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Human identification by biometric Iris Recognition using Canny Edge detection and Scalar Invariant Fourier Transform & Threshold method

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ABSTRACT

In biometric identification, there are many systems that are used for research to improve the security level in various fields It is seen that the researchers has achieved a very high recognition rates and reliability in the field of Iris security systems as these use the features of uniqueness of the Iris. The main steps that include the removal of noise in image that may be present due to eye lashes and eyelid in the image, locate the outer boundary of the iris, extract the inner circle to separate pupil from iris image and then find the threshold values that don't change even when there is change in the template of same eye. This binarized image is stored as a template for reference during matching of the real time iris image using Scalar Invariant Fourier Transform (SIFT) function. This paper explains the organization of various processes in a single algorithm. The algorithm is then implemented over ICE2005, CASIA v4.0 database and IIT Delhi Database and the accuracy of 97.39%, 99.13% and 98.93% is achieved respectively.For the implementation of this proposed work Image Processing Toolbox of MATLAB software is used.

Keywords:*Iris Segmentation, Thresholding, Growing based segmentation,Gamma correction,Normalization, Matching, SIFT.*

INTRODUCTION

With the evolution of human race, it has been an important to recognize and identify a human being. Hence the identification of a person has become a vital part of the infrastructure that is required for diverse sectors of business community that may include transportation, finance, entertainment, enforcement policies, governmental issues, health care, security and access control and many other fields that require to secure ones information. Recent years has seen the era of globalization and electrification of modern world and the borders of data intercommunication has shrunk due to Internet and high rates of data transfer. Hence the necessity has erupted for automated recognition and identification system to provide access control. The traditional methods of identification that may include the use of Passwords and Card systems are although being in use yet provide a limited level of security. These systems lack non-repudiation system as they can be shared within human race. As the definition of biometrics, as if it provides an automated system of identification based on the distinct feature of a

person such as physiological features that may include Fingerprints, Retina, Face, Iris and Hand Geometry and the behavioral features such as gait and voice. The unique feature highlighted above can never be shared with someone else and can't be misplaced hence provide a stronghold to the intrinsic identification of a person. The security provided hence gives the assurance of integrity of information and confidentiality. Biometric systems support the facets of identification/authorization, authentication and non-repudiation in information security.

There are many forms and types of biometric considerations or traits but noteworthy Iris is newest and most important identification system nowadays as compared to other systems. The most important aspect that is to be looked after is the security of data used in system. Maintaining this, the system provides a large variety of applications as well as challenges to overcome for spreading the use of biometric systems in day-to-day life. There were many attempts to break security levels with the use of False Fingerprint sensors and facial overlays. It is proved scientifically using results that the Iris system gives us a best and efficient results as compared to other features of biometric systems. The system of Iris recognition starts from the process of identifying a person by keenly analyzing the random pattern of Iris of an eye. In the work, an emphasis is given on the automated system of Iris recognition by providing a framework for image processing of iris and a peculiar use of feature extraction. The process here uses set of geometrical cum texture information hence make use of complex vessel structure of retina of eye. The feature extraction process contains the sub-processes such as image preprocessing, locating and segmentation of the region of interest (ROI).

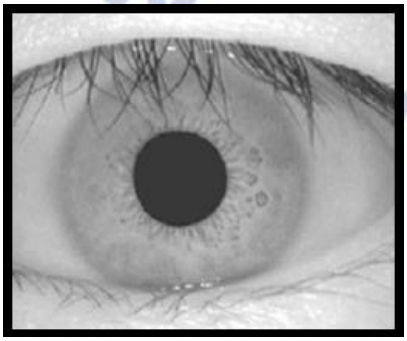


Fig.1 The eye image sample

PROPOSED TECHNIQUE

This section explains the technique of our proposed "Human identification by biometric Iris Recognition using Canny Edge detection and Scalar Invariant Fourier Transform & Threshold method.An extensive survey based study of iris recognition methods is performed and a brief review of related topics is given.The main objective of this implementation is given:

1. Canny Edge detection technique gives the best results as compared to Sobel, Prewitt and Robert's operator. But it is seen that Canny's edge detection algorithm seems to be computationallycomplex and much expensive.

2. Threshold based segmentation of the imagefollows process of partitioning a digital image into multiple segments (pixels or super pixels). This process is vitalas it simplifes and convert the presentation of image into a matrix of values that are more easier to analyze. A matrix of 16×16 is formed of a single image providing the threshold values from 0 to 255.

3. Threshold-based method is more efficient when we compare them to other traditional methods as they are required to pass through pixels only once in the whole process.

4. A histogram method of threshold even provides a better speed of processing as the value is computed from almost every pixel in the image, and the peaks and valleys are formed in the histogram and these variations are used to locate the clusters in the image.

5. For compensation of non linear effects in the image, that may be due to transfer of the signal between electrical and optical components, the gamma correction algorithm is also associated in the implementation.
6. The outer circle of iris image is detected with help of Dougman algorithm. This is a static area of iris hence an approximation of 100% is achieved in this case. Moreover the content of information is limited in this areas due to presence of noise in form of eyelashes.

