ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 5, Issue 5, May 2016

Palmprint Based Identification Using Principal Line Approach

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Abstract — **A principal line approach is used for identify accurate person based on palmprint biometrics. Palmprint is the one of the important biometrics characteristics with higher user acceptance.The palmprint are most important feature for personal identification.In this paper,the principal lines are extracted by using canny edge detection operation.The canny edge detection algorithm consist of 5 modules such as image acquisition.image preprocessing,line feature extraction ,template generation, and matching.Then finally, identify accurate person.**

Keywords—**Principle line approach, palmprint, canny edge detection algorithm, Biometrics.**

I. INTRODUCTION

A perfect person identification using palmprint biometrics information play a very important role in present.This biometrics system are used in many application such as public security, access control, forensic, e-banking, etc. Many biometric authentication techniques have been developed based on different biometric characteristics such as Physiological-based and behavioral-based . The Physiological characteristics include fingerprint, face, iris, palmprint, hand shape, etc. And behavioral-based characteristics include signature, voice, gait, etc. characteristics. The palmprint is a relatively new and most important biometrics feature; It has many advantages compared with other currently available characterictics such as fingerprint and iris devices. The palmprint contains more information than fingerprint,so they are more distinctive. And also palmprint capture device are more cheaper than iris devices. Palmprint is one of the important biometrics characteristics with higher user acceptance.

There are many unique features in a palmprint image that can be used for personal identification.geometrical features, Principal lines,wrinkles, ridges, minutiae points, singular points, and texture are regarded as useful features for palmprint representation.

However, geometrical feature include width of the palm, can be faked easily by making a model of a hand. And line feature include principal line, wrinkles. for feature like principal line and wrinkles can be obtained from low-resolution palmprint image as show in following fig. 1.

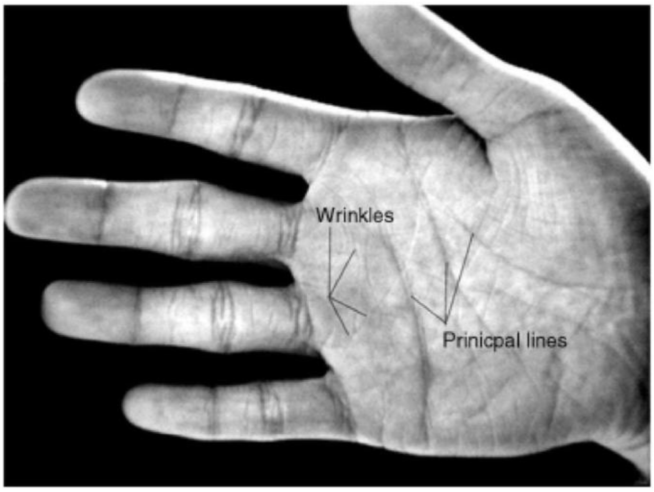


Fig. 1. Palmprint feature for principle line and wrinkles

II. LITERATURE REVIEW

In order to provide an accurate and efficient authentication system, there has been substantial research in the area of palmprint recognition system. For this, a number of relevant papers have been reviewed. Tee Connie et al' have proposed an automated palmprint recognition system [1]. In its proposed approach, they have used Principal Component Analysis (PCA), Fischer Discriminant Analysis (FDA) and Independent Component Analysis (ICA) for the feature extraction from the roi images. Patprara Tunkpien used the approach of compact extraction of principle lines from the palmprint images by using filtering operations consecutively [2]. Here, the image is first smoothed and then worked upon. For this, the palmprint images are passed through several filters. Palmprint recognition with PCA and ICA [3] have been presented by Tee Connie et al. K.Y. Rajput et al used the Kekre Fast Codebook Generation [4] algorithm for the feature extraction. I Ketut Gede Darma Putr and Erdiawan have used the two dimensional Gabor [5, 6] for the development of a high performance palmprint identification.

The Leqing Zhu, Sanyuan Zhang, Rui Xing and Yin Zhang, proposed a method [7] for personal recognition, which is based on PFI and Fuzzy logic. In this the grayscale image is smoothed with an 8-neighbourhood mean filter. Canny edge detector and locally self-adaptive threshold binarization method are combined to extract the principal lines. The Probability Feature Image (PFI) was used in order to suppress random noises in feature image. The fuzzy logic was employed in matching.

David Zhang et al have proposed an online palmprint identification system [8]. This system was developed to make authentication possible in the real time also. Hafiz Imtiaz et all have proposed a novel preprocessing technique for DCT domain palmprint recognition [9] in which the task of feature extraction is carried out in local zones using 2 dimensional Discrete Cosine Transform (2D-DCT). A survey of all the palmprint recognition systems [10, 11] has also been studied.

