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Palm Print Recognition System – Review

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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

1. Introduction

Palmprint recognition is one of the biometrics available at the present. Biometric systems are used two main categories 'physiological' and/or 'behavioral'. The physiological category includes the physical human traits such as palmprint, hand shape, eyes, veins, etc. The behavioral category includes the movement of the human, such as hand gesture, speaking style, signature etc.

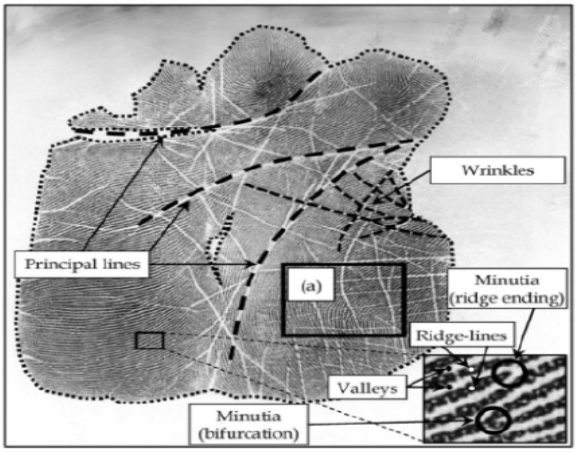

Figure 1: Feature for Palm print

The measurement of these traits helps in authentication using the biometric systems. One of the most successful biometric systems is the palmprint recognition system. This system recognizes on the basis of the palm print of a person. The interesting part is that the ridge structure is permanent. This ridge structure is formed at about the thirteenth week of the embryonic development. This formation gets completed by the eighteenth week. The palmprint recognition system has advantages over the other physiological biometric systems. Some of the advantages are fixed line structure, low intrusiveness, low cost capturing device, low resolution imaging. Thus palmprint recognition is a very interesting research area. A lot of work has already been done in this area, but there is still a lot of scope to make the systems more efficient. Here, we have tried to analyze the already existing systems and thereby propose a new approach. Various stages used in palmprint these all are following as.

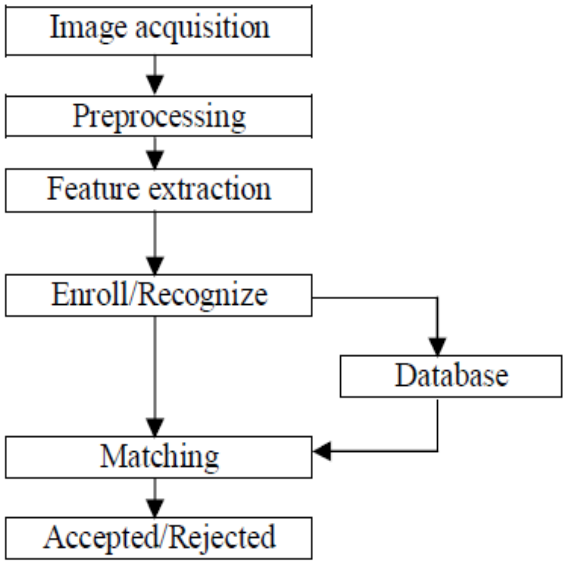

Figure 2: Stages in Palm print Verification

A. Preprocessing

To reduce the overhead, instead of directly using the palmprint images, preprocessing needs to be done. Preprocessing is used to remove distortion, align the palmprints and to crop the region of interest. This cropped ROI is used for feature extraction. This is done in five steps:

a. Binarizing the palm image
b. Boundary tracking
c. Key point's detection
d. Establishing a coordination system
e. Extracting the central part

The third step can be accomplished by two approaches, tangent based and finger based. The tangent based approach is preferred. This approach considers the edges of the 2 finger holes on the binary image to be traced. The common tangent of the two finger holes is considered to be the axis. The key points for the coordination system are calculated as the midpoint of the two tangent points.

B. ROI Extraction

The central part of the palm image is segmented after the preprocessing. Different algorithms segment circular, half elliptical or square regions for feature extraction. The square region is the easiest and widely used. The cropped image is then passed through a low pass filter (LPF), which blurs the image. In this blurred image, the minor lines get suppressed.

The major lines are also affected, but they are prominent. These are then used for feature extraction.

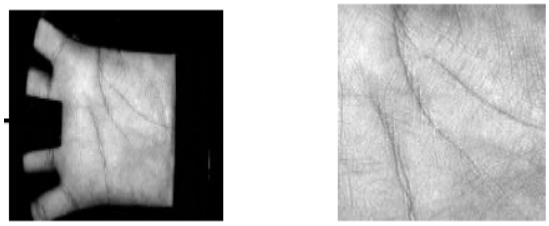

Figure 3: ROI extraction

C. Feature Extraction and Matching

For matching the palmprints, we need to extract some features first. The extracted features are then used for matching. Some of the feature extraction and matching algorithms are line based, subspace based, statistical and coding based approaches.

