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Diabetic Retinopathy Diagnosis Using Image Mining

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Abstract - *Diabetic Retinopathy is an eye problem that can cause blindness. It occurs when sugar level in blood increases, blood vessels in the back of the eye becomes weak and because of this vessel leaks the blood and lipoproteins fluid. Signs of Diabetic Retinopathy are floating spot in vision and blocked vision. If we detected early the sign of Diabetic Retinopathy then may be able to prevent additional vision loss. The main motivation is to identify the input image is normal or abnormal. When the input image is found abnormal then analysis for further DR stages is done. To identify abnormal image there are various techniques and methodology used in image mining. Image mining is an extension of data mining technique. Most of the image processing algorithms are used in image mining for preprocessing. Preprocessing Stage is one of the most commonly used in image processing for image enhancement. Features are extracted when detecting exudates. After extracting the features, classification algorithms are used. After that result is obtained and result will display that image how much normal or abnormal. Now a days web based systems are mostly useful as compare to stand alone system. If we implement web based system for detection of diabetic retinopathy, it is beneficial for rural patients and it is also save the time and money of diabetic patients.*

Key Words: Diabetic Retinopathy, Lipoproteins, Image Mining, Pre-processing, Exudates.

1. INTRODUCTION

Diabetic Retinopathy is an eye problem that can cause blindness. Small blood vessels in the back of the eye called as retinal blood vessels. Signs of Diabetic Retinopathy are floating spot in vision, blurred vision and blocked vision. When sugar level in blood increases, blood vessels in the back of the eye becomes weak and because of this vessel leaks the blood and lipoproteins fluid. After that fluid become floating spot in vision so that Diabetic patient can not see anything completely through the vision. If we do not do the treatment of this disease on the time then it may be possible of complete vision loss or blindness. If we detected early the sign of Diabetic Retinopathy, it is possible to prevent additional loss of vision.

Four stages of Diabetic Retinopathy are as follows: First stage is known as Mild Non-Proliferative Diabetic Retinopathy (Mild NPDR). In this stage, there will be balloon like swelling in the blood vessels in the retina and small balloon like swelling in the blood vessels known as Microaneurysms.

Second stage is known as Moderate Non-Proliferative Diabetic Retinopathy (Moderate NPDR). In this stage, some of the blood vessels in the retina will become blocked.

Third stage is known as Severe Non-Proliferative Diabetic Retinopathy (Severe NPDR). In this stage, more blood vessels are blocked that's why the areas of the retina will not receiving enough blood. Without proper flow of blood, the retina will not grow new blood vessels and to replace the damaged blood vessels.

Fourth stage is known as Proliferative Diabetic Retinopathy (PDR). This is advanced stage. New blood vessels will begin to grow in the retina, but they will be weak blood vessels. So weak blood vessels can leaks blood and lipoproteins fluid. In this stage chances of completely blindness increases.

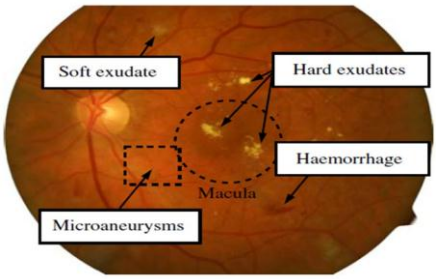

Fig -1: Eye fundus images showing Haemorrhages, Microaneurysms and Exudates (Hard and Soft)

Microaneurysms are small red dots on the surface of retina. If balloon like Swelling is occurred in the retina's blood vessels and blood vessels are blocked then we can say that these are microaneurysms. Exudates are yellow or white type of structure in the retina. There are two kinds of exudates and they are appears depending on their presence or occurrence in the vision. Hard exudate have boundaries and soft exudate have no boundaries or we can say that unclear boundaries also known as cotton wool spots. Haemorrhages occur due to bleeding and it appear as small

dot. Dot Haemorrhages are an indication of diabetic retinopathy.

