**DIAGNOSIS OF DIABETIC RETINOPATHY USING MACHINE LEARNING TECHNIQUES**

**ABSTRACT**

The complication of diabetics causes an illness known as Diabetic Retinopathy (DR). It is very widespread among middle-aged and elderly People. As diabetes progresses, the vision of patients may start to deteriorate and cause DR. People lose their eye visions because of this illness. To cope with DR, an early detection is needed. Patients will have to be checked by doctors regularly which is a waste of time and energy. DR can be divided into two groups; one is non proliferative (NPDR) while the other is proliferative (PDR). In this study, machine learning (ML) techniques are used to diagnose DR at an early stage. These are PNN, SVM, Bayesian Classification and K-Means Clustering. These techniques will be evaluated and compared with each other to choose the best methodology. A total of 300 fundus photographs are processed for training and testing. The features are extracted from these raw images using the image processing techniques. After an experiment, it is concluded that PNN has an accuracy of about 89%, Bayes Classifications 94%, SVM 97% and K-Means Clustering 87%. The preliminary results prove that SVM is the best technique for early detection of DR

**INTRODUCTION:**

Diabetes has become one of the rapidly increasing health threats worldwide. Proper and early treatment of diabetes is cost effective, since the implications of poor or late treatment are very expensive.

Fundus imaging has an important role in diabetes monitoring since occurrences of retinal abnormalities are common and their consequences serious. However, since the eye fundus is sensitive to vascular diseases, fundus imaging is also considered as a candidate for non-invasive screening. The success of this type of screening approach depends on accurate fundus image

capture, and especially on accurate and reliable image processing algorithms for detecting the

abnormalities.

Numerous algorithms have been proposed for fundus image analysis by many research groups. However, it is impossible to judge the accuracy and reliability of the approaches because; there exists no commonly accepted and representative fundus image database and evaluation protocol.

With a widely accepted protocol, it would be possible to evaluate the maturity and state-of-the-art of the current methods, i.e., produce the achieved sensitivity and selectivity rates.

In the type 1 diabetes, the insulin production in the pancreas is permanently damaged, whereas in the type 2 diabetes, the person is suffering from increased resistance to insulin.

The type 2 diabetes is a familial disease, but also related to limited physical activity and lifestyle. The diabetes may cause abnormalities in the retina (diabetic retinopathy), kidneys (diabetic nefropathy), and nervous system (diabetic neuropathy). The diabetes is also a major risk factor in cardiovascular diseases. In the type 1 diabetes, the insulin production in the pancreas is permanently damaged, whereas in the type 2 diabetes, the person is suffering from increased resistance to insulin.

The type 2 diabetes is a familial disease, but also related to limited physical activity and lifestyle. The diabetes may cause abnormalities in the retina (diabetic retinopathy), kidneys (diabetic nefropathy), and nervous system (diabetic neuropathy).The diabetes is also a major risk factor in cardiovascular diseases.

**LITERATURE:**

**Title**:

Detection of Blood Vessels in Retinal Images Using Two-Dimensional Matched Filters

**Author:**

SUBHASIS CHAUDHURI, student member, IEEE, SHANKAR CHATTERJEE, member, ieee, NORMAN KATZ. MARK NELSON, AND MICHAEL GOLDBAUM.

**Method:**

introduced a simple operator for feature detection based on the optical and spatial properties of objects (namely blood vessels) to be recognized. The proposed scheme retains the computational simplicity of the enhancement/thresholding type of edge operators, and at the same time incorporates the advantages of using model based edge detectors.

This method performs well in analyzing fluorescein angiogram images of the retina as well. With minor modifications, this method could very well be extended to the extraction of geological features from satellite images and the enhancement of fingerprint images.

**Drawbacks**

* Only edge detection is in concern
* Limited to blood vessels to be recognized,
* No Disease Detection method involved.

**Title:**

A Decision Support Framework for Automated Screening of Diabetic Retinopathy

**Author:**

P. Kahai, K. R. Namuduri, and H. Thompson

**Method:**

This paper proposed a decision support framework for automated screening of DR for the univariate case. This model can be extended to multiple disorders that would include the covariance associated with all the signs of DR. The experiments support the feasibility of a complete automated screening mechanism that includes all the disorders related to DR. The machine can be made adaptable by including Bayesian learning mechanism that would improve the accuracy of the classifier as a new feature value is presented to it by modifying the priors.

