A SURVEY ON METHODS OF AUTOMATIC DETECTION OF
DIABETIC RETINOPATHY

Swati Gupta
Research Scholar, Department of Computer Science & Engineering, Shri Ramdeobaba College
of Engineering & Management, Nagpur

A.M. Karandikar
Assistant Professor, Department of Computer Science & Engineering, Shri Ramdeobaba College
Of Engineering & Management, Nagpur

ABSTRACT

Diabetic retinopathy is the most common diabetic eye disease and a leading cause of blindness. It is caused by changes in the blood vessels of the retina. In this paper, we provide overview of a computer based approach for the detection of diabetic retinopathy using retinal images. There are many features present in retina but the exudates feature which is one of the primary signs of diabetic retinopathy and which is a main cause of blindness that could be prevented with the help of this automatic detection process. In feature extraction Pupil dilation is important step in the normal screening process but this affects Diabetes vision. The automatic detection process reduces examination time, and increase accuracy. In this paper provide review on many techniques and algorithms that helps to diagnose Diabetic Retinopathy in retinal fundus images. This paper also reviews, classifies and compares the algorithms and techniques previously proposed in order to develop `better and more effective algorithms.

Keywords- Diabetic Retinopathy, Fundus images. Exudates. Retinal blood vessels.
INTRODUCTION

Diabetes is one of the primary causes which result in blindness. Every year an estimated 65–70 new cases of blindness per 100 000 occurs. Early detection required laser therapy to be performed to prevent or delay visual loss and may be used to encourage improvement in diabetic control. Recent report presented that Diabetic retinopathy is responsible for 4.8% of the 37 million cases of blindness due to eye diseases throughout the world. After 15 years, about 2% of persons with diabetes will become blind, and about 10% will develop severe visual loss. After 20 years, more than 75% of patients will have some form of DR. Due to leakage of blood and other fluids that cause swelling in retinal tissue and gives cloudy vision. The condition usually affects both eyes. Diabetic retinopathy is of two type namely non proliferative (NPDR) and proliferative (PDR) type. NPDR is the early stage of the disease characterized by the presence of micro aneurysms. As the disease progresses the retina is deprived of oxygen and new blood vessels are formed in the retina. These vessels eventually leak and leads to clouding vision. Micro aneurysms are small red dots on the fundus image which occur due lack of oxygen and progression of the disease. Accumulation of proteins and lipids occur in the form of exudates. In the retina exudates appear as yellow or white structures. Exudates are classified into two type that are Hard exudates have well defined boundaries and the soft exudates have unclear boundaries. Hemorrhages in the retina occur due to bleeding. Dot hemorrhages lie deep within the retina and reflect leakage of the veins and capillaries.

Figure 1: Diabetes Features In Defected Human Eye
REVIEW OF METHODS

Mahendran Gandhi et. al. [1] This paper follow the RGB to grey scale image conversion then preprocessing and morphological operations are applied on the preprocessed images for the exudates feature detection and then segmentation operation is carried out. Severe risk assessed for the degree of abnormality of an image using machine learning classifier. This machine learning classifier (SVM) is used to evaluate training data to find a best way to classify images into different cases like moderate or severe. In this paper, the evaluation of the automated diagnosis system of diabetic retinopathy has been performed by using a set of 5 images captured by retinal fundus cameras. And this result was matched with that manually outlined by the ophthalmologist.

Dr. R. Geetha Ramani et. al. [2] have presented a comparative approach. This paper used two algorithms that are C4.5 Decision Tree Algorithm and Random Tree Algorithm. Both This Algorithms, were used for comparative classification. The accuracy of both the classifier is as follower: For Decision Tree 72.5% accuracy and Random Tree 65% accuracy

Anderson Rocha et. al. [3] In this without requiring specific pre or post-processing they presented identifying both red and bright lesions in Diabetic Retinopathy images. For diagnosis the proposed approach requires pinpointing the location of each lesion to allow the specialist to evaluate the image. Fundus images are classified as normal or Diabetic Retinopathy related pathology based on the presence or absence of these PoIs. Area under the curve (AUC) of 95.3% and 93.3% is achieved for white and red lesion detection using fivefold cross validation.

LI Yafen et. al. [4] have proposed a new method using different image processing techniques such as image enhancement, morphological image processing and texture analysis. For the classification purposed SVM classifier used. It gives accuracy of 89%, the sensitivity 90% and specificity 95%. This paper worked on accuracy of classifier and for that they using Directdb dataset for fundus image.

