Palm and Fingerprint Based Multimodal Biometric Technique

Mohd. Saif Wajid, Gaurav Kumar Srivastava, Neeraj Baishwar, Akanksha Singh, Pooja Verma

Abstract: ***The biometric based personal authentication method is a technique used for computing and analyzing the physical and/or behavioral characteristics of the person. The in future the biometric system may provide an alternative of digital solution to the ID cards, passwords, driving licenses, passports, etc. Nowadays the researcher and scientist are given interest on multimodal biometric because multimodal biometric gives more security and reliability over the single biometric technique. In this paper, we proposed a multimodal biometric technique based one palm and fingerprint. The IITD palmprint and UPEK fingerprint database used for the experimental evolution.***

Keywords: Palmprint, Fingerprint, Multimodal, Biometric.

I. INTRODUCTION

The personal verification system based on biometric is a method used for computing physical or social characteristics of the person. Biometrics system uses behavioral and physiological data for validation. In Biometrics technology, palmprint, fingerprint, face, iris, ear etc. are classified as physiological characteristics, while signature, keystroke, gait, etc. are classified as behavioral characteristics. The biometric system can be a substitute digital solution to passwords, ID cards, driving licenses, passports, etc. The Biometric schemes have some limitations in terms of acceptability, accuracy, universality and distinctiveness.

Generic Structure of the Biometric: In any biometric recognition system there are four main modules those are given below [9]

(i) Sensor: used for taking samples.

(ii) Feature extraction module: this is a main module in any biometrics system. This module extracts the some salient features from biometric traits which are taken by sensor.

(iii) Database for templates: The database need for storing the features extracted by the 2nd module.

(iv) Feature matcher module: This module matches the features taken from the biometric samples with the features stored in database which are occupied through the registration process.

Nowadays biometric methods for joining two or more biometric have growing responsiveness of researchers. The main aim of joining two or more biometric method is for enhancing the correctness of a safety system. The Grouping of two or more biometric system is called as “biometric fusion”. In this paper, we proposed a multimodal technique and used by palmprint and fingerprint. Biometric verification is performed by verifying the template by matching with the previously stored template in the database. It measures the difference between the inputs to the previously stored templates from the database and calculates some matching scores. It then makes a decision on the basis of a predefined threshold value [7].

The palmprint also has been used for future forecast of person being. Since, from the last decade the palmprint also has been used for biometric for individual identification. The palmprint contains several lines of different sizes and different directions. These lines can identified by any edge detecting algorithms like as Sobel, Log, Roberts, Prewitt, Zero-cross, and Canny [11].

A fingerprint is a pattern of ridges, furrows and minutiae, which are extracted using inked impression on a paper or sensors An impression left by human finger called as fingerprint. The recovery of these fingerprints from a crime scene is an important method of forensic science [12]. Humidity or grease on a finger result in fingerprints on hard surfaces like as glass or any metal. Careful impresses of whole fingerprints can be gotten by ink or other substances transferred from the peaks of friction ridges on the skin to a smooth surface such as paper. Records of fingerprint normally consists of impressions from the pad on the last joint of fingers and thumbs, though fingerprint cards also typically record portions of lower joint areas of the fingers.

Multimodal Biometric: The multimodal biometrics systems can take input from either single or multiple sensors. It calculates two or more dissimilar traits of biometric property. The fusion of that information of biometric characters can take place in any of the levels; those are sensor level fusion, feature level fusion, score level fusion, and decision level fusion.

II. LITRATURE REVIEW

Satya Bhushan et al. proposed paper performance analysis of various fusion methods in multimodal biometric [9]. In this paper they had shown the all fusion levels in multimodal biometric. They show there are four type of fusion level which are sensor level, feature level, score level, and result level. They listed all the author work on multimodal biometric with the accuracy and which type of fusion used in the paper.

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Nageshkumar et al. [5] proposed a multimodal biometric system by using face and palmprint. Firstly they captured the image of palmprint and face image by a camera. For the feature extraction from the face image and palmprint image they used canonical form which are based on PCA approach . Score level fusion used in the proposed system. In proposed method they achieved 97.00% accuracy.

Vijilious et al. [15] proposed an approach for extracting feature in palmprint by using non-subsampled contourlet Transform and Orthogonal Moments. They used pre-processing stage and then they segment Region of Interest (ROI) from hand image. Then applied feature extracted process in segmented hand image. The CASIA Palmprint database used for their experimental evaluation and they achieved accuracy =95.2%.