**Drawbacks:**

* Only screening mechanism involved,
* No early stage detection is made

**Title:**

“Automatic Diagnosis of Diabetic Retinopathy Micro aneurysm from Low Contrast Retinal Images using Mathematical Morphology Methods”

**Author:**

Raju Maher, Sangramsing Kayte, Dnyaneshwar Panchal , Suvarnsing G. Bhable

**Method:**

All digital retinal images were taken from DIARETDB1. Histogram equalization in which manipulates histograms in a consistent and meaningful manner. DIARETDB1 images were resized to 340 x 480 pixels in order to reduce the processing time of the method However, many image enhancement techniques are based on spatial operations performed on local neighbourhoods. The detection method proposed in this paper is performed in MATLAB (version 2012). The accuracy of the method was tested in the public database of fundus images DIARETDB1 database consists of 89 colour fundus images of which 84 contain at least mild

non-proliferative signs of the diabetic retinopathy and five are considered as normal which do not contain any signs of the diabetic retinopathy according to all the experts participated in

the evaluation. Images were captured with the same 50 degree FOV digital fundus camera with varying imaging controlled by the system in the Kuopio university hospital, Finland. The image ground truth provided along with the database is based on expert selected findings related to the diabetic retinopathy and normal fundus structures.

**Drawbacks:**

* there may be a problem edge filter and feature selection

**Title:**

Automatic detection of diabetic retinopathy using an artificial neural network: a screening tool

**Author:**

G G Gardner, D Keating, T H Williamson, A T Elliott

**Method:**

This study has shown that it is possible to train a neural network to recognise common features of diabetic retinopathy on fundus images. The network can be used to identify the presence of vessels, exudates, and hemorrhages with high predictive values. Retinal hemorrhages were most difficult to recognize because of their similar pixel values to vessels. Different image preprocessing and neural network variables were found to provide optimum demonstrated that a neural network program can be trained to recognize different features on a fundus image of diabetic retinopathy.

**FRONT END ARCHITECTURE**

**Retinal Image**

**Pre processing**

**Feature Extraction**

**Algorithm**

**Diabetic retinopathy**

**yes**

**Enhancement**

**Restoration**

**Invariance Imaging**

**no**

**METHODOLOGY:**

The approach of diabetic retinopathy consists of digital image studies with an aim of providing ways to diagnose the diabetic retinopathy and identifying the severity of the disease. It typically includes application of Image processing on digital images of the retinal structures. Progress in this area has been achieved in recent times and improved medical care is available for the patients. According to a recent survey, diabetes has been recognized as the main cause of blindness. If not diagnosed early and treated in time, it can lead to severe damage to retinal structure leading to partial or even complete blindness.

The constant check-up and screening activities like medical digital image processing for detection and diagnosis of diabetes related disease, like diabetic retinopathy, is very important. In diabetic retinopathy, the sensitive inner area of the eye is damaged. The two types of Diabetic Retinopathy are Non-proliferative (NPDR) and proliferative (PDR) Diabetic Retinopathy.

The early stage of the disease that affects fewer blood vessels in the eye leading blurred vision, due to fluid leaks, is known as non-proliferative diabetic retinopathy. In majority of the cases it remains like this and may not affect vision. However, in some cases, may involve macula and that may lead to more advanced stage such as proliferative retinopathy. The fluid leaks are more serious in the proliferative diabetic retinopathy. The pressure in the blood vessels may rupture causing the bleeding. This bleeding is called haemorrhage and this may cause vision loss and scarring of the retina.

¬ **Image Pre-processing:** The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. Image preprocessing is the initial step in automated retinal pathology diagnosis. It includes techniques such as contrast enhancement, gray/green component, image de-noising, etc.

¬ **Feature Extraction:** The features such as blood vessels, exudates, micro-aneurysms and optic discs are extracted for further analysis. Exudates: Small yellow white patches with sharp margins and different shapes. Exudates are one of the early occurring lesions. Soft exudates are often called „cotton wool spots‟ and are more often seen in advanced retinopathy. Microaneurysms: These are the first clinical abnormality to be noticed in the eye. They may appear in isolation or in clusters as tiny, dark red spots or looking like tiny haemorrhages within the light sensitive retina.

**CONCLUSION & FUTURE SCOPE:**

we focus on several ML techniques for DR detection. It is found that the early detection of DR can reduce the risk of vision loss up to %76 [24]. Also, this work presents a novel model to diagnose DR based on ML techniques. Among of all of these techniques it can be said that SVM is the best with a percentage of 97.3, Naive Bayes Classification %86.4 and PNN with a percentage of %78 K-Means Clustering is %81 percentage. It can be concluded from the study that results are promising. In this proposed method detection of DR has been carried out. But there is still a need for scope to develop Computer Aided System which can not only help diagnose DR but would also help in checking the progression of disease so that its growth can be restricted if not prevented. In future, we need to develop hybrid techniques for more accurate, robust as well as affordable automated techniques for DR detection at low cost.

**REFERENCES**

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