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Original Research Article

FUSION OF PALM VEIN AND PALM PRINT FEATURES FOR PERSON IDENTIFICATION

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Abstract- Biometrics is an emerging field in security and identification. Several modalities like palm print, finger print etc have been used in biometrics. However, this paper proposes a more sophisticated method where two modalities - palm print and palm vein, are fused to give more accurate results. Gabor filter and Matched filter are used for feature extraction in palm print and

1. Introduction

Biometrics which is used for identification of individuals based on their physical or behavioral characteristics.

Biometrics has gained importance in today's world where information security is essential. Hand geometry, one of the most well-known biometrics, is implemented in many verification system with various feature extraction methods. Palm based biometric systems are gaining acceptance in low to medium security applications.

The proposed system is a verification system which utilizes palm print and palm vein features for user authentication. The feature vector used in the proposed system consists of only those features which cannot vary with small variations of the palm position.

It consists of database where all the information about the authenticated user is stored. The system extracts the features from the test image and compares it with stored information on the database.

Biometric systems based on single modalities give good results but these can be improved by combining two or more modalities.

We have chosen to combine palm print and palm vein so as to combine internal as well as external features of a palm which makes it very difficult to duplicate results.

There are drawbacks to both these modalities when used separately. Palm print can be duplicated by using impressions made in different synthetic material. Also, palm prints of laborers can be distorted due to the nature of

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their work causing problems in identification. Palm print is often taken by resting the hand on a glass plate i.e. contact is necessary which can leave traces on the glass leading to false results.

Palm vein feature extraction is difficult and hence accuracy when only palm vein is used is less as compared to when the result is fused with another modality.

Hence in the proposed system fusion of palm print and palm vein modalities is suggested.

II. Literature Survey

A. Palm based recognition systems

G.S.Badrinath and Phalguni Gupta have proposed the use of stockwell transform for palm print recognition. The method proposed is based on instant phase differentiation obtained by using stockwell transform of over-lapping circular strips. A procedure is proposed to differentiate the left palm from the right. The proposed system is tested on a large database from IIT-K,CASIA and PolyU. The correct recognition rate is 100%.

Tee Connie,Andrew Teoh et al have proposed use of palm print recognition using the several linear subspace projection techniques. Specifically, PCA(principal component analysis) FDA(Fischer discriminant analysis) and IDA(Independent Discriminant Analysis). In order to analyze the images in multi resolution multi frequency representation a wavelet transform is adopted The experimental results show that for FDA, the FAR and FRR are as low as 1.356% and 1.492 %respectively.

G.Seshikala, Dr.Umakanth Kulkarni et al have propsed palmprint recognition by using multiscale wavelet edge detection. Conventional edge detection techniques like Sobel and Canny suffer from limitations like sensitivity to noise, discriminating between edges etc. These shortcomings are overcome by using wavelet based detection where sharpness of an edge can be described with Lipschitz exponent. Efficiency of correct person recognition is almost 100%.The experiments were carried out on the PolyU standard database.

B. Palm vein based recognition systems

Wei YU-Han et al have proposed the adaptive gabor filter method for palm vein recognition. The overall aim of this work is to discuss the optimization algorithm that determines the best parameter values of a single gabor filter for palm vein recognition. Experimental results show that the proposed approach is feasible and effective in palm vein recognition. The EER for this approach is 0.6%.

Kuang Shyr-Wu et al, Jen-Chun Lee et al have proposed have proposed a method of directional filter bank and minimum directional code for palm vein detection. Directional filter bank involving diff. orientations is designed to extract vein pattern and minimum directional code is employed to encode the line based vein features in binary code. The EER for the proposed method was 0.518%. The method was applied to a large database of 7200 image for training and testing

C. Palm vein and Palm print fusion based systems

David Zhang et al have proposed a online joint palm print and palm vein verification. Here the method suggested for palm print extraction is 2-D Gabor filter with different orientations. The proposed method for palm vein extraction is matching filter which are like Gaussian shaped filter along angle Ό. This method works well for the palm vein feature extraction because the histogram of the cross-section of the palm vein is Gaussian in nature.

The fusion is done at the score level where the weights of palm print and palm vein are taken into consideration as that gives a better output. The EER of the proposed system is 0.0212% .

III. Hardware setup for image acquisition of palm vein and palm print.

A separate set up had to be made for image acquisition of palm print and palm vein due

Fig 1: The hardware setup for acquisition of palm print images.

(a)

(b)

Fig 2: (a) The position of the IR LEDs in the box (b)Position of the palm and the camera .

technical problems. The set ups have been explained in depth below:

A. *Palm print acquisition setup*

A standard cardboard was used and the inside was painted completely black to avoid reflection. The illumination inside the box was provided by LED strip stuck on the inside.A digital camera of 14MP resolution was used to capture the image of the palm.

B. *Palm vein acquisition setup*

For acquisition of palm vein images a IR light source and IR sensitive camera were needed .For this purposes 50 IR LEDs of wavelength of 850 nm were used. A standard web camera of resolution 2 MP was made IR sensitive by removing the IR filter from within. The camera is placed above the palm and the light source below the palm to obtain the palm vein images. The IR light is passed through a diffusion glass to ensure proper illumination.

