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HUMAN IDENTIFICATION WITH PALM PRINT BASED ON LOCAL BINARY PATTERN

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***Abstract* – Palm recognition is one of the research areas is considered in recent years. In this paper, we introduce a new method for human palmprint identification system with local binary pattern. First, the palm images is preprocessed with morphological technics. Then the feature extraction is applied for images. We used local binary pattern (LBP) for desired features.**

This approach is tested for 500 people and there are 1, 2, 3 and 4 image from each people. Our method is compared with PCA method. The result shows that proposed method is efficiency and good performance (%92) for palmprint recognition.

***Keywords* – Identification, Palm Print, LBP.**

I. INTRODUCTION

As an emerging biometric technology, palm print recognition has been extensively researched due to its easy collection, user friendliness, high verification accuracy and reliability. Biometrics is a unique and measurable feature for identification. Biometric systems are divided into two categories: identification and verification. The first category's aim is recognizing the identification of the individual among the others in the database. In such systems, to the question "who am I?" will answer. In the second, the person offers his identity and the aim of the system is the confirming this identification and in the systems, to the question "do what I say I am?" will answer [1]. It is clear that any biometric identification system is not the absolutely best solution for identification. By international biometric group, an interesting comparison is done between different systems based on four parametric, distinctiveness, and cost of identification system, time and spending effort by the user in the identification and the rate of user's comfort during identification [2]. An ideal biometric system is a system in which contains all four enumerated parameters in the farthest place according to the center of the diagram [3]. In another study has gained the highest percentage compatibility by taking six biometric techniques (face, fingerprint, hand geometry, voice, eyes and signature) with machine readable travel documents (MRTD), facial features. In this study, parameters such as registration, refreshment, hardware requirement and public acceptance is considered. Palm recognition system is a biometric system using intelligent automatic methods to identify or verify the identification of a person based on physiological characteristics. In the past two decades, the matter of identifying of palms is the extensive research field of machine's vision and pattern recognition. One of the extensive applications for recognition of palm lines is the field of security and verification. In controlling the high population areas, such as airports, railway stations, and subway and …, this method is more effective than other methods of surveillance. So several photographs have taken from the lines in the palms of people and the device must be able to identify these people at different times, in different orientations of light and.

Current methods of identifying palms uses of four types of palm's features: texture, lines, appearance and orientation. According to the extracted features are divided into five categories [4]:

1- Texture based methods which using the filters such as Gabor, discrete Fourier, Wavelet and Rydan.
2- Line based methods are like identifier of palm's directed lines, sober performance, multi-resolution filters and Rydan filter.
3- Appearance based methods are that uses from the analyzing of principal component, analysis of linear distinct appearance of local guard and analyzing of kernel principal component.
4- Orientation based methods which usually uses the Gabor filters.
5- Multi feature based method, such as the combination of features of palm's lines and filed in a same vector. Typically combinations are done in four levels, data feature, matching, and the decision.

Combination methods in the features level are divided into four categories: series combination, parallel combination, weight combination, and core based combination [5].

In order to identification by a person's palm lines, the lines must be properly extracted. One way to define these lines are using different methods of edge detection. Sobel edge detection and Morphological operation is used in [6].

In this paper, for the complete extraction of useful features from an appearance, a simple but powerful method an uniform local binary pattern to identification of palms are expressed because this method can pull out all the useful information of an appearance.

In [14], they propose a novel and efficient texture based approach to palm print recognition based on a 2D discrete orthonormal S-Transform called as the 2D-DOST. 2D-DOST is a powerful tool for texture analysis which has been presented in recent years. It can proficiently characterize the frequency contribution of image texture in the various bandwidths. In their work, First, 2D-DOST is applied to the palm print to characterize the frequency content of palm print texture. Palm print features are obtained by computing the local energy of 2D-DOST magnitudes in different bandwidths. Then, ICA will be

employed to the extracted features to reduce the dimensionality and eliminate the redundant features.

In [15], a consistent orientation pattern (COP) hashing method to enforce fast search is proposed. Using the orientation and response features extracted by steerable filter, first given an analysis on the consistency of orientation features, and then a method used to construct COP using the consistent features. The COP is very stable across the samples of the same subject, the COP hashing method can find the target template quickly and thus can lead to early termination of the searching process.

