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Detection of Diabetic Retinopathy Using Support Vector Machine

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ABSTRACT: Diabetic Retinopathy is a diabetes complication that affects eyes. It's caused by damage to the blood vessels of the light-sensitive tissue at the back of the eye (retina). At first, Diabetic Retinopathy may cause no symptoms or only mild vision problems. Eventually, it can cause blindness. The number of doctors compared to the number of patients in India is quite low which leads to delayed diagnosis of various diseases. But delayed diagnosis of Diabetic Retinopathy leads to irreversible damage to eyes, further leading to complete permanent blindness. This disease can be treated but the damage is not completely reversible. To avoid this situation, we decided to automate the process of diagnosis by using machine learning. The increase in diabetes cases limits the ability of current manual testing. New algorithms for assisted diagnosis are becoming very important today. Early detection of diabetes can help the patients and limits the bad health consequences such as blindness, so we use support vector machine (SVM) algorithm for classification of the extracted histogram. A histogram binning scheme for features representation is proposed. The experimental results show that LESH is the best performing technique with an obtained accuracy of 0.904 using SVM with a Radial Basis Function kernel (SVM-RBF).

KEYWORDS: Diabetic Retinopathy, Retina, Machine Learning, LESH, SVM.

I. INTRODUCTION

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves. The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers to learn automatically without human intervention or assistance and adjust actions accordingly.

The number of people with diabetic retinopathy is growing higher day by day. It is estimated that the number will grow from 126.6 million to 191.0 million by 2030 and the number with vision-threatening diabetic retinopathy (VTDR) will increase from 37.3 million to 56.3 million, if any proper action is not taken. Despite growing evidence documenting the effectiveness of routine DR screening and early treatment, it is frequently leading to poor visual functioning and represents the leading cause of blindness. Most of the time it has been neglected in health care and in many low-income countries because of inadequate medical service. While researching about these factors we got motivated to work with this topic. As there are insufficient ways to detect about diabetic retinopathy, we will build a system which will give prediction about diabetic retinopathy. Thus, we decided to use Machine Learning Algorithms for the prediction of this disease.

II. RELATED WORK

During the last several years, different Machine learning applications have been proposed to improve healthcare systems. In light of this, several solutions have been proposed and some of them are listed below.

A. Shailesh Kumar, Basant Kumar Published a paper titled "Diabetic Retinopathy Detection by Extracting Area and Number of Microaneurysm from Colour Fundus Image" which presents an improved diabetic retinopathy detection scheme by extracting accurate area and area number of microaneurysm from color fundus images.



B. Omer Deperlioglu , Utku Kose Published a paper titled “Diagnosis of Diabetic Retinopathy by Using Image Processing and Convolutional Neural Network” this study describes the use of image processing and deep learning to diagnose diabetic retinopathy from retinal fundus images.

C. Kranthi Kumar Palavalasa, Bhavani Sambaturu Published a paper titled “Automatic Diabetic Retinopathy Detection Using Digital Image Processing” which proposed a novel method to detect hard exudates with high accuracy with respect to lesion level.

III. PROPOSED METHODOLOGY

In existing system, Many algorithms are used for automatic diabetic detection such as Deep neural network and CNN (convolutional neural network algorithms).

We proposed in this paper, an automated approach for classification of the disease diabetic retinopathy using fundus images is presented. In this paper, an automatic assessment system of diabetic retinopathy using Support Vector Machine has been discussed with various preprocessing techniques including post filtration followed by the extraction of several features such as color, shape, intensity, entropy, energy, texture etc. Classification of abnormalities from normal fundus retinal images can be performed with various classifiers. From observation, Support vector Machine is the best classifier for extracting and classifying the abnormalities in retina like microaneurysms, hard exudates, soft exudates, neovascularization, and macular edema in an effective manner.