IV. Database collection

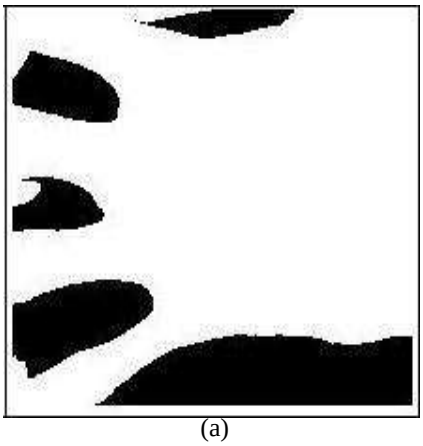
A database of 50 individuals was collected . 5 images of both palm vein and palm print were collected for every individual.

V. ROI extraction for palm vein and palm print images

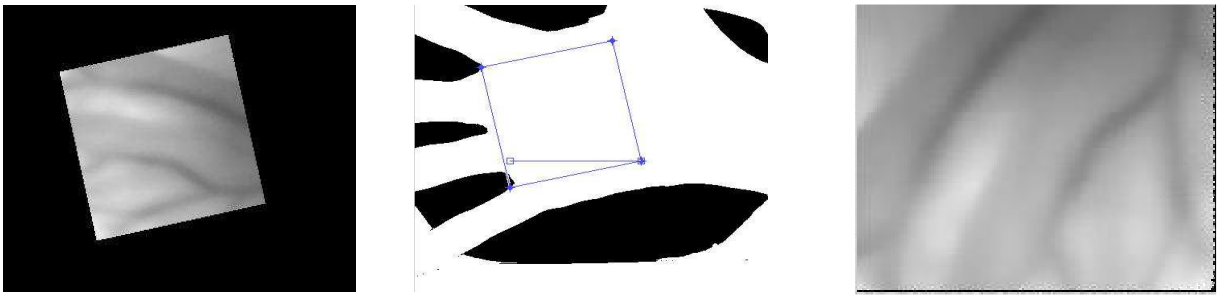
A. Algorithm for ROI extraction

The algorithm given below was used to extract the region-of-interest of both the palm vein and palm print images:

1. Read the image.
2. Even though the image appears gray it has 24 bits per pixel, so it is converted to gray scale.
3. The surroundings are eliminated from the image and image is segmented in such a way that the hand (foreground) is given pixel value 255 and background given value 0.
4. By moving a pattern mask over the image we located two webs.
5. Using two webs as vertices of a square we plotted a square on the binary image.
6. We extracted the region bounded by the square in step 5.
7. Multiplied the result of 6 with the input image to obtain the ROI.
8. Then we rotate and extract the ROI to make the matching techniques rotational invariant.



(a)

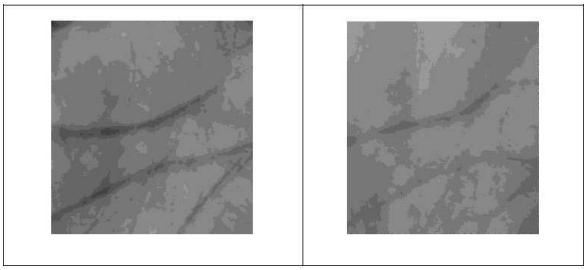


(b) (c) (d)

Fig 3:(a)Binary image obtained in step # (b)Square plotted in step 5 (c)ROI is made rotation invariant in step 7 (d) ROI extracted

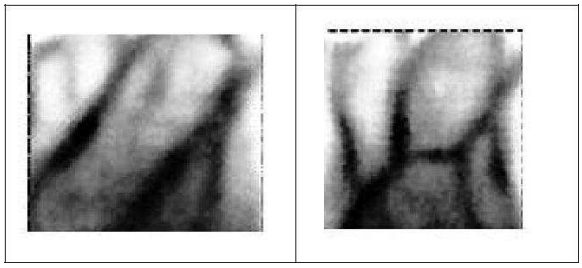
B. Experimental Results

The extracted and enhanced ROI images of palm vein and palm print are shown below.



a b

Fig 4:(a)-(b):ROI obtained from the palm print images.



a b

Fig 5:(a)-(b):ROI obtained from the palm vein images.

VI. Palm print feature extraction and matching

The palm print features can be extracted by three methods: Subspace learning, line detection and texture based coding. Of the three texture based coding is preferred in online systems due to its high level of accuracy and easy implementation.

Implementation of the oriented Gabor filter for the palm print feature extraction is ongoing.

The matching will be done by measuring the hamming distance between the obtained features map and the feature maps stored in the database.

VII. Palm vein feature extraction and matching

The cross section of the palm vein is Gaussian in nature. Due to this property, matched filers can be used for feature extraction because matched filters are Gaussian shaped filters.

Implementation of the matched filter for the palm vein feature extraction is ongoing.

The matching will be done as in case of palm print by obtaining hamming distance between feature maps.

VIII. Dynamic score level fusion

While fusion can be done at several level, like, feature level fusion ,image level fusion , score level and decision level fusion, the score level fusion reduces processing complexity and computation time. The dynamic score level fusion assigns weights to the scores of both palm vein and palm print images and the scores are then fused. The quality of palm vein images will decide the weight assigned to the palm vein image.

In case, the palm print and palm vein images are of high quality they both get weights of 0.5.However, if the quality of palm vein image is not very good, the palm print image is given higher weight.

This implementation will be carried out as soon as feature extraction of palm vein and palm print images is done.

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