
MULTIMODAL BIOMETRICS IDENTIFICATION USING FACE AND PALM-PRINT

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ABSTRACT: Biometrics is the science to measure and analyze the data of human body, features extraction from the acquired data, and comparing these features with the templates in the database. Due to many disadvantages in Unimodal biometric system, multimodal biometric systems is preferred than unimodal biometric systems. These systems are more popular and more complex than unimodal systems. In this paper, we have fused face and palm print at different levels of fusion such as sensor, feature, score and decision level. We have chosen feature extraction algorithms for face and palm print e.g LDA and LPQ. The databases from AR (for face) and PolyU (for Palm print) were considered for experiments. Experiments were conducted both under clean as well as under noisy conditions. The tool used for the evaluation purpose is MUBI. Results are also appropriately analysed

KEYWORDS: Multimodal Biometrics, Identification, Fusion, face, FKP, Matching score.

I. INTRODUCTION

Multimodal biometric systems are those which utilize more than one physiological or behavioural characteristic for enrolment, verification or identification [11-21]. A biometric system is a pattern recognition system (Figure 1). This system measures and analyzes biometrics such as fingerprints, facial patterns, eye retinas, irises, voice patterns, and hand measurements for authentication purpose. Unimodal biometric systems have limitations in terms of accuracy, enrolment rates etc. The accuracy of various recognition techniques are affected by illumination and facial expressions [6]. Biometrics became a key technology in network security.

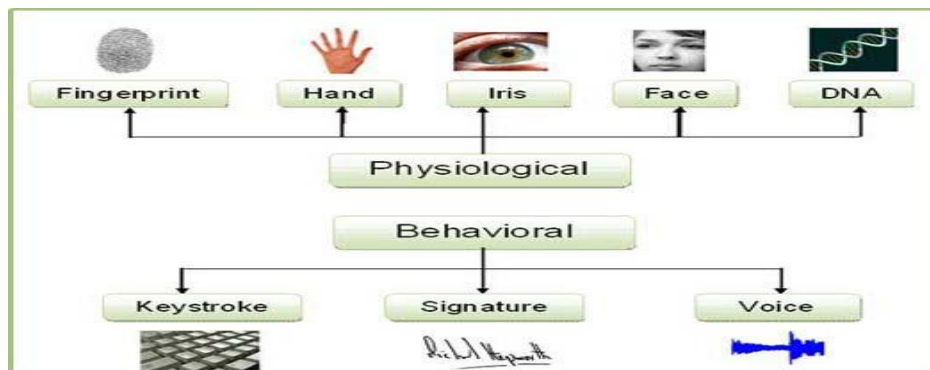


Figure 1: Factors of a biometric authentication system [1].

The two phases in a biometric system are: a) An enrolment phase b) Recognition phase i.e. verification. As shown in figure 1 the item considered such as finger print or knuckle print, is recorded using a sensor and the digital data are then available in the form of table of pixels, a digital signal, etc. The role of the enrolment module is to create a model of a person by reference to one or more copies of the attribute considered. The verification unit enables a result to be taken. In identification mode, the biometric system compares the data with the various models in the data base and selects the model corresponding most closely to the data. In the verification mode, the biometric system will compare the measured signal with one of the data base template and then authorize the person or reject him [10]. This may be a very difficult task.

II. MODULES OF BIOMETRIC SYSTEM

1. **Sensor module:** This module captures the biometric data of an individual. An example of sensor module is fingerprint sensor; it captures the ridge and valley structure of the finger of the user. (Figure 2)

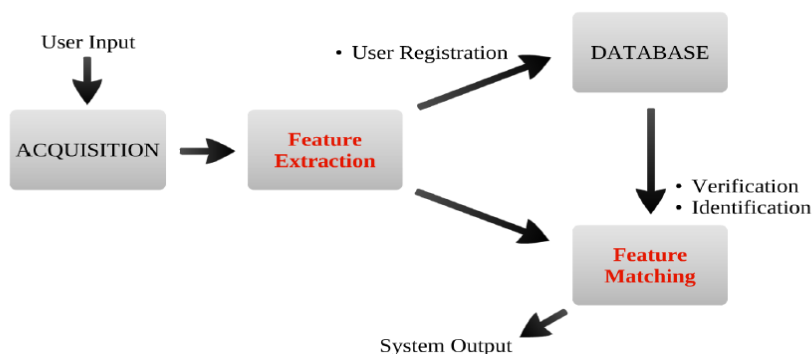


Figure 2: Architecture of biometric system

2. Feature extraction: In this, captured biometric data is processed and features are extracted.
3. Matcher module: In this module, features are compared against the templates from the database.
4. System database module: In this module, templates of the users are stored. These templates in database are updated over time.

III. FACIAL AND PAMPRINT RECOGNISATION

This system utilizes more than one physiological or behavioural characteristic for enrolment and identification. Combining different modalities shows improvement in recognition rate.



