

Robust Approach For Palm (Roi) Extraction In Palmprint Recognition System

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Abstract. Palmprint based biometric system is potentially a good choice for biometric applications due to its richness in amount of features. Palmprint contains geometric features, line features, point features, texture features, and statistical features. One of the important stages in the system is pre-processing which contains some operations such as filtering, Morphological operations, Region of Interest (ROI) extraction, normalization, etc. In this paper, we propose a simple methodology for localizing the palm and extracting the ROI. Although pre-processing has been discussed in different papers incidentally, but no definite precise approach has been introduced. We pay more attention towards more essential stage of palm Localization and ROI Extraction.

Keywords: Biometrics, Palmprint, ROI, Region based segmentation, Image pre-processing.

1. Introduction

Establishing the identity of a person is becoming critical in our vastly interconnected society. The need for reliable user authentication techniques has increased in the wake of heightened concerns about security, and rapid advancements in networking, communication and mobility. Biometrics, described as the science of recognising an individual based on his/her physiological or behavioural traits, is beginning to gain acceptance as legitimate method for determining an individual's identity. Researchers have studied such biometric characteristics as fingerprints, palmprint, hand geometry, iris, retina, face, hand vein, facial thermo gram, signature, voice, etc. to either validate or determine an identity [1]. Facial appearance and features change with age. Fingerprints can be affected by surface abrasions or otherwise compromised [2, 3]. Capturing iris images is relatively difficult, and iris scans can be intrusive. Voices are susceptible to noise corruption and can be easily copied and maintained. Palmprint is defined as the prints on a palm which is the inner surface of the hand between the wrist and the fingers. Palmprints are potentially a good choice for biometric applications because it has the following advantages: (1) palmprint contains more information than fingerprint that such as principle lines and ridges; (2) they're invariant with a person; (3) it is easy to capture and difficult to duplicate; (4) by considering all these advantages.

The rest of the paper is organized as follows. Section 2 gives short survey of related work. Section 3 describes system framework for proposed methodology. Section 4 gives the details about the acquisition of hand images and pre-processing. Section 5 states the proposed methodology for Extracting palm (ROI) by Region based segmentation. Section 6 describes the extraction of principle lines. Section 7 describes the representation of principle lines. Finally, section 8 gives the conclusions and future work.

2. Related Work

Most of the palmprint recognition schemes proposed in recent years used to extract a region on palm for personal authentication use geometrical techniques [4, 5] and spectral approach by Han et al [6]. They have used wavelet-based segmentation to find the locations of finger tips and four finger roots. For attaining this, they have found boundary of palm image and then have transformed palm boundary's coordinates to a profile of curvature. Then they have used wavelet transform to convert the curvature into multi resolution signal (which included low- and high-frequency sub-bands). At last, they separated the sub-bands and

detected corner points of palm's boundary through local minimums of transformed profile (its high frequency sub-band). Although this method shows successful in extracting ROI precisely. It suffers from high demands of processing and therefore it is not appropriate for real-time applications. On the other hand, geometrical techniques used in other researches cannot promise high accuracy in extracting ROI and most of them state their approach is an approximate (not absolute) solution [5]. Histogram analysis and inner boundary tracking algorithm is used for extracting ROI [7]. Our Goal is to improve the performance of existing palm image selection methodology by region based segmentation.

3. Palmprint Extraction System Framework

The overall recognition system includes Image acquisition, pre-processing, extraction of the region of an interest (ROI), feature extraction, and matching. We pay more attention towards more essential stage of palm Localization and ROI Extraction.

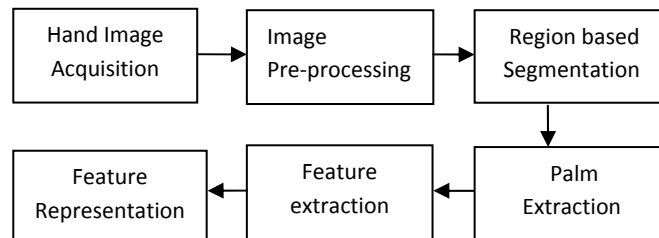


Fig.1: Complete Overview of Proposed Methodology for Palm Extraction

4. Hand Image Acquisition and Pre-Processing

The hand images are acquired thanks to general scanner of 1200 dpi, and they are stored with 256 gray levels, 8 bits per pixel. The size of the images is set to 128*128 pixels after scaling. From the acquired hand image, only the central portion of the image is used for feature extraction. Normally, the raw hand images are to be properly aligned and normalized. And the unwanted portions to be trimmed away to reduce the computation required in subsequent processing. The palm-positioning stage handles the pre-processing tasks, ultimately produce Region of Interest (ROI).

