Iris Recognition for Eyelash Detection Using Gabor Filter

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Abstract :- Iris recognition is important automatic biometric system in the area of security. By this security, identity of each person is found. In biometric system having various types such as finger prints facial features, voice recognition, hand geometric, hand writing. In iris recognition iris is biometric component which is better in terms of stability uniquence accuracy fast and non-invasive. To improve the performance of iris recognition system this paper proposes new eyelash detection algorithm based on direction filter 1-D and 2-D algorithm is used to improved to avoid two much iris texture misclassification experimental image results show that unique codes can be generated for every eyelash Image

Keywords: Iris recognition, Biometrics eyelash, 1D and 2D filter

1. INTRODUCTION

Security systems is the need of the day. Fastest recognition system is the demand of current situation a lot of biometric technologies comprising methods for uniquely recognition people based on their physical traits such as face, fingerprint, palm print which are based on video image analysis. Iris recognition has some advantageous over other biometric modalities.

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Most iris pattern are reported to remain unchanged over a lifetime. In the authentication technology Iris recognition has attracted a lot of attention. So it is necessary to improve the performance of iris recognition. So with the help of algorithms and technologies the important factors related to iris recognition system are improved the identification performance is affected due to robustness and accuracy of iris segmentation for that improvement eyelash detection is used in segmentation process. After that to improve more performance of iris recognition systems the different directional filter are used with the help of this filter feature extraction and matching areas of iris recognition improved.

2. EYSLASH DETECTION

detecting eyelashes, the eyelash candidate region is firstly selected based on the detected iris, pupil and eyelid region,

$W = 2 * R_i$, $H = R_i C_x = (P_x + I_x)/2; C_y = (I_y + E_y)/2$

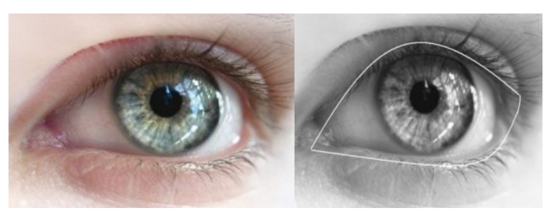

Figure 2.1 An example of eyelid detection: (a) input image and (b) result image of the eyelid detection.

is smoothed due to the blurred input image, the mask is adaptively selected according to the focus score which is measured by a 5 * 5 mask [2]. Based on the detected eyelid

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candidate points the parabolic Hough transform is used to accurately detect the eyelid

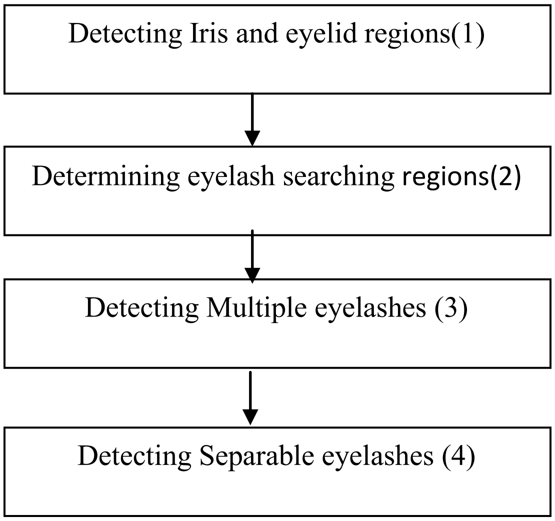

Figure 2.2 Block diagram of the proposed eyelash detection method.

where Width is denote of the eyelash candidate region and the Height of that region respectively. (C_x, C_y) denote the center position of the candidate region (P_x, P_y) that of the pupil, (I_x, I_y) that of the iris and (E_x, E_y) the position having the minimum value in the detected upper eyelid respectively. After that R_i denotes the radius of the iris. The detected eyelid line is used as the beginning position for the eyelash detection. Based on that information eyelashes classification into multiple eyelashes and separable eyelashes are detected in the eyelash candidate region [2]. Similarly to the work of Kong [3-4], eyelashes are classified into two types separable eyelashes are isolated which are also easy to be distinguished from other eyelashes. Multiple eyelashes appear overlapped or bunched together [3-4]. The proposed algorithm adopts a local window for detecting multiple eyelashes, and a convolution kernel for detecting separable eyelashes [2].

3. GABOR FILTERS

Gabor filters are able to provide optimum conjoint representation of a signal in space and special frequency. A Gabor filter is made up by modulating a sine / cosine wave with a Gaussian filter. This is able to offer the optimum conjoint localization in both space and frequency since a sine wave is perfectly denoted in frequency but not denoted in space. Modulation of the sine with a Gaussian provides localisation in space though with loss of localisation in frequency. Decomposition of a signal is modified using a quadrature pair of Gabor filters with a real part specified by a cosine modulated by a Gaussian, and an imaginary part specified by a sine modulated by a Gaussian. The real and imaginary filters are also known as the even symmetric and odd symmetric components respectively.

