Glaucoma and Diabetic Retinopathy Diagnosis using Image Mining

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ABSTRACT
In today's world human are affected by various diseases which lead to damage of some or the other body part which degrades their working speed. Eye diseases are one of the factors, which include vision loss due to glaucoma and diabetic retinopathy. Glaucoma damages the optic nerve of the eye. DR cause changes in eye damage the blood vessel. Image will undergo a standard method of applying image processing which include image acquisition, pre-processing, feature extraction followed by exact identification of disease by means of a classifier. Various classifiers are available in data mining that have been used for classification in different areas. We will use SVM for classification of the retinal images into category of Normal, DR and Glaucoma. The Overall classification rate of the proposed system will give the better efficiency and accuracy of identifying the disease with respect to existing systems.

Keywords
Glaucoma, Diabetic Retinopathy, Retinal images, Image Mining.

1. INTRODUCTION
Human are affected by various diseases. Eye is the major organ of human. In the field of medical research express that abnormal pressure and glucose levels are a major cause of eye diseases. Diabetic Retinopathy and Glaucoma has the major symptoms in the preliminary stages and findings treatment may be useful only when detected early. DR is defect in the retina of the eye caused mainly due to Diabetes leading to imperfect/loss of vision and the latter being associated with elevated pressure in the eye causing damage to the optic nerve. In these blood vessel becomes weak and due to this vessel leaks blood and fluid of lipoproteins this creates abnormalities in retina. There may exist different kinds of abnormal lesions caused by diabetic retinopathy in a diabetic's eye[1]. Glaucoma is not a singular eye disease, but is instead a term for several eye conditions that can damage your optic nerve. The optic nerve is the nerve that supplies visual information to your brain from your eyes. The result of abnormally high , increased pressure inside the eye over time can erode the optic nerve tissue, which may lead to vision loss or even blindness. If detected early, may be able to prevent additional vision loss [3].

1.1. Different Detection Techniques of Disease:
- Glaucoma can be detected by cup to disc ratio (CDR), Ratio of the distance between optic disc center and optic nerve head to diameter of the optic disc and Ratio of blood vessels area in inferior-superior side to area of blood vessel in the nasal temporal side (ISNT ratio).
- Diabetic Retinopathy can be detected by exudates, Hemorrhages, Microaneurysms and Cotton wool spots.

In this paper diabetic retinopathy is detected using exudates technique and glaucoma using count of blood vessel. There are various methods of classifying medical images and are mainly categorized into 3 parts namely Texture-based classification, Neural Network classification and the Data Mining Task [2]. Among them the Data Mining task is considered to be the best as it can not only be used effectively alone but can also be used to improve the accuracy.
The organization of paper is as follows: section II describes the literature survey, section III provides proposed methodology. Finally in section IV we present our conclusion.

2. LITERATURE SURVEY
"R. Geetha Ramani [1]" presented an automatic detection of diabetic retinopathy and glaucoma through image processing and feature extraction of the entire fundus image and classification using data mining techniques. Automatic diagnosis of eye abnormalities (Diabetic retinopathy and Glaucoma) wherein the image is primarily preprocessed and statistical, GLCM based and histogram based measurements are calculated. The measured data are given to a classifier. The classifier categorizes the fundus image to the disease category to which it belongs as Normal, DR and Glaucoma. "Satej Wagle [2]" proposed an improved model for classifying retinal fundus image as Normal and Severe image. Classification algorithm are concentrates on improving the prediction ability using weighting techniques and also uses image pre-processing techniques to select the best representative features to classify an image and to avoid the curse of dimensionality."Yuji Hatanaka [3]" proposed a system to exclude blood vessel regions from potential false positives and the blood vessels were automatically segmented by using morphological operation and thresholding. The identified regions as blood vessels were interpolated by the surrounding pixels for creating "blood-vessel erased" images. NFLDs are most prominent in the green channel of the RGB color images, thus the color images were converted to gray scale images by use of the green channel. The NFLDs appear as dark curved bands extending radically from an ONH on the spherical surface and developed different kinds of classification algorithm to detect the Glaucoma disease. "Rudiger Bock [5]" proposed a novel automated glaucoma detection system that operates on inexpensive to acquire and widely used digital color fundus images. In this specific preprocessing and different generic feature types are compressed by an appearance-based dimension reduction technique. Akara Sopharak [6], Fuzzy C-Means clustering is proposed. Contrast enhancement preprocessing is applied before four features, namely intensity, standard deviation, hue and number of edge pixels detected exudates. Akara Sopharak [7], to detect non dilated pupils it has two main segmentation steps. They are Coarse segmentation using morphology techniques and fine segmentation using Naive Bayes classification to detect the microneurysms revealed 18 per pixel features.

