Texture based Palm print Recognition using Simple Methods

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ABSTRACT
Now-a-Days Biometric based recognition is the most popular human recognition pattern. Biometric based recognition is an approach using the biological features inherent in each individual. They are processed based on the identical, portable and arduous duplicate characteristics. In the Palmprint recognition application implementing more details apart from principle lines or minutiae will be much helpful. In this paper, proposed a texture based palmprint recognition system. It is suitable to large organizations for maintaining employee entry record. Here, presents an algorithm to extract the features from region of interest (ROI) of palmprint images. In this approach 128 X 128 ROI images of the Hong Kong Polytechnic University 2D_3D_ palmprint database. From these images, extracted some texture features by using of simple methods. Training set is prepared with the help of K no. of samples per user, where K varies from 1to 4. Results are checked against remaining images in image recognition mode. Results are encouraging.

Keywords
Biometric, Palmprint Recognition, Texture Based Recognition, Pattern Recognition, Canberra Distance.

1. INTRODUCTION
Biometric based recognition is an automated methodology to uniquely recognize people by their natural biological characteristics, such as fingerprints, retina, iris, face, palmprint, voice pattern, signature or key stroke.

Palmprint based person recognition is a new biometric modality which is getting wide acceptance. Palmprint recognition is an important kind of biometric aiming to recognize human recognize through some unique features in human palms, such as principle lines, wrinkles, ridges, minutiae, single points and textures. Many feature extraction methods have already proposed for palmprint recognition in the literature. While these methods have achieved good performance, most of them just extract feature extraction on each pixel of a palmprint image and ignore the region property of the image. Palmprint recognition methods are used widely, because of their small feature size, fast matching speed and high verification accuracy. Early works on palmprint recognition focus on structural features such as principal lines, wrinkles, and minutiae in palmprint images. It develops edge detectors or use existing edge detection methods to extract palm lines, which are matched directly or represented in other formats for matching.

Texture based approaches extends texture analysis methods for palmprint recognition. The palmprint textures can be obtained by many techniques, such as Gabor wavelets [1, 2], Fourier transformation [3, 6], cosine transformation [4, 6], wavelet transformation [3, 4, 5], Standard Deviation [4, 7]. It is very hard to align the palmprint images and cropping the region of interest (ROI). Moreover, the illuminations of capturing images vary with the stretching and pressure of palms greatly. Hence the recent works on the issue how to improve the robustness against variations of orientation, position and illumination in capturing palmprint images by extracting the palmprint features. Normal people don't feel easy to have their palmprint images taken for testing. On palm lines and textures are more clearly observable features. Lines are better than texture for human vision. When human beings evaluate a couple of images, they intuitively compare line characteristics. However extracting principle lines and creases is not an easy task because it is sometimes difficult to extract the line structure that can discriminate every individual. Besides, creases and ridges on the palm are always crossing and overlapping each other, which complicates the feature extraction task.

Palmprint is rich of texture information, this pattern of texture offset stable, unique and non-duplicate features for person recognition. By extracting of these texture extraction methods and applying simple matching technique to recognize the person.

Palmprint recognition has involves many steps to recognize a person from their palmprint images they are image reading, pre-processing, Feature Extraction, Feature matching and Decision making. In the experiments utilized the Hang Kong Polytechnic University 2D_3D_palmprint database [8] palmprint images. By taking of ROI images there is no need to perform any preprocessing. Feature Extraction method contains the methods that are utilized for extracting the features from ROI. Generally Palmprint Recognition uses five different types feature extraction algorithms [5], they are Subspace based approach, Texture based approach, Line based approach and Transform based approach. Subspace based approach is also called as appearance based approach in the literature of palmprint recognition.

