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Comparison of Feature Extractions for Iris Recognition

Ei Ei Soe
Department of Information Technology,
Technological University
Thanlyin, Myanmar

Aye Kyi Pyar Shwe
Department of Information Technology
Technological University
Thanlyin, Myanmar

Ei Ei Myat
Department of Information Technology
Technological University
Thanlyin, Myanmar

Abstract: Iris Recognition is one of the most biometric identification systems that identify people based on their iris. In this paper the iris recognition system is implemented by using Hough Transform and Canny edge detection techniques. In this paper the iris recognition via many steps, these steps are image acquisition, edge detection, localization, feature extraction, and matching. Two types of extractions: eight sub-images and sixteen sub-images are used to divide the iris images. The implemented system uses CASIA iris database. This paper provides an efficient iris identification system and the software to perform this research developed using the Matlab programming language.

Keywords: Iris Recognition, Canny, Localization, Feature Extraction, CASIA

1. INTRODUCTION

Iris recognition is a reliable biometric system that can be used to identify a person by analysing the patterns found in the iris. Various methods have been intended by different researchers. But this system described accurate iris preprocessing using canny edge detection, efficient extraction of features in an eye image and generate iris feature vector from iris sub-images after feature extraction. First, the system acquires, through a video camera, a digitized image of an eye of the human to be identified. But the system applies the CASIA iris image database to classify iris features and pupil detection. The original image needs to be preprocessed. After edge detection, iris features are extracted with statistical based feature extraction method. This method based on angular orientation form and it divides the 8 potions and 18 portions. It is successfully applied as feature extractors for feature extraction stage in practical test. After applying this method on an original image, a set of sub-images is obtained at different resolution levels. The mean and dispersion of each sub-image are extracted as texture features. Finally, mean square distance is used to perform the identification stage, iris matching, and this new method achieves much higher identification rate.

The iris is highly protected, non- invasive and ideal for handling applications requiring management of large user groups, like voter ID management. The iris recognition techniques potentially prevent unauthorized access to ATM, cellular phone, desktop PCs, workstations, buildings and computer networks. The accuracy of iris recognition systems is proven to be much higher compared to other types of biometric systems like fingerprint, handprint and voiceprint.
Since biometric authentication is a very up to date technique being used for security and identification purposes, plenty of work is done on it, *T*ieniu *T*an and *Z*henan *S*un has proposed that the iris acknowledgment calculation taking into account PCA (Principal Component Analysis) is initially presented and after that, iris picture combination technique is displayed. *K*efeng *F*an has proposed a productive procedure on iris limitation, and quality appraisal. *L*ye *W*i *L*iam proposed a system consisting of two parts: Localizing Iris and Iris Pattern Recognition. They used digital camera for capturing images; from that captured images, iris is extracted. *V S*aishanmuga *R*aja, proposed a method for personal recognition based on iris recognition using Genetic algorithm and Neural Network. The process of iris recognition consists of localization of the iris region and age group of data set of iris images followed by iris pattern acknowledgement. *D*r.*E*kta *W*alia has worked on comparing the different biometric techniques and has given the clear view of accuracy received each by one of them. *Z*haofeng *H*e, *T*ieniu *T*an has given a detailed study on segmentation of image which extracts the required features.

2. IRIS RECOGNITION SYSTEM

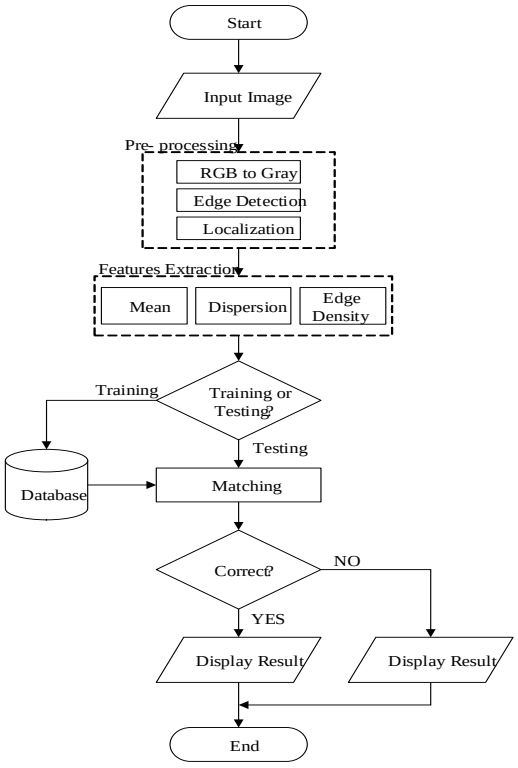


Figure. 1 System Design for Iris Identification System

2.1 Image Acquisition

Image acquisition is the main critical in iris recognition system. For image acquisition, the iris image must have an