The centre frequency of the filter is specified by the frequency of the sine/cosine wave and the bandwidth of the filter is modulated by the width of the Gaussian.

Daugman makes uses of a 2D version of Gabor filters [1] in order to encode iris pattern data. A 2D Gabor filter over the an image domain (x, y) is represented as

$$G(x,y) = e^{-\pi}[(x-x_o)^2]/\alpha^2 + [(y-y_o)^2/\beta^2]$$

$$e^{-2\pi i}[u_o(x-x_o)] + [v_o(y-y_o)]$$

where (x_o, y_o) specify position in the image (α, β) specify the effective width and length, and (u_o, v_o) specify modulation which has special frequency

$$\omega_0 = \sqrt{u_o^2 + v_o^2}$$

Daugman demodulates the output of the Gabor filters in order to compress the data. This data is compress by quantising the phase information into four types levels which is divided into possible quadrant in the complex

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plane. It has been shown by Oppenheim and Lim [5] that phase information rather than amplitude information provides the most significant information within an image.

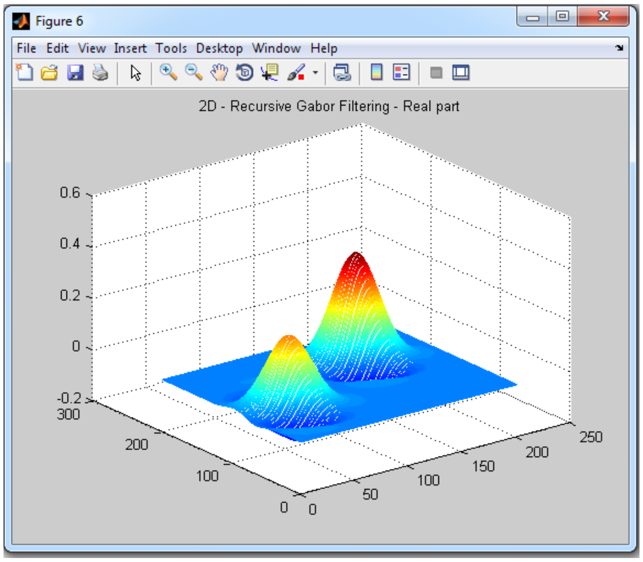

Figure 3.1 The even symmetric 2D Gabor filters

consider only the phase that will define encoding of discriminating information in the iris while discarding redundant information such as illumination, which is represented by the amplitude component.

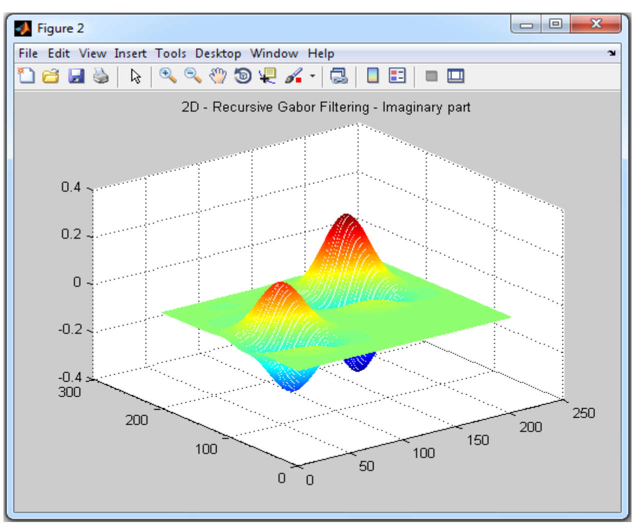

Figure 3.2 The odd symmetric 2D Gabor filters

These four levels are represented using two bits of data so each pixel in the normalised iris pattern corresponds to two bits of data in the iris system. A total of 2,048 bits are calculated for the template. In this template an equal number of masking bits are generated in order to mask out corrupted regions within the iris. This template construct a compact 256-byte template.This template are very storage and gives comparison of irises. The Daugman system makes use of polar coordinates for normalization therefore in polar form the filters are given as

$$H(r,\theta) = e^{-i\omega(\theta-\theta_0)}\ e^{-(r-r_0)^2}/\alpha^2\ e^{-i(\theta-\theta_0)^2}/\beta^2]$$

……..3.1

where *(α, β)* are the same as in Equation 3.1 and (r_0, θ_0) specify the centre frequency of the filter.

