Region of interest extraction of palm vein image

Liqaa J. Alwan, Haithem A. ALANI

Abstract— Biometrics authentication is an effective method for automatically recognizing individuals. Palm vein authentication is a means of personal authentication that uses unique palm vein features. Palm print based biometric system is potentially a good choice for biometric applications due to its richness in amount of features. The authentication consists of an enrollment phase and an identification phase. In order to get features in fixed location the image preprocessing must contain an accurate operation for defining region of interest (ROI).

In this paper a suggested methodology for extracting the ROI to improve the accuracy of identification. ROI extracted using a new technique is suitable for different types of processing as it creates a rectangular or square area around the center of activity represented by the veins. Focuses on extraction of Dynamic Region of Interest (ROI) from the palm vein image. Most of the existing work uses static region from palm print not utilizing a significant portion of the palm. Intuitively, the larger area captures more distinctive features when compared to fixed size ROI. Using this ROI method has a great effect on feature extraction accuracy that makes the percentage of recognition high even when the location changes and rotation of the Palm image.

Keywords— Biometric, Feature Extraction, Authentication, ROI.

1 INTRODUCTION

In recent years, biometric based recognition systems have been widely used as an effective method for automatically recognizing a person's identity since traditional recognition systems which are based on what a person knows(passwords) or what a person has(tokens) are not reliable due to use of several advanced techniques of forgery and password hacking. Biometric recognition is based on physiological traits such as finger print, palm print, palm vein, iris, face and behavioral traits such as gait or signature associated with the person. Biometric system consists of two subsystems; one for enrollment and second one for recognition.

In the **enrollment stage**, biometric data are acquired from the individuals, feature sets are extracted from the acquired data, and one or more templates per individual are computed and stored in database. In the recognition stage biometric systems can operate in two modes, Verification or Identification.

Verification refers to confirming or denying a person's claimed identity. In this mode the system performs one to one comparisons of the template computed from the acquired biometric data with the individual's own biometric templates stored in the database.

Identification refers to establishing a person's identity. In this mode, template computed from the acquired user's biometric input is compared with the templates of all persons enrolled in the database to establish an individual identity.

Figure 1 shows a biometric recognition system. It contains four main modules which are data acquisition module, preprocessing module, feature extraction module and matching module [2].

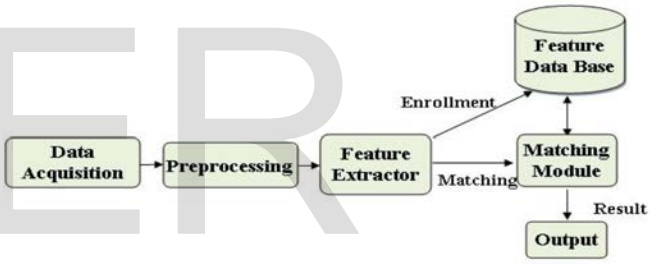

Figure (1): Biometric recognition system

In the preprocessing module, the important step is region of interest (ROI) extraction that is rich in features and it is important factor for recognition performance to develop identification accuracy.

This paper interested in this part of the preprocessing have been proposed technique to extract the ROI has proven its efficiency and its effect on extraction of features used in identification of individuals. For the purposes of the implementation and testing of the proposed technique images from CASIA multi spectral palm print were used. It takes different captures for hand geometry and palm print and palm vein. A reference to "CASIA-MS-PalmprintV1, http://biometrics.idealtest.org/ should be included

2 RELATED WORK

In this section different methods proposed by researchers for finding palm print region of interest are discussed:

In [1] The approach to ROI extraction is based on the principle of selecting a region where rich texture patterns can be

- *Liqaa J. Alwan MSc. In computer science in Al_Nahrain University, Iraq, E-mail: likaaalwan_92@yahoo.com*
- *Haithem A. ALANI Assist.prof Al_Nahrain University, Iraq, E-mail: drhaithem2013@yahoo.com*

found. The acquired image has been divided into smaller horizontal and vertical strips and the statistical properties of the edginess of these regions have been used to either select or reject the strips from the ROI. Histogram techniques are used to check suitability of extracted region.

In [2] the author suggested algorithm extract the ROI by segment the hand image from background. After that finger tips and hand valley detection algorithm is used to find the tip points of little, ring, middle and index fingers and valley points between adjacent fingers. These tip points and valley points serve as base points to find palm print ROI location.

In [3] For extracting the central parts of the palm print images utilize ost'u thresholding scheme, use morphological dilation and erosion operations, applied sobel edge detection, took double derivations on the detected palm boundary to find two reference points located at two valleys between the fingers, alignment the palm to standard pose and segment a square area as the ROI.

