# IBM PROJECT – PNT2022TMID22755


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# LITERATURE SURVEY

## Topic:

Developments for detection of diabetic retinopathy

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## Theme:

Diabetic retinopathy is caused by the retinal micro vasculature which may be formed as a result of diabetes mellitus. Blindness may appear as a result of unchecked and severe cases of diabetic retinopathy. Manual inspection of fundus images to check morphological changes in microaneurysms, exudates, blood vessels, hemorrhages, and macula is a very time-consuming and tedious work. It can be made easily with the help of computer-aided system and intervariability for the observer. In this paper, several techniques for detecting microaneurysms, hemorrhages, and exudates are discussed for ultimate detection of nonproliferative diabetic retinopathy. Furthermore, the paper elaborates a discussion on the experiments accessed by authors for the detection of diabetic retinopathy. This work will be helpful for the researchers and technical persons who want to utilize the ongoing research in this area.

## Overall inference:

Diabetes is a very common disease worldwide. It serves as a most common cause of blindness for people having age less than 50 years. It is a systemic disease which is affecting up to 80 percent of

people for more than 10 years. Many researchers acknowledged that 90 percent of diabetic patients could be saved from this disease through an early diagnose. A person having diabetes is more prone to the risk of diabetic retinopathy (DR).

The blood supply towards all layers of retina is done through micro blood vessels which are susceptible to unrestrained blood sugar level. When a large amount of glucose or fructose gathers in blood, the vessels start crumbling because of insufficient distribution of oxygen to cells. Any blockage in these vessels leads to a severe eye injury. As a result, metabolic rate slows down and leads to structural abnormality in vessels which intern DR.

Microaneurysms are an earlier sign of DR. This disease brings changes in the size of blood vessels (swelling). The indications of DR include microaneurysms (MAs), exudates (EXs), and hemorrhages (HMs) as well as the abnormal growth of blood vessels. DR normally has two different stages named as proliferative DR (PDR) and nonproliferative DR (NPDR).

Occurrence of NPDR is when blood vessels in retina are damaged and start leaking fluid onto it. As a result, retina becomes wet and swollen. Different signs of retinopathy exist at this stage, for example, HMs, MAs, EXs, and also interretinal micro vascular abnormalities (IRMA). PDR arises when new abnormal blood vessels appear in various areas of retina. It is a complex case of DR that may cause impaired vision.

DR is a progressive disease and its detection at an early stage is very crucial for saving a patient's vision; this requires regular screening. An automated screening system for DR can help in reducing the chances of complete blindness due to DR along with lowering the workload on ophthalmologists.

Diabetic retinopathy cannot be cured. To prevent vision loss, laser analysis (photocoagulation) is usually very effective if it is done before it adversely harms the retina. Provided that the stern destruction of retina has not been done, vision can be improved by the surgical elimination of vitreous gel (vitrectomy). In proliferative diabetic retinopathy, at times, an anti-inflammatory medicine or antivascular endothelial growth factor medication injection can help in the new blood vessels contraction process.

Since symptoms cannot build up until the disease turns into the stern, initial discovery via regular screening is essential. Nonproliferative diabetic retinopathy contains early indications of DR and it is extremely critical to recognize and analyze DR at its initial stages. If a person with diabetes gets legitimate eye mind consistently and treatment when fundamental, DR will once in a while cause all out blindness.

In this study of DR, a large portion of work is done to discover hemorrhages, microaneurysms and exudates, diabetic macular edema, and abnormal new blood vessels as they are indications of the

vicinity of retinopathy in fundus images. This study helps in the detection of retinopathy at an early stage; timely treatment of this disease will prevent permanent vision loss. The paper discussed experiments done by authors for the detection of diabetic retinopathy. This work will be useful for technical persons and researchers who need to use the ongoing research in this area.

## Topic:

Diabetic retinopathy detection through deep learning techniques

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## Theme:

Diabetic Retinopathy (DR) is a common complication of diabetes mellitus, which causes lesions on the retina that effect vision. If it is not detected early, it can lead to blindness. Unfortunately, DR is not a reversible process, and treatment only sustains vision. DR early detection and treatment can significantly reduce the risk of vision loss. The manual diagnosis process of DR retina fundus images by ophthalmologists is time-, effort-, and cost-consuming and prone to misdiagnosis unlike computer-aided diagnosis systems.

## Overall inference:

In the healthcare field, the treatment of diseases is more effective when detected at an early stage. Diabetes is a disease that increases the amount of glucose in the blood caused by a lack of insulin. It affects 425 million adults worldwide. Diabetes affects the retina, heart, nerves, and kidneys.

Deep learning (DL) is a branch of machine learning techniques that involves hierarchical layers of non-linear processing stages for unsupervised features learning as well as for classifying patterns. DL is one computer-aided medical diagnosis method. DL

applications to medical image analysis include the classification, segmentation, detection, retrieval, and registration of the images.

Recently, DL has been widely used in DR detection and classification. It can successfully learn the features of input data even when many heterogeneous sources integrated. There are many DL-based methods such as restricted Boltzmann Machines, convolutional neural networks (CNNs), auto encoder, and sparse coding. The performance of these methods increases when the number of training data increase due to the increase in the learned features unlike machine learning methods. Also, DL methods did not require hand-crafted feature extraction.

Automated screening systems significantly reduce the time required to determine diagnoses, saving effort and costs for ophthalmologists and result in the timely treatment of patients. Automated systems for DR detection play an important role in detecting DR at an early stage. The DR stages are based on the type of lesions that appear on the retina.

This article has reviewed the most recent automated systems of diabetic retinopathy detection and classification that used deep learning techniques. The common fundus DR datasets that are publicly available have been described, and deep-learning techniques have been briefly explained. Most researchers have used the CNN for the classification and the detection of the DR images due to its efficiency. This review has also discussed the useful techniques that can be utilized to detect and to classify DR using DL.