

Palm Print Recognition Review Paper

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Abstract- This paper provides an overview of some current palmprint research. Palmprint recognition has been investigated over the past decade. Palmprint recognition has five stages palmprint acquisition, preprocessing, feature extraction, enrollment (database) and matching. Due to rich information in palmprint it became a powerful means in person identification. The major approach for palmprint recognition is to extract feature vectors corresponding to individual palm image and to perform matching based on some distance metrics. Palmprint recognition is a challenging problem mainly due to low quality of pattern, large nonlinear distortion between different impression of same palm and large image size, which makes feature extraction and matching computationally demanding.

Keywords- palmprint acquisition, recognition, matching, distance metrics, feature extraction.

I. INTRODUCTION

Palm normally contains three flexion creases (principal lines), secondary creases (wrinkles) and ridges. The three major flexions are genetically dependent; most of other creases are not [1]. Even identical twins have different palmprints [1]. These non-genetically deterministic and complex patterns are very useful in personal identification. Palm is the inner surface of the hand between the wrist and fingers. Palm area contains large number of features such as principle lines, wrinkles, minutiae, datum point features and texture [2].

Palmprint recognition system employs high or low resolution images. Most of the system uses the low resolution image [3]. The palmprint image is captured using a palmprint scanner. Preprocessing has two parts, image alignment and region of interest (ROI) selection. ROI selection is the cropping of palmprint image from the hand image. Feature extraction stage obtains proposed features from the preprocessed palmprints. At the last matching compares the captured image features with the stored templates.

Methods belonging to low resolution images (75 or 150dpi); where only principal lines, wrinkles, and texture are evident [4]. Some of them use different edge detection methods to extract palm lines, and match them directly or after some feature transformations. Other approaches first extract some features like Gabor filter or wavelets, then use a subspace projection like principal component analysis or linear discriminant analysis to reduce their dimensionality and adopt distance measures or classifiers to compare the reduced features.

Methods belonging to the high resolution images (500dpi), where, in addition to principal lines and wrinkles, more discriminant features such as ridges, singular points and minutiae can be extracted. Jain and feng use a region growing

algorithm to extract the palmprint local orientation, then detect minutiae and in matching stage, calculate the similarity between two palmprints by means of a weighted sum of minutiae and orientation field matching score [5]. Dai and Zhou proposed a multi-feature based palmprint recognition system, where minutiae, orientation field, density map, and major creases are extracted and compared to achieve higher accuracy.

This paper is organized as follows: Section II reviews palm image acquisition devices, Section III summarizes preprocessing methods, Section IV discusses the feature extraction and matching methods, Section V concludes.

II. PALMPRINT ACQUISITION

There are various ways to capture palmprint image. Researchers utilize CCD-based scanners, digital scanners, video camera and tripod to collect palmprint images. Fig.2 shows a CCD-based scanner developed by Hong Kong Polytechnic University [6]. Rafal Kozik and Michal Choras were made a special tripod to capture palm images as shown in fig.3 [7]. Its shape and proportion minimize errors caused by camera movements and rotation. A CCD-based scanner captures high resolution images and aligns palms accurately because it has pegs for guiding the placement of hand.

Digital scanners produces low quality image and requires large time for scanning,

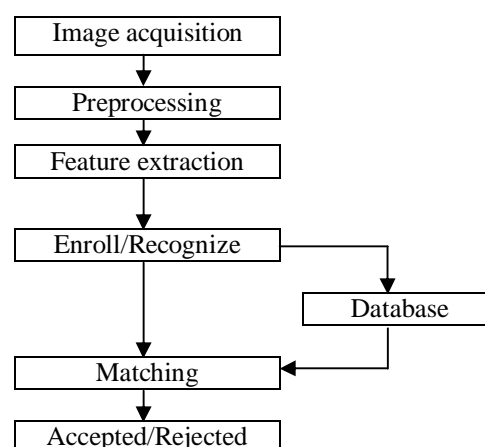


Fig.1. Stages in palmprint recognition

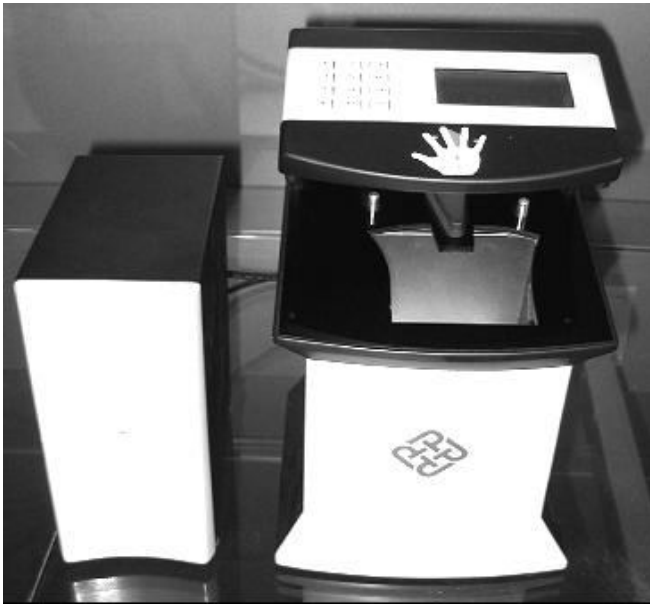


Fig.2 A CCD-based palmprint scanner



Fig.3 A special tripod

therefore it cannot be used for real time applications. Digital and video cameras can also captured palm images but can cause recognition problems.

