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A Review Paper Based on Palmprint Recognition System

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Abstract –**A biometric system is essentially a pattern recognition system which makes a personal identification by determining the authenticity of a specific physiological or behavioural characteristic possessed by the user. Palmprint recognition being one of the important aspects of biometric technology is one of the most reliable and successful identification methods. It has four stages, palmprint image acquisition, preprocessing, feature extraction 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. Researchers have proposed a variety of palmprint preprocessing, feature extraction and matching approaches. This paper presents a detailed review of palmprint recognition approaches.**

Keywords – **Image Acquisition, Preprocessing, Feature Extraction and Matching.**

I. INTRODUCTION

Biometric is automated method of recognizing a person based on a physiological or behavioural characteristic. Among the features measured are; face fingerprints, hand geometry, handwriting, iris, retinal, vein, and voice. Biometric technologies are becoming the foundation of an extensive array of highly secure identification and personal verification solutions [1]. As the level of security breaches and transaction fraud increases, the need for highly secure identification and personal verification technologies is becoming apparent.

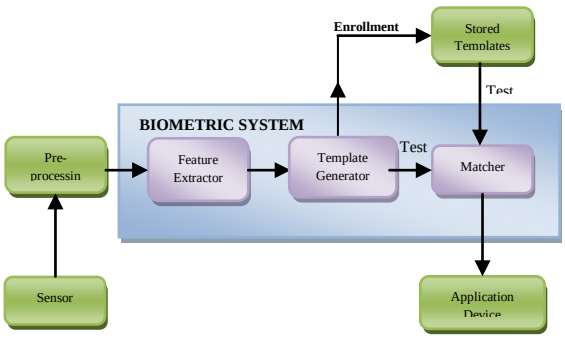


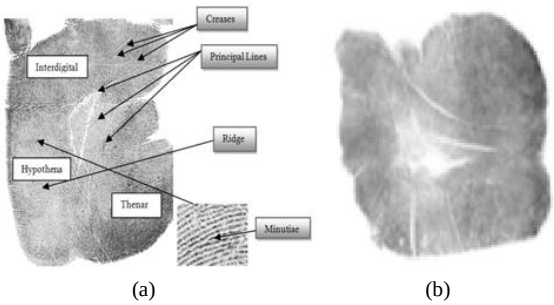
Figure 1: Biometric System

Biometric-based solutions are able to provide for confidential financial transactions and personal data privacy. There are different types of modalities available for identification purpose such as iris, fingerprints, palmprint, face etc. [2], where iris and fingerprint modalities are widely used in biometrics system as these two modalities are most reliable and possess uniqueness. Palmprint is also one of the reliable modality since it possess more features than that of the other modality such as principal lines, orientation, minutiae, singular points etc. Also palmprint modality is unique for each individual [2], moreover it is universal. Palmprint recognition is used in civil applications, law enforcement and many such applications where access control is essential.

Rest of paper is organized as follows: Section II describes Palmprint Recognition System, Section III explains review of previous work and Section IV summarizes the contributions of the paper.

II. PALMPRINT RECOGNITION SYSTEM

Palmprint identification can be divided into two categories, on-line and offline. Figure 2 (a) and 2 (b) show an on-line palmprint image and an offline palmprint image, respectively.

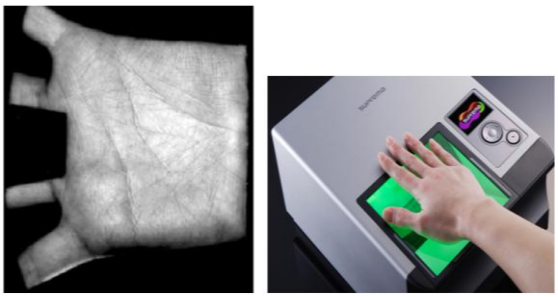


(a) (b)

Figure 2: Examples of (a) on-line, with line definitions and (b) off-line palmprint images

Research on offline palmprint identification has been the main focus in the past few years. Due to the relative high-resolution offline palmprint images (up to 500 dpi), some

techniques applied to fingerprint images could be useful for offline palmprint identification, where lines, datum points and singular points can be extracted. For on-line palmprint authentication, the samples are directly obtained by a palmprint scanner [14]. Figure 3 (a) shows a palmprint image captured by palmprint scanner and Figure 3 (b) shows the outlook of the scanner device [14].



(a) (b)

Figure 3: (a) Palmprint image captured by palmprint scanner and (b) palmprint scanner device

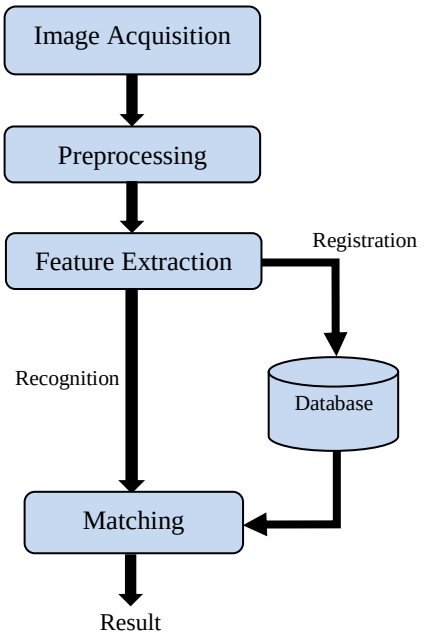


Figure 4: Generalized block diagram of Palmprint Recognition

It is believed that palm print is unique to individuals. They remain unchanged throughout at least a certain period during the adult life of an individual.

