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Human Identification Based On Iris Recognition Using Support Vector Machines

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Abstract: **-- Biometric identification is automated recognition of individuals based on their physiological and behavioral characteristics. The iris which have very unique features such as crypts, furrows etc.Iris recognition systems make use of the uniqueness of the iris patterns to derive an unique mapping where it becomes possible to apply some matching algorithms to identify a person. Here we implement iris recognition technique based on SVM (support vector machine) classifier to recognize the static image with the database images to use this application in security purpose.**

Index Terms:**-- Biometric recognition system, Daughman's rubber sheet model, Support vector machine.**

I. INTRODUCTION

A biometric system usually functions by first capturing a sample of the feature, such as capturing a digital color image of a face to be used in facial recognition or a recording a digitized sound signal to be used in voice recognition. The sample may then be defined so that the most discriminating features can be extracted and noises in the sample are reduced. The sample is then transformed into a biometric template using some sort of mathematical function. The biometric template is a normalized and efficient representation of the sample which can be used for comparisons. Bio- metric systems usually have two modes of operations. An enrollment mode is used for adding new templates into the database and the identification mode is used for comparing a template created for an individual, who wants to be verified, with all the existing templates in the database. Iris recognition involves first extracting the iris from a digital eye image, and then encoding the unique patterns of the iris in such a way that they can be compared with pre-registered iris patterns. Since each individual iris has enormous pattern variability, large databases can be searched without fear of a false match.

II.OBJECTIVE

This project has a new vision for security system, unlike other biometric traits, iris recognition is the most accurate and non–invasive biometric for secure authentication and positive identification. Due to the advantages of iris recognition systems which offer reliable and effective security in the present day, this project proposes the use of iris-based as verification system to identify the person’s identity. This project work adopts Support Vector Machines.

III.BLOCK DIAGRAM

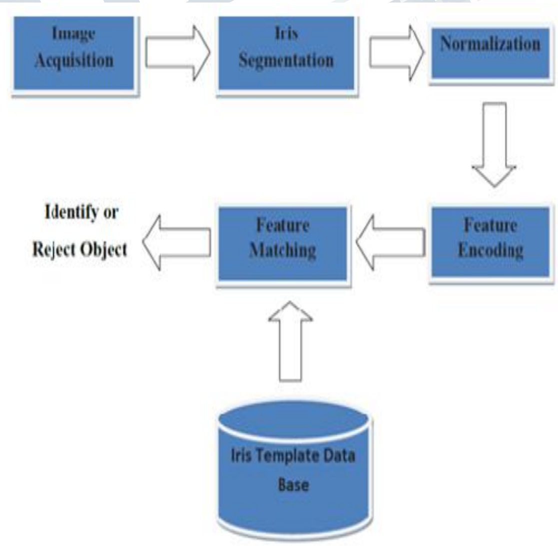

Fig 1: Block Diagram

A. Image Acquisition

To get image from any source especially hardware based any source is called as image acquisition in the image processing because without image acquisition, the processing on the image is not possible. It is the first step in the workflow, data samples are collected using iris camera.

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B .Iris Localization or Segmentation

The first stage of iris of system is to isolate the actual iris region in a digital eye image. This region is approximated by iris ring defined by the iris/sclera boundary and the iris/pupil boundary Canny edge detector and Hough transforms are used for feature and boundary detection respectively.

C. Canny edge detection

The purpose of edge detection in general is to significantly reduce the amount of data in an image, while preserving the structural properties to be used for further image processing. The aim is to develop an algorithm that is optimal with regards to the following criteria:

1. Detection: The probability of detecting real edge points should be maximized while the probability of falsely detecting non-edge points should be minimized. This corresponds to maximizing the signal-to-noise ratio.
2. Localization: The detected edges should be as close as possible to the real edges.
3. Number of responses: One real edge should not result in more than one detected edge. Canny Edge Detector is optimal for a certain class of edges (known as step edges). The pre-processing includes:
   a. Determining ROI (Region of Interest) that includes only white background besides the pump and cropping the image to this region.
   b. Conversion to gray-scale to limit the computational requirements.

