WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Diabetic Retinopathy Detection Using Image Processing.

V. Madhuri [a], V. Ragini Santhoshi [b], G. Indra Karan Reddy [c]

[a] Student Nalla Narasimha Reddy Education Society's Group of Institutions (Autonomous), Affiliated By Jntuh Hyderabad, Department Of Electronics and Communication Engineering , Hyderabad, Telangana, Pin Code 500088, India
[b] Student Nalla Narasimha Reddy Education Society's Group of Institutions (Autonomous), Affiliated By Jntuh Hyderabad, Department Of Electronics and Communication Engineering , Hyderabad, Telangana, Pin Code 500088, India
[b] Student Nalla Narasimha Reddy Education Society's Group of Institutions (Autonomous), Affiliated By Jntuh Hyderabad, Department Of Electronics and Communication Engineering , Hyderabad, Telangana, Pin Code 500088, India
Under the Guidence of DR.S.KARTHICK, ASSISTANT PROFESSOR ,Nalla Narasimha Reddy Education Society's Group of Institutions

A B S T R A C T

Diabetes Retinopathy is a common disease nowadays which could cause blindness. Earlier detection of diabetes signs from retina fundus images could help predicting and preventing the damages. Image processing methods could process the matrix data of pictures as blood vessel segmentation and exudate detection. In this research, the CLAHE algorithm with morphological transformations are used to blood vessel segmentation and determination of the Hessian matrix of images are utilized to detect the exudate blobs.

KEYWORDS: Diabetic retinopathy, a graphical user interface, image processing, fundus analysis, and the identification of retinal diseases are some of the keywords.

1. Introduction

Image processing is the process of applying certain procedures to photographs in order to produce enhanced images.It is frequently used to quickly and accurately diagnose eye disorders. On the basis of features like blood vessels, haemorrhages, exudates, etc., several strategies have been developed for the early diagnosis of DR. This includes picture enhancing techniques like histogram equalisation and adaptive histogram equalisation for the detection of DR. Retinopathy is the medical word for the retinal damage that persists over time. People with diabetes develop the condition known as diabetic retinopathy (DR), which causes the retina to progressively deteriorate.

High blood sugar levels damage the tiny blood vessels in the retina, which can cause swelling and haemorrhaging of the retina. For example, diabetic retinopathy (DR) is an eye condition linked to diabetes that develops as the blood vessels in the retina expand and leak fluid, which ultimately causes vision loss. The DR is thought to be a dangerous condition that threatens one's vision.

The categories of NPDR and PDR fall under DR. A condition known as Non Proliferative Diabetic Retinopathy (NPDR) causes the blood vessels in the retina to enlarge. New, fragile, abnormal blood vessels are formed as a result of proliferative diabetic retinopathy (PDR).

Having trouble seeing clearly at night, having blurry vision, or having an empty or black patch in the centre of the vision are all signs of DR. The International Diabetes Foundation estimates that 366 million persons worldwide have diabetes as of 2011, and that number will rise to 522 million by 2030. Every country now has 80% of the population with type-2 diabetes, with India leading the pack with 95% (18 million in 1995 and 54 million in 2025). Diabetes is the main contributor to DR, and it can result in vision loss.

In Southern India, the prevalence of DR ranges from 12.2% to 18.03%, and 16.6% to 20.9% of those over 50 are affected with DR. DR knowledge and awareness are extremely lacking. Only one-tenth of community members and one-fifth of paramedics were aware that uncontrolled diabetes is a risk factor for developing DR.

To treat DR, laser surgery known as scatter laser therapy is available in India at a reasonable cost. Hospitals that diagnose and treat DR include the Max Super Specialty Hospital in Delhi, the Apollo Hospitals in Chennai and Hyderabad, and the Lotus Eye Care Hospital in Coimbatore.