Satya verma et al proposed a Palmprint verification system based on Gabor filter and PCA approach [14]. Firstly they applied preprocessing in segmented palm print images. The preprocessing stage consists of binarization, contour analysis and edge detection. Then they used 2D Gabor filter more over they used PCA approach. The IITD Palmprint database used for the experiment and they archived 99.5% TSR and 0.50% EER.

Xuan et al. [16] proposed a 2D-Gabor wavelet based palmprint verification on contact palmprint. The pulse-coupled neural network used for extraction of feature and classification done by support vector machine. In experiment 1 they achieved 97.37% Correct Classification Percentage (CCP) in experiment 2 CCP 95.40%. Average 1.44 seconds takes for experiment.

III. PROPOSED METHOD

IITD palmprint database comprises of right and left hand color images of the 230 people and their age group are 14–56 years [2]. Six palmprint images of both hands have been taken from each individual. The contact less CMOS camera used for capturing thosed images and images are in JPG format. The segmented image of right and left hand images are also given in database that is stored 150X150 dimension at gray scale in BMP format. These segmented palmprint images are used for experiment. Figure 1(A) shows some sample images from IIT Delhi Touchless palmprint database and figure1 (B) shows segmented ROI respectively.

Figure 1: Palm images from IITD Touchless palmprint database (A) Hand image (B) segmented ROI

Gabor Filter and Local Binary Pattern: The Gabor filter is a very useful tool in the area of pattern recognition and computer vision. The Gabor filter is a famous isotropic filter. There are many advantages such as variation of rotation, translation and illumination, which comes from capturing device. It provides more flexibility in the definition of function shape, because of more general set of degree of freedom. Local Binary Pattern is used as a visual descriptor in pattern recognition and computer vision as a texture descriptor. Initially, Local Binary Pattern introduced by the Timo Ojala et al. [3, 6] has been used as a main texture analyzer for analysis of images mainly for its representation of discriminative information. The LBP successfully works in demographic classification, face recognition, object identification etc [10].

Figure2: Sample Fingerprint images UPEK Fingerprint Database

A fingerprint is a pattern of ridges and valleys. The dark area of the fingerprint is known as ridges and white areas that exist between the ridges called valleys [1]. In fingerprint minutiae denotes to specific plot points. UPEK Fingerprint Database used for verification[13]. Fingerprint recognition process based on minutiae consists of the following steps:

1. Preprocessing and Thinning: The captured fingerprint image may be in gray scale of in color. In the binarization step fingerprint image is converted into binary image [8]. In this step the fingerprint image is converted into grayscale, and then to binary data. The image enhancement also include in the preprocessing stage. During the preprocessing the image is normalized and applied filters (Gabor filter) for recover the ridge structures and remove the noise. Binarized image is thinned to reduce the thickness of all ridges lines to one pixel width. This step will help to extract minutiae points, as thinning does not change the location of the minutiae points compared to the original fingerprint

Minutiae Extraction and Minutiae Matching: This step develops the minutiae locations and angles in the fingerprint. Crossing number (Cn) is used to identify the minutiae points, which is defined as half of the sum of differences between intensity values of two adjacent pixels. If crossing number is 1, 2, 3 or greater, then the minutiae points are considered as ending, normal ridge, bifurcation respectively

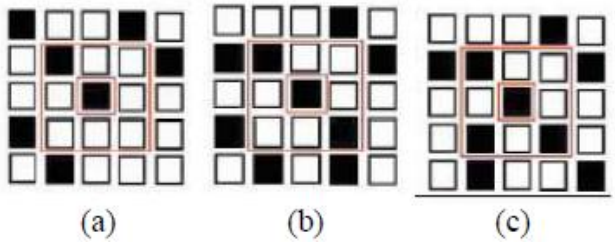

Figure : Minutiae Extraction, (a) Ending minutiae, Cn=1;(b) Normal ridge pixel, Cn=2; (c) Bifurcation minutiae, Cn=3.

FAR (False Acceptance Rate), FRR (False Rejection Rate), TSR (Total Success Rate) and EER (Equal Error Rate) has been used for evaluating the proposed method for verification. In any biometric scheme, the FAR determines the rate of invalid persons who are incorrectly accepted,

while FRR determine the total rejection rate for the right persons. The TSR (Total Success Rate) determine the correctness of any biometric system while determine total error in any biometric system.