M. Usman Akram et. al. [5] In this paper by using filter banks different system are proposed for early detection of Mas. In retinal image the proposed system extracts all possible candidate regions for Mas present. A feature vector depending upon certain properties, i.e. shape, intensity and statistics is formed to classify a candidate region as MA or non-MA. In this a hybrid classifier which combines the Gaussian mixture model (GMM), support vector machine (SVM)
and an extension of multi-model mediod based modeling approach to improve the accuracy of the system. Using a hybrid classifier the true MA regions are selected and classified. It was weighted combination of multivariate m-Mediods, GMM and SVM classifier.

Luca Giancardo et al. [6] they proposed a new methodology for diagnosis of Diabetic macular edema (DME) using a novel set of features based on color, wavelet decomposition and automatic lesion segmentation. The method proposed for the DME diagnosis is based on the classification of single feature vector generated for each image. The feature vector is based on three types of analysis: Exudates probability map, Color Analysis and Wavelet Analysis. These features are employed to train a classifier able to automatically diagnose DME through the presence of exudation.

Atul Kumar et. al. [7] This paper used the implementation of the method that segment the exudates from the image using feature based segmentation. The methodology is composed of morphological operation with the SVM algorithm. Image pre-processing is the first step to enhance the image for better analysis. Then morphological operation is implemented to localize the optic disk from the retinal fundus image. The SVM classifier uses these extracted features for classifying the exudates. The results of the algorithm is compared with expert hand-drawn ground-truths. The proposed method has achieved sensitivity and specificity as 97.1% and 98.3% respectively.

Jagadish Nayak et. al. [8] Proposed comparative classifier using two classifier that are Bayesian statistical classifier and Artificial neural network for classification. In this paper used neural network for classification of severity of deceases and it gives better result than Bayesian statistical classifier.

Fangyan Nie et al. [9] introduced a novel two-dimensional variance thresholding scheme to improve image segmentation. 2D variance-based techniques using spatial as well as pixel information have been proposed. This scheme uses 1D summation. It is almost as fast as the original 1D variance-based algorithm. In this scheme, the gray levels of the pixels and the local average gray level of the neighborhood pixels form a 2D histogram. Experimental results on bi-level and multilevel thresholding for synthetic and real-world images demonstrate the proposed image thresholding scheme performs well compared with the Otsu method, 2-d Otsu method and the minimum class variance thresholding method.
Jen-Hong Tan et al. [10] Proposed a Five different texture features such as homogeneity, correlation, short run emphasis, long run emphasis, and run percentage were extracted from the digital fundus images. These features were fed into a support vector machine classifier (SVM) for automatic classification. And the proposed system gives unknown class with an accuracy of 85.2%, and sensitivity, specificity 98.9%, 98.5% respectively using SVM classifier. They Proposed a network for the detection of feature. Gaussian and Gabor filter for the blood vessel detection

Keerthi Ram et al. [11] In this paper they mainly focused on clustering based methods to segment the exudates like feature in fundus image. And extract the features were multi space and color space feature. In this paper mainly focus on processing time factor so, due to this its speed is faster than any other techniques. In this it archives accuracy up to 89.7% and gives positive prediction values gives 87%.

C.JayaKumari, and R.Maruthi [12] they used a contextual clustering algorithm to detect the presence of hardexudates in the fundus images. After the pre-processing stage, the proposed algorithm has been applied to segment the exudates. Features extracted from the segmented regions are like the standard deviation, mean, intensity, edgestrength and compactness. These extracted features are given as inputs to Echo State Neural Network (ESNN) to discriminate between the normal and pathological image. A dataset consists of a total of 50 images have been used.

AlizeOsarehet. al. [13] developed an approach to detect the feature in fundus images all preprocessing techniques apply on color image. In this segmentation process is carried out using fuzzy. They used genetic based algorithm for feature extraction and also used C-mean for clustering purposed. This algorithm gives 90% accuracy and 92.1% sensitivity. This paper gives more realistic measurements than previous one. But this algorithm takes lots of time to generate result.

**CONCLUSION**

Different types of classifier and its performance are analyzed for the automated diagnosis of diabetic retinopathy from the features extracted. Performance analysis of various classifiers is done in terms of sensitivity, specificity analysis. There are several detection algorithms that have already been developed and proposed which perform satisfactorily. This survey paper can act as
a resource for the future researchers interested in automated detection of abnormal signs of diabetic retinopathy and help them to get an overview of this field in order to develop more efficient algorithms.

REFERENCES


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