The Feng Yue, Wangmeng Zuo and David Zhang, proposed the iterative closest point (ICP) algorithm [8] for palmprint alignment before matching. The palm-lines are extracted using steerable filter. However, due to nonlinear deformation and inconsistency of extracted palm line feature, the ICP algorithm using only position information would fail to obtain optimal alignment parameters. To improve its accuracy orientation feature is used, which is more consistent than palm line, to make ICP registration more robust against noise.

The palmprint based authentication produce best result. It required to achieve higher performance for their use in high security application. Based on the previous related work,instead of using extracting principal line based on both direction and energy. But in this paper we focus on principal line based on direction only.

In this work, canny edge detection operation is proposed to extract principal lines. For extracting principal lines the edge direction and gradient strength of each pixel in the preprocessed image are found using Sobel masks. Then edges are traced using that information. Then finally non-maximum edge are suppressed by finding parallel edges and eliminating those with weaker gradient strengths. In this way principal lines are extracted and resultant image is obtained.. The matching is done by dividing the resultant image into 9X9 blocks. The blocks are traced to create feature vector. While generating a template the feature vector bit is set if the concerned block contain the line. Personal identification is done based on distance matching between stored templates and test palmprint image.

III. DATABASES AVAILABLE

PolyU palmprint image database are available in this research paper. The Poly_U database is prepared by Biometric Research Centre of Hong Kong Poly technique University. The database consists of 7752 greyscale images from 193 users corresponding to 386 different palms in BMP image format. Around twenty samples from each of these palms were collected in two sessions. database employs user pegs to restrict the hand orientation. This helps in achieving significantly higher performance. Therefore, this database is used widely.

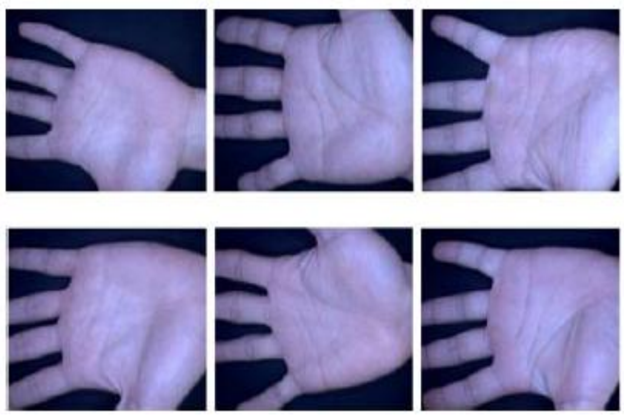


Fig. 2. PolyU Palmprint database

IV. PROPOSED SYSTEM

In proposed system,canny edge detection operation is used to extract principal line for personal identification.

A. Canny Edge Detection Algorithm:

In the image processing program, edge detection is important because it allows object separation and shape detection. The canny edge detection is a important for edge detection.

The purpose of canny edge detection in general is to reduce amount of data in an image,while preserving the structural properties to be used for further image processing.

ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 5, Issue 5, May 2016

The canny edge detection algorithm runs in 5 separate steps:

1. **Smoothing:** Blurring of the image to remove noise.

2. **Finding gradients:** The edges should be marked where the gradients of the image has large magnitudes.

3. **Non-maximum suppression:** Only local maxima should be marked as edges.

4. **Double thresholding:** Potential edges are determined by thresholding.

5. **Edge tracking by hysteresis:** Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

B. The Flow Chart For The Proposed System:

The flow chart for proposed system as shown in following fig. 3.

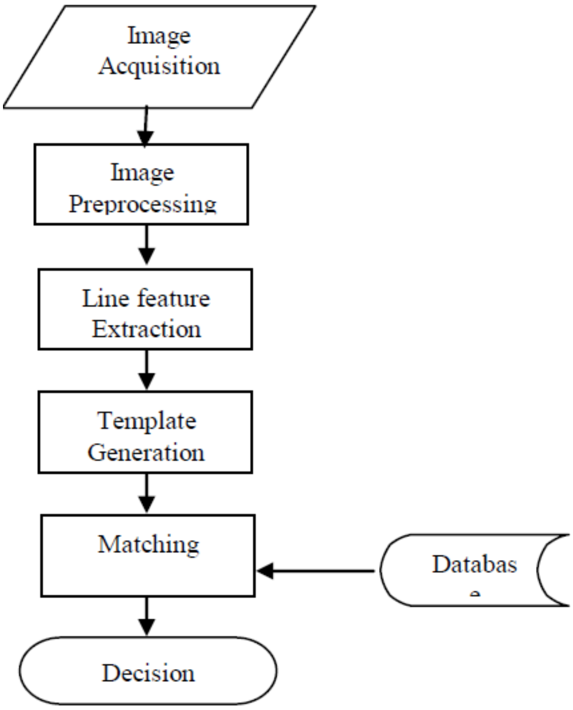


Fig. 3. Flow chart for proposed system.