2. PROPOSED METHOD

Here the primary block diagram of the research methodology has been depicted in fig. 1. It comprises of 4 modules namely 1) Fundus input image, 2) Image Preprocessing, 3) Image based Segmentation, and 4) Evaluation of Performance. At initial module, the input undergoes acquisition process where the various vision based tasks processes the image. Secondly, pre-processing has to be done in order to attain perfect resolution of the input image. This can be obtained by resizing the inputted image. Thirdly, a novel automated unsupervised blood vessel segmentation based methodology has been utilized to enhance the features of the image. Final module comprises of evaluating the proposed method by using various performance measures. Each and every modules have been explained in further sections.

.

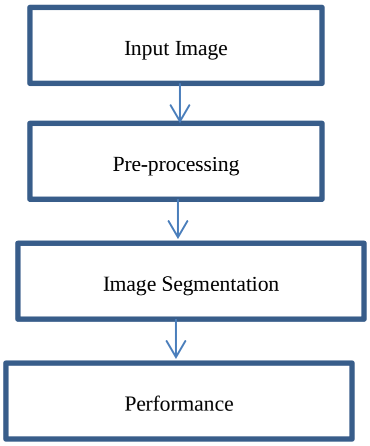

Figure 1: Block Diagram of proposed system

The preparation is more reliable because it used a trusted informative collection containing images directly from the Ophthalmologist's own compiled dataset (DIATREB). Of course, the biggest advantage is that the ophthalmologist can better assess the patient's condition. However, other shortcomings must also be considered, such as the developed system not being interactive at all or being perceived by the non-technical public. Unlike reliable fundus photography, photos taken with his mobile device can have the following drawbacks: B. Lack of clarity that can lead to misclassification.

A fundus image obtained after a screening examination serves as a basic input for the proposed method. The inner part of the retina is called the fundus. The user provides a graphical user interface (GUI) for this purpose. To upload an image, the user must first access the user interface and click the Upload Image button. Image preprocessing is then applied to this image. The photo is converted into a format required for editing or a productive format. The photo is first scaled to the desired size (e.g. 512 x 512 if necessary) and sampled. Images are converted to noise-reduced or grayscale images using color space conversion and filtering techniques such as Gaussian filtering, bilateral filtering, and grayscale conversion. Edge detection algorithms and contouring techniques are then used to properly delineate the image.

Algorithms used

1. Support vector machines (SVMs) are one of the most popular supervised learning algorithms used for both classification and regression problems. However, it is mainly used for machine learning classification problems. The goal of the SVM algorithm is to create an optimal line or decision boundary that can divide the n-dimensional space into classes, making it easier to place new data points into the correct category in the future. This best decision boundary is called a hyperplane. SVM chooses extreme points/vectors that help create the hyperplane. Such extreme cases are called support vectors, so the algorithm is called a support vector machine. Support Vector Machine (SVM) is one of the most popular supervised learning algorithms used for both classification and regression problems. However, it is mainly used for machine learning classification problems. The goal of the SVM algorithm is to create an optimal line or decision boundary that can divide the n-dimensional space into classes, making it easier to place new data points into the correct category in the future. This best decision boundary is called a hyperplane. SVM chooses extreme points/vectors that help create the hyperplane. Such extreme cases are called support vectors, so the algorithm is called a support vector machine.

