DIABETIC RETINOPATHY DETECTION USING MACHINE LEARNING

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Abstract -Diabetes is the 7th predominant disease in the world in which it cannot be cured. Diabetes will lead to blindness called Diabetic Retinopathy if the diabetes is high. Diabetic Retinopathy is an eye disease which affects people with diabetes mellitus and it is a real cause for blindness. This kind of disease can be detected by retinal analysis. Diabetic retinopathy is a disease of retina in which retinal blood vessels swell, abnormal growth of retinal blood vessels. The Existing System detects the presence of diabetic retinopathy using Siamese like convolutional Neural Network and its accuracy is about 82.9% Our Proposed system adopts SVM (Support Vector Machine) to classify the DR and Non-DR eye. Also, it finds the types of Diabetic retinopathy such as Exudates, Haemorrhages, Cercospora leaf spot etc and it finds the infected region. The accuracy is about 95%

1.INTRODUCTION

Diabetics is the predominant disease in the world to those who are above 35 years. This diabetics yields so many additional problems all over the today. One such problem in eye is a diabetic retinopathy. This diabetic retinopathy is a eye disease which occurs due to uncontrol in glucose level. In general diabetic retinopathy is a eye disease occurred due to the complications of diabetes mellitus. This is usually preventable with continuous checks and, there must be effective management of Glucose level also. The diabetic retinopathy is a damage in the blood vessel such as swelling in the Blood vessel, leakage of Blood in Blood vessel or abnormal growth of Blood vessel.

These are all named such as Exudates, Haemorrhages, and Microaneurysms etc. Where in line there are some others kinds of diabetic retinopathy under these categories such as healthy leaf, Alternaria Alternata etc. At earlier stage of diabetic retinopathy, it without show any Symptoms, if the glucose level is high and left ill-treated, it causes the symptoms such as blurred vision, difficulty in seeing colours, floaters and even total loss of vision.

These are so many complications associated with the diabetic retinopathy includes vitreous Haemorrhages, Detached retina, Glaucoma, these diabetic retinopathies occur to those does not correctly control blood sugar levels, experiences high blood pressure, has high Cholesterol, is pregnant, smokes regularly, has had diabetes for a long time. There will be basic diagnosis held by Ophthalmologist or eye specialist can detect the signs by dilute eye exam.

This Dilute eye exam process administers drop the dilute to the eye which dilute the pupil and allow the doctor to view the retina photographs are taken of the interior of the eye. Which examiner the presence of cataracts, abnormalities in the blood vessel, optic nerve, or retina, scar tissue etc. There are some diagnosis such as fluorescein angiography, Optical Coherence Tomography (OCT) etc. The treatments to this would be focal laser treatments, or Photocoagulation, Scatter laser treatment, or panretinal Photocoagulation, Vitrectomy etc.

2.LITERATURE SURVEY

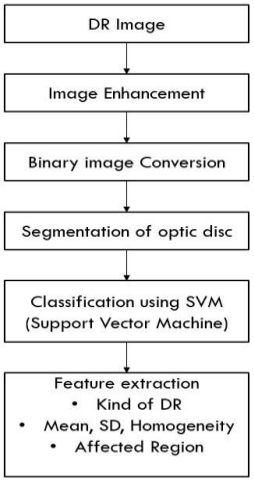
[1] Proposed several techniques convolutional neural network, deep learning, Binocular Siamese-like network. SarniSuhaila Rahim et al.

[2] Proposed several techniques for detection of microaneurysm. In system I, used adaptive histogram equalization, discrete wavelet transform, and filtering and morphology process for pre-processing. Area of pixels, mean and standard deviation are the extracted features of DR. Decision tree, K-nearest neighbor, Radial basis function (RBF) have been used for classification. Result of system I has been shown in S. S. Rahim, V. Palade, J. Shuttleworth, and C. Jayne,

[3] Used histogram equalization, shade correction, vessel segmentation, and morphological operation for pre-processing. Area of pixels, mean, standard deviation are extracted features from the preprocessed fundus images.

3. IMPLEMENTATION

3.1 BLOCK DIAGRAM



DR IMAGE

The DR fundus image are the retinal image which are photographed during diagnosis process such as dilute eye exam, Fluorescein angiography, optical coherence tomography(OCT).