3. PROPOSED METHODOLOGY

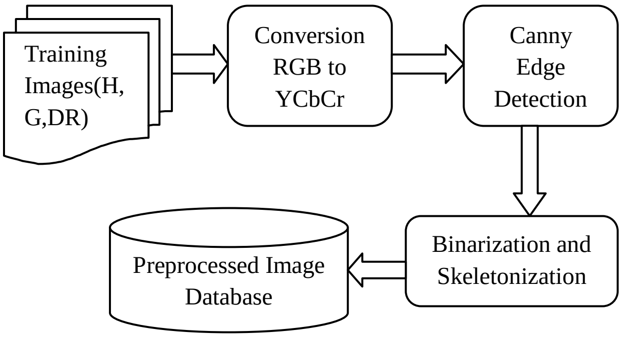

Fig 1: Preprocessing Architecture.

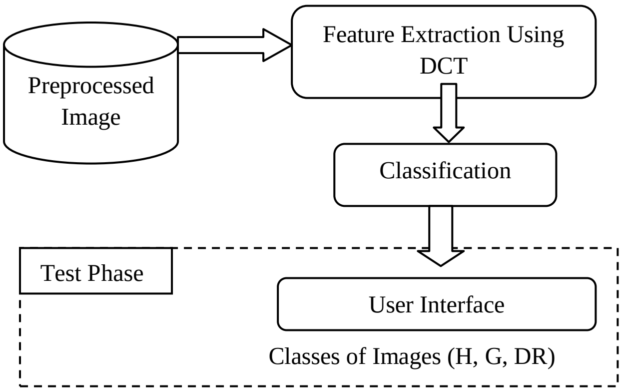

Fig 2: Proposed Model for Detection of retinal Diseases.

The retinal fundus images are taken in RGB form. Firstly, image processing is carried out due to the non-informality in color distribution of medical images. In this retinal fundus images are high variation in pigment colors and illumination of the image. As a result the image is converted to YCbCr image. Secondly, for futher processing we will use only Y plane for detection of blood vessels, optic disc and exudates. The blood vessels in the form of edge are extracted using canny edge detector from the image and also the exudates. Thirdly, to get prone image of eye we will converted the image into binary to perform skeletonization operation on the image. Then to detect Glaucoma and DR we required different feature from the image so using DCT we will extract the feature of the image and the value which we get from the particular retinal image is given for detection. Fourthly, than image is taken and given to the classifier for detecting disease in retinal fundus images (see Figure 1 and Figure 2).

3.1. The brief description of above steps are:

3.1.1. Resizing the image that it should be suitable for execution.

Resizing of image is done so that all the image will have same size to give as input.

3.1.2. Conversion of color space RGB to YCbCr

YCbCr color space has been defined in response to increasing demands for digital algorithms in handling image information. Y is luma component which represent the luminance and computed from nonlinear RGB. It is obtained as weighted sum of RGB values. Cb is difference between blue and luma component and Cr is the difference between red and luma component. The Y in YCbCr denotes the luminance component, and Cb and Cr represent the chrominance component [8].