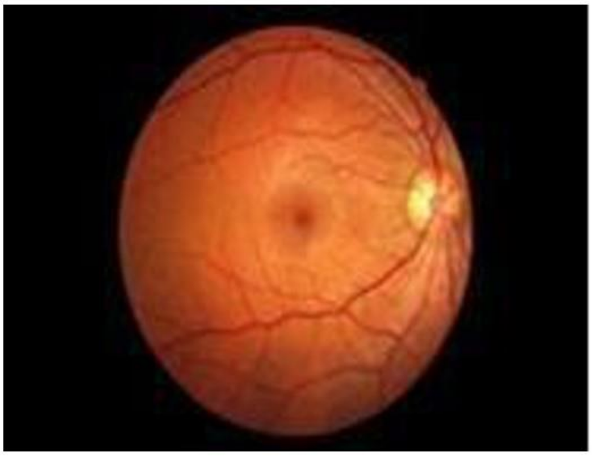

Figure 2: Rgb Image/Input Image

GRAY SCALE CONVERSION

Color Space Conversion Converting a color image into a grayscale image with amazing detail is a complex process. Contrast, sharpness, shadows, and structure in shaded images can be lost when reworked compared to grayscale images. Further counts have been proposed to support all previously specified properties of shaded images. The new computation converts the shaded image to a grayscale image using the RGB assumption, chrominance and brightness reduction and expansion. According to the computationally generated test images, the character retains the sharpness, contrast, image structure, shadows, and other elements of the shaded image well.

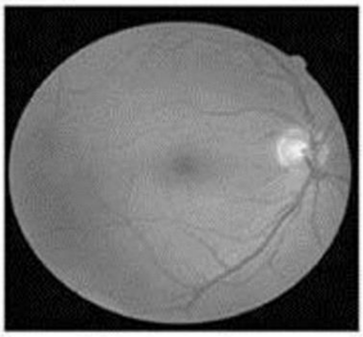

Figure 3: Grayscaling

After the image is converted to grayscale, it is sent for contour detection (also called edge detection). Here, redundant or unnecessary parts of the image that are not needed for training are detected and removed. Vessel segmentation then differentiates or identifies bleeding or dilated vessels.

3. METHODOLOGY

Insert Fundus Picture Two image databases, STARE - STructured Analysis of the Retina [19] and DRIVE - Digital Retinal Image for Vessel Extraction [20], have been used in this study project. More than 20 retinal fundus photos are included in the previous database, and 10 of those images contain problematic instances. The image is taken with a field of view of 350 using a digital camera with the name of TopCon TRV-50. The photos that are collected should have a resolution of 24 bits and 700 x 605 pixels. The pixels in the STARE pictures are manually classified as vessel or non-vessel by two observers. The thin vessels were identified by the second observer, while the first observer's identifications of the photos were used as the baseline and to assess performance.

ROI masks are not present in this database. There are 40 retinal images in the DRIVE database, seven of which are unique. The photographs are taken using a Canon CR5 3CCD non mydriatic digital camera with a field of view of 450. 768 × 584 pixels and 24 bits would make up the pixel size. The photos in this instance have been divided into training and testing components. There are 20 photos total for each part, and each image has a mask for the appropriate ROI region.

Getting input, often known as the "image acquisition stage," is the first step in every image processing process. It entails digitising and archiving the necessary image. Following the acquisition of the image, image processing operations would start. Initially, two functions called uigetfile () and imread () have been used to retrieve the picture from the source database file. Fig. 4 depicts the original coloured retinal sample image. However, if the obtained fundi picture is below the required standard.

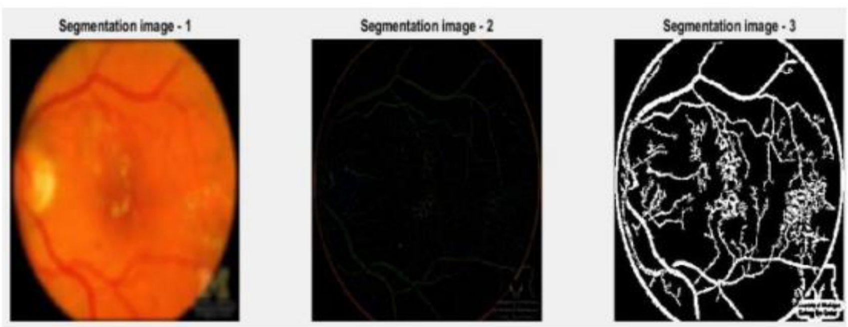

Figure. 4. Original colored Retinal image

Image Preprocessing:

Due to the wide scalable nature of the data sets and large number of image sources, these images are often considered as the artifacts which are not diagnostically applicable. In order to maintain the difficulties of these image variations and to standardize the image, image preprocessing step has to be followed. Initially, the images' pixel values should be scaled to the value in the range of 0 to 1. Then these scaled images are downsized to a standardized resolution of 512 x 512 pixel dimensions. This can be done by cropping the inner circle of the retina and placing it into a square. As scaling resizes the digital image, it is considered to be the remarkable process in image processing technology. Upon considering the vector based graphical images, the basic image should be resized using the geometrical alterations, without compromising the quality of the image.