The demodulation and phase Quantisation process can be represented as

$$H_{(Re,Im)} = sgn_{(Re,Im)} \int_\rho \int_\emptyset I(\rho,\emptyset)\, e^{-i\omega(\theta_0-\emptyset)}\, e^{-(r_0-\rho)^2}/\alpha^2\ e^{-(\theta_0-\emptyset)^2}/\beta^2]\rho\, d\rho\, d\emptyset$$

where H{Re, Im} can be regarded as a complex valued bit whose real and imaginary components are dependent on the sign of the 2D integral and I(φ, ρ) is the raw iris image in a dimensionless polar coordinate system. For a detailed study of 2D Gabor wavelets see [6].

4. EXPERIMENTAL RESULTS

In this work we will evaluate the efficiency of the proposed eyelash detection method. This algorithm aims to handle with various kind of difficulty problem, for that various databases are used and some percentage part of iris images are delected.

Multiple eyelash and seperable eyelashes both are completely detected. For that directional filter are very much useful and few textures are misclassification as

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eyelashes. 1D algorithm is complicated to describe the directional filter information of iris texture. So 2D filter is better and more effective to avoid too much iris texture misclassification. 2D filter also describes the scale and orientation information of iris texture.

In this work, two iris image databases are used. These to evaluate the proposed methods they are IIT Delhi iris database[7] and CASIA V1.0 iris database. The IIT Delhi iris database is released by IIT Delhi which consists of 1120 iris images collected from 224 subjects by using JPC1000, a digital CMOS camera. This iris database is challenging as it was acquired with the varying image quality. In this paper, eyelash detection and iris encoding methods are evaluated on this database. The other iris database is released by the Institute of Automation in Chinese Academy

of Sciences. The CASIA V1.0 iris database is a classic iris set which contains 756 iris images from 108 subjects, By this database iris textures are clear and there are seldom noises will be tested by this database the performance of iris indexing method.

A. Accuracy and Robustness of Eyelash Detection Method

In this section, we will evaluate the efficiency of the proposed eyelash detection method. The sharp contrast in iris textures has caused trouble for iris occlusion detection and our algorithm just aims to handle with this kind of difficult problem. All of the iris images in IIT Delhi database are processed by the proposed eyelash detection method and 97.2% iris images are well detected. Fig.4 illustrates two typical types of results after eyelash detection. Clearly, multiple eyelashes in Fig. 4(a) and separable eyelashes in Fig. 4(b) are both completely detected, as shown in Fig. 4(c) and 4(d). At the same time thanks to the directional filters few iris textures are misclassified as eyelashes.

B. 2D Gabor filter for eyelash Detection

In this part, we will verify the accuracy of the proposed feature extraction algorithm. The performance indices are chosen as equal error rate (EER), where the false accept rate (FAR) and the false reject rate (FRR) are equal[8] and the separability between authentic and imposter matching distributions *d'* which is defined as

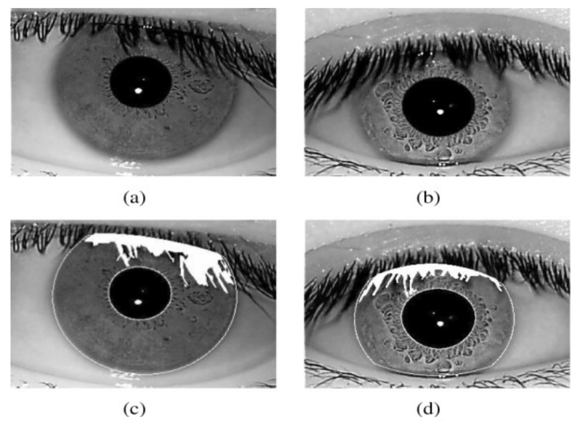

Figure 4.1. Eyelash detection with directional filters on IIT Delhi iris database.(a) and (b) The original iris images with two typical eyelash patterns.
(c) and (d) The results of eyelash detection with directional filters on (a) and (b).

$$d' = \frac{|\mu_1 - \mu_2|}{\sqrt{\frac{(\sigma_1^2 + \sigma_2^2)}{2}}}$$

Where μ_1 and μ_2 where and are the means of authentic and imposter distributions, and are their two standard deviations.
number of scales, which indicates that multiscale data fusion will improve the performance of iris recognition systems to a great extent

5. CONCLUSION

In This paper several approaches are used to improve the robustness accuracy and rapidity of iris recognition system. The eyelash detection algorithm with directional filter is need it should have some improvement that avoid two much iris texture misclassification extracting feature 2-D filtering is better and effective which describes the scale

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and orientation information iris texture in this work data fusion strategy is introduced which describe iris texture.

In the experimental evaluation process different approche are verified with databases.

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