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Diabetic Retinopathy Detection using Fundus Image

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Abstract:

The investigation of clinical reports suggested that more than ten percent patients with diabetes have a high risk of eye issues. Diabetic Retinopathy (DR) is an eye ailment which influences eighty to eighty-five percent of the patients who have diabetes for more than ten years. The retinal fundus images are commonly used for detection and analysis of diabetic retinopathy disease in clinics. The raw retinal fundus images are very hard to process by machine learning algorithms. In this paper, pre-processing of raw retinal fundus images are performed using extraction of green channel, histogram equalization, image enhancement and resizing techniques. Fourteen features are also extracted from pre-processed images for quantitative analysis. The experiments are performed using Kaggle Diabetic Retinopathy dataset, and the results are evaluated by considering the mean value and standard deviation for extracted features. The result yielded exudate area as the best-ranked feature with a mean difference of 1029.7. The result attributed due to its complete absence in normal diabetic images and its simultaneous presence in the three classes of diabetic retinopathy images namely mild, normal and severe.

Keywords: **Diabetic retinopathy; image processing; retinal fundus images; feature extraction ,exudate area**

I. INTRODUCTION

There are various factors a detecting the disease like age of diabetes, poor control, pregnancy but Researches shows that progression to vision impairment can be slowed or averted if DR is detected in early stage of the disease. One can see large no. of population suffering from the disease but still testing is done manually by trained professionals in real life which is quite time taking and lengthy process and usually due to miscommunication and delayed results eventually leads to delayed treatment and ignorance. So aim of the project is to provide a a automated, suitable and sophisticated approach using image processing and pattern recognition so that DR can be detected at early levels easily and damage to retina can be minimized Diabetic Retinopathy is one of the leading causes of Blindness. An estimated 346 million people worldwide have diabetes mellitus (DM) with more than 80% of those affected living in low and middle-income countries. Diabetic retinopathy (DR) and diabetic maculopathy (DMac) are the most common micro vascular complications of diabetes mellitus and remain the leading cause of legal blindness in the working-age population in western societies. Despite all efforts to diagnose DM early and treat aggressively in order to prevent complications later, over 60% of patients will develop some degree of DR/DMac within 20 years of diagnosis. Unfortunately, around 40% of patients already have established DR at the time of diagnosis. DR is a progressive disease; diagnosing it early provides the best chance to treat effectively and to maintain good vision. In any Diabetic Retinopathy diagnosis program, the total time taken is 10 minutes for dilation and approximately 10 minutes for diagnosis by a human expert. Thus this is a time consuming and laborious process. With the advent of computers, many of the diagnosis tasks are facilitated using some kind of image processing algorithms or the other. This has resulted in faster, accurate, and reliable diagnosis. In this work, we are focusing on optimizing the diagnosis period which may be of utmost useful during camp programs on Diabetic Retinopathy screening and also during day to day 2 routine work. To do so, we are trying to develop software for the automated diagnosis of Diabetic Retinopathy using fundus images. Automatic screening will help the doctors to quickly identify the condition of the patient in a more accurate way. The macular abnormalities caused due to Diabetic Retinopathy can be detected by applying morphological operations, filters, thresholds and other image processing techniques on the fundus images of the

