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Palm Print Recognition Using Textural Harlick Feature

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Abstract

This paper proposes a biometric recognition using palm print as a biometric trait, palm print are rich in texture feature hence texture information are using for recognition. The Region of Interest (ROI) is decomposed in multiple windows having dimension greater than the quantization level used in forming gray level co -occurrence matrix Which gives us multiple sub images of original image, then grey level co-occurrence matrix (GLCM) is formed With different orientation angle (0^0,45^0,90^0,135^0), and from these matrix Harlick features are derived from multiple sub images which used to form feature vector of original ROI .This feature vector is used match two images that is query image with template by using Euclidean distance classifier. The proposed system is tested on publically available IIT Delhi Touch less Palm print database .The system is evaluated on the basis of performance parameter Accuracy 93.15%, False Acceptance Rate (FAR) and False Rejection Rate (FRR) with values 0.041, 0.097 respectively.

Keywords: Biometric, GLCM, Feature extraction, Harlick feature, FAR, FRR

INTRODUCTION:

There are enormous applications where biometric technique is used to identify the person of claimant. Rich structure of palm print gives handful information for recognition and verification, As finger print, palm prints are mostly used as physiological traits, because of its characteristics such as distinctiveness, user friendly, low cost and so on.Therefore palm print is one of the reliable methods. Many researchers have been proposed their algorithm for palm print recognition [1]-[3].Biometric recognition methods used are Fingerprint [4,5,6,10] .Hand geometry [12], Palm print [1,2,3] .

Many researches carried out there research on palm print recognition. There are two palm print recognition methods namely- Statistical and structural [16] .One of which includes Eigen palm, Gabor filter, Fourier transform & second on statistical feature such as gray level co-occurrence matrix, Harlick feature, textural based analysis – is most useful technique to represent image feature for classification. Gabor filter is one of the technique to extract the feature of whole palm image or some region of palm, which is proposed by [1] and images are compared with hamming database. Gabor phase encoding method is suggested by [2.]. A wavelet based textural information method is given by [3.]

In structural Feature extraction method we are using structural information of palm like principle line, creases, ridges, minutiae point for feature vector formation. The Wei, Li , et.al .used principal line based design for palm print recognition. Modified finite radon transform (MFRAT) used to extract the principle lines of the palm print .Coding based method are also useful for palm print recognition competitive code with six Gabor filter with six directions. To extract orientation features from palm print. Sobel and morphological filter is used to palm print authentication. [7]

In this paper discrete wavelet transform is used to get the sub bands of original image, As approximating low pass sub bands and three high pass sub band is obtained on every scale after applying DWT to extract the feature vector [17].Grey level co-occurrence matrix (GLCM) which gives information about spatial relationship between two adjacent or equally spaced pixels. There GLCM are used to represent textural information of images [14] [13] [15] combined feature of GLCM and Gabor filter features are fused to get Feature vector in palm print texture analysis for image classification based on Harlick feature is given in [13].

In our proposed system Harlick feature based matching of palm print is used. Here we extract Harlick features of GLCM of multiple sub images of original image of ROI. Feature vector is formed with these Harlick features of sub images. The rest of the paper is organized as follows- Section 2 describes the detail of proposed palm print recognition system. Section 3 gives details about experimental result. Lastly section 4 gives conclusion of this paper.

PROPOSED PALM PRINT RECOGNITION SYSTEM

A Preprocessing:

In our proposed research palm print images from IIT Delhi Touch less Palm print database is used. The most of information of textural feature exist in central part of palm therefore this part must be extracted from palm image which is known as Region of Interest (ROI). As IITD database is also having segmented ROI palm images so we are using these images for further processing.

B. Gray level Co-occurrence matrix and Harlick Features:

Grey level co-occurrence matrix (GLCM) gives information about a distribution of intensities of a pixel and relative position of neighborhood pixel. This is used for gray level images [15]. This is one of the most useful statistical methods to the characterization of image texture, Harlick approach is one of the useful methods for analysis. GLCM can be calculated [13]. Suppose image to be analyzed is of rectangular and of size nx and ny columns and rows. Suppose ng is quantized gray level of a pixel, i.e., Gx ={0,1,2,…….ng} are the set of Mg quantized gray level. Texture related information is defined by Pij value, is the probability value. From the GLCM that is how many time two neighboring pixels separated by distance d with the grey level of reference pixel I and a neighboring pixel with the grey level of j., which gives a table of how often a different combination of pixel occur in an image to be analyzed. As we are interested in textural features, the following equations give these features. As Harlick proposed [13] 14 textural features calculated from normalized GLCM, we are using only following Harlick features in our scheme, are contrast, Autocorrelation, Energy, Homogeneity, Entropy.

Contrast: It is given by equation-

$$\text{Contrast}=\sum_{i=1}^{n}\sum_{j=1}^{n}\{(\{1i-j1)\}^2\ P(i,j)\} \quad \text{--------(1)}$$

It is used to measure the intensity contrast between a pixel and its neighborhood of the image.

Autocorrelation : It is given by equation.

$$\text{Auto correlation}=\sum_{i=1}^{n}\sum_{j=1}^{n}\{((i-\mu i)(j-\mu j)\ P(i,j))/\sigma i\sigma j\ \} \quad \text{----------(2)}$$

It gives correlation between neighbor pixels. Energy is given by equation

$$\text{Energy}=\sum_{i=1}^{n}\sum_{j=1}^{n}\{\ P\{(i,j)\}^2\ \} \quad \text{----------(3)}$$

It is a sum of squared elements in GLCM. Homogeneity is given by equation

$$\text{Homogenity}=\sum_{i=1}^{n}\sum_{j=1}^{n}\{\ (P(i,j))/((1+(i-j)))\} \quad \text{--------(4)}$$

It gives an idea about the closeness of elements in GLCM to its diagonal element.