After images have been acquired, we convert each one from RGB image to gray scale image and then binary image based on the threshold value [4]. The binary image isn't immediately suitable for extracting feature key points. The binary image is subjected to morphological operations.

$$\text{If (Original Image (i, j) < threshold) then Image (i, j) = 0.} \quad (1)$$

$$\text{If (Original Image (i, j) > threshold) then Image (i, j) = 1.} \quad (2)$$

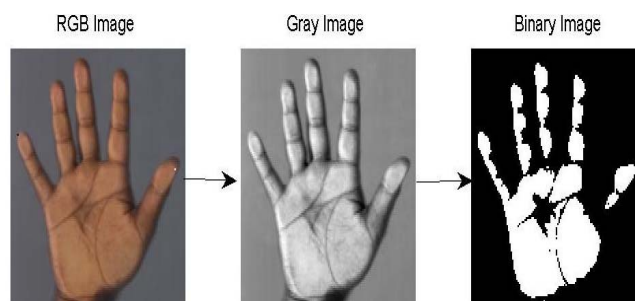


Fig. 2: Acquired hand image and Pre-processing steps

5. Proposed Methodology for Roi Extraction

After Pre-processing the images, we should find a way to distinguish palm region from fingers and background. To detect the palm region, region-based segmentation method is attempted to group pixels according to the criterion of homogeneity of regions such as Intensity, Gray level, Colour, Textures, Shape, etc. Here, the thresholding simplicity and the spatial information have been considered as similarity constraint. For all the pixels, both the characteristics are computed. The probability for a pixel to belong to the region can be obtained by satisfying the similarity constraint:

$$H(R_i) = \text{True}, i=1, 2 \dots N \tag{3}$$

Finally, the maximum connective texture region has extracted as Region of Interest which ensures the reliability of the segmentation and provides the ability to resist noise.

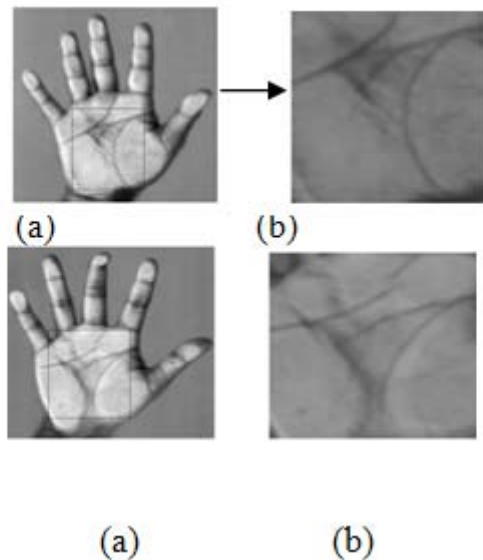


Fig. 3(a) palm region identified from two different hand images

Fig. 3(b) Extracted ROI from the palm image for the corresponding

6. Extraction of Principle Lines

Once the ROI was extracted from the hand image, suitable line-detector masks such as Sobel or canny edge detector can be used to find the principal lines. In our implementation, standard canny edge detector can be applied. This step produces an image shown in figure 4b. We use image thresholding to convert the image in to binary image, with white representing pixels on the lines, and black otherwise. The number of extracted lines depends on the threshold value. With a low thresholding value, we can extract more number of lines. Here, high thresholding value is used to respond for small number of strong principle lines.

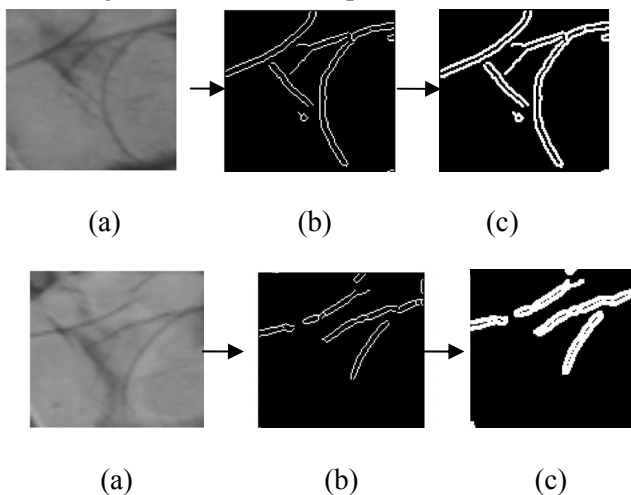


Fig. 4: Extraction of principle lines from ROI of two different images.
 (a) ROI (b) Extracted principle lines (c) Normalized principle lines

7. Representation of Principle Lines by Hough transform

The Hough transform is a technique which can be used to isolate desired features of a particular shape within an image. Because it requires that the desired features be specified in some parametric form, the *classical* Hough transform is most commonly used for the detection of regular curves such as lines, circles, ellipses, *etc.* The classical Hough transform retains many applications, contain feature boundaries which can be described by regular curves. The main advantage of the Hough transform technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise. However, a convenient equation for describing a set of lines uses *parametric* or *normal* notion:

Where, r is the length of a normal from the origin to this line and Θ is the orientation of r with respect to the X -axis. For any point (x, y) on this line, r and Θ are constant [9].

