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IRIS IMAGE BASED DIABETIC PREDICTION USING FUZZY CLUSTERING ALGORITHM AND SVM CLASSIFICATION MODEL

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1. Introduction

ABSTRACT:

Iris image analysis for clinical diagnosis is one of the most efficient non - invasive diagnosis methods for determining health status of organs Correct and timely diagnosis is a critical, yet essential requirement of medical science. The attempt is being made to explore the area of diagnosis from different perspectives .The approach used is a combination of ancestor's technology Irido-diagnosis with modern technology. Irido-diagnosis is an alternative branch of medical science, which can be used for diagnostic purposes the different algorithms are developed for image quality assessment, segmentation of iris, iris normalization and clinical feature classification for clinical diagnosis. In this paper analysis a simple and non - invasive method to detect diabetic in body and iris recognition is not only mainly for biometric identification but it can also be used as a mean to detect diabetic or maybe diagnose any diseases as iridology claimed it is supposed to be. For clinical feature analysis, enhancement is essential for extraction of deep layer features. For feature extraction various image enhancement methods like arithmetic operation, histogram equalization, and adaptive histogram equalization have been applied.

Keywords: Digital Image Processing, IrisImage,MultiSVM, Segmentation, Clustering, ANN

2. LITERATURE SURVAY

Diabetics are one of the most important causes for blindness. Automated identification of Diabetics can be of immense help to the Ophthalmologists and the society. The existing approaches towards Diabetics diagnosis is concisely presented here. Generally, the process of Diabetics

Detection involves the extraction of optic disc and cup followed by elicitation of its properties such as ISNT ratio and cup to disc ratio to differentiate normal images

from Diabetics affected images. Some of the approaches are briefed here.

- **Acharya et al., (2011)** Diabetics progression occurs due to enhance in IOP, resulting in an improved cup size. Cup is the brightest central section and thus enhance in cup size results in change of intensity based and texture based properties of the fundus image. Research is being completed using state of art machine learning techniques (texture based and intensity based features) to categorize images as Diabetics or non-Diabetics. High order spectral features were used to identify Diabetics from fundus images. Fundus image is management.
- Pre-processed followed by High order spectral features and texture feature extraction. Naïve Bayes, Support vector machine (SVM), sequential minimal optimization (SMO) and Random Forest were used to classify the images as Diabetics or non-Diabetics. Algorithm was established by 91 % accurate with random forest classifier.
- **Damon et al., (2012)** discussed about Cup detection algorithm based on vessel kinking was proposed in Algorithm proceeds with identifying vessels by categorizing several patches of interest by using features like mean and standard deviation of a fused image formed after computing wavelets of edges of green red component and gradient of green component. Vessel kink detection was concluded by localizing maximum curvature of the detected vessels. Algorithm valuation was done on 67 images, and has reduced 43.3 % errors in cup boundary detection.
- **GeethaRamani et al., (2014)** proposed a framework based on image features to identify Diabetics . The methodology included Conversion to various colour histogram, GLCM based feature extraction and classification through Grafted C4.5 yielding an accuracy of 86.67% on HRF images with 3 fold cross validation.
- **Vijapur (2014)** proposed a data driven workflow for detection of Diabetics through extraction of energy descriptors from exhaustive co-efficient images obtained through application of symlets, daubechies and bio-orthogonal wavelet filters and calculation of cup to disc ratio feature through optic disc attained through disc prediction and cup through watershed segmentation attaining a detection accurateness of 96% on images.
- **Simonthomas et al., (2014)** proposes a CAD algorithm for Diabetics using Haralick features. GLCM of input fundus is computed for the four directions (0°, 45°, 90°, and 135°) and combined by summing up and averaging to get a single matrix composed from the four direction matrices. Haralick texture features of the resultant GLCM were computed and K nearest neighbour (KNN) classifier was used to classify the images as healthy or Diabetics toes. Accuracy for a local data set comprised of 60 images was found to be 98 %.
- **Khalil et al.,(2014)** discussed the review on machine learning techniques for independent Diabetics detection provided a profound analysis on different machine learning, feature selection, training techniques. An evaluation between different spatial and frequency based features was made using different classifiers for training and testing. It was concluded that all the machine learning techniques using combination of features have ability to detect 85 % Diabetics cases.
- **Cheng et al., (2015)** proposed sparse dissimilarity coding algorithm from Diabetics screening using CDR using fundus images. Proposed methodology segments the optic disc by combining results from three disc segmentation techniques. First technique used Circular Hough transform followed by Active contour models, second technique used super pixel based feature extraction and classification, third technique used ellipse fitting. Best result of segmented disc from the three techniques was used for further processing.
- **Imran Qurush (2015)** discussed diverse image processing techniques as well as

different computer based systems concerned mainly in the detection and diagnosis of Diabetics and to highlight the sternness of Diabetics across the globe. To expresses small effort regarding detection of Diabetics disease.

- **Salem et al., (2016)** attempted to detect Diabetics through Cup to disc ratio, texture and intensity based features. The predictions from combination of texture and intensity features and cup to disc ratio are interrelated to classify the image as Diabetics, suspect or non-Diabetics. The act of the system reached a sensitivity and specificity of 100% and 87% respectively.
- **Parkas and Selvathi (2017)** put forth a morphology based methodology for segmentation of optic disc and optic cup. Optic disc mining involves extraction of red channel, morphological closing followed by morphological opening and subtraction of opened and closed image. Optic cup segmentation involves independent component analysis on the red channel image, followed by application of morphological closing and thresholding. Subtraction of obtained optic disc and cup reveals the neuro rim region. The method could attain an accuracy of 99.30% in optic disc segmentation of HRF images. Then Grey Level Co-Occurrence Matrix features and Enhance Local Binary Pattern were extracted and application of SVM classification was done to classify Diabetics and healthy images.

