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# A Review on Diabetic Retinopathy and it Early Detection Techniques

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**Abstract:- Diabetic retinopathy is a rapidly spreading diabetes-related condition that affects people all over the world. In diabetic patients, Diabetic retinopathy can result in total vision loss. Early diabetic retinopathy detection is more important in this scenario for eye restoration and timely care. Manual analysis of fundus photos for microaneurysm, exudates, blood vessels, and macula regulation is a time-consuming and exhausting process. It is tedious and time-consuming work. It is simple to accomplish with the computer-aided method and the observer's intervariability. This paper provides a comprehensive review of new non-proliferative diabetic retinopathy therapies for microaneurysms, haemorrhages, and exudates..**

***Keywords:-*** *Diabetic Retinopathy, Automatic Detection, Microaneurysms.*

## I. INTRODUCTION

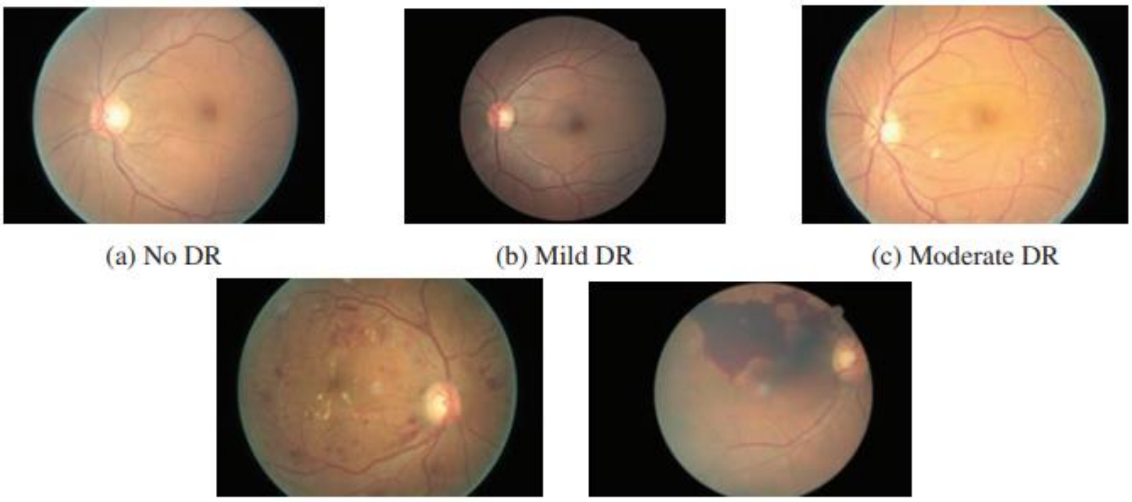
Diabetic retinopathy is caused by blood sugar regulation in the body, including diabetes (DR). Diabetes causes eye problems, which are the leading cause of blindness worldwide. This is due to diabetes-related blood vessel damage. Chronic or acute retinal damage causes DR. DR can also be the eye manifestation of a variety of systemic conditions. DR is the most common microvascular symptom of diabetes and the leading cause of blindness and vision loss worldwide. There are two types of DR: non-proliferative DR (NPDR) and proliferative DR (PDR) (PDR). DR affects the vascular retinal structure and causes progressive retinal damage. Gradual DR induces loss of vision and blindness. DR is the leading cause of workplace blindness in developed nations, and the problem is growing as a significant global public health issue.

Diabetic retinopathy ( DR) is more likely to affect a person with diabetes. A micro blood vessel that is susceptible to unrestricted blood sugar level supplies blood to all layers of retina. When a large quantity of glucose or fructose gains blood, the vessels begin to crash because oxygen has not been properly distributed in the cells. Blockages in these vessels cause serious damage to the eyes. Consequently, metabolic vessels that are internally active in DR slower and lead to structural anomalies. DR is a progressive disease and its early detection is crucial to saving a vision of the patient; regular screening is necessary. An automated DR screening system can help to reduce the chances of total blindness due to DR and reduce ophthalmologist workload. The DR screening system is designed to differentiate a retina from a normal retina with potential DR. Microaneurysms (MAs) result in abnormal sugar levels in retinal blood vessels. MA is an early sign of diabetes retinopathy, which can be regarded as a fundamental element of DR. MA is almost oval in shape and dark in color and tiny in scale. Later on, abnormal blood retinal vessels can split into the form of a retinal neovascular network. Retina. Diabetic retinopathy also contains certain other anomalies, including spotting of cotton wool, bleeding, exudates leading to non reversible blindness and impaired vision.

