Detection of Diseases in Human Eye

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Abstract: **-The blindness is caused by various diseases .Out of them the Diabetes retinopathy is a diseases occurred and most commonly seen in diabetes patients. It is caused by change in blood vessel of the retina. The eyes start affecting slowly and damage the visibility and lead to blindness. The symptoms is blur vision and swelling from the blood vessels. The detection of diabetes retinopathy must be done at earlier stage, so that precaution is taken immediately. For that we have proposed the computer based analysis of diabetes retinopathy by taking the fundus images of human eye and the features of eye is captured from raw images and then the image processing techniques is applied based on various algorithm the important region are pre - processed. After this the processed images is fed to the SVM machine it helped to categorized the diseases based on it classification is done There are three stages normal, proliferative and Non proliferative and diabetes retinopathy. In this way the detection is carried out.**

***Keyword*:-Diabetes, Retinopathy, fundus image, proliferative, non-proliferative, sensitivity, svm machine**

1. Introduction: -

According to WHO around 135 million people have diabetes around the world and might increase to 300 million till 2025. The field of medical image research has lot of opportunities and has attracted many scientist and researchers. The severe progress of diabetic blindness has increased in each and every country with the person growing old the chances of getting blind is also higher so one of the way to reduce this is by detection and diagnosis of the diabetes which causes blindness and this can be done by regular checkups of the patients. There are many approaches which are used and suggested to reduce the stress caused by constant checkup among which the digital image processing is used for detection and diagnosis of diabetic retinopathy and it is of two types Non-Proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopathy (PDR) so for regular screening of retina an automated system can be used which can detect and tell the stage of diabetic retinopathy.

2. Diabetic retinopathy: -

This disease is caused by severe damage to the blood vessels in the eyes, there are mainly two types non-proliferative and proliferative. Where non-proliferative is also called as early stage diabetes or less severe in which blood vessels start leakage of fluid in retina that causes vision blurring. Proliferative is more severe than the previous and is advanced form of disease, where new blood vessels start growing in the eyes this vessels are weak and may burst out inside eyes which cause vision loss so having severe diabetes for longer period of time can cause retinopathy. Retinopathy may also occur to a person who has handled it poorly, and almost everyone who had diabetes for more than 30 years is likely to get diabetic retinopathy the symptoms are blurred vision, shadows missing, blindness, floaters in vision so everyone should have regular checkup of human eye.

3. Proposed work: -

In this paper, the computer assisted analysis of diabetes retinopathy is carried out with the help of Matlab software in which the code is run as per the algorithm which are followed by image processing techniques .The fundus image of eye is passes through the pre-processing method such equalization ,discrete wavelet filtering, segmentation .This are used here to enhanced the region of retina which is used further to extract the features such as area, pixels and standard deviation. As this three features are enough to do the classification. With the help of this well known features svm machine is able to categorized the images, it classifies the images into three stages. Basically ,here the three stages are shown 1.normal 2.proliferative diabetes retinopathy 3. Non-proliferative diabetes retinopathy. The sensitivity is provided 100% for the normal.

4. Preprocessing of images: -

The preprocessing of image includes Grayscale Conversion, Adaptive Histogram Equalization, Discrete Wavelet Transform, Matched filter response and Fuzzy C-means Clustering for segmentation of Blood Vessels.

Flow chart-

Fig. 1 Flow Chart of process

Fig.2 Gray Scale Image

2. Adaptive histogram equalization: -

This technique is specially used for digital image processing to improve contrast in images. It is considered image enhancement technique is capable of improving images contrast. The main objective of this is to define point of transformation within fairly large window and we can see it with the assumption of intensity and it covers the entire intensity of range of image.

Fig. 3 Adaptive Image

3. Discrete Wavelet Transform:-

In the transform of a signal is just another form of representing the signal. The content of the signal is not changed in the information. This Transform is used for a time frequency representation of signal. Therefore Wavelet Transform use multi resolution technique from which different frequencies are to be analyzed for different resolutions. There are various wavelet transform so we have used Haar transform for paper as a result the size of this images is reduced to almost half.

5. Pre-processing Methods:-

1. Gray scale conversion: -

The colored image of human eye is taken as input and that is to be converted to gray scale image. To convert any color to grayscale representation to luminance we shall obtain first values of red, green and blue (rgb) primary colors. Then 30% of red, 59% of green and 11% of blue value is added together. The effective luminance of pixel is calculated using the formula Y=0.3 RED+0.59 GREEN+0.11 BLUE this value of pixel can be converted to grayscale pixel.

