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On a Methodology for Detecting Diabetic Presence from Iris Image Analysis

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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. From the literature survey, it is found that modern technology also fails in lot of cases to diagnose disease correctly. The attempt is being made to explore the area of diagnosis from different perspectives. By using combination of ancestor's technology Iridodiagnosis with modern technology; Iridodiagnosis is an alternative branch of medical science, which can be used for diagnostic purposes; To begin with a database is created of eye images with clinical history of subject's emphasis on diabetic (type II) disease in pathological laboratory. The various algorithms are developed for image quality assessment, segmentation of iris, iris normalization and clinical feature classification for clinical diagnosis. The entire process shows classification accuracy of 90 ~ 92 percent between diabetic and non-diabetic subjects. A significant improvement is demonstrated in classification performance over the existing approaches. This approach will be useful in the diagnosis field which is faster, user friendly and less time consuming.

KEYWORDS: Diabetic, Feature extraction, iridodiagnosis, Iris, Segmentation

I. INTRODUCTION

Iridolgy is the branch of science that deals with the study of iris i.e. colored part of the eye. The Iris is the greenish-yellow area surrounding the transparent pupil (showing as black). The white outer area is the sclera; the central transparent part is the cornea. The main intention of irido diagnosis is to collect some information about underlying disease. As technology has developed, there are various methods present for the diagnosis which are highly reliable and accurate. Basically, irido-diagnosis is consists on empirical science, to look into the particular area of eye for systemic health condition of the specific organ of the body. Iridology is the diagnosis of medical conditions and "pre-disease states" through abnormalities of pigmentation in the iris. The location of abnormalities on the iris is associated with the location of the medical condition in the body. The iris of the eye is divided into 60 sectors; each sector is corresponding to an inner organ. The iris is associated via multiple nerve connections to the organs. Depending on the features of the iris classification is done and diabetic is detected. Iridodiagnosis can also be used to detect Gall Bladder Disease in the patient's iris.

II METHODS AND PROCEDURES

The framework followed in this paper is illustrated in the fig (1).

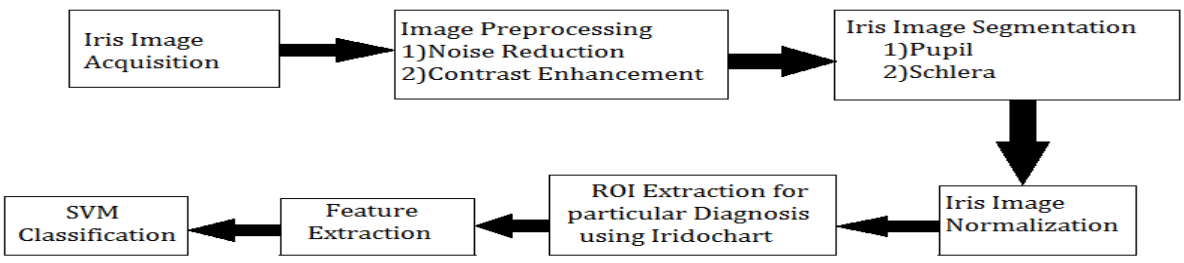

Fig.1: Block diagram of proposed approach

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A) Eye Image Acquisition:
Initially the eye image is captured with the help of certain cameras, and stored in the database which contains normal as well as abnormal results of iris.

B) Image pre-processing:
The pre-processing is done in order to reduce the presence of noise in the iris image and enhancement is done in order to manipulate an image so that the result is more suitable than the original. It makes the hidden features of an image more available for us. Enhancement is done for improving the details of an image.

C) Segmentation:
Segmentation is done in order to find inner and outer boundaries of the iris. By subtracting pupil from sclera, we will get the iris part of an eye [5]. Once the iris region is segmented from an eye, the next step is to transform the iris region into fixed dimensions. After subtraction, we will get the iris pattern into circular shape.