ROI extraction in [7] by Zohaib Khan et al. is based on the two valley points identified one between middle and index finger and another between ring and little finger. The line joining the two valley points is considered as one side of ROI region and another line parallel to it at 2/3 rd of distance from valley points is considered as another side of ROI region. End points of these two lines are considered as four corners of ROI region.

3 Proposed Region of Interest Extraction

A palm vein ROI extracting scheme for palm vein images must be extremely effective and efficiency. In this research there are five stages to get the region of interest:

1- Because of noise in images and undesirable object, we apply median filter to remove this noise.

2- Binarizing the image by apply Ost'u threshold algorithm.

3- Apply an edge algorithm to detect the boundary of palm and then apply crop process that make the ends of the fingers attached to the edges of the image.

4- Determine two important reference points and rotate image using the process shown in (algorithm 3.1.2).

5- Draw rectangle or square around the region of interest (ROI) using the process shown in (algorithm 3.1.4).

These stages are shown in figure (2) where (a) original image (b) apply median filter (c) apply ostu threshold for binary (d) detect the boundary of palm and determine the references point then rotated image (e) draw rectangle around the ROI (f) extract the ROI.

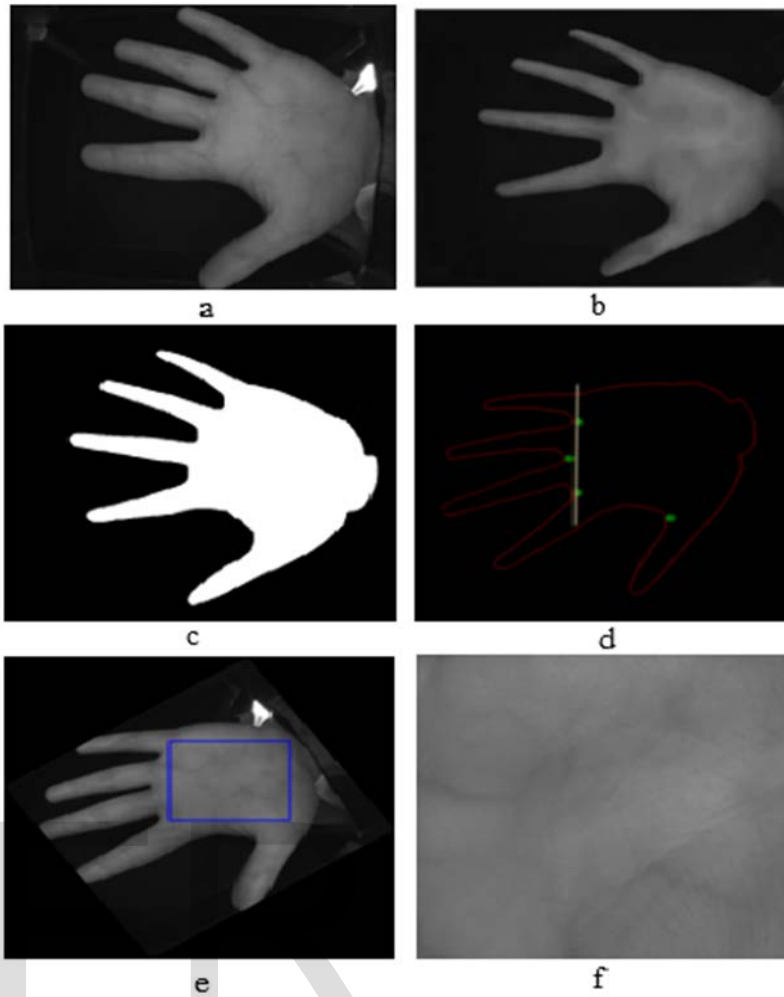

Figure (2): The stages of ROI extraction

3.1 Algorithm for extracting region of interest

In order to extract the ROI from the palm image there is a requirement to find suitable key points in the image, the following steps are implemented for that purpose:

1- Determine the joints by scanning the image vertically row by row (green points) as shown in figure (3)

2- Determine the location of the thumb end then start from the opposite direction and determine the first joint horizontally as the first point (p1) that is shown in figure (3) and explained in (algorithm 3.1.1).

3- The two reference points which will be used to draw the ROI are First point between the little finger and ring finger as (p1), second point is the point between middle finger and index finger as (p3). These points are considered as connecting points.

4- Determine the second point through the third joint and draw straight line between the two points (p1, p3) as explain in (algorithm 3.1.3).

5- Rotate image to draw the line of ROI correctly.

6- From these connected points draw the rectangle (ROI) that explain in (algorithm 3.1.4).