IMAGE ENHANCEMENT

It is a process of removing all the noise from the image as the image is brought from several sources. Which will be of more noises and that will be removed by using CLAHE (Contract Limited Adaptive Histogram Equalization). Where it is a technique to enhance the visibility of local details of an image by increasing the contrast of local regions. By enhancing the contrast of the image, it converts into grayscale image P (I, J).

BINARY IMAGE CONVERSATION

Once, the image is converted into grayscale, the binary image conversion takes place using threshold value (T). There will be another matrix called b [I, j] initializing all zeros, and the grayscale image P (I, j) and the binary image matrix B (I, j) gets XORed to have a single image with bicolor.

SEGMENTATION OF OPTIC DISC

The binary image is again fed into median filtering to reduce salt and pepper noise. It is a non-linear operation and it is a effective than convolution when the goal is to simultaneously reduce noise and preserve edges and the efficient image is fed into segmentation. A structured element for segmentation is prepared. These structural element will indicate the or segment the blood vessels/the needful location for checking the actual value.

CLASSIFICATION USING SVM

Once segmentation happens, clustering will be made out for each segmentations. Where each cluster will be classified to identify whether diabetic retinopathy is present or not. If so, the kind of diabetic retinopathy will be checked according to the infected region and other segments too. As there are two classification happens, we say it is a multi-SVM. There are possibilities where a single eye can possess more than one kind of diabetic retinopathy such as healthy leaf and Alternaria Alternata.

3.2 ALGORITHMS

CLAHE

Adaptivehistogramequalization (AHE) is a computer image processing technique used to improvecontrastin images. It differs from ordinaryhistogramequalizationin the respect that the adaptive method computes severalhistograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image.

It is therefore suitable for improving the local contrast and enhancing the definitions of edges in each region of an image. However, AHE has a tendency to over amplifynoisein relatively homogeneous regions of an image. A variant of adaptive histogram equalization calledcontrastlimited adaptive histogramequalization(CLAHE)prevents this by limiting the amplification.

MEDIAN FILTERING

The Median Filter is a non-lineardigitalfilteringtechnique, often used to removenoisefrom an image or signal. Suchnoisereductionis a typical Preprocessing step to improve the results of later processing (for example,edgedetectionon an image). Median filtering is very widely used in digitalimageprocessingbecause, under certain conditions, it preserves edges while removing noise (but see discussion below), also having applications insignalprocessing.

IMAGE SEGMENTATION

The image segmentation is the process of partitioning a digital image into multiple segments (setsofpixels, also known as image objects). The goal of segmentation is to simplify and or change the representation of an image into something that is more meaningful and easier to analyze Image segmentation is typically used to locate objects andboundaries(lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set ofcontoursextracted from the image (seeedgedetection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such ascolour,intensity, ortexture. Adjacent regions are significantly different with respect to the same characteristic(s).When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create3Dreconstructionswith the help of interpolation algorithms like marching cubes.

SUPPORT VECTOR MACHINE (SVM)

In machine learning, support vector machines (SVMs, also support-vector networks) are supervised learning models with associated learningalgorithmsthat analyze data used forclassificationandregressionanalysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a no probabilisticbinarylinearclassifier(although methods such asPlattscalingexist to use SVM in a probabilistic classification setting). An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a

category based on the side of the gap on which they fall. In addition to performinglinearclassification, SVMs can efficiently perform a non-linear classification using what is called thekerneltrick,implicitly mapping their inputs into high-dimensional feature spaces.

K-NEAREST NEIGHBOR (KNN)

The *k*-nearest neighbours algorithm (k-NN) is anonparametricmethod used forclassificationandregression. In both cases, the input consists of the *k* closest training examples in thefeature space. The output depends on whether KNN is used for classification or regression: In *k-NN classification*, the output is a class membership. An object is classified by a plurality vote of its neighbours, with the object being assigned to the class most common among its *k* nearest neighbours (*k* is a positiveinteger, typically small). If $k = 1$, then the object is simply assigned to the class of that single nearest neighbour.

In k-NN regression, the output is the property value for the object. This value is the average of the values of *k* nearest neighbours. *K-NN* is a type ofinstance based orlazy learning, where the function is only approximated locally and all computation is deferred until classification.

