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Region of Interest Detection Algorithm for Palmprint

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Abstract: ***The advance of technology makes the demand on palmprint recognition; which is one of biometric technologies are increasing. In this work, a ROI segmentation system is presented. The framework passes through three main stages: preprocessing stage, localization stage and segmented stage. After reading the color palm image as JPEG file format, the first stage is preprocessing which consists of three steps: Convert to HSV, Skin color modeling, and remove noise. The second stage is Palm Localization which consists of these steps: clip from left, clip from right, clip form top, clip form bottom, palm clip. The third stage is ROI segmentation and extraction which consists of two steps: Determine and Extract ROI. The system was tested over a dataset contains 10 palm images were collected form internet in different images background, size and orientation (left and right hand); excellent results have been achieved for these dataset.***

Keywords: Physical biometric, Palmprint, ROI segmentation, HSV colorspace.

1. Introduction

Palmprint recognition is one of the current biometrics techniques, which is based on biological attribute to identify people; it is one of the current research that receive a great deal of concentration over last period because this application is needed in many vital applications in security and surveillance field, in identity authentication and image database investigations, also in other domains. The biometric based technique has risen as the most promising option for perceiving persons based on their biological attribute, as an alternative of using passwords, PINs and smart cards which are based on what the person has or remember [1], [2], [5].

2. Palimprint Recognition Approach

Palmprint is one of the most reliable features in personal identification because of its stability and uniqueness; the inner sur-face of the palm is explained in Figure (1). With theincreasing of intrest in palmprint recognition, researchers have proposed a variety of palmprint feature extractions and matching approaches, which can be grouped into three categories: holistic-based, feature-based, and hybrid methods. [1], [6].

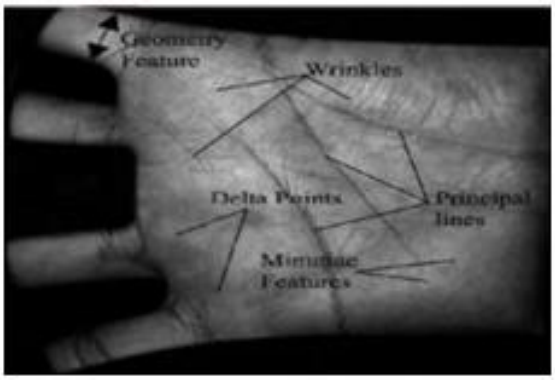


Figure 1: Inner surface of the palm

2.1 Holistic-Based Approaches

In the holistic-based palmprint recognition approach, the original palmprint image is used as the input of a holistic feature extractor or matcher (classifier) [3].

2.2 Local Feature-Based Approaches

There are two classes of local features for palmprint recognition ridges and creases which can be extracted from high resolution and low resolution palmprint images, respectively [3].

2.3 Hybrid Approaches

It has been argued that the human vision system uses both holistic and local features to recognize the object of intrest, and hybrid approaches are thus expected to be promising for palmprint recognition [3], [7].

3. HSV Color Space

Hue Saturation value (HSV) color space is one of RGB color space transformation; it is also named Hue Saturation Bright-ness (HSB). The main characterize this color space is presents the property of color numerical. Equations (1), (2), and (3) represent transformation rules to obtain the (H, S, V) values from RGB color space [4].

$$H = \begin{cases} \left(\frac{G-B}{Max-Min}\right)/\ 6 & if\ R = Max \\ \left(2 + \frac{B-R}{Max-Min}\right)/\ 6 & if\ G = Max \\ \left(4 + \frac{B-R}{Max-Min}\right)/\ 6 & if\ B = Max \end{cases} \quad (1)$$

$$S = \left(\frac{Max-Min}{Max}\right) \quad (2)$$

$$V = Max \quad (3)$$

4. ROI Segmentation Algorithm

The framework of the proposed system comprises from three main stages: preprocessing stage, localization stage and segmented stage, as shown in Figure (2).

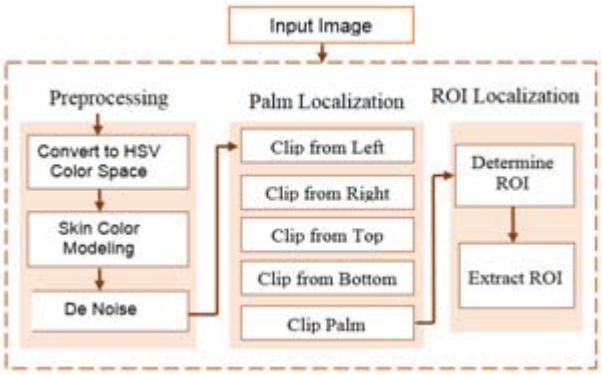


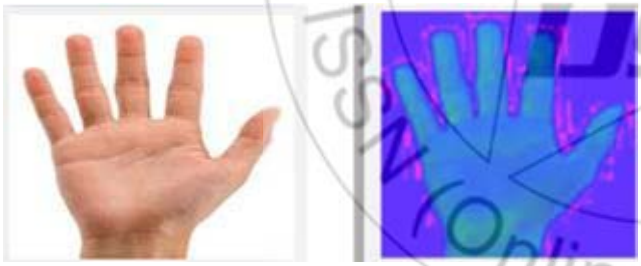
Figure 2: The layout of the proposed system