III. PREPROCESSING

Preprocessing is used to correct distortions, align different palmprints, and to crop the region of interest for feature extraction. There are five steps 1.Binarizing the palm image 2. Boundary tracking 3.Key points detection 4.establishing a coordination system and 5.Extracting the central part. Fig.4(a) shows key points and coordinate system, fig.4(b) shows ROI extraction.

The first two steps are common for any preprocessing algorithm. Third step has different variations such as tangent based, finger based to detect the key points between fingers. The tangent based method considers the edges of two fingers holes on binary image which are to be traced and the common tangent of two fingers holes is found to be axis. The middle point of the two tangent points is defined as the key points for establishing coordinate system [4].

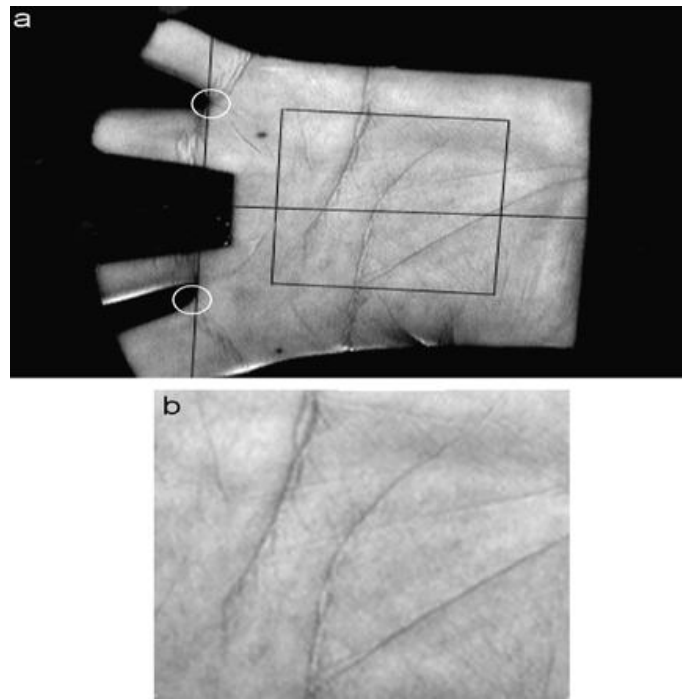


Fig.4 (a) key points and coordinate system, (b) ROI extraction

The central part of palm image is then segmented. Most of the algorithms segment square regions for feature extraction but some of algorithm extracts circular and half elliptical regions. The square region is easier than others.

IV. FEATURE EXTRACTION AND MATCHING

The aim of this section is to recognize a correct person to authenticate and to prevent multiple people from using the same identity. In identification, the system recognizes an individual by searching the templates of all users in the database for matching. Research on feature extraction and matching algorithms are classified as follows: Line based, subspace based, Statistical based and coding based.

A. Line Based Approaches

This approach develops edge detectors or use existing one to extract palm lines [8]. Palm line are matched directly or represented in other format for matching. First using sobel masks magnitude of palm lines are computed. The magnitude are projected in x and y directions to form histograms. They computed first and second order derivative of palm images. These derivatives can be obtained by rotating the masks. The zero crossing of first order derivative is used to identify the edge points and corresponding directions. Second order derivative is used to identify the magnitude of the lines. The weighted sum of local directional magnitude is an element in the feature vector. Euclidian distance is used for matching.

B. Subspace Based Approaches

This involves Principal Component Analysis (PCA) [7], Lin-ear Discriminant Analysis (LDA) and Independent

Component Analysis (ICA). The subspace coefficients are considered as features. With these researchers also employs wavelets, DCT and kernel.

C. Statistical Approaches

There are two types local and global. The local approaches transforms images into another domain and divide the transform into several regions such as mean and variance of each small region. The global features like moments, centre of gravity and density directly from the whole transformed images.

D. Coding Approaches

Palm code uses a single Gabor filter to extract the local phase information of palm print [2].

Kong et al. introduced a fusion code method to encode the phase of the filter responses from a bank of Gabor filters with different orientations. A practical palmprint recognition algorithm using 2D phase information (i) reduces the registered data size by registering quantized phase information and (ii) deals with nonlinear distortion between palmprint images by local block matching using Phase-Only Correlation.

E. Other Approaches

Some approaches are difficult to classify because they combine several image processing methods to extract palmprint features such as neural network to make final decision, two dimensional dual-tree complex transform on preprocessed palmprint to decompose the images, phase only correlations etc.

F. Fusion

Fusion means combining other biometric traits with palmprints such as face, fingerprints, palm veins [11] and iris. Combining hand geometry and finger surface with palmprint allows these features and palmprint to be extracted from a single hand image i.e. only one sensor is needed. Researchers have examined fusion rules like sum, maximum, average, minimum, support vector machine (SVM) and neural networks. Fusion increases accuracy, computation costs and template sizes and reduces false acceptance.

V. CONCLUSION

In this paper we have reviewed the several existing methods used for palm print recognition system. The work of D. Zhang et al. for palmprint acquisition using CCD based scanner is recommended. We also recommend palm code, fusion code, competitive code and the theory of coding method. There will be lot of work to do with palmprint feature extraction methods and matching algorithms for increasing speed and accuracy.

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