All the techniques used for the classification were good in performance, but SVM is more efficient than CNN and DNN from the obtained results. Thus, this work has given a successful Diabetic Retinopathy Diagnosing method which helps to diagnose the disease in early stage which mutually reduces the manual work.

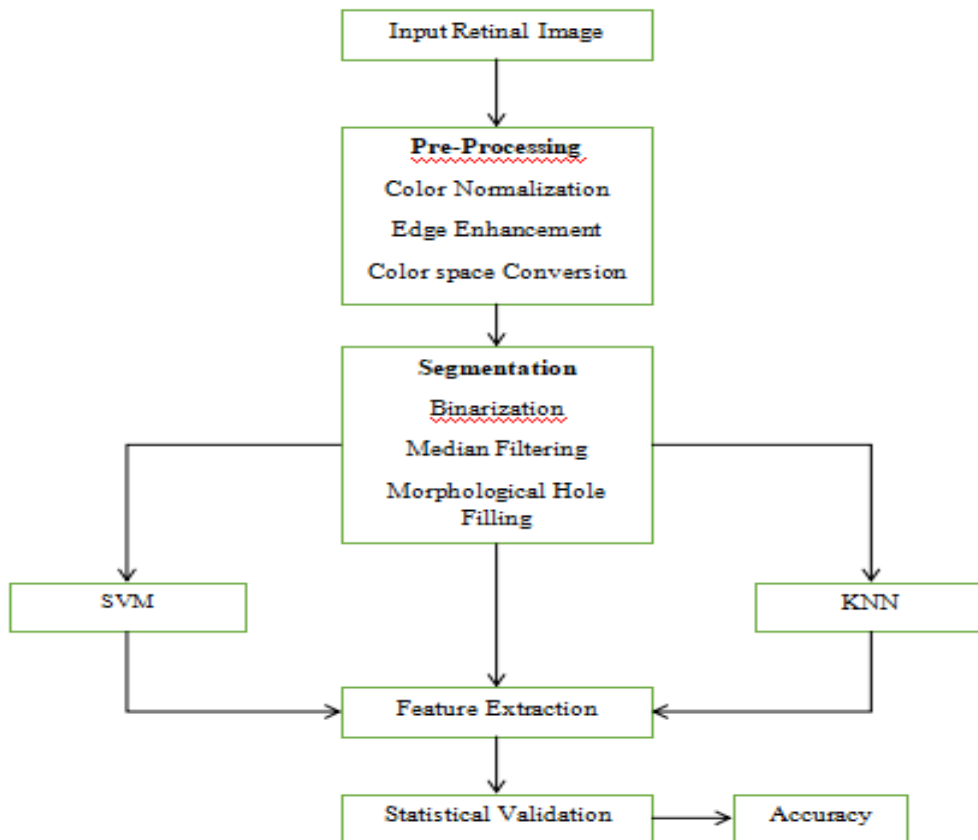


Figure 1. Working of the model

Pre-Processing

In detecting abnormalities associated with fundus image, the images have to be Pre-Processed in order to correct the problems of uneven illumination problem, insufficient contrast between exudates and image background pixels and presence of noise in the input fundus image.

Segmentation

The main objective of segmentation is to group the image into regions with same property or characteristics. It plays a major role in image analysis system by facilitating the description of anatomical structures and other regions of interest.

