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# Analysis And Detection of Ridge Ending For Person Identification System

Arati A.Yadav[1], Dhanashree P.Patankar[2], Rubina S.Nandrekar[3]
*B.E Students, Department Of Electronics And Telecommunication, Shivaji University, India.*

**Abstract:-** Palmprint recognition is an effective biometric authentication method.The palmprint itself consist of principal lines , wrinkles , ridges, valleys, etc. This paper establishes correspondence between two palmprints based on ridge ending and ridge bifurcation points. Palmprint images were collected from COEP database which consist of 167 persons palmprint images. The absolute aim of this project is an attempt to design such a system that can bring out an efficient authentication system for Palm print recognition.

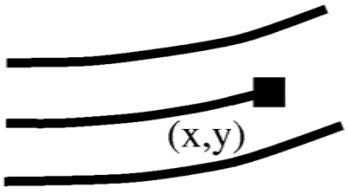
**Keywords:-** Palmprint, Biometrics, Image acquisition, Preprocessing, Feature extraction, Matching

## I. INTRODUCTION

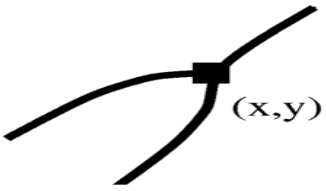
The biometric systems are automated methods of recognizing the identity of person on the basis of physiological or behavioral characterstics . Two main categories of biometrics are physiological and behavioral. The physical categories includes physical characteristics such as palmprint ,eye,hand shape, veins etc. The behavioral categories includes movement of the human such as hand gesture , speaking style, signature etc. One of the most reliable and successful biometric system is palmprint recognition system.

Palmprint recognition system can be used to analyzed two palmprint images , one is original image and another one is template image stored in the database. Palmprint identification is used to specify person identification with one to n matching . Most automatic palmprint recognition systems are based on the widely used feature called minutiae which is usually defined as ridge ending and ridge bifurcation . In this paper , person identification approach is based on ridge features intresting part is that ridge feature is permanent (unique). Mainly ridges are divided as: 1.Ridge end points 2. Ridge bifurcation points. Ridge end point is end of the ridges and bifurcation point is one single ridge is divided into two ridges.

The minutiae based palmprint recognition systems consists of two steps : minutiae extraction and minutiae matching. In minutiae matching process , The minutiae feature of given palmprint is compared with the minutiae template and matched minutiae will be found out. Person identification can be done by using matching score[4].




a)Ridge end point




b) Ridge bifurcation point

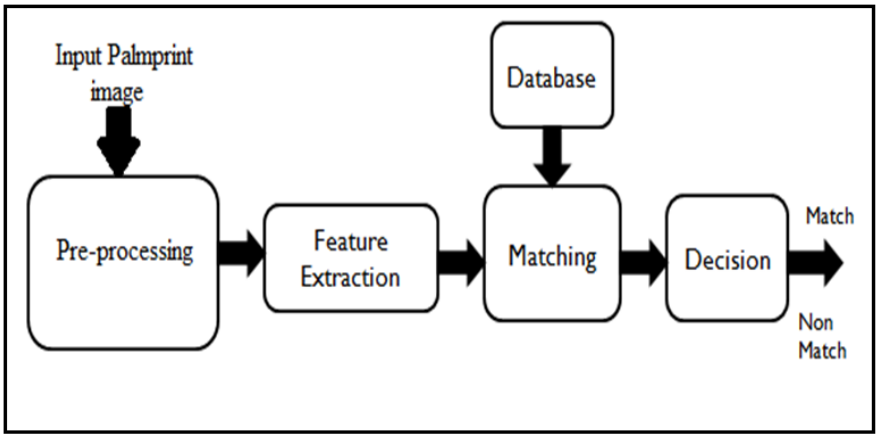
## II. Releated work

In this paper we present the result of implementation of algorithm on the matlab . Matlab software provides best image processing toolbox. The complete algorithm is as follows:

Acquisition of palmprint image.

1. Convert image into binary form.
2. Apply thinning process on binary image .
3. Find the total number of ridge end points and ridge bifurcation points .

4. Match both the minutiae points for the palmprint verification. If the total number of minutiae points of two palmprints are same then it is proved that both the palmprints are same or matched else both the palmprints images are not samed and releated to the two distinguish peoples.




## 2.1 Image Acquisition

The proposed system uses COEP database of palmprint images which contains about 1336 palmprint images.various Matlab functions are used for acquiring image from database.

## 2.2 Preprocessing

### *2.2.1 Binarization*

It is the process of converting gray scale image to a black and white image(or binary image).In MATLAB,value 1 represents that pixel and value 0 represents that pixel is black.For binarization ,thrsholding process is used.some MATLAB functions automatically adjust threshold value.

In thresholding,each pixel values are analyzed to input threshold.Those pixel values which are smaller than threshold value is placed to zero.and those pixel values which are greater than threshold value is placed to one.At the end image has been modified to binary form.