When considering Raster graphical image, a robust fresh image should be generated with lower or higher quantity of pixels. If the number of pixels are scaled down, then the image might lose its quality. Thus the scaling of image is important in maintaining the image quality. It will enable the image segmentation by segmenting the retinal disorders of the given set of images. Image Segmentation Here, the proposed methodology implements an automated-unsupervised vessel segmentation for the retinal fundi images. The multi-dimensional based feature vector has been developed by utilizing green-channel intensity.

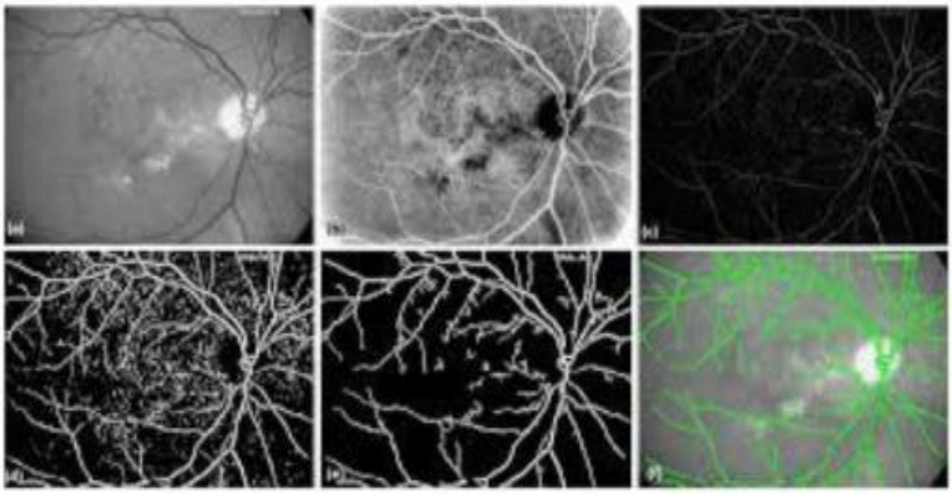

Figure 5. Segmented Retinal images

For example, the detection of exudates requires a collection of reference images which contains remarkable quantity of exudates. After the completion of training, the detection system then compare the sample image with neural network algorithm from the training set and it will detect the region of interest (ROI) of exudates in sample retinal images. Finally, the segmented images are detected to get whether they are MAs, Optic Discs, Exudates, and Hemorrhages. Figure 5 represents segmented retinal images. The morphological operations are explained below,

Dilation: This process will add the pixels to the object's boundaries in an image. The output pixel value is considered to be the highest value of all the given pixels in the neighborhood. This operation makes the objects to be more visible and can fill in small holes of the objects.

Erosion: This operation will removes the pixels on the object boundaries. Usually, the pixels that are added or eliminated from the objects of an image depends in shape and size of the structured element. In both the operations, the state of the provided pixel of any output image is evaluated by applying the respective rule of the corresponding pixel along with the neighbors in the input image.

4. RESULTS

The output of this project is the image processing method used on the provided fundus images, which can optionally be disabled. The GUI displays the input image of the patient in the interface as shown in the image below. The halalic metrics produced by the grayscale co-occurrence matrix for each image in the training data set are also shown in the following figure, and these metrics are later used for comparison with the input image metrics. In this case, the patient has proliferative diabetic retinopathy. The results are shown in the final figure below. This includes the patient's future course of action.