In [16], an ultrasound technique for extracting 3D palm prints is experimentally evaluated. A commercial ultrasound imaging machine, provided with a high frequency (12 MHz) linear array, is employed for the experiments. The probe is moved in the elevation direction by a motorized stepper stage and at each step a B-scan is acquired and stored to form a 3D matrix representing the under skin volume. The data from the 3D matrix are elaborated to provide several renderings of the 3D ultrasonic palm print.

In [17], palm print recognition with blanket dimension and its expansions was investigated. The efficiencies of horizontally and vertically expanded blanket dimensions for extracting the directional feature of palm print were compared, and a palm print recognition algorithm based on horizontally expanded blanket dimension (HEBD) was proposed according to the comparison results. Furthermore, a multi-scale HEBD (MHEBD) algorithm for palm print recognition was also presented, and the MHEBD was demonstrated to be more effective than the single-scale HEBD for feature extraction.

The rest of the paper is organized as follows: in section 2, local binary pattern is generally offered. Histogram will be explained in section 3. In section 4, Appearance database will be described. Results of the implementation are given in Section 5. The final section of the paper is conclusion.

II. Local Binary Pattern (LBP)

One of the best ways to represent texture is LBP technique which is widely used in various applications in the recent years. Approval of good separation and important features such as invariance in monotonic changes of gray level and computational efficiency cause to made this method as one of the most useful methods for appearance analysis. Palm is composed of a combination of several small models so by this method it can be described so well.

2.1. Description of the Local Binary Pattern

The local binary pattern is considered as the strong approach to texture analysis. For the first time, it was proposed as square operator 3 × 3 by Ojala and his co-workers [7]. The operation of this method is like which 8-neighborhood on operator are comparing with the central pixel. If each of the eight neighboring pixels will be greater or equal to the amount of the central pixel will be replaced by 1 and otherwise, their amount will be zero. At last, the central pixel is replaced by summing weighted binary neighboring pixels and 3 × 3 window will pass to the next pixel. By getting histogram of these amounts, a descriptor for appearance texture is obtained. Figure 1 demonstrates the local binary pattern operator.

And the equation (1) shows the composing relationship of local binary pattern in each pixel:

$$LBP_{P,R(x,y)} = \sum_{P=0}^{P-1} s(g_p - g_c)2^P \quad (1)$$

Which S denotes the sign 1, g_p and g_c, denotes the amount of the gray levels of neighboring and central pixels. Also 2^P is a required factor for each neighbor because LBP method contains tissues with different ratios.

2.2. The Uniform Local Binary Pattern

The first improvement of the LBP was introduced as uniform pattern in 2000 [8].

If a local binary pattern consists of a maximum of 2-bit transition from 0 to 1 or vice versa is called uniform. For example 0000000000 patterns (0 transition) and 11001001 (4 transitions) are respectively the uniform and non-uniform. It has been shown that using the neighborhood (1, 8) and (16, 2) respectively are about 90% and 70% of entire pattern. The overall pattern of binary with P bits consists of P + 2 (P - 1) of monotone model. From LBP $(^{u2}_{P,R})$ notations has been using for LBD uniform which below script express use of neighborhood (P, R) and the superscript indicates the using of uniform pattern. Uniform binary model according to equation (2) is calculated.

$$LBP^{U2}_{P,R}(x,y) = \begin{cases} I(LBP_{P,R}(x.y)) & if \begin{cases} U(LBP_{P,R}) \le 2 \\ I(z) \in [0,(P-1)P+2] \end{cases} \\ (p-1)p+2 & otherwise \end{cases} \quad (2)$$

That U(x) is the detonator of the number of transitions between bits, and is defined like equation (3):

$$U(LBP_{P,R}) = \left|s(g_{P-1} - g_c) - s(g_0 - g_c)\right| + \sum_{P=1}^{P} \left|s(g_{P-1} - g_c) - s(g_{P-1} - g_c)\right| \quad (3)$$

If U(x) is smaller than 2 pixels, the currently pixels labeled with an indicator function I (z), otherwise, the (P-1) P + 2 will assigned to it. Indicator function index I (z) which includes the (P - 1) P + 2 which is applied for specific index for to each of the uniform patterns.

III. Histogram of Appearance

In a scalar appearance, the image pixels have specific amounts. First gray level histogram or histogram shows how the brightness distribution is in the image. The horizontal axis of a histogram, the pixel brightness values of the appearance and its vertical axis represents the number of corresponding pixels to each value of the brightness of the appearance. Suppose that the input image is a gray image with 256 levels of brightness, so each image pixel can have range in value (0 255). To getting the appearance histogram, it is sufficient that with traversing all the pixels of the image, we calculate the number of pixels of each brightness level.