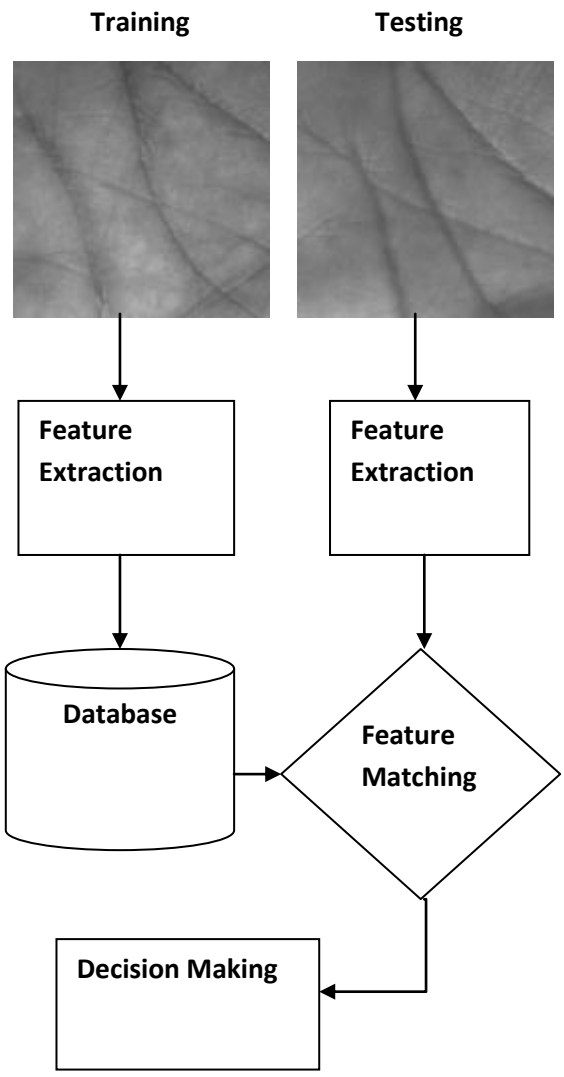

Fig: 1. Architecture of the proposed System

Texture based approach algorithms are to extract textures features of palmprint and compares distances of features. Line feature approach algorithms are to extract palmprint line orientations and compares similarities between different images. Among these types, the proposed approach uses texture based algorithm. For feature matching purpose the proposed approach uses Canberra distance [9], and depending on these values decision is taken to recognize the person.

The rest of the paper is organized as follows: Section 2 presents various Feature Extraction methods, Section 3 presents Proposed Feature Extraction algorithm, section 4 presents Feature matching methods and Experimental results on various methods, section 5 presents conclusion and followed by References.

2. FEATURE EXTRACTION

Feature extraction is to describe a palmprint in a wavelet feature set other than the original image. A feature with good discriminating ability should exhibit a large variance between individuals and small variance between samples from the same person. To use palmprint textures as features, transformation based approach is generally used. Among the work that appear in the literature are Gabor filters[1,2], Fourier transform[3,6], Discrete Cosine transform[4,6], Wavelet Transform [3,4,5] and Standard deviation [4].

The Gabor filter has good performance for feature extraction however the extraction is time consuming and sensitive to non-linear distortions and rotations. Fourier transformation includes both forward and reverse transformations of spatial to frequency and frequency to spatial conversion is possible. It is used for image enhancement, where high pass filter is used to suppose the edge lines and low pass filter used to smooth the image. But they do not provide more values to palmprint feature extraction except the frequency domain. Discrete Cosine Transformation (DCT) is a Fourier related transform that is equivalent to roughly twice the length of Fourier Transform but operating on real data, is used in image processing for the purpose of data compression, feature extraction. While using a large number of features for recognition it takes a large time to extract features, and it gradually decrease the recognition rate. Discrete wavelet transform for which the wavelets are discrete sampled. The wavelet transform, it is suited for analyzing images where most of the information content is represented by components. The wavelet function is designed to strike a balance between time domain and frequency domain. Wavelets are also give good feature extraction but, the selection of wavelet family and wavelet selection was difficult processor.

3. PROPOSED FEATURE EXTRACTION

Feature extraction is to describe a palmprint in a good discriminating ability should exhibit a large variance between individuals and small variance between samples from the same person. The palmprint database used in this work is the Hong Kong Polytechnic University 2D_3D_palmprint database [8]. It consisting of 400 users each of having two sections and each section has ten samples of user totally 8000 palmprint ROI images are taken. The original size of the images is 128 X 128 pixels. Then we cropped the main image into number of sub blocks of non-overlapping for purpose of extracting the features then the proposed approach can extract the more features using of standard deviation.

The proposed algorithm for feature extraction method is

Step1: Read ROI images

Step2: Crop Original ROI image into 64 X 64, 32 X 32 and 16 X 16 non-overlapping and intersect of previous sub images as show in figure 2.

Step3: Calculate, Standard Deviation for all sub images and store the values into Feature Vector.

