# Research on Harris Corner Detection Method in Palmprint Recognition System

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***Abstract*—Palmprint location is the premise of feature space extraction and feature recognition,the speed and accuracy of palmprint location directly affect the speed and accuracy of palmprint recognition system, and the extraction of contour feature points is the key of palmprint location. The contour of palmprint is extracted by gray morphological gradient;then, based on the analysis of palmprint appearance characteristics, Harris corner is used to extract the key feature points of the image, and the reference coordinate system is established according to the key points to realize the location and segmentation of palmprint.**

***Keywords-Palmprint Recognition System; Palmprintlocation; Harris Corner***

## I. EXTRACTION OF CONTOUR FEATURE POINTS BY IMPROVED HARRISCORNER DETECTION METHOD.

Figure 1. Palmprint corner detection

Harris corner detection algorithm is a common corner extraction algorithm at present, but it can not get ideal effect when we use it directly to extract the contour feature points defined by us. As shown in Figure 1, this paper improves Harris corner detection algorithm purposefully, thus realizing the extraction of palmprint contour feature points.

## II. HARRIS CORNER DETECTION

The predecessor of Harris algorithm is Morave algorithm. Morave's corner detection formula is:

*1) In formula E, the brightness change occurs when a small window (u, v) is moved at a point (x, y). w (x, y) is a Gaussian smoothing factor.*The essence of formula (2.11) is the autocorrelation of two-dimensional signals. The above formula is expanded by Taylor series:

*2) Formula:* Represents the horizontal and vertical derivatives of the point in the image respectively. Ignore the higher order terms and write them into quadratic form:

$$E(u,v)\big|_{(x,y)} \approx [u,v]M\begin{bmatrix} u \\ v \end{bmatrix}$$

*3) Formula:*

After M similar diagonalization, the results are as follows:

The eigenvalue of matrix M is obtained. Because matrix M has rotation invariance and is proportional to

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the curvature of gray scale of pixel points, if the minimum eigenvalue is greater than a given threshold, it is determined as a corner point.

Harris algorithm needs to determine threshold, variance of Gauss function and constant variable K. When the image size is, the window size of derivative is, and the window size of Gauss filter is, the complexity of the operator is, and the algorithm is slow.

## III. IMPROVEMENTS OF HARRIS CORNER DETECTION ALGORITHMS

In Harris algorithm, the eigenvalues of matrix M are closely related to the first derivatives of pixel points in X and Y direIn the edge region, there is only a large change in the horizontal or vertical direction, that is, only one of them is largections; In flat areas, the changes in horizontal and vertical directions are the smallest, that is, they are small;Corner area in the horizontal and vertical direction of the changes are larger points, that is, larger. According to this feature, the corner detection algorithm is improved.

The feature points of palmprint contour extracted by us are located in the convex and concave areas between fingers on Palmprint contour. They are composed of some flat areas and points that vary in a certain range of slope areas.

In the image region, the difference between the third line and the first line is close to the derivative in the Y direction.The difference between the third column and the first column is close to the derivative in the X direction. Firstly, two templates DX and Dy are designed. For any image region Z, the derivatives of center point Z5 in X and Y directions can be defined, respectively:

$$Z = \begin{bmatrix} z1 & z2 & z3 \\ z4 & z5 & z6 \\ z7 & z8 & z9 \end{bmatrix}$$

$$dx = \begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix} \quad dy = \begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$

Figure 2. The image region

The input image is the palm edge image after thinning. According to the principle of image graphics, it is a closed curve composed of continuous single pixel points. Its gray value is only 0 and 255. It can be defined that the black edge point is response point 1 and the white background is non-response point 0, then when there is no response point in Z region (that is, all white back) ==0;

For the refined contour line, the corner function value C is calculated. In the case of C > 0, the candidate corner points are obtained. As shown in Figure 2 (b), the X coordinate values of the candidate corner points are sorted, the array of corner points is determined, and then the maximum y value of each corner point group is obtained as the corner points we want, as shown in Figure 2 (c). In order to further verify the feasibility of this algorithm, we have searched for some representative images to test the performance of corner detection algorithm, such as pentagonal star edges and some building blocks edges as shown in Fig. 3 (a), and detected the points that satisfy the condition C > 0. The results are shown in Fig. 3 (b). When C > 0 (i.e., the detected feature points).