D. Smoothing

Gaussian filers are used in image processing because they have property that their support in spatial domain is equal to their support in the frequency domain. It is inevitable that all images taken from a camera will contain some amount of noise .To prevent that noise is mistaken for edges, noise must be reduced. Therefore the image is first smoothed by applying a Gaussian filter. Co efficient of Gaussian kernel is obtained .The original image is filtered with the Gaussian kernel as in equation resulting in smoothened image.

E. Finding gradients

The Canny algorithm basically finds edges where the gray scale intensity of the image changes the most. These areas are found by determining gradients of the image. Gradients at each pixel in the smoothed image are determined by applying what is known as the Prewitt-operator. The gradient magnitudes then can be determined as Euclid distance measure by applying law of Pythagoras or by Manhattan distance measure.

F. Hough transform

After the edges are detected using canny edge detector, Hough transform is applied to find the various parameters such as inner and outer boundary, eye lashes occlusion. The range of radius values to search for was set manually, depending on the database used. In order to make the circle detection process more efficient and accurate, the Hough transform for the iris/sclera boundary was performed first, then the Hough transform for the iris/pupil boundary was performed within the iris region, instead of the whole eye region, since the pupil isalways within the iris region. After this process was complete, six parameters are stored, the radius, and x and y centre coordinates for both circles. Eyelids were isolated by first fitting a line to the upper and lower eyelid using the linear Hough transform. A second horizontal line is then drawn, which intersects with the first line at the iris edge that is closest to the pupil. The second horizontal line allows maximum isolation of eyelid regions. Canny edge detection is used to create an edge map, and only horizontal gradient information is taken. The linear Hough transform is implemented using the MATLAB Radon transform, which is a form of the Hough transform.

G. Normalization

The normalization process will produce iris regions, which have the same constant dimensions, so that two photographs of the same iris under different conditions will have characteristic features at the same spatial location. Normalization process carried out by using Daughmans Rubber Sheet Model. The homogenous rubber sheet model devised by Daugman remaps each point within the iris region to a pair of polar coordinates (r,θ) where r is on the interval [0; 1] and θ is angle [0; 2π].

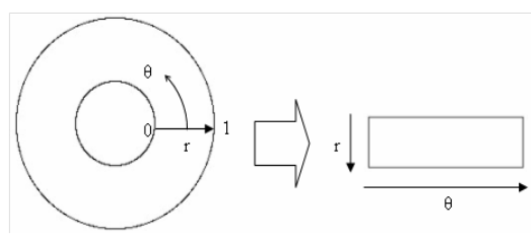

Fig 2: Daughman's rubber sheet model

The remapping of the iris region from (x, y) Cartesian coordinates to the normalized non-concentric polar representation. The rubber sheet model takes into account pupil dilation and size inconsistencies in order to produce a normalized representation with constant dimensions. In the Daugman system, rotation is accounted for during matching by shifting the iris templates in the direction until two iris templates are aligned. A number of data points are selected along each radial line and this is defined as the radial resolution. The number of radial lines

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going around the iris region is defined as the angular resolution.

H. Enhancement

Image enhancement is the process of adjusting digital image so that the result are more suitable for display or further image analysis. Resultant image is enhanced by using Histogram equalization process. Histogram equalization process is technique for adjusting image intensity to enhance contrast.

I. Feature extraction

After image normalization it is important to extract the most discriminating feature in its pattern so that the comparison can be done. In this section feature extraction using Gabor Filter .Gabor Filters are products of Gaussian filter with oriented complex sinusoids. These filters are come in pairs, each consisting of a symmetric filter and an anti symmetric filter.