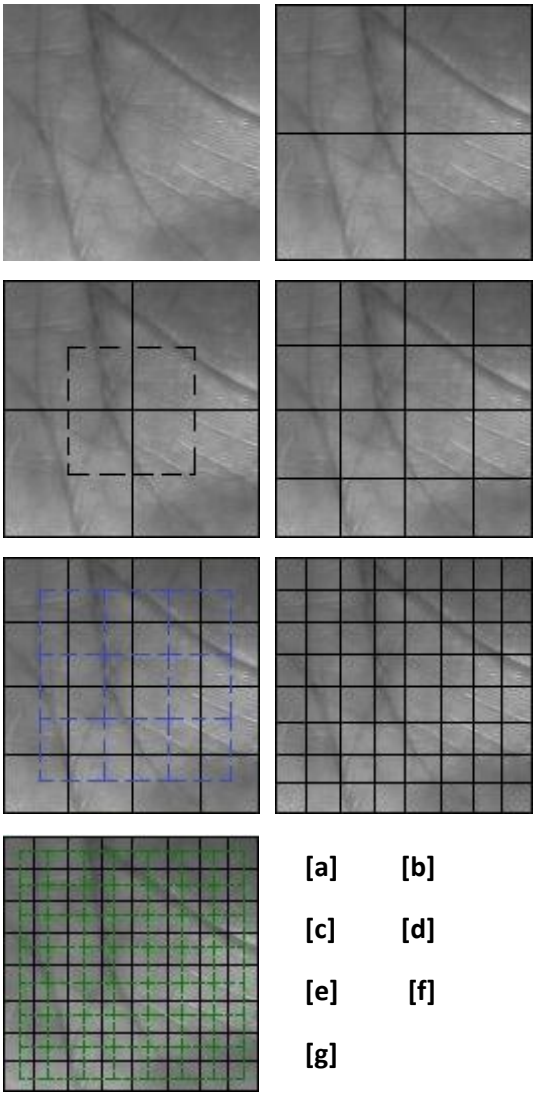

Figure:2. Feature Extraction Procedure
[a]. Read ROI.
[b]. Cropping 64X64 non-overlapping sub-images.
[c]. Cropping 64X64 intersect sub-images.
[d]. Cropping 32X32 non-overlapping sub-images.
[e]. Cropping 32X32 intersect sub-images.
[f]. Cropping 16X16 non-overlapping sub-images.
[g]. Cropping 16X16 intersect sub-images.

The standard deviation [9] shows how much variation exits from the average. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data points are spread out over a large range of values. We can calculate standard deviation

$$\mathcal{SD} = \sqrt{\frac{\sum_{i=1}^{N}(x_i-\bar{x})^2}{N-1}} \quad (1)$$

Where x_i is the observed value of the sample item, and $\bar{x}$ is the mean value of these observations. N-1 is known as corrected estimator.

4. FEATURE MATCHING METHODS AND EXPERIMENTAL RESULTS

The performance of proposed algorithm is compared with Fourier transformation (FFT), Discrete cosine transformation (DCT), Discrete Wavelet Transformation (DWT). FFT, DCT and DWT are applied to sub-images and then extracted features from those sub-images. While applying these methods, decomposition is carried out up to three levels for 64 X 64, and up to one level decomposition for 32 X 32 sub-images and directly apply on 16 X 16 sub-images. Then calculated standard deviation for each one obtained previously. Total 273 features are extracted. By 64 X 64 sub-images five and applying up to three levels so each sub-image contains 12 features total 60(5x12=60) features are extracted. Then 32 X 32 sub-images are 25, 16 non-overlapping direct sub-images and nine intersected sub-images of above sub-images, and applying one level for each sub-image so each sub-image will contains 4 features total 100(25x4=100) features are extracted. Then select 16 X 16 sub-images are 113, 64 non-overlapping and 49 intersected non-overlapping images are taken. Then directly apply methods on them so we can get 113 features for these sub-images, totally 273 features obtained for recognition. And when applying of direct standard deviation method 143 features obtained as feature vector. Because of having total 143 sub-images each will give one feature. The database is created using of K palmprint samples per user, where K varies from 1 to 4. When the training set increases the rate of recognition will be increased. The algorithm is checked in recognition mode, by comparing remaining images from the database, the total no. of images are used for training is made as training set and remaining images are made as testing set are given in following table 1.

Table1: Total number of images used for Training and Testing

No. of Images are taken per user	Training Set	Testing Set
1	1X2X400=800	9X2X400=7200
2	2X2X400=1600	8X2X400=6400
3	3X2X400=2400	7X2X400=5600
4	4X2X400=3200	6X2X400=4800

Once feature vector is ready for testing, then feature vectors are extracted from the database and calculating the Canberra distance [9] between Testing vector and all the training vectors. Among the all distances, the minimum distance one is considered the Recognized user vector.

The matching process will be done with Canberra distance. Canberra distance will be calculated as follows:

$$\mathfrak{D} = \sum_{i} \frac{|\mathcal{A}_i-\mathcal{G}_i|}{\mathcal{A}_i+\mathcal{G}_i} \quad (2)$$

The results will be shown in table 2, the percentage of Genuine Acceptance Rate (GAR) for checking all testing images against the feature vectors of the training images set. GAR mathematically calculated by

$$GAR = \frac{Total\ no.of\ images\ \ genuine\ \ mat\,hced}{Total\ no.of\ images\ in\ testing\ set} X100 \quad (3)$$

The results will be shown in table 2.

Table2: Resultant GAR of the approach

No. of images used for training	1	2	3	4
No. of images used for testing	9	8	7	6
Acceptance ratio with FFT	47.00	63.78	73.46	77.89
Acceptance ratio with DCT	53.89	70.33	78.73	82.70
Acceptance ratio with DWT	91.64	96.77	98.23	98.65
Acceptance ratio with Proposed approach	93.14	97.54	98.50	98.93

Using standard deviation as simple feature vector the proposed approach obtained GAR up to 98.93%. The proposed approach is obtained a good accuracy and fast feature extraction rather than the others. The proposed algorithm will take only 0.0087sec for feature extraction. The comparison of time taking for feature extraction is given in the following table 3.

Table3: Time taking for extracting the Feature Vector

Feature Extraction approach	**Time taken for Extracting Feature (in Sec)**
FFT	2.6769
DCT	1.795138
DWT	1.245468
Proposed approach	0.008719

5. CONCLUSION

In this paper a palmprint recognition algorithm is proposed and results are compared with FFT, DCT and DWT. The texture patterns are spread over entire palmprint image those are used for feature extraction. These features are extracted using simple method standard deviation to achieve high performance with minimum processing time. The more unique and efficient features obtained are used to achieve good accurate recognition rate.

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