3. METHODOLOGY

This is the most important step of the project as textures obtained will be taken as input material for neural nets which will classify the images in their respective classes.

IMAGE COMPRESSION

As one can see there are different types of images in dataset with different resolution, different camera quality and different sizes my work is to classify them in different classes. So first problem I faced was related to heterogeneity of the dataset. For this compressed all my training and test images in 256*256 formats.

LAYER SEPARATION

In later parts we are going to use 6 features as input to classifier namely Red layer of parameter, Blue layer of parameter, Green layer of parameter, Red layer of area, Green layer of area, Blue layer of area so in this step all 3 layers of namely Red, Green and Blue are separated from the images.

ADAPTIVE EQUALIZATION

After last step there are large intensity variations in the image and one can see that veins and other eye features are not clearly seen there. For making intensity variations uniform I applied histogram equalization to the image.

Histogram equalization is technique which identifies various intensity variations in the given image and increases its global contrast. For equalization tried both Histogram Equalization and Contrast Limited Adaptive Histogram Equalization but Contrast Limited Adaptive Histogram Equalization giving a little better feature than simple one.

So in this step I have used CLAHE object on purpose

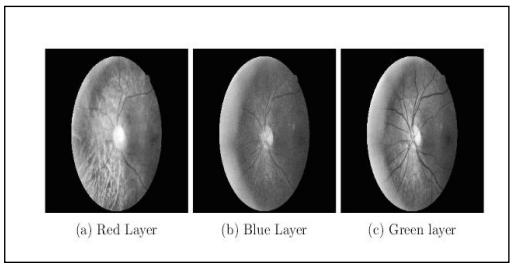
MORPHOLOGICAL OPERATIONS

In this part various morphological operations are employed to enhance blood vessels and to remove noise in the background. I used method proposed in (use cite here) to enhance to required features. Blood vessel rupture is main element of the disease DR. So it is important to extract and distinguish them from the background and remove background noise as much as possible.

Two types of structuring elements are used in this step.[2, 8]

- Diamond like structure(for clearer veins)
- Disk like structure(to remove noise)

For this part I have used morphological openings. In this part I first used disc SE with R=5 then I used diamond of R=3.



(a) Red Layer (b) Blue Layer (c) Green layer

FEATURE EXTRACTION

This is final image processing step for the project. In this step I will first extract perimeter from all three layers and then extract area of three layers

- Canny edge detection
- Thresholding
- Fuzzy c-means clustering

Canny edge detection

In this step we proceed towards finding perimeters of all 3 layers. This is done by canny edge detection. In canny edge detection Gaussian filters are applied then using double threshold edge of intensity variation part is detected.

Thresholding

This step is applied on morphed images which gives area of the 3 layers. This is done by adaptive thresholding. Tried using Otsu's thresholding and simple thresholding but later is giving better areas then other two

Fuzzy C-Means Clustering

Fuzzy clustering plays an important role in solving problems in the areas of pattern recognition and fuzzy model identification. A variety of fuzzy clustering methods have been proposed and most of them are based upon distance criteria. One widely used algorithm is the fuzzy c-means (FCM) algorithm. It uses reciprocal distance to compute fuzzy

Value (between 0 and 1), which is computed using 2nd Equation. The algorithm assigns a feature vector to a cluster according to the maximum weight of the feature vector over all clusters.

Algorithm techniques

Step 1: Set the number **c** of the cluster prototypes, fuzzification parameter **m** and the stopping condition

Step 2: Initialize randomly the fuzzy partition matrix.

Step 3: Set the loop counter **b** = 0.

Step 4: Calculate the cluster prototypes using (1).

Step 5: Compute membership values using (2).

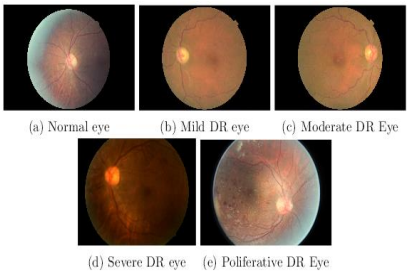
Step 6: If **max** $\{U^{(b)}-U^{(b+1)}\} < \varepsilon$ then stop, otherwise, set **b = b + 1 and** go to step 4.

CLASSIFICATIOSUPERVISED LEARNING [SVM and ANN]

This is the last part of the whole process.

Here used deep neural nets with 3 convolution layer. In this part first balanced classes are created by using above images and then they are given as input in neural nets along with labels. This on output gives predicted labels.

Table 1: Class name descriptions



(a) Normal eye (b) Mild DR eye (c) Moderate DR Eye

(d) Severe DR eye (e) Poliferative DR Eye

4. CONCLUSION

The system is very fast in applying segmentation algorithm. This simulation software is very particular in reducing the difficulty in segmentation algorithms. Through this paper, the problem of manual pattern is eliminated. Since very less input is given, any persons can use the researches. Once the pixel value is found to be incorrect in given rectangular area, the entire area is ignored for further fuzzy pixel comparison. This experimental result in fast work and their overall recognition time is reduced. The end users are required to have minimum working experience in systems to run this software. The future clustering reduces recognition time and helps in improving error free and efficient patterns identification. The proposed system is tested well so that the end users use this software for their whole pattern recognition related operations.