II. LITERATURE REVIEW

The result of the paper review indicates that diabetic retinopathy affects approximately two-fifth of the population who identify themselves as having DM [9]. Harding et al. first detected diabetic retinopathy by screening the eye structure of normal and diabetic patient using ophthalmoscope screening tool. The specificity and sensitivity obtained were 97 and 73 percent respectively [5]. The normal features of the fundus images included the optic disc, fovea and blood vessels. The main abnormal features of diabetic retinopathy included exudates and blot hemorrhages [6]. Philips et al. first performed exudates detection and identification. Three strategies namely thresholding, edge detection, and classification were deployed for exudate detection. Global and local thresholding values were used to segment exudates lesions. The sensitivity and specificity calculated were 100% and 71%, respectively [10]. The significant pros found out for single-field fundus photography as explained by trained readers is its potential to detect retinopathy. The sensitivity for it varies from 61% to 90%, and specificity falls in the range between 85 to 97 percent" [11]. Optical disk boundary is extracted using the red and green channel. The location methodology succeeded in 99% of cases. Segmentation algorithm rendered automated segmentations and true OD regions of 86% [12]. Ravishankar et al. proposed a new methodology for optic disk detection where they first identified the major blood vessels and used the bifurcation of these to find the approximate location of the optic disk. Many classifiers have been tested including Fuzzy C-means clustering, SVM, Neural Networks, PCA, and simple Bayesian classification[13]. GG Gardener et al. used a back propagation neural network. The feature selected for the detection were exudates area, blood vessel area, hemorrhages area, edema and microaneurysms area. It was performed by analyzing images of one hundred forty-seven patients with DR and thirty normal retinal images with exudates, retina with hemorrhages or microaneurysms, retinal images without blood vessels and retinal images containing blood vessels. The result showed the specificity and sensitivity values to be 88.4 and 83.5 respectively [14]. Mookiah et al. proposed a new methodology for the fully automatic classification of all the retinal fundus images into various classes by forthwith identifying the blood vessels and hard exudates. The features taken into account were mainly area, Shannon entropy, Kapur entropy, and bifurcation point between two blood vessels. To extract the textual features, they used the concept of Local Binary Pattern (LBP). It was observed that C4.5, a type of decision tree achieved an accuracy of 88.46% whereas SVM with linear kernel achieved an accuracy of 77.56%.The results also showed a specificity and sensitivity value of 95.7 and 94.2 respectively. Akara et al. proposed an exudate detection method based on mathematical morphology on retinal images of non-dilated pupils for low-quality images [15]. The standard deviation of the stimulus showed the main characteristics of the closely distributed cluster of exudates which was obtained using local variation operator for the preprocessing result. The sensitivity and specificity value for exudate detection were found to be 80% and 99.5%, respectively [16]. Xiaohui et al. proposed a solution for the three main difficulties in the detection of MA and that of the non-uniform illumination and interference of similar objects. The KPCA yielded a better result than PCA for SVM classifier. When the number of FP left is 2 per image, KPCA successfully obtained 90.6% True Positive [17]. Judah et. al. took the extracted feature from the image and segmented it by applying SVM and KNN classifier for classifying the image according to its severity grade[18]. Alireza et al. proposed a segmentation based on a combination of color representation in Luvs color space and an efficient coarse to fine segmentation using fuzzy c-means (FCM) clustering. They took advantage of retinal color information toward our objectives and showed the improvement obtained by gray-level-based techniques. The FCM clustering yielded an accuracy of 85.6% and a sensitivity value of 97.2 and specificity of 85.4 [10].

In this paper, we are presenting the preprocessing retinal fundus images, feature extraction steps followed for feature ranking. This paper also includes exudate elimination, optic disc elimination, contrast enhancement, extraction of green channel and MA and hemorrhage detection.

III. METHODOLOGY

Method used in this project can be classified in two steps

Image Processing and Feature Extraction Supervised learning

3.1Image Processing and Feature ExtractionThis is the most important step of the project as textures obtained will be taken as input material for neural nets which will classify the images in their respective classes.

3.1.1 Image compression

As one can see there are different types of images in dataset with different resolution, different camera quality and different sizes My work is to classify them in different classes. So first problem I faced was related to heterogeneity of the dataset. For this compressed all my training and test images in 256*256 format.

3.1.2 Layer separation

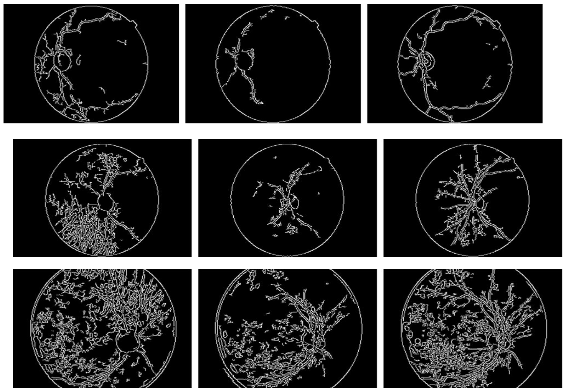
In later parts we are going to use 6 features as input to classi er namely Red layer of parameter, Blue layer of parameter, Green layer of parameter, Red layer of area, Green layer of area, Blue layer of area so in this step all 3 layers of namely Red, Green and Blue are separated from the images.