This paper looks at automated systems for DR detection. In order to evaluate its causes and effects on the human body, this review is structured as follows: first of all we talk about the diseasing behind them. We focus on the impact of diabetes on the eye following the aims of this article. This leads to features like blood flow field, workouts, hemorrhages, microaneurysms and textures. Such technologies are used to automatically identify DRs. They reviewed several automated detection systems documented in the scientific literature for automatic detection of DR stages.

## II. DIABETIC RETINOPATHY

Diabetes mellitus is a chronic, systemic disease that has a negative impact on our lives. Insulin and hormones are not properly secreted or controlled in diabetics. This contributes to an unanticipated rise in blood glucose levels. Over time, high glucose levels damage blood vessels, particularly those in the retina. DR affects the retina, a thin layer of tissue; this damage contributes to the eye condition known as DR. The inner portion of the eye is about 0.5 mm wide. The retina as a whole is a spherical disc with a diameter of 30 to 40 mm. The optical discs are 3 to 4 mm in diameter. Due to the elevated blood glucose level that leaks blood and fluid into the retina, the vascular walls are impaired. The leakage due to high glucose levels can have a detrimental impact on the system and causes some clinical characteristics in the retina, listed briefly below. During the early stage of diabetic retinopathy, there are no noticeable signs. But, in the latter stage of DR, the signs are blurred vision, swellings and sudden vision loss. Figure 1 shows fundus images of different stages of diabetic retinopathy.



(a) No DR (b) Mild DR (c) Moderate DR

(d) Severe DR (e) Proliferative DR

Fig 1: Fundus Images of Different Stages of Diabetic Retinopathy

Diabetic Retinopathy develops through four stages, consisting of mild diabetic non-proliferating retinopathy (NPDR), moderate NPDR, extreme NPDR, and proliferative DDR. Mild NPDR is the first step in which micro aneurysms occurs early in this state. In this point, MAs and H appear as this disease progresses to moderate NPDR. Not only micro aneurysms, hard exudates, hemorrhages cotton wool spots appear in the severe NPDR phase. New blood vessels grow as this disease advances to the PDR stage. As a result, micro aneurysms are present in all of these four stages. For an automated pre-screening system, detection of micro aneurysms is critical.

## III. LITERATURE REVIEW

DR detection is important because the progression of the disease may be reduced by treatment methods. Laser processing is used with most care procedures. Laser photocoagulation cauterizes the eye vessels which stops their leakage effectively. The fixation laser method decreases the thickening of the retinal. This can prevent retinal swelling from deteriorating. In particular, the risk of vision loss is reduced by 50 percent by this treatment. Improvement is possible in a small number of cases, with total vision loss.

Maher et al. [1], presented an automated system to analyze the retinal abnormal features. Better preprocessing techniques was utilized to attenuate the noise to improve the contrast and mean intensity. Hard exudates were detected and segmented from database images. Also, dark lesion detection methods were proposed by utilizing polynomial contrast enhancement. SVM based supervised learning tool were applied for data classification based on regression.

In a study by Somfai et al. [3] presented and evaluated a non-linear prediction method for early detection of DR on OCT images.

Shruthi et al. [4] developed an automated system to identify early signs of DR. Retinal features were detected and extracted using Top-Hat and Bottom-Hat operations and K-means clustering technique. Statistical parameters were calculated and K-NN classifier was used to identify healthy and unhealthy retinal images.

Welikala et al. [7] described an automated method for detection of new vessels in the retinal images due to DR. Two vessel segmentation approaches were applied by using standard line operator and a novel modified line operator. Both operators were processed and features were measured from each binary vessel map to produce two separate feature sets. SVM were used for independent classification of each feature set and the combination of individual classification was used for final decision.