7. The inner circle of iris is detected using canny edge detection technique and Hough's transform is used for refinement of region of

interest (ROI) for template making and image recognition using matching process.

8. The Template matching with real time image is performed using Scalar Invariant Fourier Transform (SIFT). This transform matches the exact value of pixel at exact coordinates of template and test image.

EVALUATION AND RESULTS

The above explained processes are combined in an algorithm and the effectiveness and qualities of the same is tested by conducting many experiments on several images. A real time image or test image is loaded in the Matlab and using image processing toolbox the performance of the algorithm is overviewed.The results are tabulated as under:

Database	No. of IRIS Images in Database	Images Detected accurately	Accuracy of literature	Algorithm Accuracy
CASIA v4.0	2639	2616	98.17%	99.13%
IIT Delhi	1120	1108	-------	98.93%
ICE2005	2950	2873	96.40%	97.39%

Table: Comparison of CASIA v4.0 , IIT Delhi and ICE2005 Databases

Below are steps of our proposed work:

At first, the work begin with the development of GUI for this implementation. The code to load an image for test is developed and linked with the GUI. GUI based approach of design and programming makes the process easier to understand and more organized.

Secondly, a code is developed for the edge detection using various techniques proposed and explained in methodology and hence is applied on the image.

Thirdly, A code is developed for the gamma correction with histogram thresholdfor implementation of processes such as segmentation and normalization. This process helps us to find the region of interest of iris image.

Hence, a code is developed for matching test image with the template stored of the database sung SIFT function.The main figure window of our proposed method is given below:

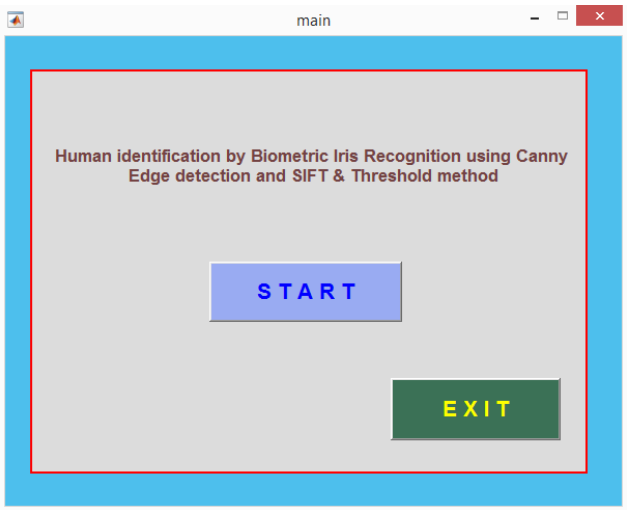


Fig.2 Main Figure Window

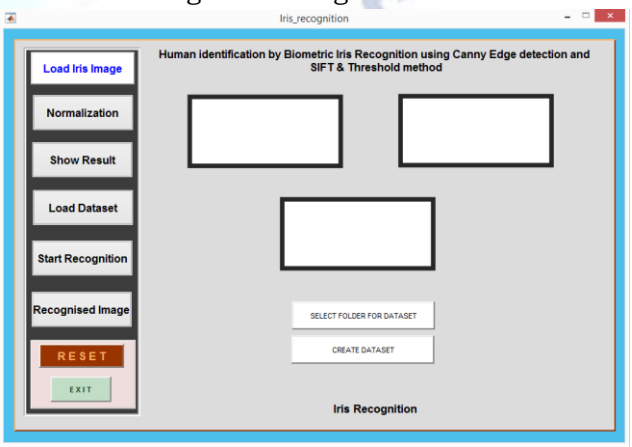


Fig.3Work Panel Figure Window

Results: (Example)