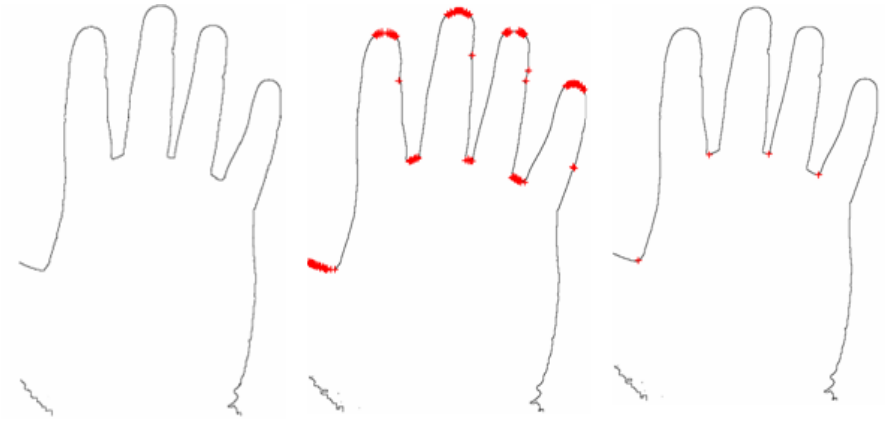

Figure 3. Extraction of palmprint contour feature points

## IV. EXTRACTION PROCESS OF PALMPRINT CONTOUR FEATURE POINTS

Consistent with our previous deduction, it contains not only the points in the top corner areas, but also the points on the edge of the inclined angle, which is up and down the horizontal line (as shown in the shadows in

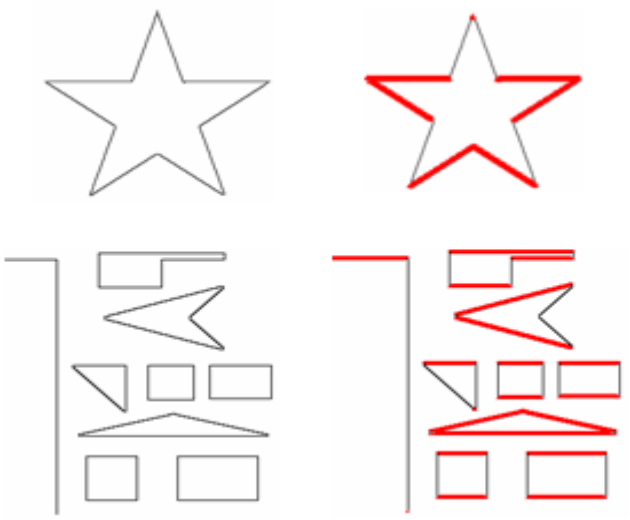

Figure 4. Palmprint contour feature points

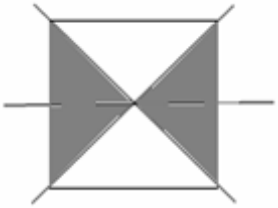

Figure 5. Declination range

The purpose of localization and normalization of palmprint image is to extract appropriate reference points from Palmprint and establish reference coordinate system to reduce the influence of non-linear factors such as rotation, translation and distortion introduced in the sampling process and improve the robustness of matching recognition algorithm. Good positioning results can not only provide reference frame for other palmprint features, but also provide benchmark for palmprint matching and feature matching. At the same time, it can segment the central area of palmprint, reduce unnecessary noise interference, reduce the complexity of subsequent matching algorithm, achieve azimuth-independent matching, ensure the accuracy and effectiveness of the recognition system, and in palmprint identification system. It has very important significance.