3.1.3 Equalization

After last step there are large intensity variations in the image and one can see that veins and other eye features are not clearly seen there. For making intensity variations uniform I applied histogram equalization to the image. Histogram equalization is technique which identifies various intensity variations in the given image and increases its global contrast. For equalization I tried both Histogram Equalization and Contrast Limited Adaptive Histogram Equalization but Contrast Limited Adaptive Histogram Equalization giving a little better features than simple one. So in this step I have used CLAHE object for equalization purpose.[2, 3, 6, 7]

(a) Red Layer (b) Blue Layer (c) Green layer

3.1.4Morphological operations In this part various morphological operations are employed to enhance blood vessels and to remove noise in the background. I used method proposed in (use cite here) to enhance to required features. Blood vessel rupture are main element of the disease DR. So it is important to extract and distinguish them from the background and remove background noise as much as possible. Two types of structuring elements are used in this step.[2, 8]Diamond like structure(for clearer veins) Disk like structure(to remove noise)For this part I have used morphological openings. In this part I rst used disc SE with R=5 then I used diamond of R=3.



3.1.5Feature extraction

This is final image processing step. In this step I will rst extract perimeter from all three layers and then extract area of three layers.

Canny edge detection

In this step we proceed towards finding perimeters of all 3 layers. This is done by canny edge detection. In canny edge detection gaussian filters are applied then using double threshold edge of intensity variation part is detected.[2, 3, 9]

IV. CONCLUSION

Diabetes is a chronic disease which is a serious concern in recent years. On the other hand, the human eye is ametabolically active organ means the blood affected by diseases is sure to affect the eye at the early stages and diabetes is one of such kind of disease. If the severity of diabetes is more, there is a chance of blindness.

Therefore, at the early stage detection is essential for processing of diabetic retinopathy conditions. diabetic retinopathy (Mild), Moderate diabetic retinopathy and diabetic retinopathy (severe) and is aimed at helping ophthalmologists to detect early symptoms of diabetic retinopathy with ease.

The proposed strategy can manage different sources of input which can be far superior to handle vulnerability during the investigating period. This present framework can be extended by expanding the number of inputs. Therefore, This Technology will have a great impact in future and will be beneficial for Society.

SIGNIFICANCE STATEMENTS

This study discovers the easier, faster and cheaper way to it is detect diabetic retinopathy. It is beneficial for the society as it is possible to detect diabetic retinopathy with only two of the nine tests available. The patient can opt for more tests for better clarity if the first two show normal eye according to our. This system also shows the level of severity of diabetic retinopathy i.e.

a) Normal eye

b) Mild diabetic retinopathy

c) Moderate diabetic retinopathy

d) Severe diabetic retinopathy

This study will help the researcher to uncover the critical faster detection of diabetic retinopathy which usually

V. REFERENCES

[1]kaggle Challenge Diabetic Retinopathy Detection. https://www.kaggle. com/c/diabetic-retinopathy-detection

[2]Wong Li Yun , U. Rajendra Acharya, Y.V. Venkatesh, Caroline Chee, Lim Choo Min, E.Y.K. Ng Identi cation of di erent stages of diabetic retinopathy using retinal optical images. July 2007

[3]Jagadis h Naya k, P Subba nna Bhat, Rajen dra Achar ya U,C. M. Lim, Manjunath Kagathi Automated Identification of Diabetic Retinopathy Stages Using Digital Fundus Images November 2007

[4]Diabetic Retinopathy http://en.wikipedia.org/wiki/Diabetic_ retinopathy

[5]Starter code Startercode,http://bit.ly/1Eefvvd

[6]Equalizationhttp://en.wikipedia.org/wiki/Histogram_ equalization

[7] Morphological operations http://opencv-python-tutroals. readthedocs.org/en/latest/py_tutorials/py_imgproc/ py_morphological_ops/py_morphological_ops.html# morphological-ops

[8]Canny edge detection http://opencv-python-tutroals.readthedocs.

[10] Thresholding http://opencvpython.blogspot.in/2013/05/ thresholding.html