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Retina Recognition using Curvelet transformation based on Gabor Filter& SVM

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Abstract: *The work presented in this paper 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 grey scale 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.*

Keywords: - *Anti-spoofing, Direct Attacks, Fake IRIS images SVM, Gabor Filter*.

I. Introduction

Biometric authentication is basically a pattern recognition system in that we can identify a individual by its physiological and its behavior characteristics which a individual have. These characteristics vary according to the person. These characteristics are based on the various factors like the shape of body, like its fingerprint, palm print, rating scanning, DNA, iris recognition etc. behavioral characteristics are based on the behavior of a person like its voice its rhythm etc. the biometric method for the recognition is being accepted worldwide instead of conventional methods like the PIN or password recognition. These conventional methods are not much secure and can be attack by the attackers. The biometric identification makes the security system more accurate because for this a person have to be physically present and by this we can minimize the extra security efforts like he doesn't need to carry a token or he doesn't have need to remember a password thus makes the security checking more user friendly. As in today scenario there are various applications which needs the reliable human identification thus this method is accepting worldwide and gaining more popularity due to its advantages over the other methods. While choosing the perfect biometric recognition scheme we have to consider various factors on which it being tested. Seven factors which are being considered while selecting a biometric recognition scheme are as follows: Universality, Uniqueness, Permanence, Measurability, Performance, Acceptability and Circumvention. Universality means that the every person which is using that system has that identification trait. Uniqueness means that the trait must be present in all the personals but it has different for the different individuals like they can be easily differentiate from the others. Permanence shows that how a trait is varied with time. Measurability shows that how much easier the method for the calculation thus it shows the measurable nature of the trait. Therefore the data must be present in such a form that it can easily be processed and the output can be received in the desired form. Accuracy related to the speed accuracy and the robustness of the technology we used. Acceptability relates to the personal choice that is the personal agree to accept that technology is they ready to give their biometric signature for the access. Examples of biometric characteristics which are being accepted now a days are fingerprint, voice, face recognition and iris recognition. But these are only the few characteristics which are used except these there are various traits which are being evaluated like ear shape, head resonance, body odor and ECG. As there are various characteristics which can be used so we need a variety of image recognition technologies for this method. 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.

II. Iris Image Pre-processing & Iris Localization

In general, there are three important factors that influence the iris recognition result. First, the size and location of the iris in the images are different. Second, the eyelashes can shade the iris. At last, the iris image gray scale is variable because of non-uniform illumination. In order to reduce these influences, the pre-processing of the iris localization, removal of eyelash shading and image normalization should 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.

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III. 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.

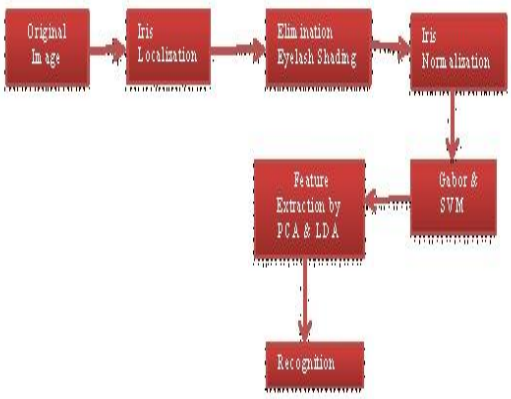


Fig. 1: Proposed Algorithm

The specific algorithm steps are as follows:

Step 1. Preprocess all training images by localization, elimination of the eyelash shading and normalization.

Step 2. 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, $N = \lfloor \log2(\min(A,B)) - 3 \rfloor$where $A \times B$ denotes the size of image, $\lfloor f \rfloor$s 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 *Xi*L.

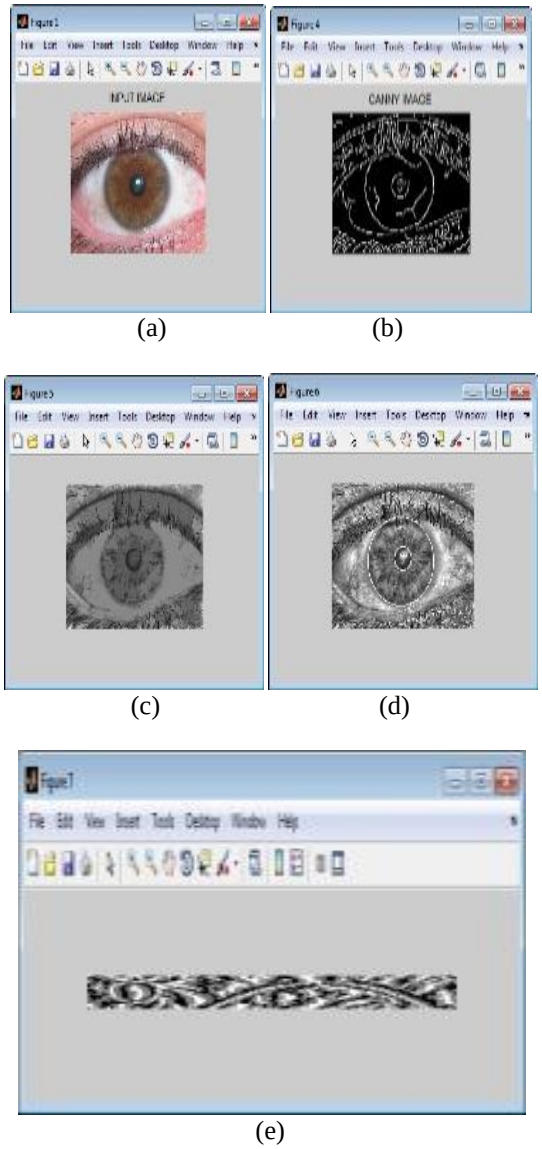
Step 4. Extract the feature of the training sample sets and reduce the feature dimensions by using Gabor and SVM.

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

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

IV. Simulation Result

In this paper, 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

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V. 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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