Multi-scale Palmprint Recognition Using Registration Information and 2D Gabor Feature*

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Abstract. This paper describes a novel method for palmprint recognition based on registration information and 2D Gabor features. After preprocessing, a unified coordinate system is constructed for each palmprint image and used to guide ROI extraction. A multi-scale matching strategy is employed to match registration information and 2D Gabor features. In the first two levels, registration information is extracted and used to measure the global similarity between two palmprint patterns. In the third level, two palmprints are aligned with their registration information and then are matched using their corresponding Gabor features. The experimental results demonstrate the effectiveness of the method.

1 Introduction

In information and vastly interconnected society, biometric technologies have been paid more attention in personal authentication since they are more convenient, reliable and stable. Different techniques have been developed and applied in many fields. From all these techniques, palmprint is considered as a relatively new biometric feature for personal verification and have several advantages: stability and uniqueness; medium cost as it only needs a platform and a low/medium resolution CCD camera or scanner; it is very difficult to be mimicked; high user acceptance. It is for these reasons that palmprint recognition has attracted more interests from researchers.

There are many features in a palmprint image that can be extracted for authentication. Principal lines, wrinkles, ridges, minutiae points, singular points, and textures are regarded as useful features for palmprint pattern representation[1]. For palmprint, though, there is no universal method of feature extraction and recognition. In existing research, the majority focused on: points and lines[2][3][4][5]; texture analysis[6][7][8]; statistic features[9][10] and hybrid of different types of features[11].

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In this paper we investigate a novel palmprint recognition method which uses multi-scale verification strategy based on registration information and 2D Gabor features. In Level-1 stage we register two ROI images and extract their registration information using Fourier-Mellin Transformation (FMT) and phase correlation technique. In Level-2 stage, each ROI image is divided into $2 \times 2$ blocks and each pair of corresponding blocks is registered to obtain more detailed registration information. Registration information describes global similarity between two palmprint patterns at coarse level. In Level-3 stage each pair of blocks is firstly aligned with their registration information previously extracted, then a Gabor feature based image matching is performed in the superposition area of two blocks at fine level for the final confirmation. Our method is focusing on palmprint verification and is different with the method proposed in [12], which adopted multiple features and matching criteria and mainly used for palmprint identification in a large database.

The rest of this paper is organized as follows. In the Section 2 is the preprocessing stage. Section 3 presents palmprint registration with FMT and Section 4 is devoted to multi-scale palmprint verification strategy. Experimental results are listed in Section 5. At last, we discuss our algorithm and future work in Section 6.

2 Preprocessing

Our work is carried on the PolyU Palmprint Database[13]. The images of this database contain the whole palmprint and other parts of a palm and background. Therefore a preprocessing step is needed to extract the ROI. The detailed information about preprocessing steps can be referred [14]. Fig.1 shows these steps and ROI image after preprocessing.

![Fig. 1. The main steps of preprocessing. (a)Original database image, (b)Binarizing half of image, (c)Tracking boundary and searching line segment, (d)Building coordinate system, (e)Extracting ROI, (f)Normalizing ROI.](image-url)