Entropy: - is given by the equation

$$\text{Entropy}=\sum_{i=1}^{n}\sum_{j=1}^{n}\{\ P(i,j)\ \log\{p(i)\}\ \ \}$$

It is used to measure the amount of disorder in a system.

C- Formation of feature vector and matches

C.1: - Harlick Feature Extraction

GLCM are calculated for every sub image of ROI with different orientation (0^0,45^0,90^0,135^0) with considering eight and sixteen quantization level of gray values and distance between two neighboring pixel one .Then from this GLCMs Harlick feature are calculated of every sub images of palm print ROI. After that averaging of these Harlick features over all four orientation angle we get averaged value of all five Harlick feature for every sub images. Then by combining these values Harlick feature single feature vector is formed for every ROI of palm print. Then we normalize this feature vector.

C-2: - Matching

In the matching, process comparison is done between template and query (test) image. In this method, we use a Euclidean distance similarly method to decide the matching score. The matching score [15} between template and test image is given by

$$\text{Matching score}=1-\{\|X-Y\|\}^2/(\{\|X\|\}^2+\{\|Y\|\}^2)$$

Where X and Y are feature vector of template and test image respectively. The value of matching score is in between 0 and 1. If matching score is greater than reference threshold then we consider user as genuine. If it is less that reference threshold we consider as an imposter.

EXPERIMENTAL RESULT:

A. We experimented our method on IIT Delhi Touch less palm print database Version1-0 [18]. Thus database mainly consists of hand images acquired by the Biometric research Laboratory using digital CMOS camera .These images are in bitmap format. This data base contains left and right-hand images of more than 230 subjects, at least five hand image samples from left as well as right hand. In addition to that, automatically segmented and normalized palm prints are

available which are used in our method. The resolution of the images is 800x600 pixels with segmented cropped ROI images with size 150x150 pixels. For the evaluation of this algorithm, randomly selected 20 users are used with five images for each user. Out of this five user 04 images are used for template and 01 image per user for testing.

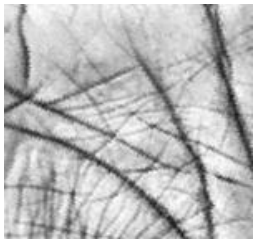

Figure1 - ROI- image palm print of IIT Delhi database

Performance Analysis:-

The performance of the system is measure using EER equal error rate for verification. At any particular threshold, the probability of accepting imposter is called as False Acceptance Rate (FAR) and the probability of rejecting the genuine user is called as False Rejection Rate (FRR) .Threshold value of our algorithm is calculated based on Equal Error Rate(EER) .FAR is defined as

FAR= (Number of imposter user claims accepted/Total number of imposter user accesses)

FRR is defined as

FRR= (Number of rejected claims of genuine user/Total number of genuine user accesses)

Accuracy is defined as

Accuracy= (1- (FAR+FRR)/2)* 100%

B. Classification Stage:

The ROI of palm print is the 150x150 pixel. Then we divide this ROI it into number of distinct sub images. The size of sub images should be at least greater than grey quantization level used for obtaining GLCM. As we are performing experimentation on 8 quantization level as well as 16 quantization level therefore we have chosen sub image size of 25*25 and 50*50 pixels. When size of sub image is 25*25 Pixels the ROI of palm print is divided into 36 sub images ,we are extracting five Harlick feature namely contrast, Autocorrelation, Energy, Homogeneity, Entropy. It means we represent each ROI of palm print with 5*36=180 features to form a feature vector .Similarly when sub image size is 50*50 pixels, then ROI is divided into 9 sub images in this case size of feature vector is 9*5=45. For above mentioned two cases of sub images we use 8 quantization level of GLCM and also 16 quantization level of GLCM. After formation of feature vector of all ROI images it is stored as template. During comparison of query image again we follow same procedure to get feature vector of query image which is used in template formation. The matching is carried out using Euclidian distance classifier to decide genuine and imposter claim. If value is greater than threshold then user accepted as genuine otherwise it is imposter. Experimentation results are given in following table number 1 and 2.

Table1. Experimental result for different quantization level with 25*25 sub image size.

Quantization level	Accuracy	FAR	FRR
8 grey levels	93.15%	0.041	0.097
16 grey levels	91.74	0.043	0.125

Table2. Experimental result for different quantization level with 50*50 sub image size.

Quantization level	Accuracy	FAR	FRR
8 grey levels	89.02%	0.042	0.181
16 grey levels	88.12%	0.055	0.193

CONCLUSION:

We have developed algorithm palm print recognition system based on textural feature based Gray level co-occurrence matrix. For each ROI we extracted Harlick feature of sub images to form feature vector. We have used Euclidean distance classifier. The size of a feature vector is compositely very small still we get better accuracy and also there is the improvement on performance parameter the False Acceptance Ratio (FAR) and False Rejection Ratio (FRR). Also we conclude that for our data base used we get better accuracy with sub image size of 25*25 as compared with sub image size of 50*50.We also conclude that better accuracy in case of 8 grey quantization level of GLCM in comparison with 16 grey quantization level of GLCM

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