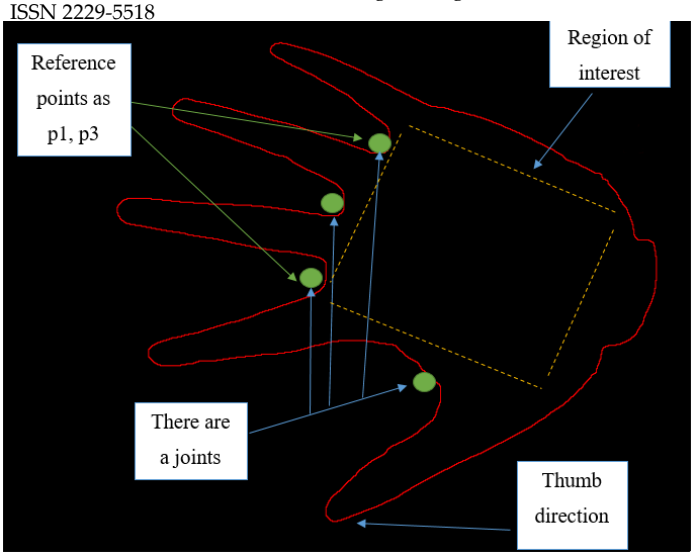

Figure (3): Diagram of the important parts in the palm

3.1.1 Algorithm to determine the thumb direction

Step 1: start
Step 2: Define point=0
Step 3: Do loop i=0 to image_width
Do loop j=0 to image_height
If color of point is green and the i>point
Then point=i (this is the thumb direction)
Step 4: End

3.1.2 Algorithm to determine reference points

Step 1: start
Step 2: define p1, p2, p3 as points
Step 3: define c=0 as counter
Step 4: do loop i=0 to thump_point -1
Do loop j=0 to height_image
If the green point is found c=0
Then increment c and save i,j in p1
Else if the green point is found c=1
Then increment c and save i, j in p2
Else if the green point is found c=2
Then increment c and save i, j in p3
Step 5: End

3.1.3 Algorithm to draw line between two reference points

Step 1: start
Step 2: if the Y-coordinate of p1 is not equal to the Y-coodinate p3
rotate the image until they will equal
step 3: draw line from p1 to p3
step 4: end

3.1.4 algorithm to draw rectangle or square (ROI)

step 1: start
step 2: define h, w as (height and width of rectangle)
step 3: Set h=line-(distance between green point and the end of line)/2.
Step 4: Set w=line+pixels
If the ROI need to add some pixels to fit this region by retangle
Then draw_rectangle (p1, p3, h, w)
Else draw_square (p1, p3, h, h)
Step 5: End

4 EXPERIMENT RESULT

This proposed system extracts the ROI of a lot of images in which the shape of the hand is different. The system faced some problems for example:

1. Original image has noise as shown in both figures (4) and (5).
2. The references point (p1, p3) as shown in figure (3) is in different location, the system cannot be able to draw rectangle, it can solve this by rotate the image until the Y-axis of two points are equal explain in algorithm (3.1.3) then draw the rectangle as shown in both figures (4) and (5).
3. Some of images are rotated in a different degree as shown in figure (4).
4. The illumination is different as shown in figure (5).

In spite of these problem the system can extract the ROI as shown, in figure (4) (a) original image is in straight direction (b) original image rotated in small degree (a2, b2) detect the boundary of palm and determine the references point then rotated image (a3) draw the square around the ROI (b3) draw the rectangle around the ROI (a4, b4) extract the ROI.