Suppose that are analog values between 0 and 1 E_R, E_G and E_B that describe how much red, green and blue there is in a pixel (given eight bit quantization we have $E_R=R/255$, $E_G=G/255$ and $E_B=B/255$). A typical conversion (ITU-R Recommendation 624-4 System B, G) to luminance-chrominance is then given by

$$E_Y = 0.299.\ E_R + 0.587.\ E_G + 0.114.E_B \quad \ldots(1)$$

$$E_{Cb} = -0.169.\ E_R - 0.331.\ E_G + 0.500.E_B \quad \ldots(2)$$

$$E_{Cr} = 0.500.\ E_R - 0.419.\ E_G - 0.081.E_B \quad \ldots(3)$$

Where E_Y is between 0 and 1 and E_{Cb} and E_{Cr} are between -0.5 and 0.5. Conversions to 8-bit values are then done by:

$$Y = 219.\ E_{Y\,+}\ 16 \quad \ldots(4)$$

$$C_b = 224.E_{Cb\,+}\ 128 \quad \ldots(5)$$

$$C_r = 224.\ E_{Cr} + 128 \quad \ldots(6)$$

From the above equation we will convert the retinal images into YCbCr form and the Y plane is consider for further processing.

3.1.3. Edge detection

Edge Detection is one of the most commonly used image processing techniques for detecting edges in a very robust manner. Canny edge detection is a process to identify and locate sharp in images. To work accurately it has to follow the algorithm steps which are very important to find out edges and should not miss the edge from the images. Secondly, edge points will be localized well means distance between actual edge and edge pixels as found by the detector should be minimum. Thirdly single edge should have only one response. While implementing we can get multiple response to an edge. Based on these criteria, the canny edge detector first smoothes the image to eliminate and noise. It then finds the image gradient to highlight regions with high spatial derivatives [9][10].

3.1.3.1. Edge detection algorithm Steps:

- Noise Reduction : use Gaussian filter
- Compute Gradient Magnitude and Angle
- Non-Maximum Suppression
- Hysteresis Thresholding

3.1.4. Skeletonization

Skeletonization is an algorithm that is performed in order to obtain the center of an image. Knowing the center of the image or skeleton is useful because the original image can be recreated from it. The skeleton of an object is conceptually defined as the locus of center pixels in the object. Therefore, skeleton is used to find out interior structure of the image. This image is a prone image. It is very useful to find out edges, small and big dots accurately which we required for detection of diseases. Edges and dots will represent us blood vessel and exudates, hemorrhages of retinal image. These are different feature used for detection of retinal image.

3.1.5. DCT (Discrete Cosine Transform)

The DCT Transform a signal from spatial representation into a frequency representation. Lower frequencies are more obvious in an image than higher frequencies so if we transform an image into its frequency components and throw away a lot of higher frequency coefficients, we reduce the amount of data needed to describe the image without sacrificing too much image quality [12]. After using DCT we will get the single value of the image which will describe the different features which we are used for detection.

3.1.6. Data mining: SVM(Support Vector Machine)

Support vector machine constructs a hyperplane or set of hyperplanes in a high- or infinite-dimensional space, which can be used for classification, regression, or other tasks. The algorithm searches for the optimal separating surface, it works in hyperplane that it is find out categories of classes from hyperplane. The first kernel function is used for the linear data which separate the data linearly. Finally, for noisy data, when complete separation of the two classes may not be desirable, slack variables are introduced to allow for training errors. Algorithm depends on the data only through dot-products. Kernel function computes a dot product in some possible high dimensional feature space. Linear classifier is used to detect the categories of retinal disease as Normal, Glaucoma and Diabetic retinopathy very efficiently and accurately [13] [14][15].

4. CONCLUSION

In this paper a medical image classification model for retinal fundus images is proposed. This work specifically places focus on the feature relevance and classification techniques to accurately categorize the disease associated with the retina based on the features extracted from retinal images through image processing techniques. SVM classifier is trained through supervised learning for the features extracted to classify the retinal images. The Overall classification rate of the proposed system will give the better efficiency and accuracy of identifying the disease with respect to existing systems.

5. REFERENCES

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