Figure 3: Different samples of palm-prints [5].

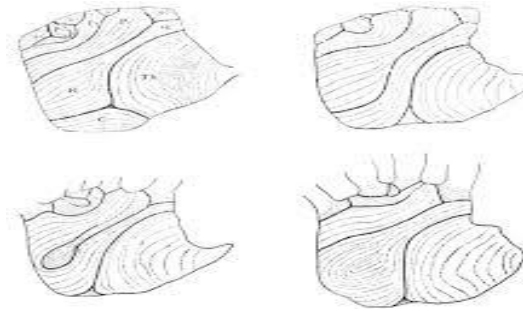


Figure 4: Lower Palm Prints of different Human being.

Facial recognition is one of the most common biometric methods of identification. Here face is detected from a person image and then features are extracted from the face image [2-3]. Palm-print refers to an image acquired of the palm region of the hand. It can be either an online image (i.e. taken by a scanner or CCD) or offline image where the image is taken with ink and paper [4], [5]. After capturing all images of the palm-print, the next step is to binary conversion the images (Figure 3 and Figure 4).

IV. PROPOSED MODEL

Gabor wavelets demonstrate two desirable characteristic: spatial locality and orientation selectivity [8]. Existing system: Initially unimodal biometrics systems were depending on a single source such as a single fingerprint or knuckle print for authentication [9]. Seven factors to be used to assess the suitability of any trait for use in biometric authentication. Uni-biometric will not meet all the requirements of every possible application. Since it has several problems, multimodal biometrics was introduced. Proposed system: Here we are providing new method for fusion of palm-print and face images. Here preprocess will be done for input images. Then feature extraction is executed for pre-processed images by bifurcation extraction and Gabor feature. Then bifurcation feature will be found for palm-print images and Gabor feature for face images. Then score will be finding for input images. The input images for palm-print and face will be fused.

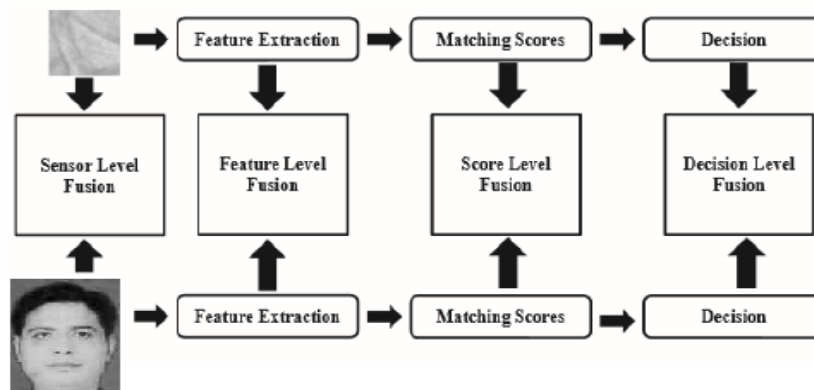


Figure 5: Fusion of face and palm-print

Face and palm-print fusion at different levels: Following Figure 5 shows the proposed block diagram of the proposed multimodal biometric system. Fusion can be performed as: (i) Fusion prior to matching (ii) Fusion after the matching. In fusion prior to matching, the several information can take place either at sensor level or at the feature level [9]. On the other hand, while combining the information after the matching, fusion can be performed at score level or decision level. In our multimodal biometric fusion system, we performed the fusion at four levels. We have used wavelets based image fusion scheme for

the fusion of palm-print and face images at sensor level. At feature level we used different normalization techniques namely Min-Max, Z-Score and Hyperbolic tangent. We used fusion rules, such as sum, max and min rule, to combine the two matching scores at score level, at decision level we adopted logical AND and OR to combine the output decisions by different matchers. The proposed algorithm for authentication based on fusion of palm and face print identifiers have been shown in figure 5.

V. RESULT AND ANALYSIS

After normalization, the fusion rules like simple sum, weighted sum, minimum score, maximum score or product rule can be used to find a unique similarity measure by combining the scores. To do this, we fuse face with palm-print.

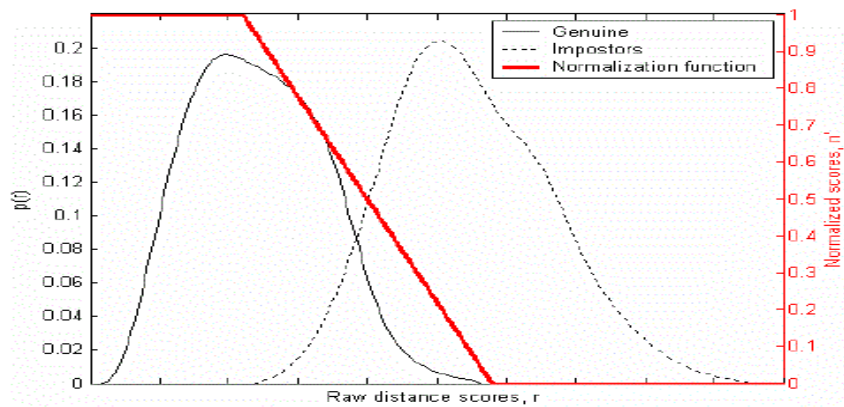


Figure6: Genuine and imposter score distribution.

