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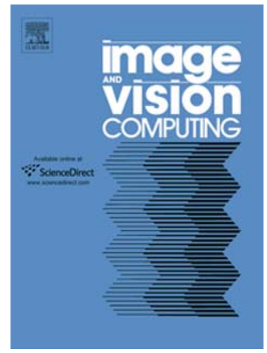

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A novel iris weight map method for less constrained iris recognition based on bit stability and discriminability

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Abstract

In this paper, we propose and investigate a novel iris weight map method for iris matching stage to improve less constrained iris recognition. The proposed iris weight map considers both intra-class bit stability and inter-class bit discriminability of iris codes. We model the intra-class bit stability in a stability map to improve the intra-class matching. The stability map assigns more weight to the bits that have values more consistent with their noiseless and stable estimates obtained using a low rank approximation from a set of noisy training images. Also, we express the inter-class bit discriminability in a discriminability map to enhance the inter-class separation. We calculate the discriminability map using a 1-to-N strategy, emphasizing the bits with more discriminative power in iris codes. The final iris weight map is the combination of the stability map and the discriminability map. We conduct experimental analysis on four publicly available datasets captured in varying less constrained conditions. The experimental results demonstrate that the proposed iris weight map achieves generally improved identification and verification performance compared to state-of-the-art methods.

Keywords: iris recognition, less constrained environment, iris weight map

1. Introduction

The human iris contains rich texture which is highly stable and distinctive. Therefore, iris recognition has become one of the most promising technologies for biometric authentication. The existing state-of-the-art iris recognition algorithms have achieved remarkable performance [1, 2, 3, 4, 5], with the iris images captured in a well controlled environment and with full cooperation of the users. Recently, significant research effort has been devoted to improve the usability and practicality of iris recognition technology by allowing the iris images to be captured in less constrained environments, with the subject at-a-distance and on-the-move [6, 7, 8, 9, 10, 11, 12, 13, 14, 15], or with cross-sensor captures [16, 17, 18, 19]. These less constrained iris recognition systems meet the increasing demand for forensic, surveillance and mobile devices security applications. However, there are still challenges in less constrained iris recognition. With the subject at-a-distance and on-the-move, the captured iris images usually suffer from noise and degradations, including low resolution, specular reflection, motion blur, out of focus, occlusion of glasses and eyelids, *etc.* Such images deteriorate the iris recognition performance [20]. As for cross-sensor iris captures, the iris recognition performance may drop because of the variation in the captures of different sensors [18].

An iris recognition system usually consists of three components: iris segmentation, feature extraction and iris matching. Currently, iris segmentation and feature extraction for captures in less constrained environments have been extensively investigated [7, 10, 11, 12, 13, 21, 22, 14, 15, 23, 24, 17, 16, 19]. However, relatively fewer works focus on designing a robust iris matching strategy [9, 8, 6, 25, 26].

Piilai *et al.* [26] use sparse representation as a robust iris matching method. This method requires noiseless representative iris images to construct a dictionary. It is less applicable to less constrained environments, since for captured images with noise corruption and degradation, or cross-sensor variation, it is difficult to obtain noiseless and representative images to construct the dictionary.

Other methods use an iris weight map to assign more weight to more important bits in iris codes. Hollingsworth *et al.* [9] illustrate the existence of fragile bits: some bits in the iris code are more likely to flip than the others. [9] shows that the iris recognition performance can be improved by eliminating too fragile bits in iris matching stage. It is equivalent to a binary iris weight map with the fragile bits assigned a weight of 0 and the other bits assigned a weight of 1. Based on the concept of bit fragility, adaptive real value weight maps, like the personalized weight map [8], and the power law based weight map [6] are proposed, achieving better performance. Theoretically, according to the proof in [8], if the inter-class matching follows a binomial distribution with a mean of 0.5, the above iris weight maps can be viewed as opti-

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