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Iris Recognition Using Curve let Transformation Based on Gabor Filter& SVM

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Abstract
The work presented in this thesis involved developing an 'open-source' iris recognition system in order to verify both the uniqueness of the human iris and also its performance as a biometric. For determining the recognition performance of the system two databases of digitized greyscale eye images were used.
The iris recognition system consists of an automatic segmentation system that is based on Support Vector Machine and is able to localize the circular iris and pupil region, occluding eyelids and eyelashes, and reflections. The extracted iris region was then normalized into a rectangular block with constant dimensions to account for imaging inconsistencies. Finally, the phase data from 1D Log-Gabor filters was extracted and quantized to four levels to encode the unique pattern of the iris into a bit-wise biometric template.

Key Words: - Anti-spoofing,Direct Attacks ,Fake IRIS images SVM, Gabor Filter

Introduction

A biometric authentication system is basically a pattern recognition system which makes a personal identification by determining the authenticity of a specific physiological and/or behavioral characteristic possessed by the user. Physiological characteristics are related to the shape of the body, such as hand geometry, Palm print, face recognition, fingerprint, DNA, iris recognition, retina and odor. Behavioral characteristics are related to the behavior of a person, such as typing rhythm, gait, and voice. The method of identification based on biometric characteristics is preferred over traditional passwords and PIN based methods for various reasons such as: The person to be identified is required to be physically present at the time of identification and identification based on biometric techniques obviates the need to remember a password or carry a token. Since, today, a wide variety of applications require reliable verification schemes to confirm the identity of an individual, recognizing humans based on their body characteristics became more and more interesting in emerging technology applications.The selection of a particular biometric for use in a specific application involves a weighting of several factors. Seven such factors to be used when assessing the suitability of any trait for use in biometric authentication: Universality, Uniqueness, Permanence, Measurability, Performance, Acceptability and Circumvention. Universality means that every person using a system should possess the trait. Uniqueness means the trait should be sufficiently different for individuals in the relevant population such that they can be distinguished from one another. Permanence relates to the manner in which a trait varies over time. Measurability or collectability relates to the ease of acquisition or measurement of the trait. In addition, acquired data should be in a form that permits subsequent processing and extraction of the relevant feature

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sets. Performance relates to the accuracy, speed, and robustness of technology used. Acceptability relates to how well individuals in the relevant population accept the technology such that they are willing to have their biometric trait captured and assessed. Circumvention relates to the ease with which a trait might be imitated using an artifact or substitute. Examples of physiological and behavioral characteristics which are currently in use for automatic personal authentication include fingerprints, voice, iris, retina, hand geometry, face, handwriting, keystroke, and finger shape. But this is only a partial list as new measures such as gait, ear shape, head resonance, ECG and body odor are being developed all of the time. Because of the broad range of characteristics used, the imaging requirements for the technology vary greatly. Systems might measure a single one-dimensional signal, several simultaneous one-dimensional signals, a single two-dimensional image, multiple two dimensional measures, a time series of two-dimensional images or a three dimensional image. The rest of the paper is organized as follows. Section II outlines the Iris Pre-processing and Iris Localization. Proposed Algorithm is discussed in Section III. Section IV is concentrated on the simulated results. The conclusions are given in Section V.

Iris Image Pre-processing& Iris Localization

In general, there are three important factors that influencethe iris recognition result. First, the size and location of the iris in the imagesare different. Second, the eyelashes can shade the iris. At last, the iris image grayscaleis variable because of non-uniform illumination. In order to reduce these influences, thepre-processing of the iris localization, removal of eyelash shading and image normalizationshould be done before iris feature extraction.

After acquiring the iris image, the first step is to segment theiris. We take an iris image with a resolution of 480×640 from CASIA-Iris Syn of CASIA Iris V4. The texture of the iris is contained between the inner and outer approximate circle boundary parts, so the inner and outer boundariesshould be extracted. The iris inner boundary is approximately circular with a large gray gradient. According to this characteristic, the pupil is separated through the thresholding method and the iris inner boundary is extracted. Then the outer edge is detected by using the Canny edge detector[9].

The iris can be located accurately in the iris image. Further, the eyelash shading will influence the recognition result, so it is necessary to be eliminated. We can see that the shading of eyelash can be eliminated effectively.

Proposed Methodology

Considering the curveinformation of Iris such as iris crypt, fold and pigment spots, in order to extract the curve feature of the iris, reduce the feature dimension and improve the lower recognition rate caused by environment noise, an iris recognition method by combining Gabor & SVM is proposed. The flow chart is shown in Fig.1.

