Diabetic Retinopathy Disease Extraction using Digital Image Processing Techniques – A Review

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ABSTRACT:
The human eye is a structure which gives a sense of sight. Diabetic Retinopathy is an eye disease which gives a leading cause of blindness in India. Diabetic Retinopathy is a disease in which the retinal blood vessels swell and it also may leak. This damages the retina of the eye and may lead to vision loss if the level of diabetes is very high. Primary diagnosis of Diabetic Retinopathy can stop vision loss in patients. The researcher proposed the algorithms for detection of Diabetic Retinopathy disease, Microaneurysms, Hemorrhages and Exudates etc. These types can be extracted using fundus images of patients and processing these fundus images through an appropriate image processing technique.

I. INTRODUCTION
Diabetic Retinopathy (DR) is an eye disease which happens due to diabetes. It damages the small blood vessels in the retina which causes the loss of vision. The risk of the disease increases with age and therefore, middle aged and older diabetics. The National Eye Institute estimates that 40 to 45 percent of Americans having diabetes are exaggerated by diabetic retinopathy due to which around 24,000 people become blind every year. Symptoms of diabetes retinopathy do not surface until visual damage to the retina has arisen, usually by partial vision. Therefore consistent eye screening is necessary to provide early diagnosis and treatment before substantial damage is caused to the retina as it potentially reduce the risk of blindness in these patients by 50%. An early detection of DR allows laser therapy to be performed to stop or delay visual loss and may be used to encourage enhancement in diabetic control. Therefore an automatic detection and treatment of the diabetic retinopathy in an early stage can avoid the blindness [1].

Diabetic retinopathy (DR) is the most common microvascular complication of diabetes and can lead to several retinal abnormalities including microaneurysms, exudates, dot and blot hemorrhages, and cotton wool spots. Automated early detection of these abnormalities could limit the rigorousness of the disease and help ophthalmologists in exploring and treating the disease more efficiently. Segmentation of retinal image features provides the basis for automated assessment. In this study, exudates lesion on retinopathy retinal images was segmented by different image processing techniques [2]. Diabetic Retinopathy is an eye disease that cause haemorrhage in retinal nerves of the eye which indications to blindness if not treated earlier with correct care. This disease is caused mainly for diabetic patients. Present work is mainly for computerized diagnosis of diabetic retinopathy from digital fundus images and fluorescein angiography images of eye retina. In this study, the diabetic retinopathy is discovered from the fundus images and fluorescein angiography images of the eye retina with image segmentation techniques [3]. The diabetic retinopathy lesions are extracted with the help of 2-D Gabor wavelet and for classification Support Vector Machine is used [4]. Retinal image analysis using mobile phones is also addressed as an expected future trend in this field [5]. Diabetics is a fast increasing worldwide problem which is characterized by defective metabolism of glucose that causes long-term disorders of various organs of human body. Diabetic Retinopathy (DR) is a most common complication of diabetes. Currently it is the primary causes of blindness and visual impairment in adults. This can be prevented if diagnosed and treated in its early stages by detecting the Microaneurysms (MAs) and Exudates in the retina of the diabetic patient. The proposed work develops an efficient system for ophthalmologist to analyze the MAs and exudates. The abnormalities in the captured color fundus image is detected using digital image processing techniques by applying morphological, etc., The extracted features are used to detect the severity of DR with accuracy of 94% [6]. Diabetic Retinopathy is the most common vision frightening complication of diabetes which is primarily caused by prolonged and uncontrolled blood sugar levels. The early sign of Diabetic Retinopathy is the exudates. Morphology methods help to eliminate normal features of the retinal image to detect abnormal features that leads to Diabetic Retinopathy. The proposed work is focuses on the diagnosis of Diabetic Retinopathy through the detection of exudates by eliminating optic disc, macula and blood vessels from the retinal fundus image using Mathematical Morphology Methods [7]. Diabetic retinopathy does not
show any symptom of the disease till the person is fully affected with it. The fundus of the eye opposite the lens and includes the retina, optic disc, macula and fovea and the posterior pole. The first stage encompassing the detection of patients affected with diabetic retinopathy and the second stage is evaluating to what extent the patient has been affected [8]. This work presents an algorithm that integrates image processing and machine learning to diagnose diabetic retinopathy from retinal fundus images. This automated method classifies diabetic retinopathy based on a dataset collected from some publicly available database such as DRIDB0, DRIDB1, MESSIDOR, STARE and HRF. Our approach utilizes bag of words model with Speeded Up Robust Features and demonstrate classification over 180 fundus images containing lesions (hard exudates, soft exudates, Microaneurysms, and hemorrhages) and non-lesions with an accuracy of 94.4%, precision of 94%, recall and f1-score of 94% and AUC of 95% [9]. Proposes a method for detection of neovascularization near the optic disk due to diabetic retinopathy. Images of the retinal fundus are examined using a measure of angular spread of the Fourier power spectrum and spatial variance are adopted to distinguish normal optic disks from those affected by neovascularization. The two-sided Kolmogorov–Smirnov nonparametric test is used to evaluate the significance of the difference of entropy between normal and abnormal optic disks. Based on the computed measures, we employ a linear classifier to discriminate normal from abnormal optic disks. The proposed method was able to classify a small set of five normal and five neovascularization cases with 100% accuracy [10].