The genuine and imposter score distribution is shown in figure 4. Based on the DCT coefficients, the proposed feature extraction method is compared with several existing local feature extraction techniques as shown in Figure 6 and Figure 7. The proposed method achieved the EER of 0.6% and the highest recognition rate of 97% using 30 DCT coefficients.

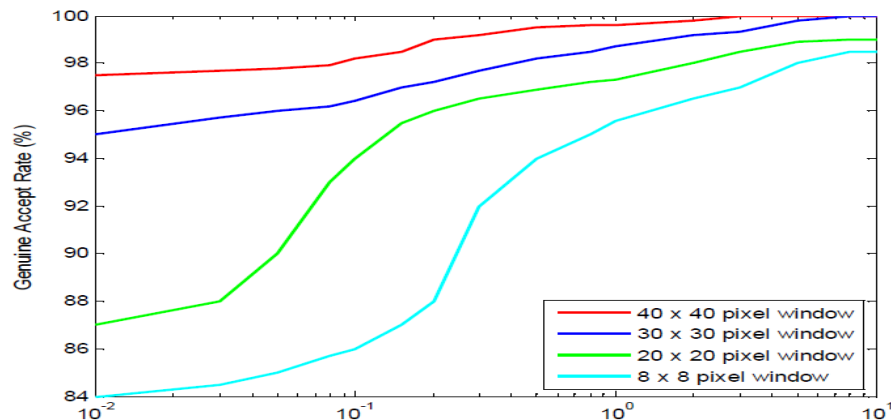


Figure 7: Analysis of the effect of different patch size on genuine acceptance rates

The three other local feature extraction methods used in the comparison are the DCTmod2, DCT modified and DCT overlap, which are used to extract facial features and then modeled as feature distributions using GMM. All of these methods use sub-block windows to extract local DCT coefficients

from the original image without implementing multi resolution analysis which is a powerful tool for texture analysis.

By comparing the method proposed here that use multi resolution analysis based on Gabor transforms, more information can be gain when using Gabor analysis on each patch window. By using Gabor analysis on each patch window, it is found that the use of window overlapping can be avoided, which is one of the steps that must be conducted in existing local features methods. These methods compute the feature vector based on a 50% window overlap in the small 8x8 pixels windows, and also suggest, that 8x8 patch windows give the best local feature representation that can be used to train using GMM and HMM.(Figure 8)

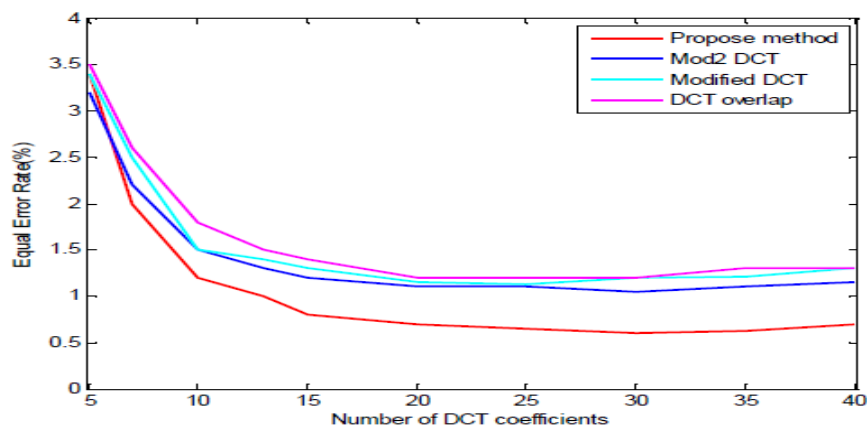


Figure8: Comparison of the proposed method with three existing local feature extraction method based on DCT transform.

In the proposed method, it was found that by using multi resolution analysis local features can be extracted in larger sub block windows producing feature vectors that are independent of each other due to the non-overlapping of sub windows.

VI. CONCLUSION

In this paper, we propose a framework for evaluating the performance of multimodal biometric system. Here we have considered face and palmprint data sets with several fusion techniques. This paper shows fusion of face and palm print at different levels of fusion to determine best technique of fusion for face and palm print data set. On every level of fusion, we have chosen the optimal fusion strategy for these two modalities. According to us, these strategies will help all of us to know the appropriate level of fusion for face and palm print modalities. The results are evaluated with the help of MUBI tool which is available freely on the internet. Different graphs are generated to analyze the results. The proposed method achieved the EER of 0.6% and the highest recognition rate of 97% using 30 DCT coefficients. Graphs shows that the fusion framework is more effective than the previous works. Also it can be applicable on large databases to attain fruitful results.

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