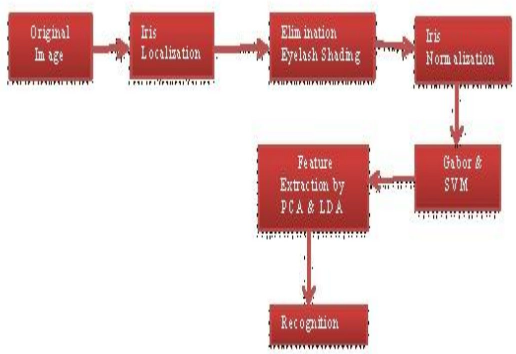


Fig 1 Proposed Algorithm

The specific algorithm steps are as follows:

Step1. Preprocess all training images by localization, elimination of the eyelash shading and normalization.

Step2. Transform the preprocessed images X_1, X_2……$X_M$by Curvelet and obtain the first,second,…….,N^{th}Curvelet coefficients of the images. Generally, $N = \lfloor \log 2(\min(A,B)) -$

3⌋where $A \times B$ denotes the size of image, ⌊⌋is the floor rounding
function. We adopt $N = 3$ in this paper. The second to the $(N - 1)$ *th*layers are fine scales, which represent the detailed feature of the iris image. If iris recognition adopts the fine scales as the features, the result shows that the feature dimension is very high.
So we only choose the first layer Curvelet coefficients as the feature.

Step 3. Normalize the first layer Curvelet coefficients of all images to form row vectors *XiL*.

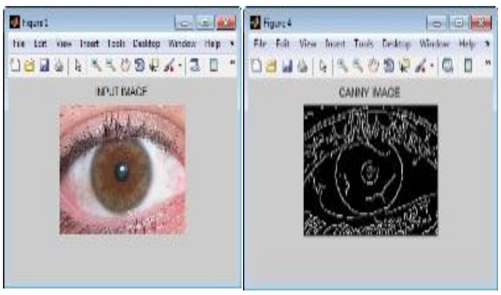
Step 4. Extract the feature of the training sample sets and reduce the feature dimensions by using Gabor and SVM.

Step 5. Preprocess the test sample sets and then extract the feature and reduce thedimension of the feature by Gabor and SVM.

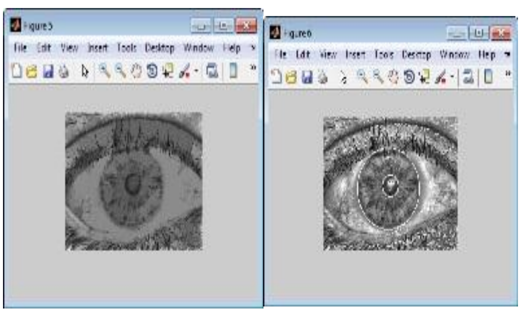
Step 6. Adopt the nearest neighbor algorithm to recognize the iris.

Simulation Result

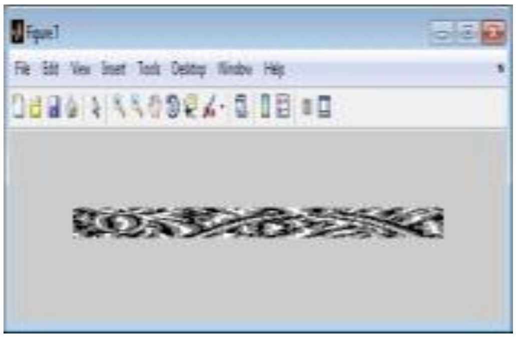
In this thesis, we only select the first frequency Curvelet coefficients as feature. Then, we perform the Gabor filter and Gabor + SVM iris recognition methods respectively on the same set.



(a) (b)



(c) (d)



(e)

Fig 2 (a-e) Different Iris Recognition Process

To better evaluate the experimental results, we perform 10 runs for each experiment, and then calculate the average recognition rate. The comparison results are shown in Table 1.

Table 1 Average recognition rates of different runs with different irisrecognition methods (%)

Number of samples	Gabor	Gabor + SVM
1	64.16	26.60
2	74.07	81.10
3	77.78	85.84
4	81.48	84.83
5	84.44	92.08
6	87.04	95.56
7	86.42	96.44
8	85.19	98.01
9	92.59	97.57

Conclusion

In this paper, we propose an iris recognition method based on Curvelet, Gabor and SVM. First, we preprocess the iris images by iris localization, elimination of eyelash shading and iris normalization. Then, we adopt the Curvelet transform to decompose the normalized images into 3 layers and only choose the first layer Curvelet coefficients as their features. Lastly, we further extract the feature and reduce the feature dimension by Gabor and SVM. The proposed iris recognition algorithm not only considers the iris texture curve features and eliminates the influence of environment noise, but also reduces the feature dimension. The experimental results show that our method can recognize the iris effectively.

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