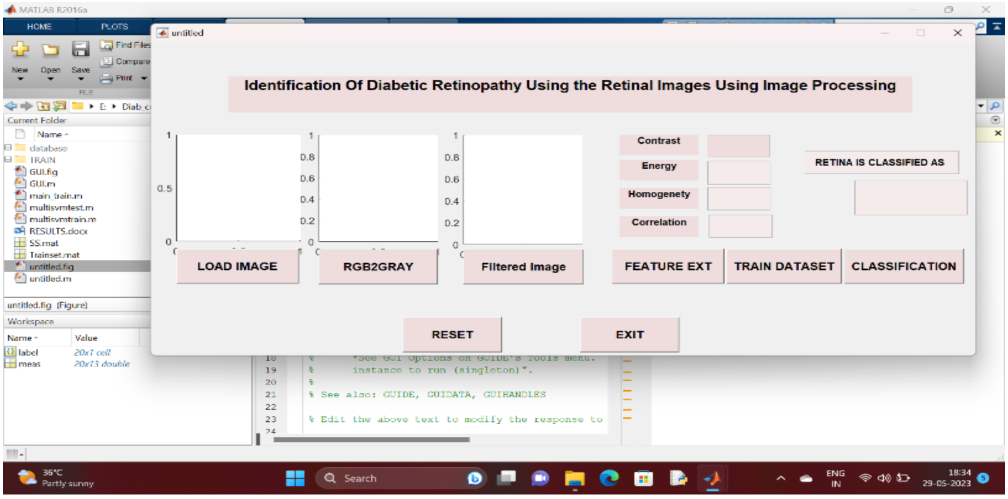

Figure 5: Gui window

This will open a tab to load the input image and select the image. Then click the "RGB2GRAY" button. The image will be converted to grayscale and proceed to the next operation.

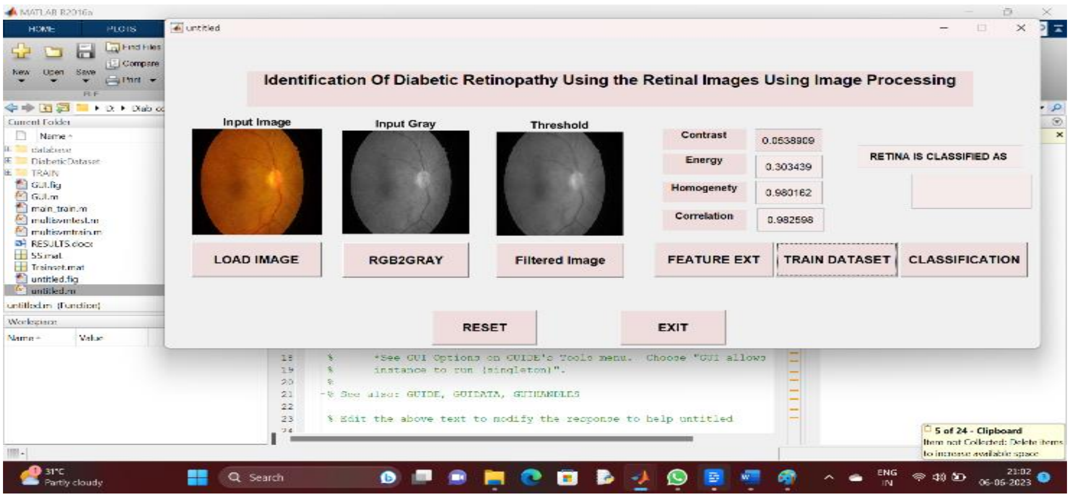

Figure 6: Conversion of Rbg2 Gray and Filtering Image

Clicking on classification here will produce output as follows:

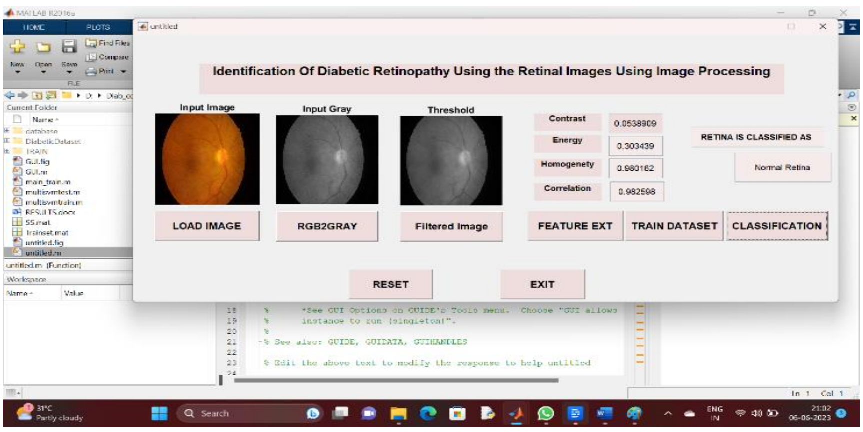

Figure 7: Final Output

5. CONCLUSIONS

The current focus of this research is to provide a graphical user interface for users/patients to use fundus images as input to the graphical user interface and to determine whether they have diabetic retinopathy from a reliable source. To be able to know more quickly. Future improvements may include applying more sophisticated algorithms such as convolutional neural systems that help organize images better than the discrete classifiers currently in use. Additionally, features such as customer service numbers and manuals should be provided in the graphical user interface to help customers unfamiliar with graphical user interfaces. Additionally, features such as helplines and user manuals should be provided in the graphical user interface (GUI) to assist users unfamiliar with current development and application usage.

References

1 A. Aquino, D. Marín, M.E.Gugendomarieuz “Detecting the optic disc boundary in digital fundus images using morphological, edge detection, and feature extraction techniques,” IEEE Trans. Med. Imag., vol. 29, no. 11, pp.1860–1869, Nov. 2012.

2 A.M. Mendonca and A.Campilho, “Segmentation of retinal blood vessels by combining the detection of centerlines and morphological reconstruction,” IEEE Trans. Med. Imag., vol.25, no. 9, pp. 1200–1213, Sep. 2009.

3 M. E. Martinez-Perez, N. D. Hughes, S. A. Thom, and S. H.Parker, “Improvement of a retinal blood vessel segmentation method using the insight segmentation and registration toolkit(ITK),” in Proc. IEEE 29th Annu. Int. Conf. EMBS. Lyon, IA,France, vol.34, pp. 892–895, Dec 2014.

4 M. Lalonde, M. Beaulieu, and W.L. Gagnon, “Fast and robust optic disc detection using pyramidal decomposition and Hausdorff-based template matching,” IEEE Trans. Med. Imag., vol. 20, no. 11, pp. 1193–1200, Nov. 2015.

5 S. Dua, T. Kandiraju, and W. Thompson, “Design and implementation of a unique blood-vessel detection algorithm towards early diagnosis of diabetic retinopathy,” in Proc.IEEE Int. Conf. in Inf. Technol., Coding Comput., vol 13. , pp. 26–31, Mar 2012.

6 T.H. Kauppi and T.Kälviäinen, “Simple and robust optic disc localization using colourdecorrelated templates,” in Proc. 10thInt. Conf. Advanced Concepts for Intell. Vision Syst., Berlin, Germany: Springer-Verlag, vol 7, pp. 719–729, Apr 2008.

7 Gladence, L. Mary, M. Karthi, and V. Maria Anu. "A statistical comparison of logistic regression and different Bayes classification methods for machine learning." ARPN Journal of Engineering and Applied Sciences 10, no. 14 (2015): 5947-5953.

8 Sethuraman, R., Sneha, G., Swetha Bhargavi, D. "A semantic web services for medical analysis in health care domain" 2017 International Conference on Information Communication and Embedded Systems, ICICES 2017.

9 Sanchana, V.B., Renuga, S., Saravanan, M.,” A novel approach for efficient data handling in cloud environment “, ARPN Journal of Engineering and Applied Sciences. Vol. 11 No. 17,2016