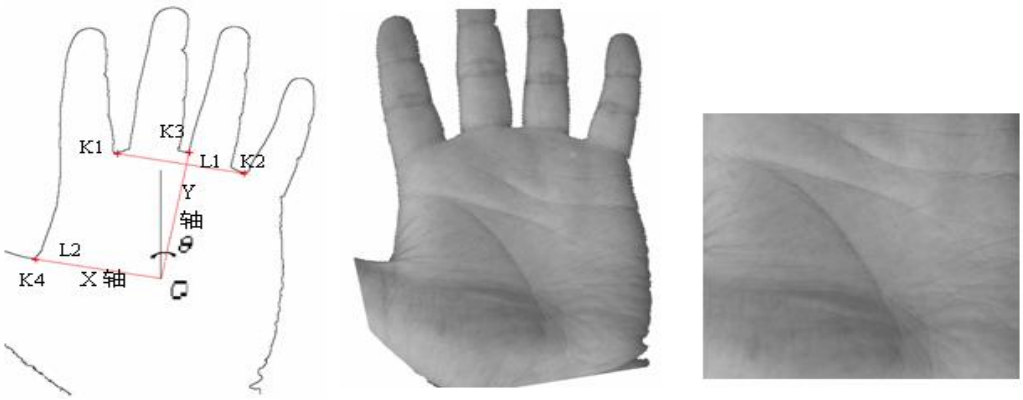


Figure 6. Palmprint location and feature space extraction

After extracting the corner points, we set up the coordinate system according to the following steps: make the line L1 = K1K2, draw an axis perpendicular to the line L1 from K3, and we set it as the Y axis; make a line L2 parallel to the line L1 and the crossing point K4, obviously the line L2 is perpendicular to the Y axis, which can be defined as the X axis, and the intersection point of the X axis and the Y axis as the O point, as shown in Fig.6 (a).The palmprint image is rotated counter-clockwise along the O-point, as shown in Fig.6(b), then the central area of palmprint is extracted and normalized as the Palmprint Feature space, as shown in Fig.6(c).

Under the above acquisition conditions, a palmprint test image database is established, which is composed of 80 images with a size of 40*2 (40 persons, each person collects 2 images).The positioning accuracy is shown in Table 1. The experimental results show that the desired feature points can also be found for the images with unsatisfactory collection effect. Among them, 79 images can be located accurately according to the above algorithm, so the accuracy rate is 98.75%.

TABLE I. LOCATION RESULTS

| Total image count | Correct Location Number | Error Location Number | Location accuracy |
|---|---|---|---|
| 80 | 79 | 1 | 98.75% |

According to the analysis of palmprint images, the main reasons for wrong location are insufficient extension of palm, incorrect placement of palm, or insufficient separation of four fingers. If the position and posture of the palm are further standardized, the error positioning rate can be further reduced. The experimental results show that the above method is simple, effective, fast and can locate and score palmprints quickly and accurately.

## V. CONCLUSION

In this paper, a new and purposeful exploration is made on the extraction of contour feature points in palmprint images, and the Harris corner detection algorithm is improved to realize the effective extraction of contour feature points. This algorithm avoids the need to determine the threshold artificially in the traditional corner detection algorithm, simplifies it, reduces the amount of calculation, grouping candidate corners and taking only one feature point in each group, thus improving the robustness of the algorithm, and

provides a new and effective method for solving the problem of palmprint location in palmprint recognition.

## REFERENCE


[1] Jain, R.Bole, S.Pankanti. Biometrics: Personal Identification in Networked Society. Kluwer Academic Publishers. 1999

[2] The David Zhang. Automated Biometrics is one Technologies and Systems. Kluwer Academic Publishers. 2000

[3] N.Duta, A.K.Jain, K.V.Mardia. Matching of Palmprint. Pattern Recognition Leters.2001, 23(4): 477-485

[4] David Zhang. Automated Biometrics-Technologiesand Systems. Kluwer Academic Publishers, 2000

[5] A.Jain, R.Bolle, S.Pankanti .Biometrics: Personal identification in Networked Society. Kluwer Academic Publishers, 1999

[6] WeiShu, D.Zhang. Palmprint verification: an implementation of biometric technology. IEEE International Conference on Pattern Recognition. 1998, 1:219-221

[7] N.Duta, A.Jain, K.Mardia. Matching of palmprint. Pattern Recognition Leters.2001,23 (4):477-485

[8] C.Han, H.Chen, C.Lin, K.Fan. Personal authentication using palm-print features. Pattern Recognition.2003,36 (2):371-381

[9] C.Poon, D.C.M.Wong, H.C.Shen. A New Method in Locating and Segmenting Palmprint into Region-of-Interest Proceedings of the 17th International Conference on Pattern Recognition IEEE

[10] S.Mallat. Multi-frequency Channel Decomposition of Images and Wavelet Model. IEEE Transactions on Information Theory.1989,37(12)