### 2.2.2 *Thinning*

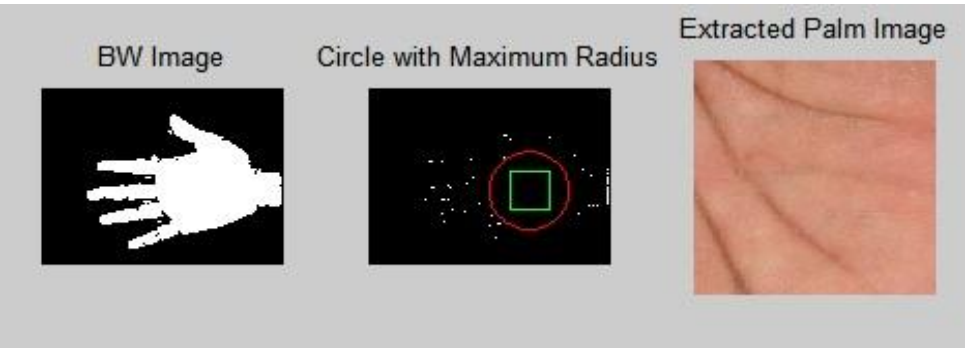
After binarization,next step is thinning.It is the process of decreasing thickness of all ridges into single pixel value.Ridge thinning are used to destruct the extra pixel of ridges till ridges are just one pixel broad. Thinning is a morphological operation that successively erodes away the foreground pixels until they are one pixel wide resulting in a skeleton image as per thinning algorithm[5]

### *2.2.3 ROI Extraction*

**2.2.4** In proposed system,Fit circle algorithm is used for ROI extraction.[2]

### Fit circle algorithm:

- Padding array is necessary to fit the circle inside the contour image.
- Find the edge of the palmprint image and find the x,y co-ordinates that is the center of circle having radius R.
- Draw the maximum circle with radius R inside the contour image.
- After that by using center of circle draw rectangle having dimensions R*R&distance between sides of rectangle and center of circle is R/2.
- Finally ROI was successfully extracted from palmprint image.




### 2.3 Feature extraction

In this paper,two minutiae points i.e ridge ending points and ridge bifurication points are considered.The classification of ridge ending point and ridge bifurication point is done on the basis of crossing number method(CN)[3] by creating matrix in MATLAB.

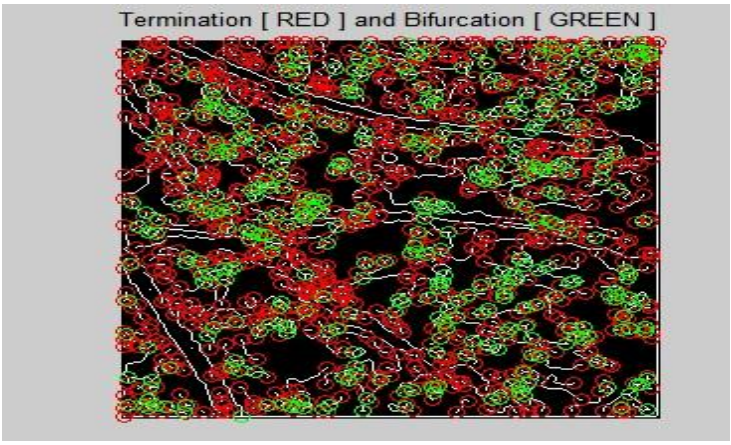
| | | |
|---|---|---|
| $P_4$ | $P_3$ | $P_2$ |
| $P_5$ | P | $P_1$ |
| $P_6$ | $P_7$ | $P_8$ |

In this method, a window of 3x3 pixels is used to examine the local neighbourhood of each pixel in the image and the CN value is computed as half the sum of the differences between pairs of adjacent pixels in the eight- neighbourhood pixels.
The CN for ridge pixel P is given as:

$$CN = 0.5 \sum_{i=1}^{8} |p_i - p_{i+1}|$$

The CN value for a pixel on the ridge is used to identify whether it is a ridge ending or ridge bifurcation. A CN value of 1 can corresponds to a ridge ending or termination and a value of 3 corresponds to a ridge bifurcation.

| CN | Property |
|---|---|
| 0 | Isolated point |
| 1 | Ridge ending point |
| 2 | Continuous ridge point |
| 3 | Ridge bifurcation point |
| 4 | Crossing point |