It consists of five modules:
1.Image Acquisition
2.Image Preprocessing
3.Line Feature Extraction
4.Template Generation
5.Matching

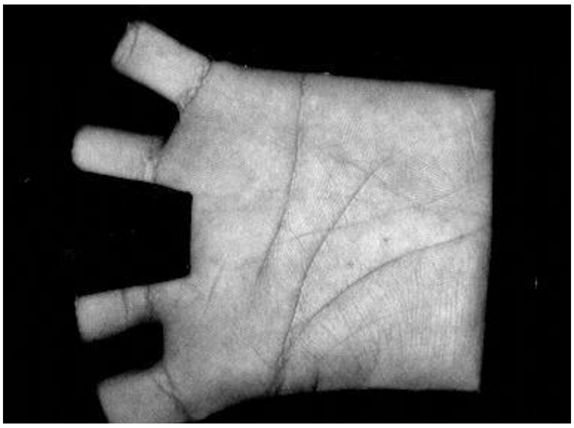
1. Image Acquisition:

Image acquisition is the first step in a palmprint biometrics system. In the proposed system image taken from PolyU palmprint database . The images are captured by an online CCD-camera-based device.

2. Image Preprocessing:

In preprocessing steps,it is necessary to obtain sub-image from the captured palmprint image, and to eliminate the variations caused by rotation and translation. The sub-image are extracted,first image are rotated using uniform directed and image are smooth using Gaussian filter. Then the smooth image is blurred, so that using this image is prepared to extract palm line effectively. The blurred palmprint image is binarized i.e. converted into black & white, in order to derive a single pixel wide palm lines of the palmprint image. Otsu's auto-thresholding method [14] is used to obtain a binary image from Gray level image. From the binary image, the mid point is found between fore finger and ring finger using 8eighbourhood to obtain the sub-image from the centre of the palm. For that consider the number of pixels of an image in row wise (‘X’) and find the mid point by dividing the number of pixels by two (X/2). The mid point is scan towards right to get the ‘I’ [B(x, y+1) =1].

The pointer is move up from ‘I’ to get the corner point ‘k1’. And pointer is move down from ‘I’ to get the corner point ‘k2’. Then find middle point ‘mid’ between corner point ‘k1’ and ‘k2’. Move the pointer from the point ‘mid’ with the fixed number of pixels towards centre of the palm and position the fixed sized square to crop the image. As the centre of the palm contains more information the region of interest (ROI) or sub-image of size 160 × 160 is cropped from the centre of the palm.



(a)

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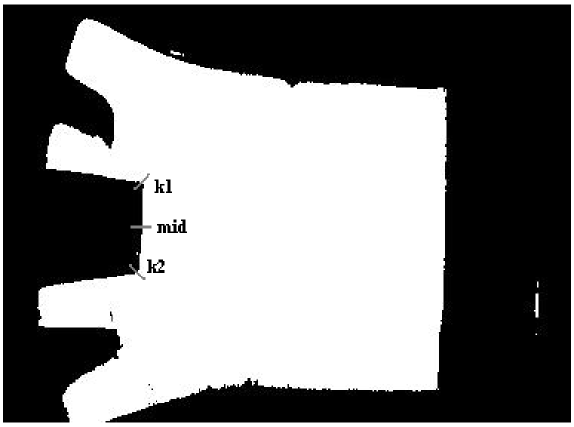

(b)

(c)

Fig. 4. (a) Original Image and (b) image with pixels k1,k2 and mid and (c) Region of Interest (ROI) of palmprint

3. Line Feature Extraction:

After pre-processing, the canny edge detection algorithm is used to extract line features i.e. principal lines from the sub-image or ROI. First, to Thresholding can also be used if the objects of interest are significantly contrasted from the background and detailed textures are irrelevant. Next, the edge direction and gradients at each pixel in the smoothed image are determined by applying the Sobel-operator. The gradient in the x-and y-direction is found by applying the kernels is shown below.

$$K_{Gx} = \begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix}$$

$$K_{Gy} = \begin{pmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{pmatrix}$$

The gradient magnitude i.e edge strength is determined as an Euclidean distance measure by applying the law of Pythagoras as shown in Equation (1). sometimes simplified by applying Manhattan distance measure to reduce computational complexity as shown in Equation (2).

$$|G| = \sqrt{G_x^2 + G_y^2} \quad (1)$$

$$|G| = |G_x| + |G_y| \quad (2)$$

where: G_x and G_y are the gradients in the x- and y-directions respectively.