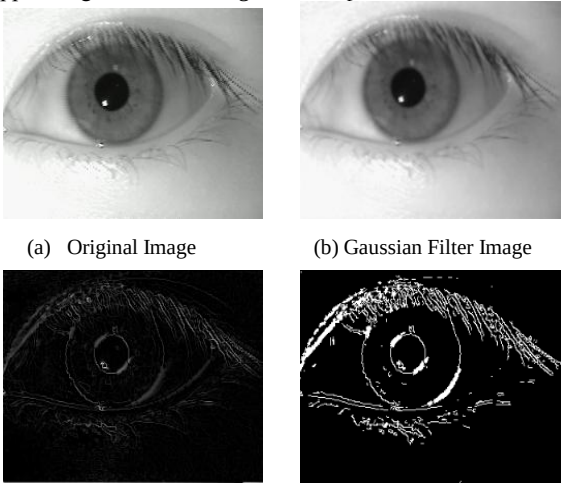
average diameter of 12mm and the camera used should have enough resolution to capture the details of the iris pattern. The proposed system uses CASIA iris database. CASIA iris database image uses a special camera that operates in the infrared spectrum of light, not visible by the human eye. This paper is based on the CASIA image database. Images are 320x320 pixels grayscale taken by a digital optical sensor designed by NLPR (National Laboratory of Pattern Recognition) of Chinese Academy of Sciences. There are 108 classes or iris in a total of 756 iris images.

2.2 Image Pre-processing

2.2.1 Edge Detection

Edge detection is used for the edges in an eye image. It consists of three major steps. The proposed system uses canny edge detection algorithm. The Canny edge detection algorithm is widely known as the optimal edge detector. The first and most apparent is low error rate. It is important that edges occurring in images should not be missed and that there be no responses to non-edges. The second criterion is that the edge points will be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. A third criterion is to have only one response to a single edge. This was applied because the first two were not substantial enough to completely eliminate the possibility of multiple responses to an edge.

It is a multi-step detector which performs smoothing and filtering, non-maxima suppression, followed by a connected-component analysis stage to detect "true" edges, while suppressing "false" non-edge filter responses.



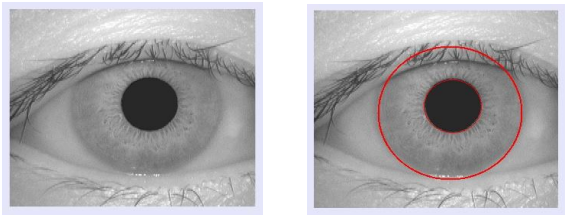
(a) Original Image (b) Gaussian Filter Image

(c)Non-maximum Suppressed Image (d) Final Canny Image

Figure. 2 Example of an image with acceptable resolution

2.2.2 Localization

Iris localization is very important for an iris recognition system and it is crucial for the performance of that system. Hough circle transformation method in the font named Times. Right margins should be this research aims to find the parameters, centers and radii, of the two iris boundaries, detecting the lower and upper eyelid and isolating eyelashes. Localizing the iris outer boundary, an approach based on boundary point detection and curve fitting is adopted. First, a set of radial boundary points is detected by performing the image integral projection along angular directions within specified image blocks.



(a)Original Image (b) Localized Image

Figure 3. Iris Region Boundary Localization: (a and b)

2.3 Feature Extraction

Feature extraction is the most important stage in the iris recognition system. The success or failure of identification system highly depends on the utility of the information that the feature extraction stage provides. Feature extraction involves selecting the significant features from an input pattern, and transforming them through some function that can provide some informative measurements for the input pattern. There are many different methods in feature extraction. Various methods have been proposed by different researchers. Important features are extracted from an eye image.

3. COMPARISON OF FEATURE EXTRACTIONS

Eighteen sub-images and eight sub-images values were calculated for the comparison of the eye image.