1) Line based approach*:* This approach develops edge detectors and makes use of the magnitude of the palm lines. The magnitudes of the palm lines are projected in x and y coordinates forming histograms. After this, the first and second order derivatives of the palm images are calculated. The first order derivative is used to identify the edge points and corresponding directions. The second order derivative is used to identify the magnitude of lines. Then the Euclidiandistance is used for matching.

2) Subspace based approach: This approach makes use of Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and Independent Component Analysis (IDA). The spatial coefficients are considered as the features used for matching. This approach does not need any prior knowledge of the palmprints.

3) Statistical approach*:* These are of two types, local and global. The local approach transforms the image in another domain. This transformed image is then divided into several regions such as mean and variance of each region. The global features include moments, center of gravity and density. The global approach is applied on the whole palmprint image. This is the only difference between the local and global approach. The local approach is applied on the segments of the palmprint image whereas the global approach is applied on the whole image.

4) Coding approaches: This approach uses a single Gabor filter to extract the local phase information of palmprint. This extracted phase information is used by the palmprint recognition systems to reduce the registered data size and to deal with non-linear distortion between palmprint images. This approach has very low memory requirement and fast matching speed.

D. Accept / Reject

The users are authenticated by the palmprint recognition systems. These accept the users, who are authenticated, i.e. whose palmprint match with a palmprint present in the database. If the user is not authenticated, then the user is rejected. This process of accepting and rejecting the user is done on the basis of the matching algorithm. This matching is done on the basis of the extracted features. Classification is the basis for the palm images to be accepted or rejected. Similar samples are grouped in the same class. Some of the similarity measures are Mahalanob is, Euclidean and Manhattan distances. Another classification approach is the construction of decision boundaries. This can be achieved by the use of techniques such as Artificial Neural Networks (ANN).

2. Other Approaches for Palmprint

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 complexes transform on preprocessed palmprint to decompose the images, phase only correlations etc.

1) Fusion

Fusion means combining other biometric traits with palmprints such as face, fingerprints, palm veins 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.

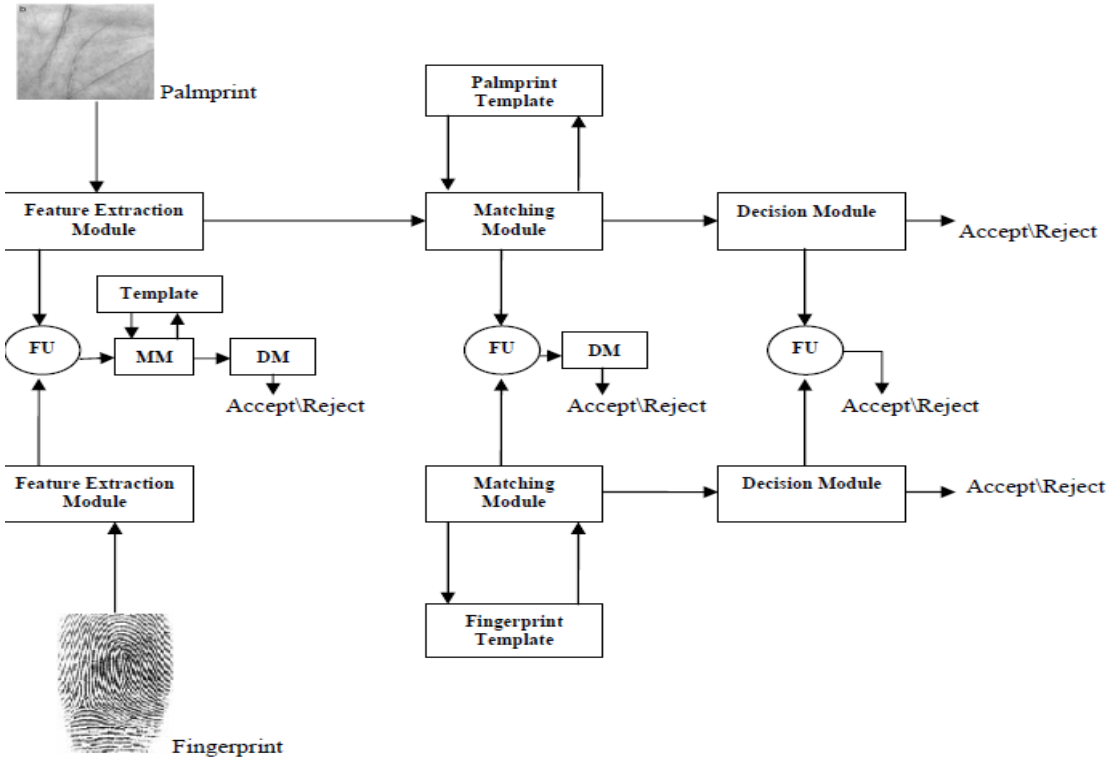

Figure 4: Levels of fusion in a bimodal biometric system

FU: Fusion Module, MM: Matching Module, DM: Decision Module.