A filter bank is formed by varying the frequency, the scale and the filter orientation. Filter banks are formed by Modulating a sine/cosine wave with a Gaussian. It provides conjoint localization in both space and frequency .Decomposition of a signal is accomplished using a quadrature pair of Gabor filters. The real part specified by a cosine modulated by a Gaussian, while the imaginary part is specified by a modulated sine. The real and imaginary filters a real so known as the even symmetric and odd symmetric components respectively. The center frequency of the filter is specified by the frequency of the sine/cosine wave. The bandwidth of the filter is specified by the width of the Gaussian.

J. Matching

The template that is generated in the feature extraction process will also need a corresponding matching matrix, which gives a measure of similarity between the two iris templates. In this project we use **Support vector machine** to match the extracted feature with database. SVM is a machine learning algorithm which is based on the principle of structural risk minimization (minimizing the classification error) and it optimally separates the two classes of data. SVM as pattern classification technique which is based on iris code model feature vector size is transformed to one dimensional vector which reduces by using averaging technique contains the average value to recognize an authorized user and unauthorized.

K. Decision based on matching

Based on the matching results got using SVM classifier if the features is matched with the database then the person is accepted, if not the person is rejected.

IV. EXPERIMENTAL RESULTS

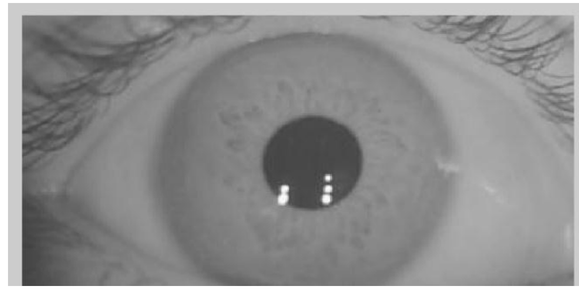

Fig 3: Cropped and RGB to Gray Scale Converted Image

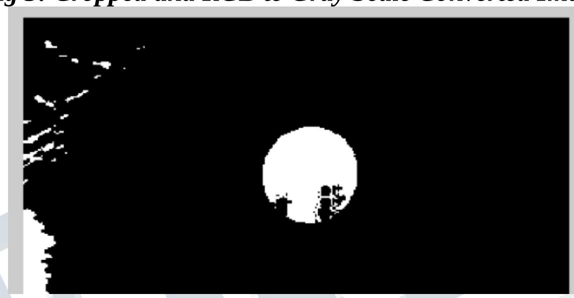

Fig 4: Region of Interest

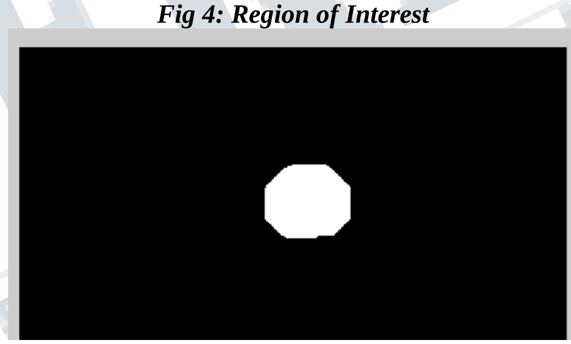

Fig 5: Removal of Noise

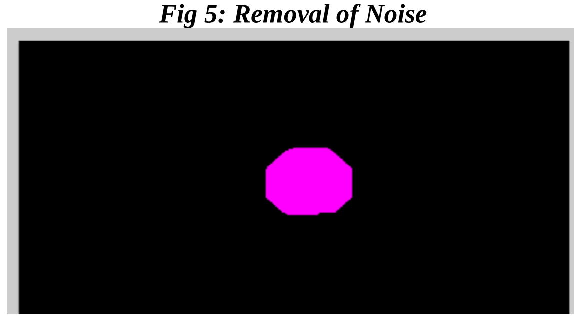

Fig 6:Masking the Pupil Region

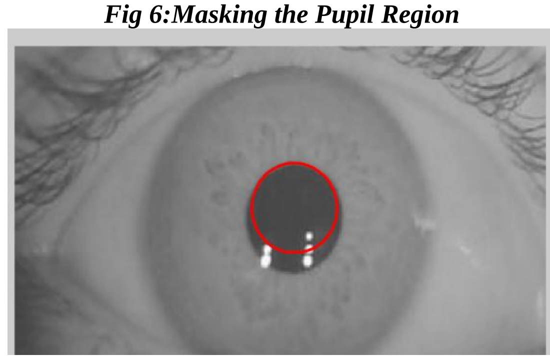

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Fig 7: Pupil Region

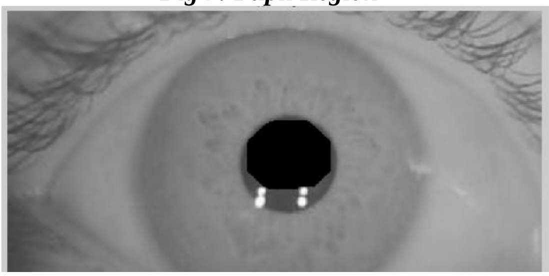

Fig 8: Cropped Image

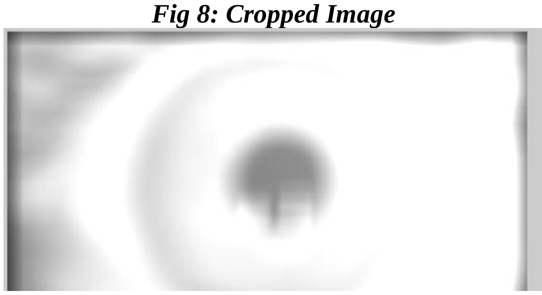

Fig 9: Smoothened Image

Fig 10: Edge Operated Image

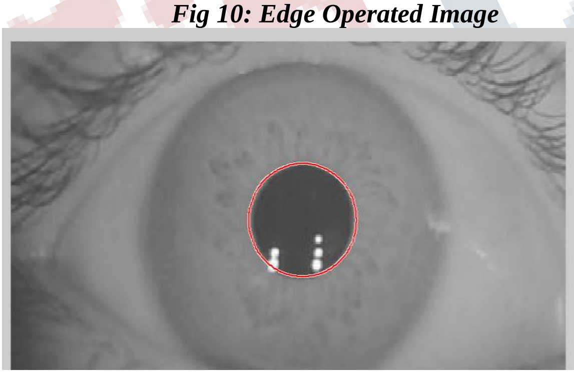

Fig 11: Inner Radius of Iris is Found then Circle Drawn

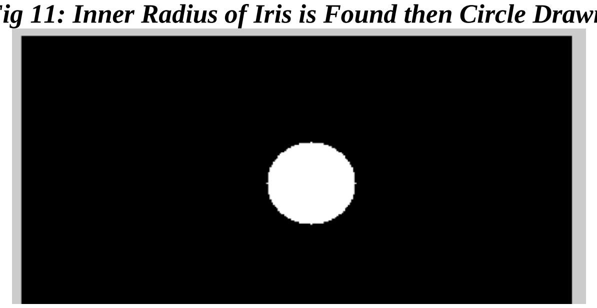

Fig 12: Inner Radius of Iris

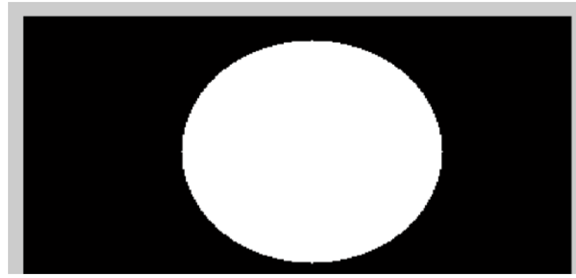

Fig 13: Outer Radius of Iris

Fig 14: Iris portion is found

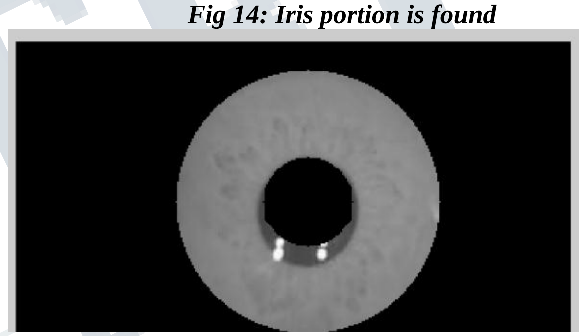

Fig 15: Image Converted to Gray scale Image

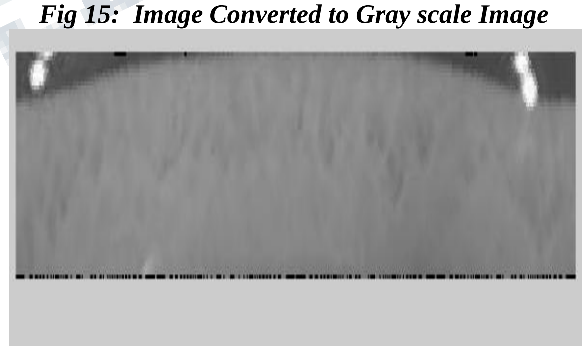

Fig 16: Normalized iris image

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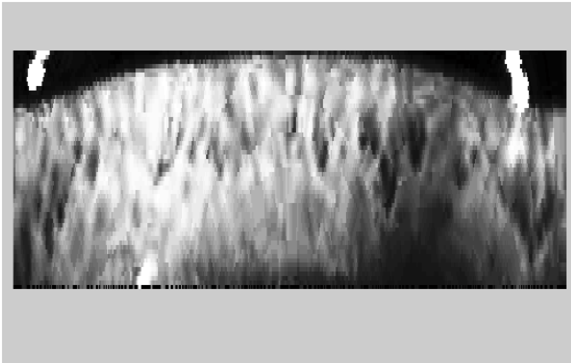

Fig 17: Enhanced Image

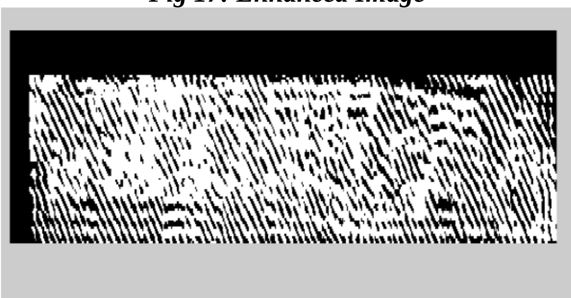

Fig 18: Image for Feature Extraction

V. APPLICATION

National border controls: The iris as a living passport, Computer login: the iris as a living password ,Cell phone and other wireless-device-based authentication, Secure access to bank accounts at cash machines, Ticketless travel; authentication of rights to services, premises access control (home, office, laboratory, etc),Driving licenses; other personal certificates ,Entitlements and benefits authorization ,Forensics; birth certificates; tracing missing or wanted persons, credit-card authentication ,Automobile ignition and unlocking; anti-theft devices.

VI. CONCLUSION

This Paper has presented an iris recognition system, which was tested using Adhar database of eye images in order to verify the authorized user of iris recognition technology .Image samples are acquired using iris camera . In segmentation part, Canny edge detector is used to detect edges of circles. Hough transform is used to determine centroid and radius of circles. Normalization is done by using Daughman's rubber sheet model. Enhancement of resultant normalized image is done by using Histogram Equalization process. Features are extracted using Gabor filter. Matching is done using support vector machines classifier .Finally the authorized person is accepted and unauthorized person is rejected with the 80% of accuracy with very high computational speed.

Acknowledgements

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