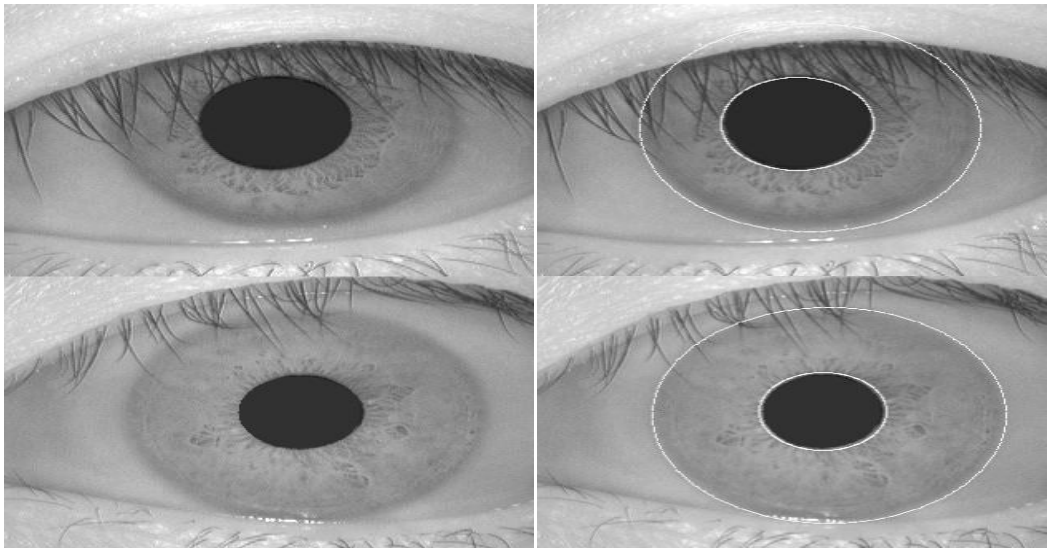

Fig.2: Iris segmentation

D) Normalization: Normalization is done to convert circular iris pattern into rectangular shape.

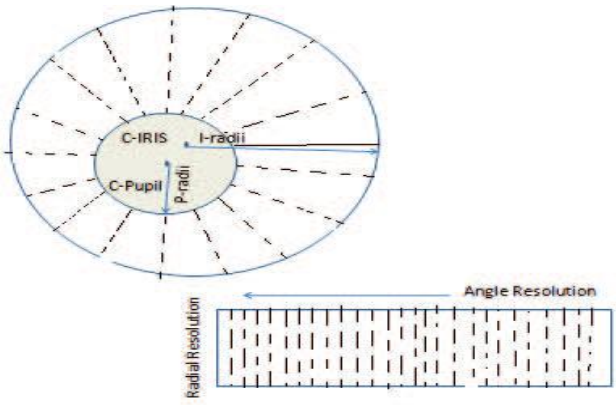

Fig. 3: Iris Normalization

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E) ROI extraction:
After normalization, the next step which comes into picture is ROI extraction. ROI extraction is nothing but cropping particular portion of normalized iris image.

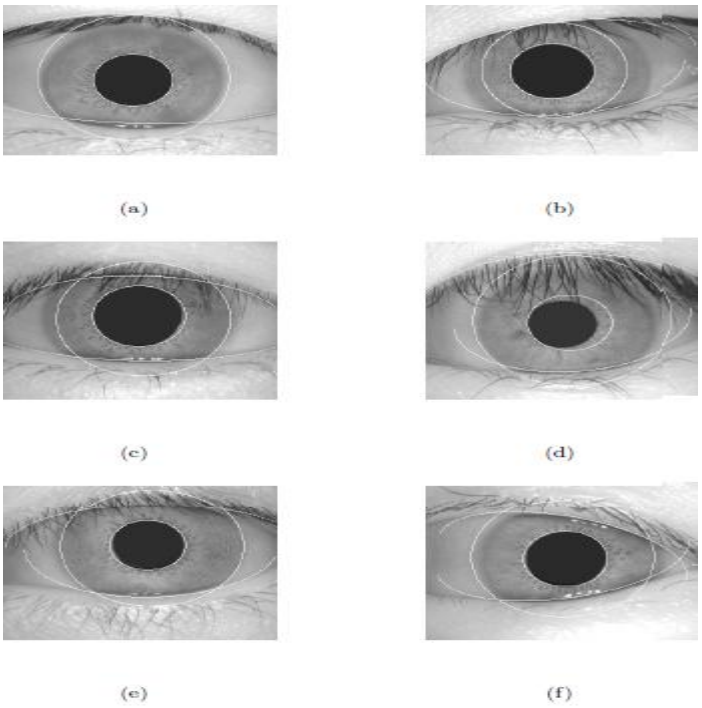

Fig. 4: (a)-(f) illustrate the inaccurate results of limbus detection because of low contrast of limbus and presence of eyelids and eyelashes.

F) Feature extraction:
The region of interest is identified by visual inspection as per chart of Iridology. The feature is defined as a function of one or more measurements, each of which specifies some quantifiable property of an object, and is computed such that it quantifies some significant characteristics of the object. We classify the various features currently employed as follows:
General features: Application independent features such as color, texture, and shape. According to the abstraction level, they can be further divided into:

Pixel-level features: Features calculated at each pixel, e.g. color, location.
Local features: Features calculated over the results of subdivision of the image band on image segmentation or edge detection.

Global features: Features calculated over the entire image or just regular sub-area of an image.
Domain-specific features: Application dependent features such as human faces, fingerprints, and conceptual features. These features are often a synthesis of low-level features for a specific domain.
Color Features: The color feature is one of the most widely used visual features in image retrieval.

Images characterized by color features have many advantages: Like Robustness, Effectiveness, Implementation simplicity, Computational simplicity, Low storage requirements, Texture. Texture is another important property of images. Texture is a powerful regional descriptor that helps in the retrieval process. Texture, on its own does not have the capability of finding similar images, but it can be used to classify textured images from non-textured ones and then be combined with another visual attribute like color to make the retrieval more effective.

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Texture has been one of the most important characteristic which has been used to classify and recognize objects and have been used in finding similarities between images in multimedia databases.