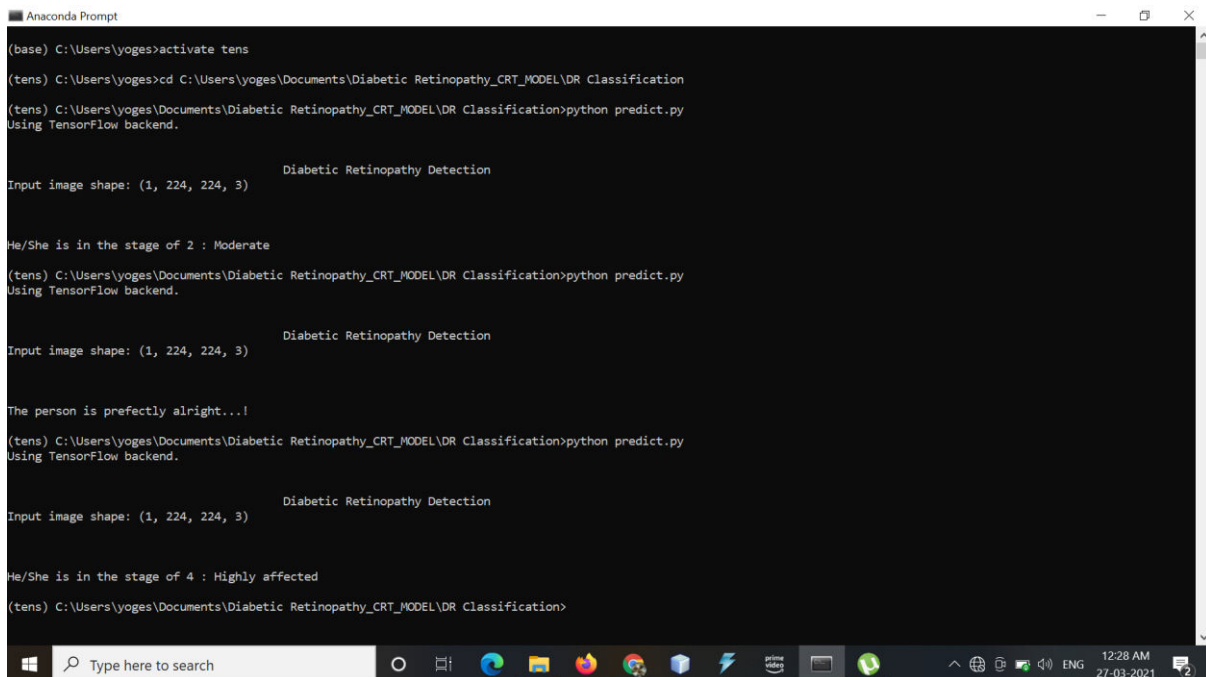
Edge Enhancement

Edge enhancement is an image processing filter that enhances the edge contrast of an image to improve its apparent sharpness. Most digital cameras also perform some edge enhancement.

Color space conversion

Color space conversion is the translation of the representation of a color from one basis to another. This typically occurs in the context of converting an image that is represented in one color space to another color space, the goal being to make the translated image look as similar as possible to the original.

III. RESULTS



```
(base) C:\Users\yoges>activate tens
(tens) C:\Users\yoges>cd C:\Users\yoges\Documents\Diabetic Retinopathy_CRT_MODEL\DR Classification
(tens) C:\Users\yoges\Documents\Diabetic Retinopathy_CRT_MODEL\DR Classification>python predict.py
Using TensorFlow backend.

Diabetic Retinopathy Detection
Input image shape: (1, 224, 224, 3)

He/She is in the stage of 2 : Moderate
(tens) C:\Users\yoges\Documents\Diabetic Retinopathy_CRT_MODEL\DR Classification>python predict.py
Using TensorFlow backend.

Diabetic Retinopathy Detection
Input image shape: (1, 224, 224, 3)

The person is perfectly alright...!
(tens) C:\Users\yoges\Documents\Diabetic Retinopathy_CRT_MODEL\DR Classification>python predict.py
Using TensorFlow backend.

Diabetic Retinopathy Detection
Input image shape: (1, 224, 224, 3)

He/She is in the stage of 4 : Highly affected
(tens) C:\Users\yoges\Documents\Diabetic Retinopathy_CRT_MODEL\DR Classification>
```

Figure 2. Result

IV. CONCLUSION

The proposed system proposes the machine learning algorithms like SVM classifier and KNN is used and SVM classifier which gives at the yield the level of diabetic retinopathy. Early diagnosis and treatment have been shown to prevent visual loss and blindness.

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