FRR = (NFR / NEA) X100 %
FAR = (NFA/NIA) X100 %
TSR = (1 – (FAR+FRR)/TNA) X100 %
Where,
NFR= Number of false rejection,
NEA=Number of Enrollee Attempts,
NFA=Number of False Acceptance,
NIA=Number of Impostor Attempts,
TNA=Total Number of Attempts.

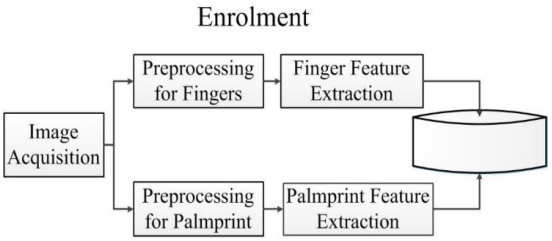

Figure 3: enrolment process of proposed system

In above figure 3 represent the complete structure of the enrolment process of the proposed system. Firstly we capture the image by using any image sensor, and then apply preprocessing in both palm image and finger image. Moreover we apply feature extraction n approach in preprocessed image.

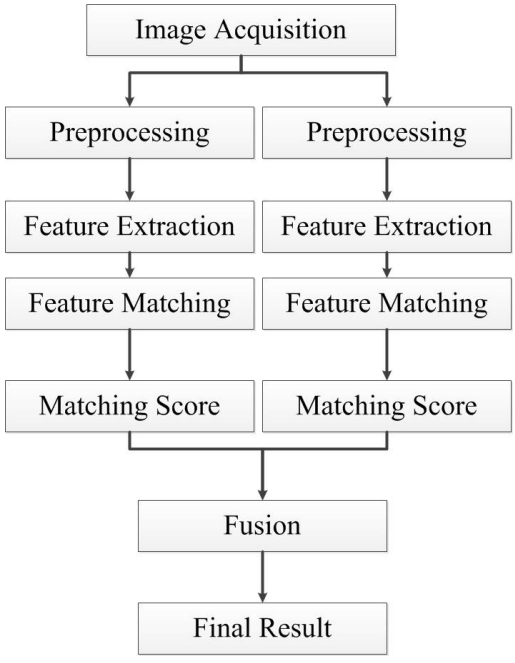

Figure 4: Verification Process of Proposed system

The above figure 4 represents the complete structure of the verification process of the proposed system. The first stage is image acquisition, in this stage we capture the image by using any image sensor, and then apply preprocessing in both palm image and finger image. Moreover we apply feature extraction n approach in preprocessed image, and then compare with the features and calculating the matching score. Then combine the matching score and get the final result.

IV. EXPERIMENT AND RESULT

Table 1: Results in TSR, FAR, and FRR in Palmprint, Fingerprint, and with the fusion of Palmprint and Fingerprint

Sr. No.		FAR	FRR	TSR
1	IIT Delhi Palmprint database	1.5%	2.5%	99.00%
2	UPEK Fingerprint Database	2.5%	2.0%	98.50%
3	Fusion of Palmprint and Fingerprint	2.00%	2.25%	98.75%

The above table 1 shows the experiment results of the proposed model in FAR, FRR, TSR, and EER by using UPEK Fingerprint database and IIT Delhi Touchless palmprint database. The proposed model has achieved highest FAR=1.5%, FRR=2.5% and TSR=99.00% at IIT Delhi Touchless palmprint database, and FAR=2.5%, FRR=2.0% and TSR=98.50% at the UPEK Fingerprint database separately.

The score level fusion used in the proposed system and then create a final score. The final score used for verification, in the proposed system we achieved FAR=2.0%, FRR=2.25% and TSR=98.75%. The experiment of the proposed model is carried out by using MATLAB R2015a on the laptop with Intel® core i3-2310 2.1 GHz processor and 4 GB RAM. The proposed method takes 0.88 seconds for palmprint verification, 0.95 second for fingerprint verification, and 1.90 seconds for the complete multimodal verification. The proposed system is quite fast compared to other techniques. The experiment results confirm that the proposed model is more suitable for real-time palmprint verification than other models.

V. CONCLUSION

A biometric personal authentication method is a technique used for computing and analyzing the physical and/or behavioural characteristics of the person. Nowadays the researcher and scientist are given an interest in multimodal biometric because multimodal biometric gives more security and reliability over the single biometric technique. The IITD touchless palmprint and UPEK fingerprint database used for the experimental evolution. The proposed system achieved FAR=2.0%, FRR=2.25% and TSR=98.75%, and a total of 1.90 seconds takes for matching.

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