comparing.

Block diagram of entire system:

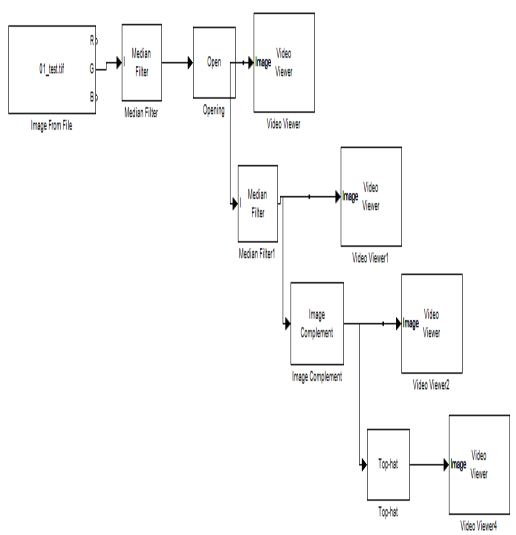


Block Diagram of entire system

V. SIMULINK MODEL

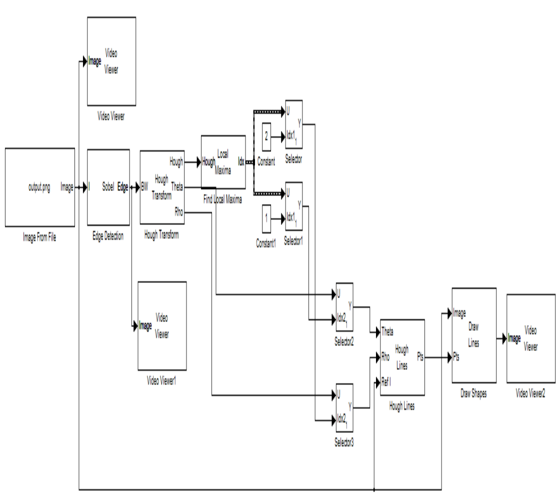
Simulink is a simulation and model-based design environment for dynamic and embedded systems, integrated with MATLAB. Simulink is a data flow graphical programming language tool for modeling, simulating and analyzing multi-domain dynamic systems. It is basically a graphical block diagramming tool with customizable set of block libraries. It allows you to incorporate MATLAB algorithms into models as well as export the simulation results into MATLAB for further analysis. Simulink Verification and Validation enables systematic verification and validation of models through modeling style checking, requirements traceability and model coverage analysis. We have designed the simulink model for preprocessing and feature extraction

A. Simulink model for Pre-processing

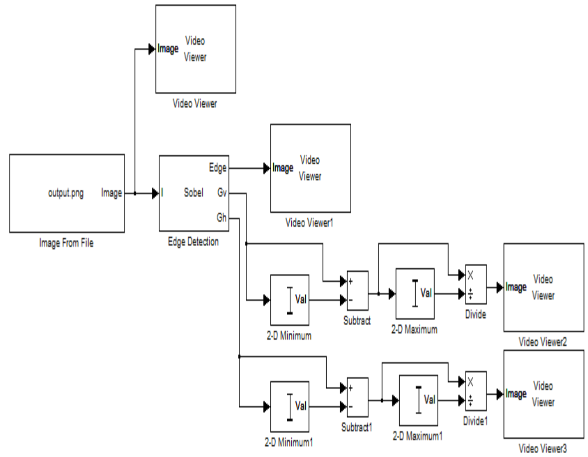


B. Simulink model for feature extraction

I. Line Detection

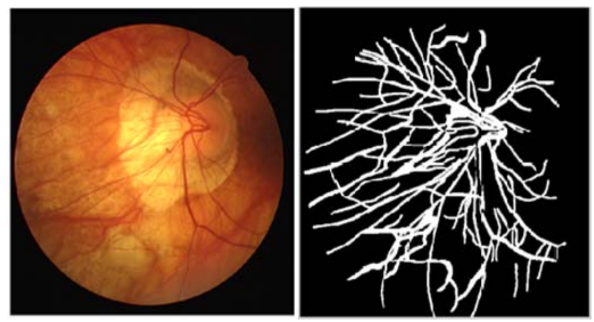


II. Edge Detection



Vi. Results

Result of Blood vessel extraction



(a) (b)

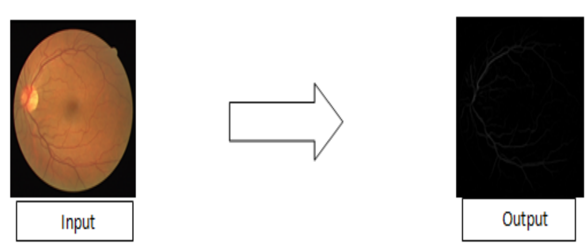
(a)Original Image (b)Blood vessel Extraction

Result of exudate Detection

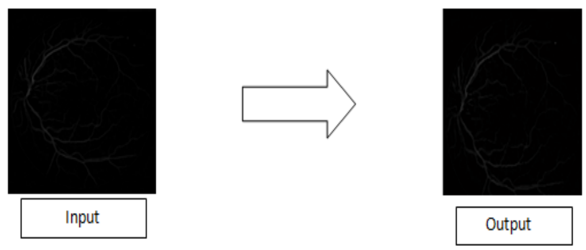
(a) (b)

(a)Oiginal Image (b) Exudate Detection

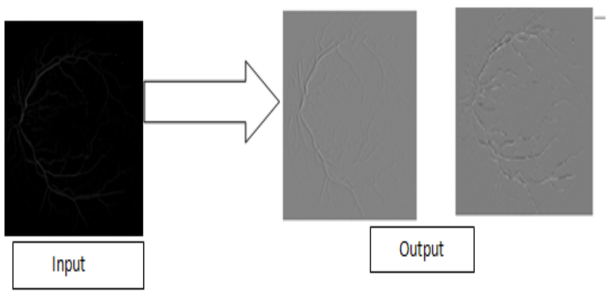
Result of Simulink model for pre-processing



Result of Simulink model for Line Detection



Result of Simulink model for edge Detection



VI. CONCLUSION

We have provided an percentage of Diabetic Retinopathy to eye specialist which helps in their further classification. Our project provides cost efficient system to detect diabetic retinopathy in earlier stages.Here pre-processing is done to preserve vessel structure. It gives effectiveness and robustness .Its pixel classification procedure is based on computing features for each pixel. It work on both DRIVE and STARE databases. Here proposed method work better on DRIVE database than STARE database. From the output one could easily predict diabetic retinopathy and it assist to proper analyze it. This robust and fast implementation of vessel segmentation makes diabetic retinopathy detection quick and easy

REFERENCES

[1] Diego Marin, Arturo Aquino, Manuel Emilio Gegundez-Arias, and Jose Manuel Bravo “A New Supervised Method for Blood Vessel Segmentation in Retinal Images by Using Gray-Level and Moment Invariants-Based Features”, IEEE Transactions on Medical Imaging, vol. 30, no. 1, January 2011.

[2] Jegatha R, Lakshmi K “Retinal Blood Vessel Segmentation Using Gray-Level And Moment Invariants-Based Features”, Journal of Computer Applications, ISSN: 0975-1925, vol. 5, Issue EICA2012-3, February 10, 2012.

[3] S. Muthu Lakshmi “Supervised Blood Vessel Segmentation in Retinal Images Using Features Based Classification”, International Journal of Advanced and Innovation Research, ISSN: 2278-7844, vol. 1, Issue 1, June 2012.