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A Quality Assessment Method of Iris Image Based on Support Vector Machine*

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Abstract

The quality of iris image is one of the key factors influences the performance of iris pattern recognition. Based on the existing quality assessment measures of iris image, and in consideration of the most prominent factors that lead recognition to fail, we firstly put forward iris rotation which is a new quality assessment measure. Then iris rotation, iris visibility, iris eccentricity and iris definition are together as quality assessment measures of iris image and the quality assessment of iris image is done by Support Vector Machine (SVM) classifier. The experiment results express that the method we propose can select the images with good quality and has strong predictability for the performance of iris pattern recognition.

Keywords: Iris Recognition; Quality Assessment; Iris Rotation; SVM Classifier

1 Introduction

As a key step of iris recognition, the quality assessment of iris image has a great influence on the performance of iris pattern recognition and it exists a variety of methods that qualify iris images. Daugman [1] evaluated iris image quality by calculating high-frequency energy of the two-dimensional Fourier spectrum of the iris image. Wildes [2] qualified iris image by determining the gray scale gradient of boundary between iris and sclera. Ma [3] proposed a method that first calculated the different frequency band energy of the two-dimensional Fourier spectrum of iris image and then used SVM classifier to select qualified images. J. Chen [4] used the high frequency energy of iris texture extracted by using wavelet packet decomposition as evaluation standard. L. Xing [5] combined three factors, image definition, eccentricity of inside and outside, and iris visibility to qualify iris image comprehensively.

In summary, the main quality assessment measures includes definition, visibility and eccentricity. However, from the experiment, we found that these quality measures could cause false rejection in recognition stage when it comes to iris rotation in the process of acquisition.

Therefore, in this paper, we propose a compositive quality assessment method of iris image by

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combining the existing quality measures and iris rotation, a new quality measure we put forward. First, we roughly evaluate the definition and visibility of iris image so that the low quality images can be removed quickly and ensure the subsequent location of iris and eyelid is correct. Then according to the localization results, iris rotation, iris visibility, iris eccentricity and iris definition are calculated respectively and the quality assessment of iris image is done by the SVM classifier.

2 Rough Assessment

2.1 Definition

Although the gradient function is not sensitive to small changes of image definition, it is fast in real-time and can effectively eliminate the strong bright and strong dark images. So the gradient function is enough to be a rough assessment method of image definition.

If *Width* and *Height* represent the width and height of input image respectively, then the steps are as follows:

(1) G_x and G_y that represent the lateral and longitudinal directional derivative respectively are given in Eq. (1).

$$\begin{cases} G_x = I(x-1,y) - I(x+1,y) \\ G_y = I(x,y-1) - I(x,y+1) \end{cases} \tag{1}$$

where $x \in$(0, Width-1], $y \in$(0, Height-1]. $I(x,y)$ is the gray value at the point (x,y).

(2) The cumulative sum of gradient magnitude is calculated, then the rough assessment index of the image definition Q is defined in Eq. (2).

$$Q = \frac{\sum_x \sum_y \sqrt{G_x^2 + G_y^2}}{Width \times Height} \tag{2}$$

the bigger Q is, the clearer image would be.

2.2 Visibility

Based on the rough assessment method of visibility that Luo et al. [6] proposed, we first retain the pupil by image binarization and then eliminates the influence of image spots by using opening operation based on morphological knowledge. Finally the area of visible pupil S is calculated according to the pixels of visible pupil. We take the mean of the pupils' radius in sample as R. If it satisfies Eq. (3), the iris visibility would be good.

$$S > 0.8\pi R^2 \tag{3}$$