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Original Article

Palm Print Recognition Using Texture and Shape Features

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Abstract - *Image Processing techniques are used to perform some operations on a digital image to get an enhanced image or extract some features. The biometric system is used everywhere for security and personal identification in today's world. This paper aims to present palm print recognition using image processing techniques. To improve the efficiency of image recognition, during the pre-processing stage, an image must be resized and converted into another colour space. After pre-processing, the retrieved image can be enhanced with the help of a Gaussian filter. The Laplacian of Gaussian technique is used to detect the edges of an image. Then the image is performed using feature extraction methods such as GLCM (Gray Level Co-occurrence Matrix) and Shape and Merged (Texture and Shape) methods. Further, the Statistical measurements are calculated. Euclidean distance is used to retrieve an accurate matching image. The Merged method produces a better result than individual methods. This analysis can be used for criminal, forensic or commercial applications.*

Keywords - *Gaussian, LOG, GLCM, Euclidean Distance.*

1. Introduction

Image Processing is a recently growing technique in the world. It defines the processing of digital images using a digital computer. The image plays a major role in human perception. Image analysis is between image processing and computer vision[1]. A biometric identification system is used to solve the security problem and identify individuals quickly and quickly through unique individual characteristics such as fingerprint, face, iris and voice of personal identification [2]. Identification is a process of matching one image with N images of previously-stored samples. Verification is a process of matching one-to-one between an individual's previously acquired template and a sample we want to authenticate [3]. A palm print is defined as the skin pattern of a palm and the physical characteristics of the skin pattern, such as lines, points and texture. Palm print finds principal lines, wrinkles, ridges, singular points and minutiae points. As the security system is very important in several fields, it is important to authenticate the users for access [4]. Palm print identification is one of the popular biometric technologies for personal identification. It is the process of matching an unknown palm print against a database of known prints to establish a person's identity. Palm features are unique for every individual and have rich information that can be used for feature extraction [5]. The sample palm images are taken from various people and shapes by applying advanced techniques for analyzing the texture and Shape of the palm.

2. Literature Survey

K.Y Rajput, Melissa Amanna, Mayank Sharma, "Palmprint Recognition Using Image Processing". This paper is used to identify palms by applying different methods such as KFCG, DCT and F.D[6].

S. Kanchan, "Palm-Print Pattern Matching Based on Features Using Rabin-Karp for Person Identification". This paper discussed RPPM(Rabin-Karp Palm Print Matching)[8].

N.B Maheshkumar and K.Premalatha, "PalmPrint Authentication System Based on Local and Global Feature Fusion Using DOST". This paper is used to recognize palms with the help of ROI extraction and the LGIF method[9].

Zhiheng Tu," Palmprint Image Acquisition and Analysis System Based on IOT Technology". This paper proposed the Fourier Transform algorithm to identify palmprints[10].

Hsne-AI-Walid, Tasnia Sadia, Anika Tahsin," Palm Print Recognition System Using Naive Bayes Classifier". This paper proposed a median filter to recognize palm print with a Naive Bayes Classifier[11].

3. Methodology

The methodology is the theoretical analysis of the methods applied in this study. The implementation process of palm print recognition methods is shown in the following Fig.1

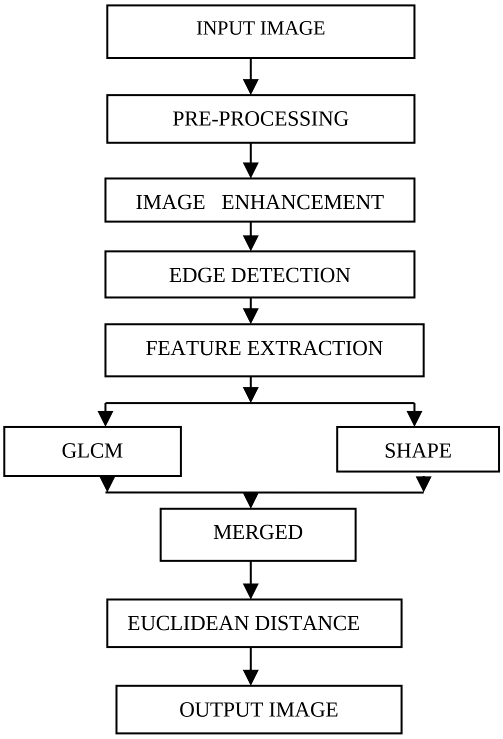

Fig. 1 Implementation process palm print recognition

3.1. Pre-Processing

The goal of pre-processing is to enhance the visual appearance of images. Pre-processing of an image is used to analyze and extraction of some information. The image size must be varied between each image. So all the images must be resized with 256*256. Then the image is acquired in RGB colour space. It is converted into grayscale because it carries only the intensity information, which is easy to process instead of processing three components RGB.