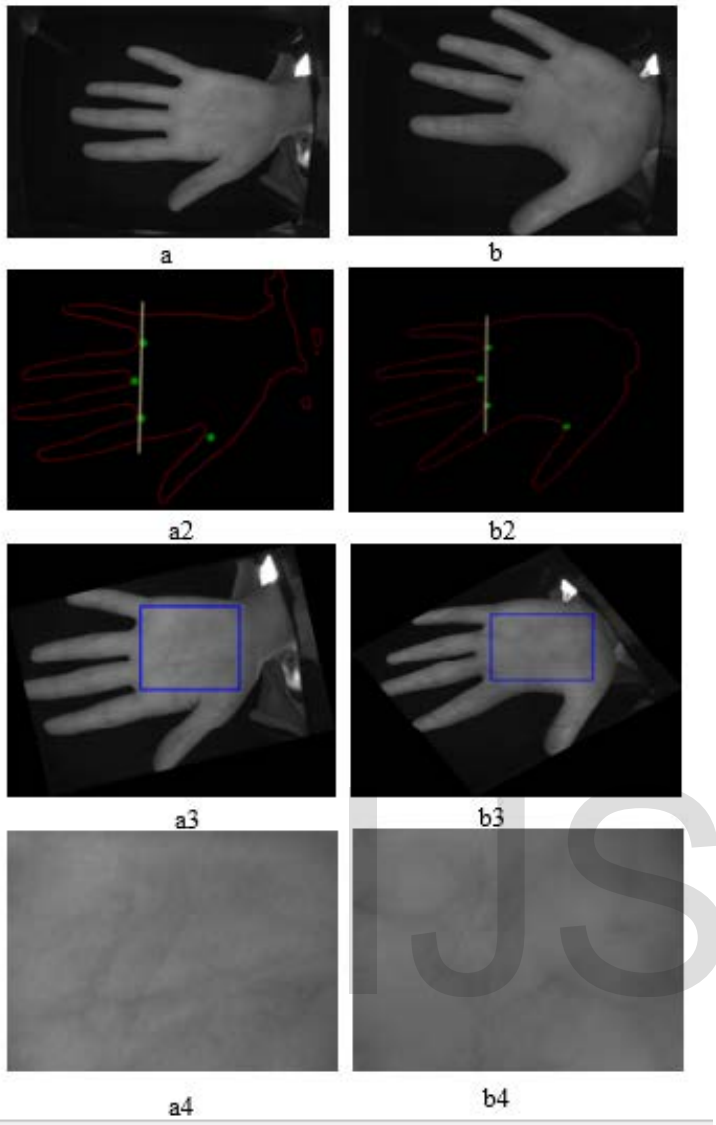

Figure (4): The ROI extraction explain the difference in image rotate.

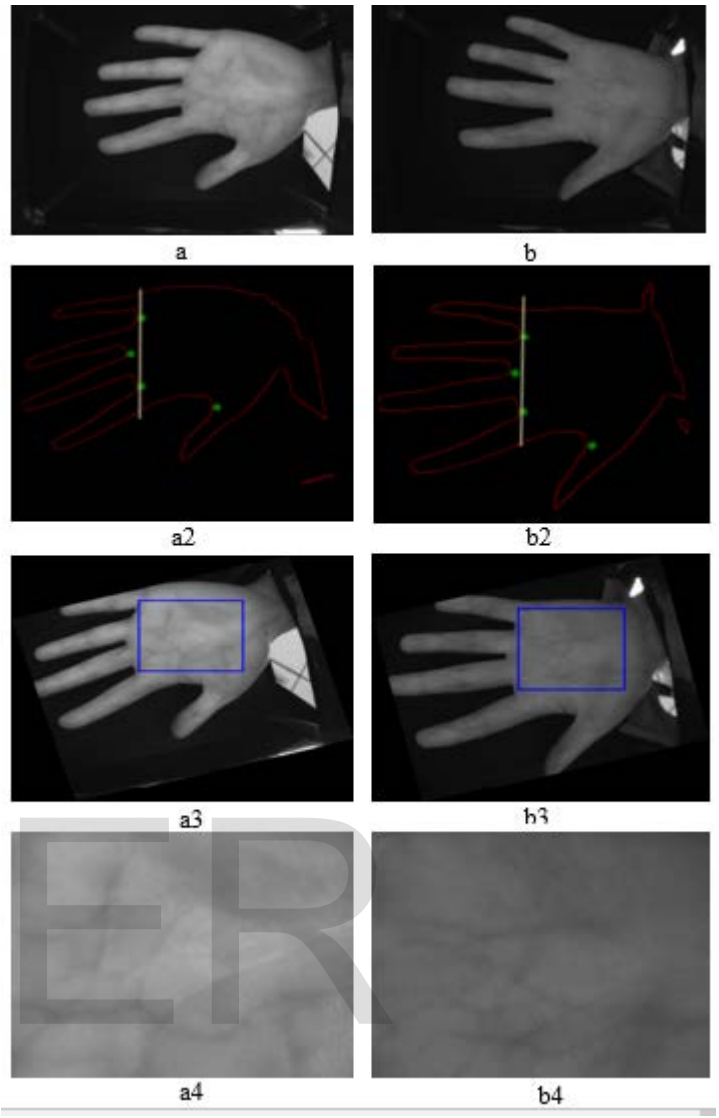

Figure (5) The ROI extraction explain the difference of illumination

In figure (5) (a) original image in high light (b) original image in low light (a2, b2) detect the boundary of palm and determine the references point then rotated image (a3, b3) draw the rectangle around the ROI (a4, b4) extract the ROI.

5 Conclusion

In this paper, a new technique to extract the ROI from a palm vein image is proposed. The removal of noise from the palm Vein image has an important effect on ROI extraction process. Locating the points that separate between the joints are important in determining the ROI that covers most area of palm.
When image is blurred even after the use of filter there will be an error in determining of rectangle of ROI in the area of palm that effect to the use of rectangle, the modified suggested algorithm succeed to find the proper ROI rectangle.

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