II. METHDOLOGY

Following is the flow for extraction of diabetic retinopathy diseases.

Figure 1: Flow for Extraction of Diabetic Retinopathy Disease

Image pre-processing is a process to reduce the presence of unwanted features of the image such as noise. The purpose of image pre-processing is to improve the quality of the image being process. As a result, it provides a much accurate results for any image analysis made. Histogram equalization is a method in image processing of contrast adjustment using the image's histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Afterwards, Texture features are derived from the gray level matrix for an image. Finally, for the classification of diseases SVM is

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Diabetic Retinopathy lesion</th>
<th>Distinctive Ophthalmoscopy Features</th>
<th>Mechanism</th>
<th>Common Associated Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hard Exudate</td>
<td>Deep yellow with sharp margins, often circinate</td>
<td>Leakage from pre-capillary arterioles</td>
<td>Diabetes, hypertension, von Hippel Lindau disease, radiation</td>
</tr>
<tr>
<td>2</td>
<td>Cotton Wool Spot</td>
<td>Fluffy gray-white; usually near optic disc</td>
<td>Microinfarction</td>
<td>Hypertension, diabetes, connective tissue disease, HIV</td>
</tr>
<tr>
<td>3</td>
<td>Microaneurysms</td>
<td>It is Tiny swelling in the wall of a blood vessel</td>
<td>Leakage from pre-capillary arterioles</td>
<td>Diabetes, hypertension, von Hippel Lindau disease, radiation</td>
</tr>
<tr>
<td>4</td>
<td>Haemorrhages</td>
<td>They are located in the middle layer of the retina</td>
<td>Leakage from pre-capillary arterioles</td>
<td>Diabetes, hypertension, von Hippel Lindau disease, radiation</td>
</tr>
</tbody>
</table>

Table 1: Diabetic Retinopathy Lesion
applied which is discriminative classifier formally defined by a separating hyper plane.

III. CONCLUSION

Diabetic retinopathy, is retinopathy caused by complications of diabetes, which can eventually cause a blindness. It is an ocular manifestation of diabetes, a systemic disease, which affects up to 80 percent of all patients who have had diabetes for 10 years or more. Notwithstanding these intimidating statistics, research indicates that at least 90% of these new cases could be reduced if there was proper and vigilant treatment and monitoring of the eyes. To detect the diabetic retinopathy diseases, some authors used digital image processing techniques, wavelet, Fourier transform, etc. and for classification SVM is widely used by the researcher.

REFERENCES