1.1 Levels of fusion

Based on the type of information available in a certain module, different levels of fusion can be defined as shown in fig 4.

a. Fusion at the data or feature level: Either the data itself or the feature sets originating from multiple sensors/sources are fused.
b. Fusion at the match score level: The scores generated by multiple classifiers pertaining to different modalities are combined.
c. Fusion at the decision level: The final output of multiple classifiers is combined

3. Palmprint Acquisition Literature Review

There are various ways to capture palm print image. Researchers utilize CCD-based scanners, digital scanners, video camera and tripod to collect palm print images. A CCD-based scanner developed by Hong Kong Polytechnic University. Rafa Kozik and Michal Choras were made a special tripod to capture palm images. 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, Jiwen Lu et al proposes an efficient palmprint recognition method using locality preserving projections (LPP) andextreme learning machine (ELM) neural network. Firstly, two-dimensional discrete wavelet transformation (DWT) is applied in the region of interest (ROI) of each palmprint image and then principal component analysis (PCA) and LPP are used for dimensionality reduction [1].Followed by the same author Leqing Zhu, proposed a novel palm print recognition algorithm based on principal lines: anew irregular geometrical shape was employed to get valid palm print region, which decreased the influence of large noises; not only structure feature, but also intension in formation were included in the final extracted principal lines, which provides much sufficient clues for palm print recognition; the probability feature image (PFI) was used in order to suppress random noises in feature image; features from several training samples were merged into one template, which guaranteed the integrity of feature; fuzzy logic was employed in matching algorithm [2].As mentioned in [5], different neural network based approaches are evolved for palm print recognition by using some other domain method like wavelet transform etc. for training purpose. Different stage classifications can also be useful in such cases for optimum classification of appropriate features. Various proposed system is based on geometrical features and texture features extracted using kernel principal components analysis (KPCA).In the coarse-level stage, the hand geometrical features are applied in the SOMNN to select a small set for further matching, and in the fine-level matching, texture features are input into the BPNN for final identification. Since, Palm print-based personal identification, as a new member in the biometrics family, has become an active research topic in recent years. The rich texture information of palm print offers one of the powerful means in the field of personal recognition. Hence, many researches proposed, a novel approach for handprint identification.

4. Conclusion

Several existing methods have been reviewed for palmprint recognition. Palm print acquisition using CCD based scanner is recommended. Palm print recognition is a good field and only limited works were carried out researchers to invent new methods to reduce the error rates and to improve the accuracy and speed of the system. The future work can be extended to apply gaussianization, the feature normalization method on the high Resolution Images Where Multiple features can be extracted.

Reference

[1] K. Ito, A. Morita, T. Aoki, T. Higuchi, H. Nakajima. , "A fingerprint recognition algorithm combining phase-based image matching and feature-based matching", Lecture Notes in Computer Science (ICB2006), vol. 3832, pp. 316–325, (Dec. 2005).

[2] K. Miyazawa, K. Ito, T. Aoki, K. Kobayashi, and H. Nakajima., "An efficient iris recognition algorithm using phase-based image matching," Proc. the 2005 IEEE Int. Conf. Image Processing, pp. II–49–II–52, (Sept. 2005).

[3] Y.K.Rajput, Melissa Amanna, MankhushJagawat, Mayank Sharma. , "Pam print Recognition using image processing "TECHNIA, Vol, 3 ISSN 0974-3375), (Jan, 2011)

[4] Jiansheng Chen, Yiu Sang Moon. , "Using SIFT Feature in Palm print Authentication" IEEE, (2008)

[5] W. Li, D. Zhang, and Z. Xu. , "Palmprint Identification by Fourier Transform", Int'l J. Pattern Recognition and Artificial Intelligence, vol. 16, no. 4, pp. 417-432, (2002).

[6] C.C. Han, H.L. Cheng, K.C. Fan, and C.L. Lin. , "Personal Authentication Using Palmprint Features", Pattern Recognition, Special Issue: Biometrics, vol. 36, no. 2, pp. 371-381, (2003).

[7] A. Kong, D. Zhang and M. Kamel., "Palmprint identification using feature-level fusion", Pattern Recognition, Vol. 39, No. 3, pp. 478-487, (2006).