Palm print recognition employs either high or low resolution images. Most of the research on palm print recognition uses the low resolution images [3].

The palm print recognition system consists of four stages: Palm print image acquisition, Preprocessing, Feature extraction and matching as shown in Figure 4. The palmprint image is acquired using a palm print scanner. Preprocessing has two parts, image alignment and region of interest selection. Image alignment is done by referring to the key points. Region of Interest selection is the cropping of palmprint image from the hand image. Feature extraction obtains discriminating features from the preprocessed Palmprints. The matching compares the captured image features with the stored templates.

A. Palmprint Image Acquisition

In this phase, image of palmprint is first capture with the help of different types of digital cameras. Acquired image may be blurred or it may have noise, which decreases the quality of an image and affects the performance rate of palmprint recognition system directly. The palmprint image acquired may vary by position, direction and stretching degree [2].

B. Preprocessing

After capturing the data or image of the palmprint, pre-processing is formed on image. 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:

1. Binarizing the palm image.
2. Boundary tracking.
3. Key points detection.
4. Establishing a coordination system.
5. 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.

C. Feature Extraction

Feature extraction is followed by pre-processing. The objective of this step is to extract variables that describe, unequivocally, the forms belonging to the same class while differentiating them from the other classes. In other words it is the process in which phase features of palm are extracted like principal lines, orientation field, minutiae, density map, texture, singular points etc. These features are helpful for identification or verification of individual. Extracted features are stored in *database* for further process of matching.

Research on feature extraction and matching algorithms are classified as follows: Line based, subspace based, Statistical based and coding based approaches.

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 Euclidian distance is used for matching.

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.

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.

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. Matching

Matching is next to the feature extraction phase. Feature matching determines the degree of similarity of recognition template with master template. Different approaches are used for matching. Input provided by an individual is matched with templates present in the database. Matching is dependent on whether the system performs identification or verification. If it performs identification, then one-to-many matching, which matches input as palmprint of individuals with all templates of database, otherwise one-to-one match is done for verification, where input of an individual is matched with only the template he/she claims to be.

III. REVIEW OF PREVIOUS WORK

Some recent papers are reviewed for Palmprint recognition:

Sang et al. proposed a robust, touchless, palmprint recognition system which is based on colour palm-print images. This system uses skin-color thresholding and hand valley detection algorithm for extracting palmprint. Then, the local binary pattern (LBP) is applied to the palmprint in order to extract the palmprint features. Finally, chi square statistic is used for classification [4].

Khalifa et al. focused on three feature extraction techniques based on the discrete wavelet transform, the Gabor filters and the co-occurrence matrix. The support vector machine is used for the classification step [5].

Puranik et al. proposed an innovative touch-less, web camera based palm print recognition system. It describes to use a low-resolution web camera to capture the user's hand at a distance for recognition. The user does not need to touch any device for their palm print to be acquired [6].

Seshikala et al. used multi scale wavelet edge detection to carry out the feature extraction of palm print. The performance is compared with conventional edge detection techniques like Sobel and Canny methods [7].

Shashikala et al. proposed a palmprint identification system based on DWT, DCT and QPCA (PIDDQ). Histogram equalization is used on palmprint to enhance contrast of an image. The DWT is applied on Histogram equalized image to generate LL, LH, HL and HH bands. The LL band is converted into DCT coefficients using DCT. QPCA is applied on DCT coefficients to generate features. The test and database palmprint features are compared using Euclidean Distance (ED) [8].

Kumar et al. presented a paper in which the palmprint images are mapped to Eigen-space and a robust code signature is generated from different camera snapshots of the same palm to incorporate tonal and lighting variations. To enable real-time identification, the signature is represented by a low dimensional feature vector to reduce computational overheads [9].

Gayathri et al. presented a paper in which the Gabor wavelet is used to extract multiple features available on the palmprint, by employing a feature level fusion and classified using nearest neighbour approach. Here, the features are extracted using wavelet entropy consist of contrast, correlation, energy, and homogeneity. The features are fused at feature levels. Palmprint matching is then performed by using nearest neighbour classifier [10].

Guo et al. presented a paper in which five methods of feature extraction are used. They are statistics feature, Fourier transform, DCT transform, Gabor transform and local binary pattern (LBP). The feature vectors of all the sub-images are combined together to form the feature vector of the palmprint image. Finally the pattern classification can be implemented by the nearest neighbour classifier [11].

Malik et al. also presented a paper in which several method of feature extraction are used. Sobel Code operators, canny

edge and Phase Congruency methods are applied to the palmprint image to extract palmprint features. The corresponding feature vectors are matched using sliding window with Hamming Distance similarity measurement method. In this paper, a Min Max Threshold Range (MMTR) method is described that helps in increasing overall system accuracy by reducing the False Acceptance Rate (FAR) [12].

Yih et al. also presented a paper [13] in which different feature extraction methods, namely: Discrete Cosine Transform energy features, Wavelet Transform energy features and SobelCode are applied to the resized image to obtain feature vectors.

IV. CONCLUSION

In this paper we have reviewed the several existing methods used for palm print recognition system. A lot of work has to be done with the feature extraction algorithms as well as the matching algorithms. The aim of working on the palmprint recognition system is to develop a system with increased speed and accuracy.

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