Steps for detection of Diabetic Retinopathy:

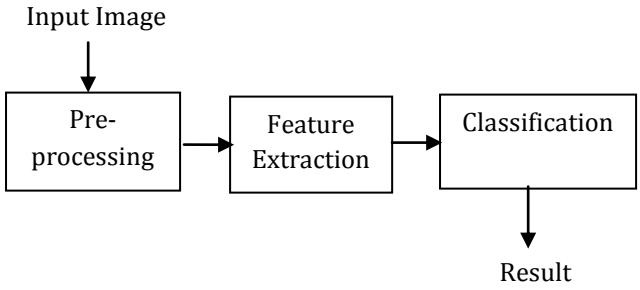

Fig -2: Steps for Detection of Diabetic Retinopathy

2. LITERATURE SURVEY

"Karkhanis Apurva Anant, et al. [1]", Diabetic Retinopathy Analysis using Image Mining to Detect Type 2 Diabetes. This paper, mainly focus on detection of DR. DR come under type 2 diabetes. Type 2 diabetes is a familial disease. The diabetes may cause abnormalities in the retina (Diabetic Retinopathy), kidney (Diabetic nefropathy), and nervous system (diabetic neuropathy). It used Standard Database DIARETDB1 and HRF. It consists of DR and normal images. The images taken by digital fundus camera. 1500 * 1152 is Resolution of color fundus image. In preprocessing, images are resized into 512*512. After that Green channel is used. DWT and GLCM are used for feature extraction. Authors has proposed wavelet and texture features for classification. And classification done by using KNN classifier. This classifier classifies input image as normal or abnormal by calculating the Euclidean Distance between the images. The performance parameters are Sensitivity, Specificity and PSNR. The obtained binary image is given to DWT and GLCM for extracting the frequency domain features and texture features. Combination of DWT and GLCM features is used for evaluation using sensitivity, specificity parameters.

"Neelam D. Panse, et al. [2]", Glaucoma and Diabetic Retinopathy Diagnosis using Image Mining. Author has mainly focus on detection of Glaucoma and Diabetic Retinopathy. Glaucoma can be detected by cup to disc ratio (CDR). Diabetic Retinopathy can be detected by Exudates, Hemorrhages, Microneurysms and Cotton Wool Spots. RGB images is converted into YCbCr. Y plane is used for detection of blood vessels, optic disc and exudates. After candy edge detection, image will converted into binary to perform Skeletonization operation. DCT is used for feature extraction. Author has proposed DCT (Discrete Cosine Transform) for feature extraction. Extracted feature goes to SVM classifier. After that SVM Classifier categories into Normal, DR and Glaucoma.

"R. Radha and Bijee Lakshman [3]", Retinal image analysis using morphological process and clustering technique. This paper proposes a method for the Retinal image analysis through efficient detection of exudates and recognizes the retina to be normal or abnormal. Morphology operators are applied to the enhanced image in order to find the retinal image ridges. A simple thresholding method along with opening and closing operation indicates the remained ridges belonging to vessels. The clustering method is used for effective detection of exudates of eye.

"R. Priya, P. Aruna [4]", SVM and Neural Network based Diagnosis of Diabetic Retinopathy. Automated diagnosis system of diabetic retinopathy have been performed by using a set of 250 images which is a combination of normal, NPDR and PDR affected images. In this, Probabilistic Neural Network (PNN) and Support Vector Machine (SVM) are used for diagnosis of Diabetic Retinopathy. The DR has been classified into two categories NPDR and PDR using PNN and SVM. So SVM performance is better than PNN from obtained results.

"Praveen S Palegar, Dr K. S. Prabhushetty [5]", Comparative Study of segmentation techniques in Diabetic Retinopathy Detection. For detection of Diabetic Retinopathy, has three methods like color Histogram Thresholding, Probabilistic Neural Network (PNN), and Support Vector Machine (SVM). All the three techniques used for the classification were good in performance, but from the results it is clear that the performance of Color Histogram Thresholding is better than PNN and SVM. Performace parameter evaluated by using Sensitivity, Specificity and Accuracy.