Table 1. Eighteen Sub-Images of Iris Feature Values

18 Sub-Images	Edge Density	Dispersion	Mean
Part 1	0.1564	11.5941	95.4757
Part 2	0.2954	11.7722	97.9030
Part 3	0.3511	9.7574	96.3957
Part 4	0.2603	14.1467	106.2335
Part 5	0.2342	12.2321	102.5084
Part 6	0.27770	7.8647	88.3298
Part 7	0.3449	5.9610	82.3341
Part 8	0.3087	6.3256	80.3383
Part 9	0.1755	5.8858	75.8266
Part 10	0.1818	6.1078	75.1924
Part 11	0.3333	5.6751	76.1350
Part 12	0.3404	5.9255	79.1681
Part 13	0.2700	7.7473	84.9417
Part 14	0.2215	8.9747	89.4705
Part 15	0.2622	13.0465	97.2135
Part 16	0.3362	12.6356	101.7636
Part 17	0.3129	13.0233	102.0211
Part 18	0.1697	11.9636	97.1495

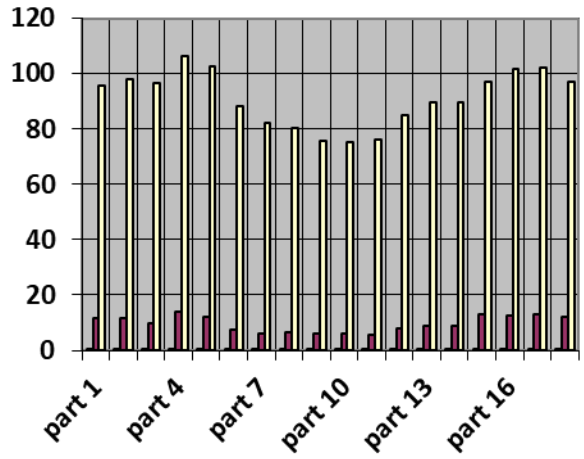


Figure 4. Eighteen Sub-Images of Iris Feature Values

Table 2. Eight Sub-Images of Iris Feature Values

8 Sub-Images	Edge Density	Dispersion	Mean
Part 1	0.2270	6.4949	76.1352
Part 2	0.2164	6.6338	84.0064
Part 3	0.2361	6.9559	90.5629
Part 4	0.2507	7.0209	85.4034
Part 5	0.2568	6.4472	85.0665
Part 6	0.2776	4.9611	82.9079
Part 7	0.2340	4.9591	76.1535
Part 8	0.2344	6.4510	74.0331

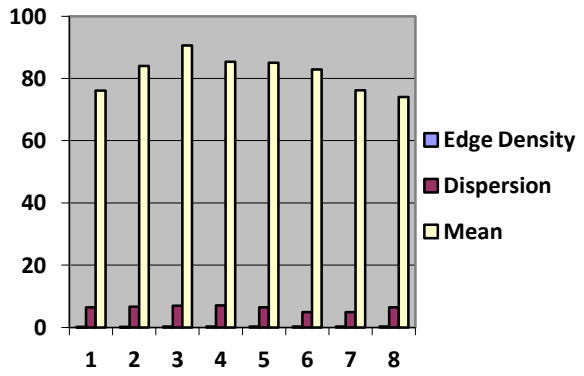


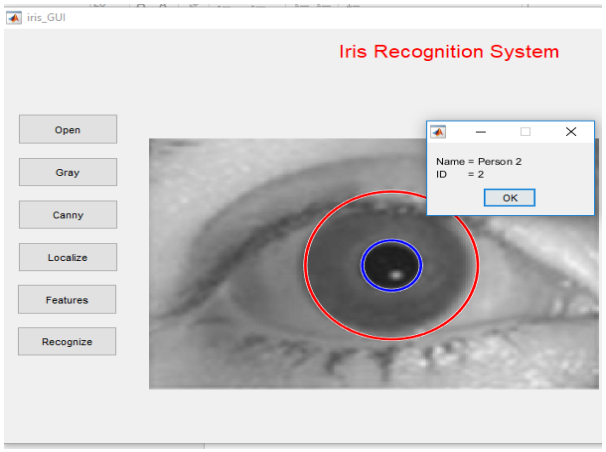
Figure 5. Eight Sub-Images of Iris Feature Values

4. CLASSIFICATION

For the comparison of the two iris images, mean square distance measure method is used. Mean square distance is one of the techniques that measures the distance with eye vector. It defines as:

$$d_i = \sum_{k=1}^{N} (I_k - X_{ik})^2$$

If d_i measurements of I known samples of feature vectors and X samples of each, then N features space that contains the $I \times X$ points according to the Equation. If the point is selected, in the feature space, which is closest to the current sample, then it is selected the sample's nearest neighbor.



5. CONCLUSION

This paper has proposed on iris identification system, which has been tested using different types of feature extraction. The purpose approach drives data from CASIA database and iris recognition system shows that the approach is secure and privacy-preserving. The system also shows the experimental results on iris. Experimental results show that the proposed approach has good recognition performance and speed. In the feature, it would be necessary to experiment on a larger iris database in various environments to make the system more reliable.

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