$$x \cos \theta + y \sin \theta = r \quad (4)$$

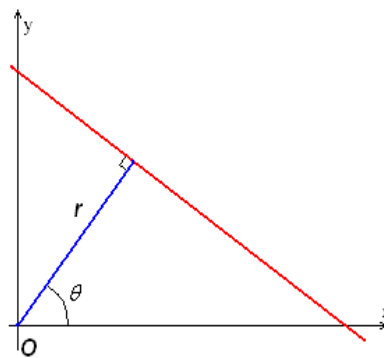


Fig.5: Line detection using the Hough transformation

The Hough representation of principle lines extracted from ROI is

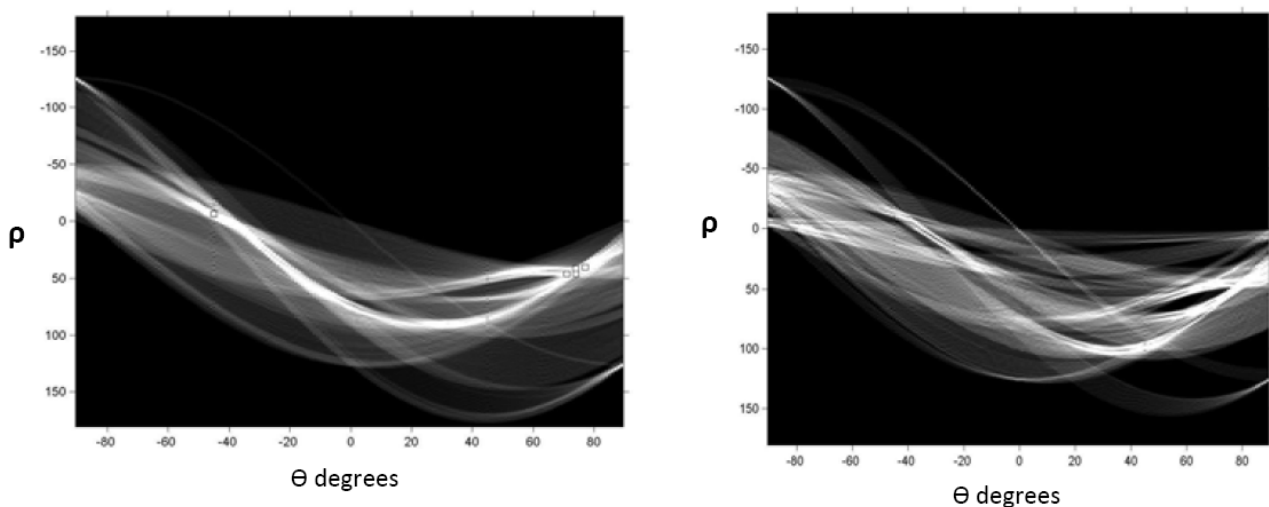


Fig.6 (a, b): Line detection on real images using the Hough transformation.

8. Conclusion and Future Work

Palm segmentation is the key step in palmprint recognition system. Segmentation of palm includes separation of palm which is in between the wrist and fingers of hand images. In this paper, a new method of palm selection and extraction of ROI is proposed. We found that the efficiency of our segmentation approach agrees with the other systems in the state of art and is better for well focused images as it is easier to find the stable corresponding lines. One could imagine the use of additional information such as skin colour, hand shape, and positions of finger creases, etc. to improve the overall accuracy of matching strategy. The other parts such as feature vector Extraction, and matching strategy of the whole system to be improved. In a word, there are many challenges for us in the future.

9. References

- [1] A.K.Jain, A.Ross, and Prabhakar, "An introduction to biometric Recognition", IEEE Trans. On Circuits and systems for Video Technology, vol. 14, pp. 4-20, Jan 2004.
- [2] D.Zhang, "Automated Biometrics: Technologies and systems", kluwer academic publishers, 2000.
- [3] Edward WONG Kie Yih, G.Sainarayanan, Ali chekima, "Palmprint Based Biometric System: A comparative Study on Discrete Cosine transform Energy, Wavelet Transform Energy and sobelCode Methods" Biomedical Soft Computing and Human Sciences, vol.14,No.1,pp 11-19,2009.
- [4] D.Zhang, W.K.Kong, J.You, M.Wong (2003),"Online Palmprint Identification", IEEE Trans. On Pattern Analysis and Machine Intelligence, Vol.25, no. 9, pp. 1041-1050.
- [5] C.L.Lin, T.C.Chuang, H.C. Fan, "palmprint identification using Hierarchical Decomposition",patter Recogn., Vol. 38, pp.2639-2652,2005.
- [6] C.C.Han, H.L.Cheng, C.L.Lin, K.C.Fan, " Personal Authetication Using palmprint Features" patter Recogn., Vol. 36, pp.371-381,2003.
- [7] Mohammad Amin Kashiha, Karim Faez, " Developing a Method for Segmenting Palmprint into Region-Of-Interest", Proceedings of Fourth International Conference on Sciences of Electronic, Technologies of Information and Telecommunications (SETIT).March 2007.
- [8] 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 2004. (ICPR 2004). Vol.4, pp. 533-536.
- [9] <http://homepages.inf.ed.ac.uk/rbf/HIPR2/hough.html>