"Mahendran Gandhi, Dr. R. Dhanasekaran [6]", Diagnosis of Diabetic Retinopathy Using Morphological Process and SVM Classifier. In this, Diagnosis of diabetic Retinopathy using morphological operations like erosion followed by dilation for detection of exudates. After that GLCM features are calculated. Before that they have used preprocessing operation like enhancement operation. After feature extraction image get segmented and which was applied to classifier to classify the image according to its severity grade. In this SVM classifier is used to classify images into different cases like mild, moderate or severe.

"SujithKumar S B*, Vipula Singh [7]", Automatic Detection of Diabetic Retinopathy in Non-dilated RGB Retinal Fundus Images. Author has mainly focus on a method for automatic detection of microaneurysms in digital eye fundus image. Diabetic Retinopathy is detected by identifying microaneurysms digital retinal fundus image. Different preprocessing, feature extraction and classification algorithms are used. The

performance of the automated system is based on their Sensitivity and Specificity.

"Bethanney Janney.J, et al. [8]", Detection and classification of exudates in retinal image using image processing techniques. Author has proposed an algorithm for automatic exudates detection by using Fuzzy 'C' Means (FCM) algorithm. In preprocessing stage of exudates detection including image resizing, noise removal and contrast improvement is performed. Canny edge detector is also applied to find exudates. Feature extraction based on Gray Level Co-occurrence Matrix (GLCM) technique is implemented. Fuzzy 'C' Means (FCM) algorithm and K-Nearest Neighbor (KNN) classifier are used for classification of retinal exudates types.

"Priya R, Aruna. P [9]", Review of automated diagnosis of diabetic retinopathy using the support vector machine. The main stages of diabetic retinopathy are Non-proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopathy (PDR). Author has proposed an approach for the detection of diabetic retinopathy stages using color fundus images. The features are extracted using the image processing techniques and then SVM classifier is used for classification. The results displayed a sensitivity of 99.45% for the classifier and specificity of 100%.

"Shraddha Jalan, A. A Tayade [10]", Review paper on Diagnosis of Diabetic Retinopathy using KNN and SVM Algorithms. In this paper author has mainly focus on automatic detection of Diabetic Retinopathy through detecting exudates in color fundus retinal images and also classify the lesions. Discuss on various methods available to detect the exudates. Making of decision for the severity level of disease was performed by collaborating KNN and SVM classifier which gives more accuracy and reduces the time of detection of DR.

"R. F. Mansour, et al. [11]", Identification of Diabetic Retinal Exudates in Digital Color Images Using Support Vector Machine. In this proposed system, the algorithm is based on analysis of Discrete Cosine Transform (DCT) and SVM makes use of color information to perform the classification of retinal exudates. Evaluation of the algorithm based on their performance using a database containing 1200 retinal images with variable color, brightness, and quality. Result can be achieve through accuracy, sensitivity and specificity to identify the images containing any evidence of Diabetic Retinopathy.

"Mr. Pratap Vikhe, Ms. Preeti Mistry, et al. [12]", Automatic Detection of Diabetic Retinopathy Level Using SVM Technique. Author has mainly focus on automated system for the detection of Diabetic Retinopathy using fundus images, by extracting features such as Area of blood vessels, Area of Exudates and Texture Features. The selected features are trained and tested using Support Vector Machine to classify the disease stages as normal, Background or Non-Proliferative Retinopathy (NPDR) and Proliferative Retinopathy (PDR).

"Madhura Jagannath Paranjpe, Prof. M N Kakatkar [19]", Automated Diabetic Retinopathy Severity Classification using Support Vector Machine. Author has focus on determination of three important types of Diabetic Retinopathy, Macula Edema, Hemorrhages and Exudates. These type can be extracted using image processing technique. In this color fundus image as input goes to Gray Scale Conversion and then median filtering. Before feature extraction Histogram equalization and thresholding are used. When features are extracted then SVM classifier is used and then it detect Macula Edema, Hemorrhages and Exudates.

3. CONCLUSION

The main motivation of this system is to provide reliable and accurate features so that we can save the time and money of diabetic patients. If we implemented this type of system then it can reduces the burden of the Diabetes specialist.

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