It is clear that in a simple histogram, all of the pixel locations information is missing and just amount of gray values are calculated.

In other words, the values are large amounts of numbers on the main diagonal and gradually will reduce minor diameters.

IV. Appearance Database

The databases of images that used in this article, is part of the image database which is collected at Hong Kong Polytechnic University. A device that is used for taking pictures is scanner which is based on CCD camera. The size of images is 384 × 284 pixels with 750 dpi resolution. Figure 4 shows the image acquisition device and the sample images which is captured by it [12].

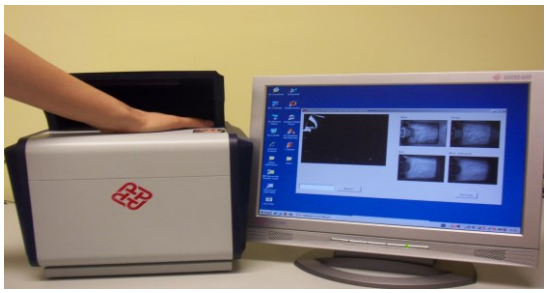

Fig. 4. Image acquisition device and the sample images which is captured by it.

To evaluate the proposed method, a number of image from this databases are selected these image due to skin pigmentation and the small difference between levels of gray lines and other areas; they have different levels of brightness. The size of the original images is 384 × 284. After preprocessing, the central part of the image (size is 128 × 128), is cropped for feature extraction and matching. Fig. 5 shows some samples of one palm after preprocessing.

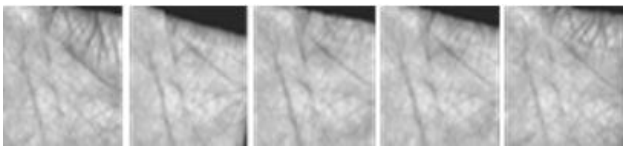

Fig. 5. Some samples of one palm after preprocessing

V. The Simulation Results

Evaluations were done on a standard database of palms of Polytechnic University of Hong Kong Poly U Palm print. Dataset included the 600 picture of palms of 500 person which is included in the approximately there are 12 available images from per person. There are two solutions for calculating the similarity between feature vectors. Ones calculate the distance between two feature vectors, and second, calculate the similarity. These two measurements are against each other. There are different criteria to evaluate the distance and similarity, that in this paper, the similarity between test image S and the training image T we used chi-square distance [13].

It is expressed as Eq. 5.

$$D(S,T) = \sum_{n=1}^{N} \frac{(S_n - T_n)^2}{(S_n + T_n)} \qquad (5)$$

Minimum 1 and maximum 4 images in the palm of our test subjects got used to the training.

Experiments were performed on the database, Table 1 shows the obtained results.

As it is clear, the PCA method among other methods has the worst result, and LBP standard method has higher accuracy than other remaining methods. The proposed method has higher accuracy than the LBP standard.

Performance-based approaches which appear strongly have been influenced by the number of training images. So in the third experiment, we investigated the influence of this parameter on our method. In this experiment we used minimum and maximum of 4 images of per person to train ourselves. Experiments were performed on the database, and the results are presented on different algorithms.

In our experiments the number of training images for one of the database has changed from 1 to 4, and the last photo is selected for testing. This experiment was performed 20 times in each stage.

The obtained average values are recorded. In Figure 6, the change in accuracy percentage terms of the training number images is shown.

VI. Conclusion

More recognizing machines from the brightness intensity of the pixels are used as input data. Brightness intensity dates' from the palm were under the influence of rotation and changing of environment brightness. In our proposed method, the local binary pattern is used which was strong in state, light changes. Additionally, most of the palm recognition systems which based on binary pattern uses for identifying, just from a steady LBP form and only with a certain scale. Obtained characteristics by using LBP single-scale methods gain structure of the image at a particular resolution is not useful for diagnosis of overall image texture and by this method with many discriminate models to obtain useful properties are excluded. Multi-scale approach can provide more features under different settings. So to achieve more discriminate features with less waste, we used from combination of uniform local binary pattern with a different radius. The results show that the proposed method has also been stated that the accuracy of all methods is higher and its speed is like the similar algorithm.

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