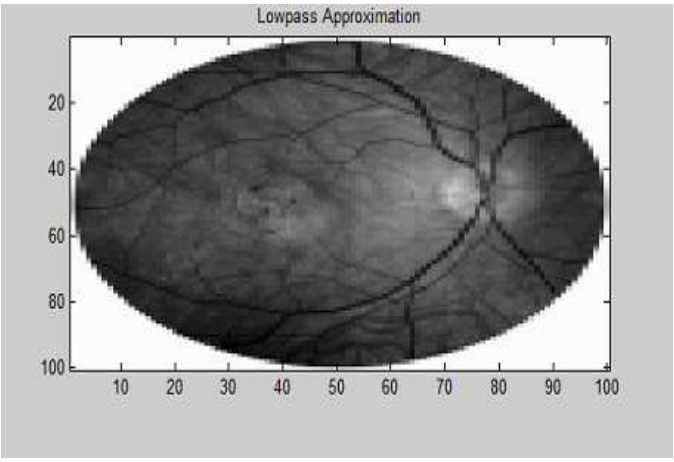

Fig. 4 Discrete wavelet Image

4. Matched filter response: -

Matched filter is linear filter used to maximize the signal to noise ratio (SNR) in presence of additive stochastic noise. This optimal filter is known as the matched filter. All filters are implemented with twelve 16 * 16 pixel kernel. A Gaussian function is used to model blood vessel profile. We have used the matched filter for detection of signal to detect piecewise linear segments of blood vessel for retinal fundus images and construct the new 12 different templates to search for vessel segments for all possible directions. This matched filter has been applied by convolving a retinal image with all 12 kernel.

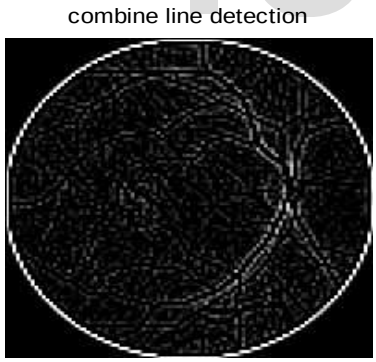

Fig. 5 Matched Filter Image

5. Fuzzy C-Means Clustering: -

Fuzzy C-Means it is a method for clustering which allow one piece of data which belong to two or more cluster. At medical diagnostic system, fuzzy c-means algorithm is used to give better results than hard k-mean algorithm. In this segment is used as the input eye image and to detect the blood vessels. All the information about blood vessels could be used for grading of disease severity.

6. Features extraction: -

This steps comes into picture when all the preprocessing steps are performed, we get the image and the features are extracted from that image 1. Area of pixels 2. Mean 3. Standard deviation.

1. Area of pixel: Its area of white pixel with value 1 over the black and white image.
2. Mean: It is arithmetic average for set of values, or distribution. Here in image of eye, it has been obtained by adding all values of the pixel together, and dividing by the number of old value.
3. Standard Deviation: The Standard deviation for an image is found by squaring each pixel values of all the individual samples, and then calculating average for the number of samples N. Here standard deviation measures spread of all data about its mean value. So standard deviation is approx equal to average deviation around the mean.

7. SVM modeling technique for classification: -

After feature extraction the image is given to SVM. SVM is used to classify the group of eye images is either affected or normal depending on feature values. Support vector machine are set of supervised learning method used for classification. A Support Vector Machine (SVM) is used to perform classification by construction of an *N* dimensional hyper plane that separate the data with two categories. Here input space is mapped to a high dimensional feature space. The hyper plane which maximize margin of separation between classes is constructed. Here the point that lie closest to decision surface are known as support Vectors and directly affect the location. Here the classes are not separable and the optimal hyper plane is one that minimizes the probability of classification error. So goal of SVM modeling is used to find the hyper plane that separate clusters of vector in such a way that causes with one category of target variable are on one side of the plane and cases with other category are on other side of the plane.

The vectors in the hyper plane are used in *support vectors*. So given a set of training example, for marked each as belonging to one of two categories, as SVM training is for algorithm which builds a model which predicts whether the example falls into any one category or the other. To fit the non-inear curves of data, SVM makes use of kernel function to map data into different spaces where hyper plane could be used to do separation.

8. Conclusion: -

Therefore in this paper we have performed various pre-processing techniques on fundus images and obtained the exudates & hemorrhages from which it can be determined whether the eye is normal or with npdr or pdr, the patient will go through a faster process and that to with less pain by using fuzzy C-Means classification is done and the white spots and the eye macula is also shown so with svm training the system will be trained several times for accurate results with different sets of fundus images.

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