3.2. Image Enhancement

Image Enhancement is the process of improving the quality of original data before processing. There will be a lot of noise in the images because the images are taken from the camera. An enhancement technique is needed to remove the noise portions and enhance the images. Linear spatial filtering modifies an image by replacing the value at each pixel with some linear function of values with nearby pixels. Here, we are using a Gaussian filter. A Gaussian filter is used for smoothening and reducing noise in the images. It replaces the intensity of each pixel. The output image is enhanced.

3.3. Edge Detection

Edge detection is a fundamental tool in image processing. It is used to find the boundaries of objects within images. It allows observing the features of an image for a significant change in the gray level. The Laplacian of the Gaussian edge detector is used to calculate the derivative. The Laplacian of Gaussian is useful for detecting edges that appear at various image scales or degrees of image.

$$\Delta^2 G(x,y) = \partial^2 G(x,y)/\,\partial x^2 + \partial^2 G(x,y)/\,\partial y^2$$
$$= \left(X^2 + y^2 - 2\sigma^2 / \sigma 4\right) e^{\,x2+y2/}2\sigma^2$$

It smooth's the image and computes the Laplacian, which yields a double-edge image. Locating edges then consists of finding the zero crossings between the double edges.

4. Existing Methodology

4.1. Feature Extraction

Feature extraction is a part of the dimensionality reduction process, in which an initial set of raw data is divided into more groups. So it is easy to process the data. Transforming an input image into a set of features. Then it will extract the input image's relevant information to perform the desired task.

4.2. Gray Level Co-Occurrence Matrix

For extracting texture features, the Gray-Level Co-occurrence Matrix is used. It is the statistical method that assigns the spatial relationship of pixels. The GLCM is a square matrix of order N*N, where N is the number of different gray levels in an image. Let O be an operator that defines the position of two pixels relative to each other and consider an image f(x,y) with L possible intensity levels. Let G be a matrix whose element g_{ij} is the number of times pixels pair with intensities z_i and z_j occur in the image f in the position specified by O, where 1<=I, and j<=L. A matrix formed in this manner is referred to as a grey-level co-occurrence matrix. Table 1 shows the statistical measurements of GLCM.

4.2.1. Contrast

Returns a measure of the intensity contrast between a pixel and its neighbor over the entire image. Range= [0 (size (g,1)-1)-2). The contrast is 0 for a constant image.

4.2.2. Correlation

Returns a measure of how correlated a pixel is to a neighbour over the entire image.
Range= [-1 1]. Correlation is 1 or -1 for positive or negative correlated images. Nan for a constant image.

4.2.3. Energy

Returns the sum of squared elements in G. Range= [0 1]. Energy is 1 for a constant image.

4.2.4. Homogeneity

Returns a value that measures the closeness of the distribution of elements in the G to the diagonal of G. Range= [0 1]. Homogeneity is 1 for a diagonal G.

Table 1. Statistical Measurements of GLCM

Contrast	Correlation	Homogeneity	Energy
0.0658	0.2828	0.9678	0.8466
0.0586	0.3034	0.9706	0.8606
0.0652	0.2412	0.9674	0.8535
0.0665	0.2976	0.9667	0.8432
0.0638	0.2882	0.9684	0.8505
0.0506	0.2991	0.9746	0.8795
0.0589	0.2671	0.9705	0.8641
0.0686	0.2122	0.9656	0.8488
0.0634	0.3044	0.9682	0.8492
0.0622	0.2099	0.9689	0.8633
0.0623	0.3301	0.9688	0.8483
0.0622	0.3033	0.9688	0.8522
0.0576	0.2584	0.9711	0.8678
0.0622	0.3446	0.9688	0.8466
0.0594	0.2453	0.9702	0.8653
0.0538	0.3495	0.973	0.8662
0.0762	0.1932	0.9618	0.8349
0.0722	0.1939	0.9638	0.8432
0.0546	0.328	0.9726	0.867
0.0615	0.2759	0.9692	0.8572

4.3. SHAPE

Shape analysis is a method of finding the Shape of irregular objects using two types of descriptors called line and area descriptors. Line descriptors are used to find the length of irregular boundaries in a digital image in terms of pixels. Area descriptors are used to find out the Shape of the irregular object and its characteristic properties such as Area, Centroid Eccentricity etc. Table 2 shows the statistical measurements of Shape.