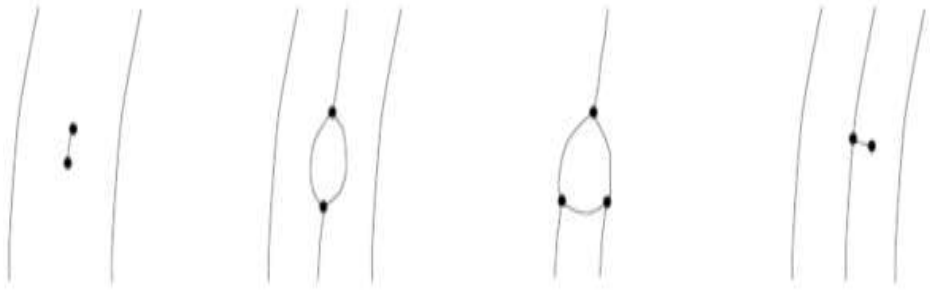


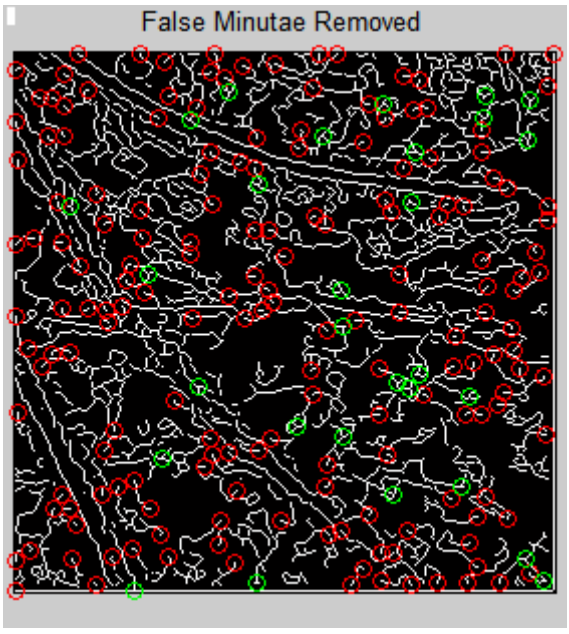
### 2.4 False minutiae removal

False minutiae on the skeleton may appear due to factors such as noisy images, and image artefacts
created by the thinning process. Hence, after the minutiae are extracted, it is necessary to employ post processing stage for validitation of minutiae[3].

Ridge ending point that is connected to a bifurcation point should have a certain distance threshold, below which it is eliminated as an invalid minutiae.The Euclidian distance is calculated as:

$$deuclid\ (i_1, j_1)(\ i_2, j_2\ ) = [(i_1 - i_2)^2 + (j_1 - j_2)^2]^{1/2}$$






### 2.5 Matching

Given the MCC descriptors of two palmprints, the proposed matching approach consists of: 1) a local matching step, where the similarity between each minutia descriptor in the first palmprint and each descriptor in the second one is computed; 2) a global matching step, where a global score, denoting the overall similarity of the two palmprints, is obtained from the local similarities[1]

**A. Local Matching Of Minutia Descriptors:**

Thanks to the robustness against distortion and the invariance for translation and rotation of the local structures, the similarity between two minutiae can be efficiently estimated by applying simple *bitwise* operations between the two corresponding binary vectors.

**B. Relaxation And Global Score:**

In order to compare two palmprints, a global score (denoting their overall similarity) needs to be derived from the local similarities. The proposed system uses the following approach to calculate the global score.

Given the minutia descriptors of two palmprints

A = {a1, a2, . . . ,$a_n$A} , B = {b1, b2, . . . , $b_n$B} ,s(a, b) be the local similarity between minutia a ∈ A and b ∈ B, with s : A × B → [0, 1] .After the normalization, nR minutiae pairs are:

nR = min{nA, nB, $n_R^{max}$}

A normalized similarity matrix $\hat{S}$ is obtained from $S$

$$\widehat{S}[r\ \ c] = \left(1 - \frac{\left(\sum_{\substack{i=1 \\ i\neq r}}^{n_A} S[i,c] + \sum_{\substack{j=1 \\ j\neq c}}^{n_B} S[r,j]\right)}{n_A + n_B - 2}\right) \cdot S[r,c].$$

P be the set of selected nR minutiae-index pairs:

P = {($r_t$, $c_t$)}, . . , nR

Global matching:

Global score is calculated as the average of the corresponding local similarities:

$$S(A,B) = \frac{\sum_{(r,c)\in P} \mathrm{S}[r,c]}{n_P}.$$

Where ,

S[r,c] = Local similarity

$n_p$ = Total no. of minutiae

S(A,B) = Global similarity

## III. Conclusion and future work

The main focus of this work has been to develop and test an automated palmprint recognition algorithm based on features minutiae, which can address some issues in some existing algorithms. As a pre processing step has been performed on all images before they are passed onto feature extraction stage. The invalid or false minutiae have been removed before the template has been formed.

Here the detailed features of the palm prints are taken and hence matching is done the palm prints using local minutiae matching and global minutiae matching. The input is full palm print and the output is a set of matching minutiae. The minutiae based matching score is computed and hence the maximum similarity score of the minutiae is calculated and hence the output is the matched palm print whether authenticated or not.

In this paper, the system has been proposed for user identification based on unique biological feature i.e ridge ending .The system provides high level of security to the users .The system achieves authentication with minimal time.In the future works, the proposed matching algorithm can be further improved by making use of global ridge structure through global optimization for the low quality palmprints.

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