3.3 EXPERINMENTAL SETUP

HARDWARE REQUIREMENTS

Platform : Windows 8/10

RAM : 4GB above

Processor : Intel 64bit

SOFTWARE REQUIREMENTS:

Tool : MATLAB 2017

4.RESULTS

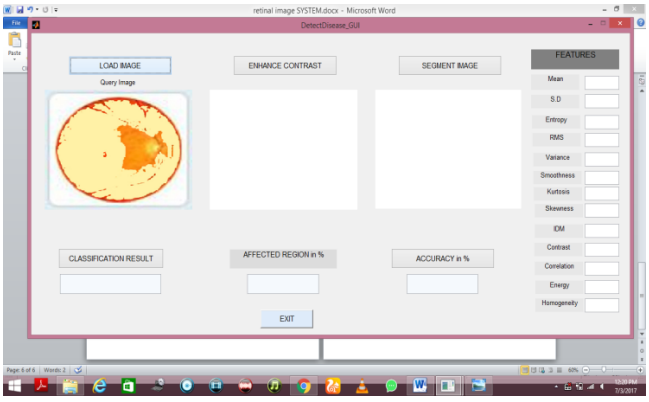


Fig 4.1: Loading the DR image

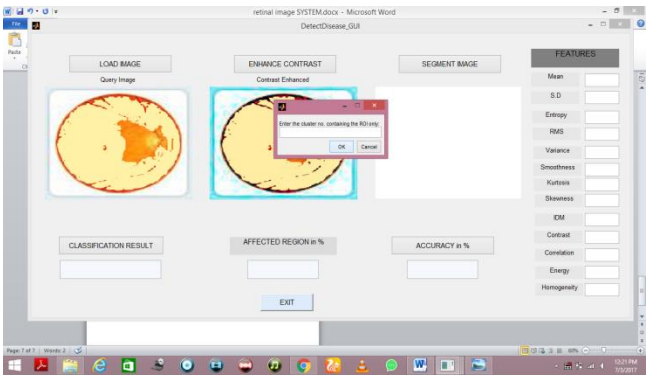


Fig 4.2: Image Enhancement

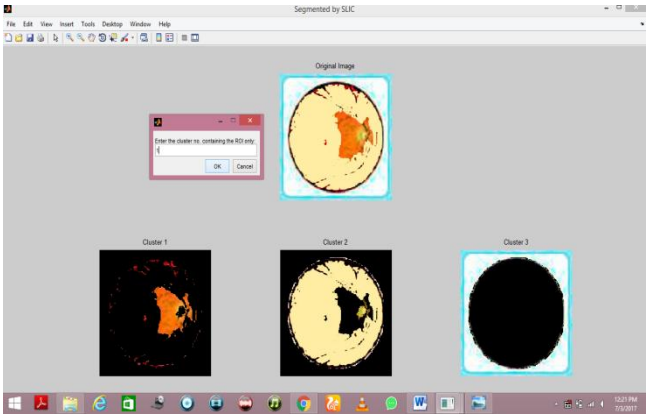


Fig 4.3: Clustering and Segmentation

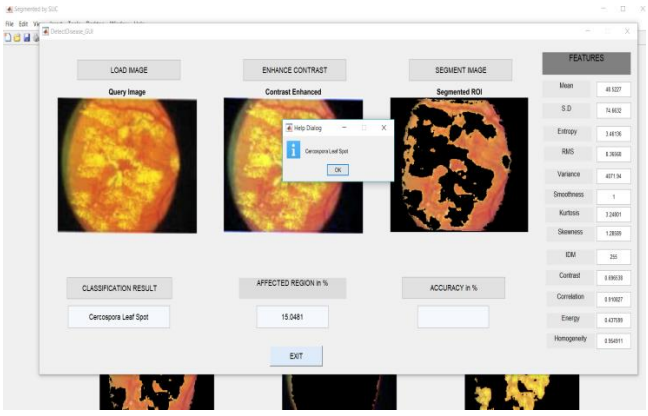


Fig 4.4: Classification

5. CONCLUSION

In existing system,DiabeticRetionpathy is detected using Binocular siames like CNN. The classification of the type of Diabetic Retinopathy was not done thus, detection alone cannot help in finding accurate results. In the proposed system Diabetic Retinopathy is not only detected but also the type is identified at a higher accuracy of 95%.

6. FUTURE ENHANCEMENT

There are a number of things that can be improved upon and added to the system. Improve the filtering process for an image and the feature extraction of retinal tissues are to be collected for identifying the severity level of a disease. Neural networks have shown great promise in this area, and would likely be the main focus for future work. It can analyze the classification part in accurate manner. Detection of microaneurysms and also maculopathy be predicted and performance can be compared.

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