4.3.1. Area

The number of pixels in a region.

4.3.2. Centroid

1*2 vector: centre of mass of region. The first element of a Centroid is the horizontal coordinate, and the second is the vertical coordinate.

4.3.3. Eccentricity

Eccentricity is the distance between the foci and the major axis length. The value is between 0 and 1.

4.3.4. Perimeter

The distance around the boundary of each of the k-regions in the image.

Table 2. Statistical Measurements of Shape

Centroid	Eccentricity	Area	Perimeter
106.4438,127.501	0.7151	876	2.4759
2,8	0.9805	7	1.1173
3.0833,222.4167	0.9509	2	986.172
85.5724,40.7387	0.8419	290	2.6055
49.5705,114.6586	0.8939	318	1.2124
2.6000,4.0000	0.866	25	126.65
97.1532,176.8882	0	18	0
2,128	0.9933	35	41.748
2.7778,15.0000	0.9972	27	51.448
2,147	0.9428	26	28.268
7.1176,9.0588	0.9433	17	35.198
3.5000,2.0000	0.9523	7	10.288
34.4278,43.8889	0.6655	1	509.754
4.6250,5.2500	0.9782	21	583.199
18.1373,23.9216	0.985	4	16.582
5.8000,6.4000	0.9952	10	21.842
7.8727,40.0545	0.9739	98	125.716
4.0769,51.0000	0.6263	56	215.356
8.2500,24.5000	0.8815	26	52.5
8.3929,13.3571	0.9627	2	62.167

4.4. Euclidean Distance

In image analysis, the distance transforms measure the distance of each object point from the nearest boundary and are an important tool in image processing and pattern recognition. The Euclidean distance is the straight-line distance between two pixels. The distance can never be negative; therefore, we take the absolute value while finding the image using the formula

d=sqrt ((x1-x2)^2+(y1-y2)^2)

5. Proposed Method

Two methods of features are extracted from palm images in this analysis. The first method is based on texture features on GLCM (Gray Level Co-Occurrence Matrix), and the second is based on shape features. This proposed (texture and shape) method performs better than individual methods. Accuracy is also a statistical measurement. It defines the percentage of correctly classified image.

Accuracy=2*(Recall*Precision)/(Recall+Precision)

Methods	Accuracy in %
GLCM	**74%**
Shape	**80%**
Merged	**98%**

6. Experimental Result

Experimental Results show after applying different techniques in image processing. Fig 2 shows an Original image. Fig 3 shows Pre-Processing of an image. Fig 4 shows after applying the Gaussian Filter. Fig 5 shows were applying the Laplacian of the Gaussian Technique.

Fig. 2 Query image

Fig. 3 RGB to Gray Scale Conversion

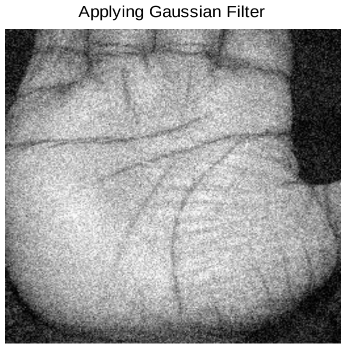

Fig. 4 After applying the gaussian filter

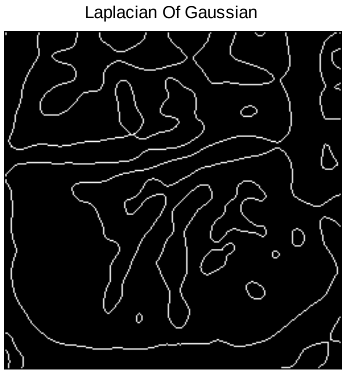

Fig. 5 After applying edge detection

7. Conclusion

In this analysis, different texture and shape features are used to extract palm images that are stored in the database. The detection and classification of palm images is a very important tool in identifying criminal suspects. It is the most effective biometric system for confirmation and security purposes. To improve the accuracy of results in future with some advanced image processing techniques.

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