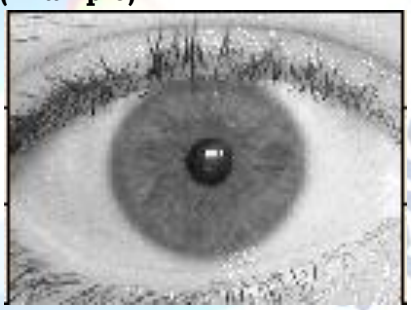


Fig.4 Original Iris Image

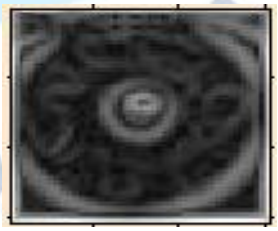


Fig.6Processed Image

Fig.5 Canny Edge Image

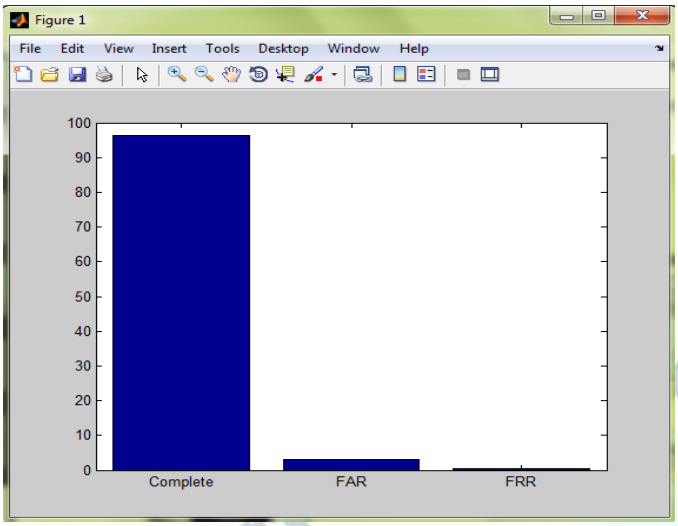


Fig. 9 Comparison of FAR, FRR and complete%

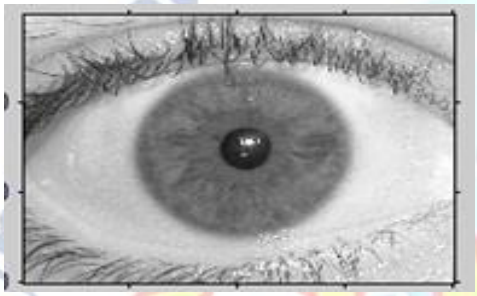
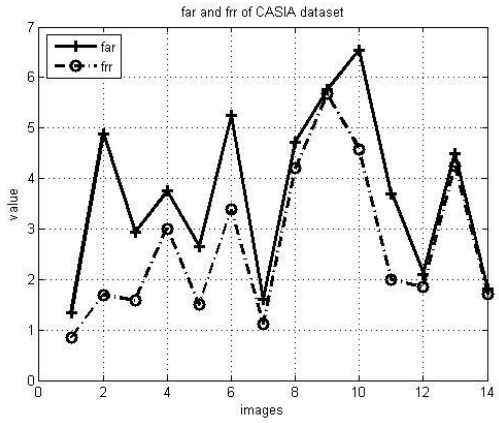
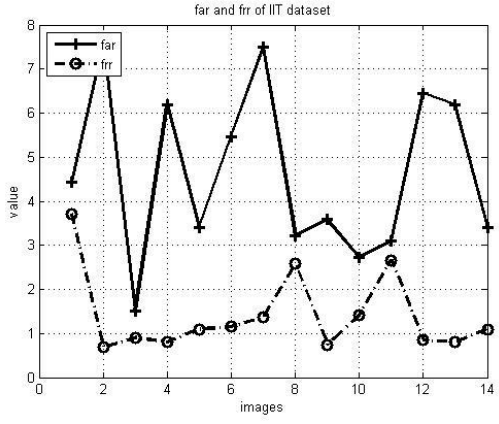


Fig. 10. Result Image

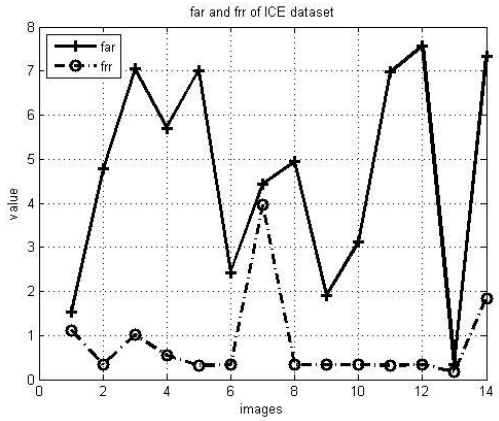
The FAR and FRR plotted for the databases for 14 images are as shown:-



Graph1:FAR and FRR plot of CASIA v4.0 database



Graph2:FAR and FRR plot of IIT database



Graph1:FAR and FRR plot of ICE2005 database

CONCLUSION AND FURURE SCOPE

As explained before, Iris recognition is found to be most accurate and hence a reliable biometric identification system. The process ofimage de-noising is used for eliminating noise that may be present as eyelid and eyelashes in case of outer circle and sub-image in pupil inside inner circle of region of interest, which gives better result. First step is to filter out any noise in the original image before trying to locate and detect any edges. It uses exclusively the Canny algorithm. Segmentation of iris is the main stage of iris recognition, because if areas that are wrongly identified as necessary regions will be corrupted in biometric templates resulting in very poor recognition. So the ocular region should be identified very accurately. The Specula reflection are observed in the pupil region as sub-image and hence eliminated.

The experiments presented in the paper demonstrate that at its best, the iris region holds a lot of promise as a novel modality for identifying humans with a potential of influencing other established modalities based on ocular and face. At the very least, the results suggest a potential for using iris region as a soft biometric. Future work includes evaluation of more iris features, comparison of iris based recognition performance to a commercial face recognition algorithm, exploration of how the capture conditions and the image quality such as uncontrolled lighting, or subjects wearing cosmetics affect the skin texture and color, among others.

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