4.1 Preprocessing Stage

Preprocessing is the first stage in the proposed system, as explained in Figure (2) consists of three main steps, this stage is considered as crucial task for both localization and extraction tasks.

4.1.1 Convert to HSV Color Space

RGB color space is not suitable for skin detection; because in this color space; too great changing in color values might not be detected by a human observer. HSV color space is suitable for representing human skin color, has been applied in the proposed system. Figure 3 shows palm image converting form RGB to HSV color space.



(a) **(b)**

Figure 3: Convert color Image to HSV Color Space; (a) color image, (b) HSV image

4.1.2 Skin color modeling

After applying certain rule on number of color hand images, the thresholds of (H,S and V) is determined. The rule for clas-sifie skin area is got from the HSV color space; the blue values exhibit the most detectable split of the skin and non-skin areas as shown in Figure (3), The skin in band H is characterized by values between 0 and 40, in the band S from 30 to 160 and in the band V from 150 to 255 as given in equation (4).

Make check for all hand pixels, each pixel that is achieved in equation (4) is classified as a skin color pixel and set to value 255, and non-skin pixels are set to zero, Figure (4) shows example of palmprint skin color detection.

(a) (b)

Figure 4: Detection of skin area; (a) before detection, (b) after detection

4.1.3 Remove Noise

Some noise pixels may appear after classifying the pixels skin and non skin, for removing these pixels medium filter is ap-plied. After ascending all the values of the pixels in the neighborhood; median is just the middle value. Figure (5) presents test noisy palm image, the size of median filter applied is (3x3), and is applied three times.

(a) (b)

Figure 5: Palmprint Image De-nosing; (a) before de noise, (b) after de noise

4.2 Palm Localization Stage

The objective of this stage is determining the location of palm in image. The skin area is determined in order to determine intresting clip in testing palmprint image, checking process is done for four directions; left, right, top and bottom, the coor-dinates of skin area is determined and extracted, Figure (6) explain the localization of palm skin area.

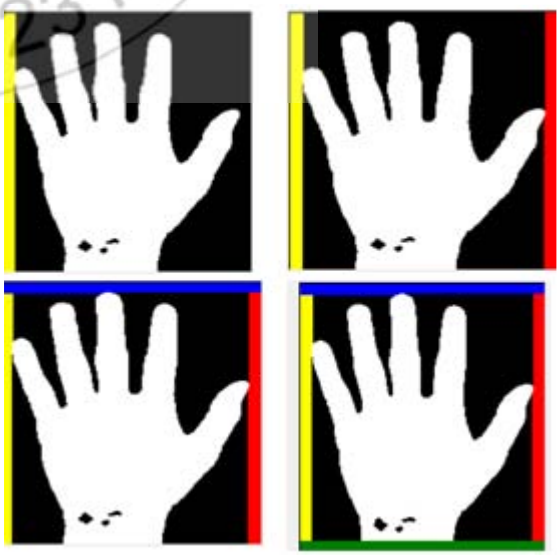


Figure 6: Explain the steps of obtaining Palm clip

4.3 ROI Segmentation and Extraction Stage

The aim of this stage is determining and extracting the position of ROI clip from palm clip. This is done by:

4.3.1 Determine of ROI

The proposed ROI Segmentation Algorithm depend on determine ten valleys of the fingers, v1, v2 … v10 as explained in Figure (7) and (8). Depending on the information of these crucial locations, the location of the ROI could be gotten as follows:

Step 1: The ten valleys represent the location in palm clip that convert from black to white or from white to back; these loca-tions are determined.

Step 2: the valleys points (v1, v2) and (v7, v8) obtained from step (1) are used to find the midpoints, m1 and m2, based on the midpoint formula.

Step 3: The two midpoints, m1 and m2, are connected as explained in Figure (7) to form the base line.

Step 4: Depending on the line obtained from step (3) the intrest squre is formed; based on the principal of geometrical square where all the four edges having equal length, as explained in Figure (8).