G) SVM classification:
SVM classification is the important part of the approach because the overall process depends upon the classification done through this algorithm. SVM is relatively new method of classification and it expands very quickly. That will certainly cause wider use of SVM in different areas, also in medicine.

SVM use in medicine: SVMs are helpful in text and hypertext categorization as their application can significantly reduce the need for labeled training instances in both the standard inductive and transductive settings.
SVMs can be used to solve various real world problems

II. PREPROCESSING

Images may be contaminated with noise during transmission, scanning or conversion to digital form. We can categorise noises by identifying their features & can search for similar patterns in document image to choose appropriate methods for their removal. Noise removal is one of the steps in pre processing. The processing involves filtering, normalization, segmentation, and object identification. The output of this stage is a set of significant regions

Pre-processing:
The image is first processed in order to extract the features, which describe and objects. Image pre-processing is the name for operations on images at the lowest level of abstraction whose aim is an improvement of the image data that suppress undesired distortions or enhances some image features important for further processing. It does not increase image information content. Its methods use the considerable redundancy in images. Neighbouring pixels corresponding to one object in real images have the same or similar brightness value and if a distorted pixel can be picked out from the image, it can be restored as an average value of neighbouring pixels. Image pre-processing tool, created in Mat Lab, realizes many brightness transformations and local pre-processing methods.

Noise Removal:
Many filters are used to remove the noise from the images. Linear filters can also serve the purpose like Gaussian, averaging filters. Median filtering is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges.
For example average filters are used to remove salt and pepper noise from the image. Because in this filter pixel's value is replaced with its neighbourhood values .Median filter is also used to remove the noise like salt and pepper and weighted average filter is the variation of this filter and can be implemented easily and give good results. In the median filter value of pixel is determined by the median of the neighbouring pixels. This filter is less sensitive than the outliers.

Image Cropping and Filtering:
The first step in image pre-processing is image cropping. Some irrelevant parts of the image can be removed and the image region of interest is focused. This tool provides a user with the size information of the cropped image. Mat Lab function for image cropping realizes this operation interactively waiting for a user to specify the crop rectangle with the mouse and operates on the current axes. The output image is of the same class as the input image.

IV EXPERIMENTAL RESULTS

For clinical feature analysis, improvement is necessary for extraction of deep layer features. For feature extraction various kinds of image enhancement methods like arithmetic operation, histogram equalization, and adaptive histogram equalization have been applied.

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The detection of diabetes using Iridology includes image acquisition, pre-processing, segmentation, Iris region, Normalization, Feature extraction, Classification. The results shown in fig are up to region of interest extraction for particular diagnosis using iridochart.

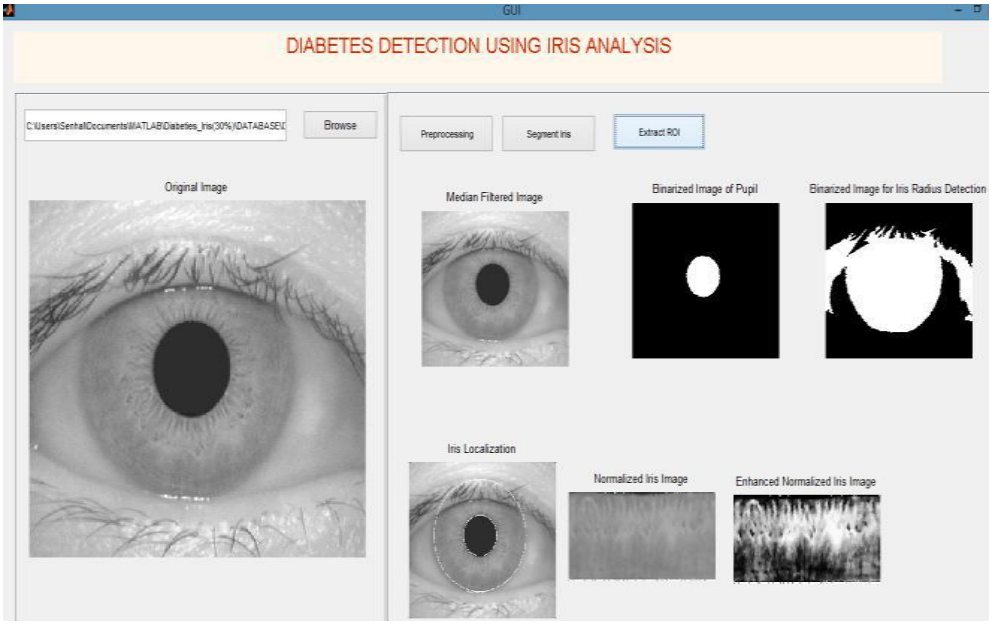

Fig. 5: Simulation of result

V CONCLUSION

We conclude that there is 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. The approach used is a combination of ancestor's technology. Iridodiagnosis is an alternative branch of medical science, which can be used for diagnostic purposes. This approach will be useful in the diagnosis field which is faster, user friendly and less time consuming.

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