In different studies an automated analysis and detection of exudates due to DR was developed [8]. Both Fuzzy Logic and NN tool were utilized to identify the abnormalities in the foveal region. The BPN algorithm was used to minimize the objective function which was a multi-stage dynamic system optimization method. Kaur et al. [10] developed an automated system for normal and abnormal features from retinal fundus images for DR. Filter based approach was applied to segment the vessels and were tuned to match the vessels extracted and non-vessels based on thresholding method.

In another study, anatomical structures such as blood vessels, exudates and Mas were segmented [11]. Based on the segmented features, the gray level co-occurrence features were used to classify DR images. The classifier utilized was the SVM classifier.

Kumar et al. [12] developed an automated system for MAs detection in non-dilated RGB Fundus images. Early symptoms of DR were aimed to be detected to reduce the incidence of blindness. The proposed method followed fundamental steps as preprocessing, feature extraction based on texture feature and the last to classify the severity of DR.

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Sopharak et al. presented an automated exudates detection using optimally adjusted morphological operators even for low contrast images [14]. The proposed system, work effectively even on a poor computing system.

## IV. CONCLUSION

Recently, digital imagery was made available as a diabetic retinoapthy screening tool. It provides high-quality permanent retinal appearance records that can be used for progression monitoring and treatment response and are auditable by an ophthalmologist, as well as the ability to process digital images using automated analysis. Blindness caused by DR can be avoided in more than half of cases by combining correct and early detection with adequate care. It is therefore critical to perform DR screenings on diabetic patients on a regular basis. In this paper, we discussed several methods for extracting characteristics and automated DR level identification.

## REFERENCES


[1]. Maher RS, Dhopeshwarkar M. Automatic Detection of Microaneurysms in Digital Fundus Images using LRE. J Comput Eng 2016; 18: 11-17.
[2]. Walvekar M, Salunke G. Detection of Diabetic Retinopathy with Feature Extraction using Image Processing. Int J Emerg Technol Adv Eng 2015.
[3]. Somfai GM, Tatrai E, Laurik L, Varga B, Olvedy V, Jiang H, Wang J, Smiddy WE, Somogyi A, Debuc DC. Automated Classifiers for early detection and Diagnosis of Retinopathy in Diabetic Eyes. BMC Bioinformatics 2014; 15: 106.
[4]. Shruthi CH, Ramakrishnan N, Krishnan MM. Detection and Classification of Diabetic Retinopathy condition in Retinal Images. Int J Innovat Res Elect Commun 2014; 1: 31-40.
[5]. Abràmoff MD, Garvin MK, Sonka M. Retinal imaging and image analysis. IEEE Rev Biomed Eng 2010; 3: 169-208.
[6]. Shingade AP, Kasetwar AR. A Review on Implementation of Algorithms for detection of Diabetic Retinopathy. Int J Res Eng Technol 2014.
[7]. Welikala RA, Dehmeshki J, Hoppe A, Tah V, Mann S. Automated Detection of Proliferative Diabetic Retinopathy using a Modified Line operator and Dual Classification. Comput Methods Programs Biomed 2014; 14: 247-261.
[8]. Vandarkuzhali T, Ravichandran CS, Preethi D. Detection of Exudates Caused by Diabetic Retinopathy in Fundus Retinal Image using Fuzzy K-means and Neural Network. J Elect Electron Eng 2013; 6: 22-27.
[9]. Faust O, Archarya R. Ng YK. Algorithms for the Automated Detection of Diabetic Retinopathy using Digital Fundus Images- A Review. J Med Syst 2012; 36: 145-157.
[10]. Kaur J, Sinha HP. Automated Detection of Diabetic Retinopathy using Fundus Image Analysis. Int J Comput Sci Informat Technol 2012; 3: 4794-4799.
[11]. Selavathi D, Prakash NB, Balagopal N. Automated Detection of Diabetic Retinopathy for Early Diagnosis using Feature Extraction and Support Vector Machine. Int J Emerg Technol Adv Eng 2012.
[12]. Kumar SB, Singh V. Automatic Detection of Diabetic Retinopathy in Non-dilated RGB Retinal Fundus Images. Int J Comput Appl 2012.