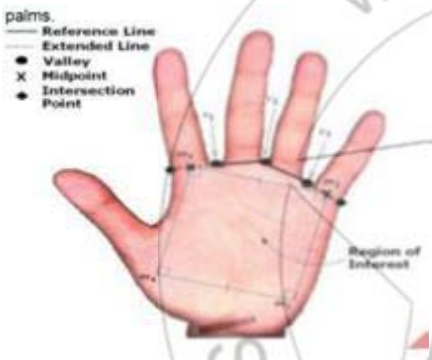


Figure 7: The ROI clip Segmentation Algorithm

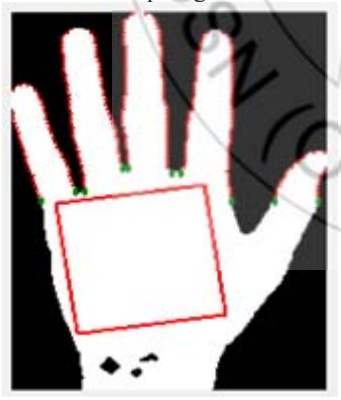


Figure 8: The ROI clip Segmentation Algorithm

4.3.2 Extract of ROI

The aim of this step is to obtain ROI clip, as explained; Figure (9) below explains the steps to update the ROI clip coordinates extracted from the previous step.

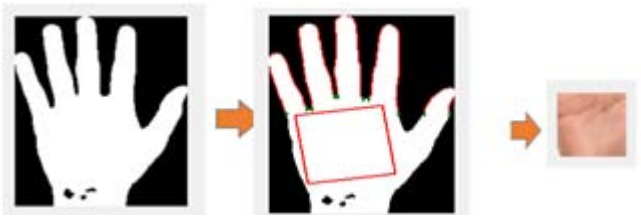


Figure 9: The ROI Clip Extraction

5. Experimental Results

Experiments were conducted using several tests hand images. The proposed system has been established using Visual Ba-sic.Net (2013) programming language and the tests have been conducted under the environment of Windows-8 operating system, laptop computer processor: Intel Pentium Dual CPU T230, 1.60 GHz, and (2GB) RAM, some of test hand images are shown in Figure (10).

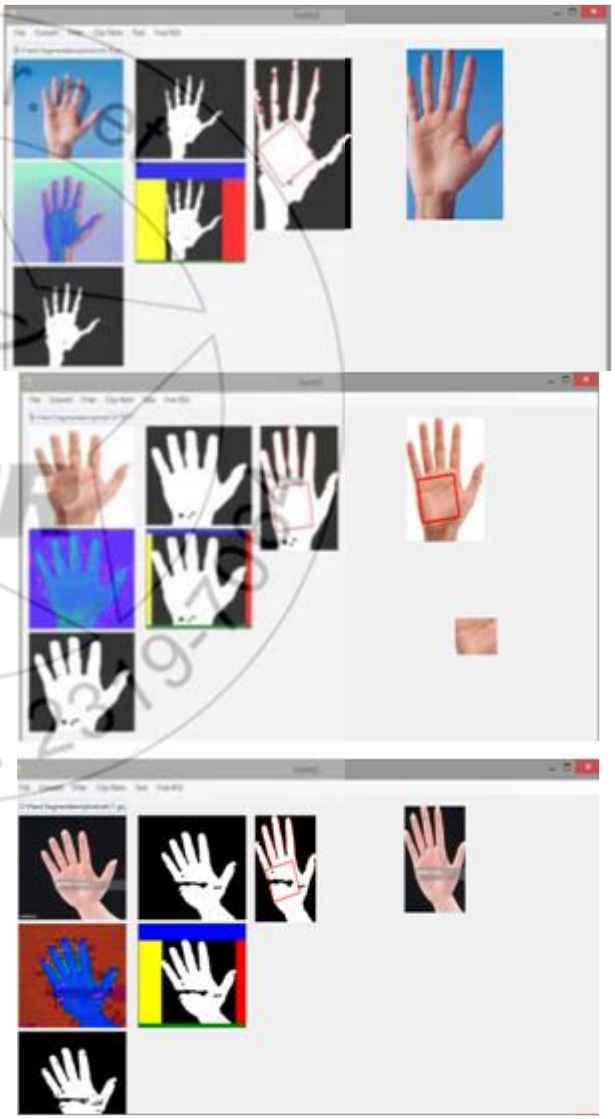


Figure 10: Tests hand images results in deferent orientation and background

6. Conclusion

Several conclusions have been derived from the test results; Skin detection stage based on color features indicates that the use of HSV color space for skin color modeling leads to excellent detection results. The proposed algorithm for localizing and extracting palm clip and ROI clip shows best result; even though there are invariant of hand orientation, size and image background.

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