However, the edges are typically broad and they do not indicate exactly where the edges are. the direction of the edges must be determined and stored as shown in Equation (3).

$$\theta = \arctan\left(\frac{|G_y|}{|G_x|}\right) \quad (3)$$

Using above information the edge are traced. And the “blurred” edges in the image of the gradient magnitudes is converted to “sharp” edges by preserving all local maxima in the gradient image, and deleting everything else. Next double thresholding is done by marking the edge pixels stronger than the high threshold as strong and edge pixels weaker than the low threshold are suppressed and edge pixels between the two thresholds as weak. Finally, in this way principal line are extracted and those with week gradient strengths are eliminated. The extracted principal line and strong wrinkles are shown in following fig. 5. This figure corresponds two parallel edges in Canny Edge Detection algorithm.

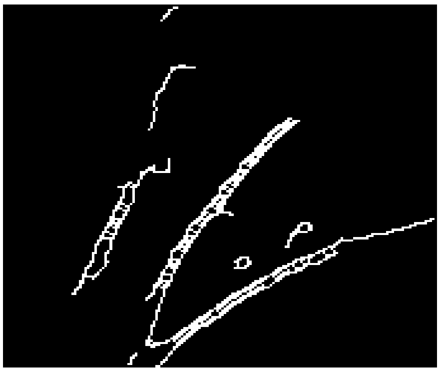

Fig. 5. The extracted principal lines and strong wrinkles

5. Template Generation:

The extracted principal line images are divided into 9×9 blocks of size 20×20. The blocks are traced to create feature vector. While generating a template 'if the concerned block contain the line then feature vector bit is set to '1'. else the feature vector bit is set to '0'.

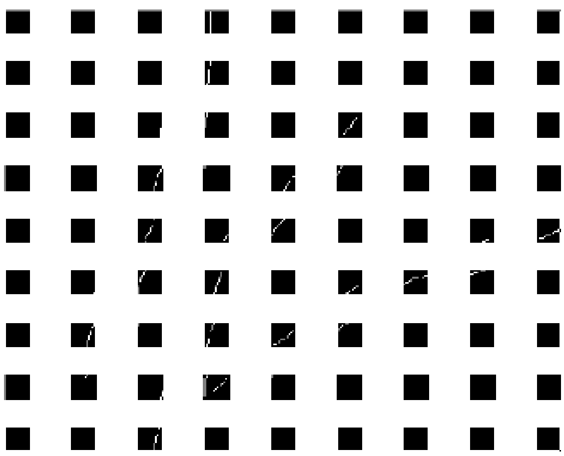

Fig. 6. The resultant image is divided into Blocks

F. Matching:

In matching test, sample feature vector is compared with feature vector of the enrolled templates, and checked with that template from which maximum similarity is obtained by taking the average similarity of all samples of particular user. Next if the average similarity is greater than the threshold value then matching is successful otherwise unsuccessful match.

For identification, let us assume, T and E is the matrix of test palmprint sample and enrolled palmprint database. The images are partitioned into m sub-blocks respectively as.

$$T = t_{1,1}\ t_{1,2}\ t_{1,3},\ldots\ldots.t_{1,m}$$

$$E = \begin{matrix} e_{1,1}\ e_{1,2}\ \ldots\ldots\ e_{1,m} \\ e2.1, e2.2\ldots\ldots..e2.m \\ - \\ - \\ e_{n,1}\ e_{n,2}\ \ldots\ldots\ e_{n,m} \end{matrix}$$

Where 'n' be the number of enrolled templates in database. The test sample palmprint T is assumed to be matched with enrolled template 'e' if the maximum similarity is obtained by taking average similarity of all samples of particular user. The matching is successful if the average similarity is greater than the threshold value otherwise unsuccessful.

If (Max (D_n) > H)) then
Successful match
Else
Unsuccessful match

Where 'Dn' is the average similarity and 'H' is threshold value, whose value is set based on trials.

V. CONCLUSION

Principal lines of the palm print image form one of the most important features for palm print recognition. In this paper, a novel approach is devised to extract principal line from palm print images. In preprocessing, images are smoothed and ROI was extracted. In Canny edge detection operation produce to extract principal line features. Using sobel mask The edge direction and gradient strength of each pixel in the preprocessed image are found. Then edges are traced using that information. Finally, non-maximum edges are suppressed by finding parallel edges and eliminating those with weaker gradient strengths.

In this way principal lines are extracted and resultant image is obtained. The matching is done by dividing the resultant image into 9 X 9 blocks. The blocks are traced to create feature vector. While generating a template the feature vector bit is set to'1' if the concerned block contains the line.

Personal identification is done based on the distance matching between the stored templates and the test palmprint image. So, this paper presents a simple and efficient method to extract principal lines for personal identification.

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