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Highly Secured Bio-Metric Authentication Model with Palm Print Identification

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ABSTRACT
For securing personal identifications and highly secure identification problems, biometric technologies will provide higher security with improved accuracy. This has become an emerging technology in recent years due to the transaction frauds, security breaches and personal identification etc. The beauty of biometric technology is it provides a unique code for each person and it can't be copied or forged by others. To overcome the draw backs of finger print identification systems, here in this paper we proposed a palm print based personal identification system, which is a most promising and emerging research area in biometric identification systems due to its uniqueness, scalability, faster execution speed and large area for extracting the features. It provides higher security over finger print biometric systems with its rich features like wrinkles, continuous ridges, principal lines, minutiae points, and singular points. The main aim of proposed palm print identification system is to implement a system with higher accuracy and increased speed in identifying the palm prints of several users. Here, in this we presented a highly secured palm print identification system with extraction of region of interest (ROI) with morphological operation there by applying un-decimated bi-orthogonal wavelet (UDBW) transform to extract the low level features of registered palm prints to calculate its feature vectors (FV) then after the comparison is done by measuring the distance between registered palm feature vector and testing palm print feature vector. Simulation results show that the proposed biometric identification system provides more accuracy and reliable recognition rate.

Index terms: personal identification, finger print recognition, face recognition, IRIS recognition, ROI, Hybrid wavelet and recognition rate

I. INTRODUCTION

Identifying our selves is omnipresent in daily lives at many places such as accessing bank accounts, cash draw from ATM, computer logging, entering into a protecting sites and so on. Formally, one can access their self by physically carrying the passports, remembering pass words, access cards, keys; personal identification numbers (PINs) and secret codes. Regrettably, all the mentioned identifications can be lost, copied, forgotten or even stolen. Such loopholes or deficiencies cause many serious issues to all concerned people. For example, all over world the hackers often interrupt computer networks; credit card fraud is approximated at billion dollars per annum. Forgotten passwords cost will be very high, Therefore, we need a solution for all the above deficiencies in conventional personal identification techniques which is more reliable, robust and foolproof personal identification solution that could verify that physically he/she claims to be. A biometric is a method that recognizes the identity of a person or human being automatically by doing the statistical analysis of biological characteristics. The measurable characteristics can be physical, such as finger, eye, face or palm. Common modalities being used as biometric personal identification systems are face recognition and finger print identification. But authentication with face is still a problem due to its illumination invariance, occlusion effects and pose variations where as finger print does not have a good psychological effect on the user because of it wide use in investigations of crime. Hence, in future if any biometric system that should get succeeds have the attributes like accuracy, easy acquisition, richness, uniqueness, reliability and all above user acceptance. Palm print identification system is a new modality of biometric system which will overcome all the deficiencies occur with conventional personal identification systems such as finger print, face recognition and iris recognition. It not only has the unique information but also has far more amount of details such as principal lines, creases and wrinkles. Moreover, it has rich features to analyze more effectively and to improve the security. It has entered into a biometric family and become most promising personal identification system with higher security and improved accuracy due to its easy acquisition, reliability and high user acceptance. There are many researchers in the literature, who have developed palm print based personal identification systems using edge detection, region of interest

(ROI), discrete cosine transform (DCT), short time fourier transform (STFT), principle component analysis (PCA) and independent component analysis (ICA). All the above algorithms have suffered from lack of features extraction and time complexity. Here, in this we presented a highly secured palm print identification system with extraction of region of interest there by applying hybrid wavelet to extract the low level features of registered palm prints to calculate its feature vectors then after the comparison is done by measuring the distance between registered palm feature vector and testing palm print feature vector.

II. EXISTING METHODS

In the literature, there are many researchers who have developed biometric authentication modules based on various spatial and transformation domain techniques. D. Huang, W. Jia, and D. Zhang[1] proposed a novel algorithm for the automatic classification of low-resolution palmprints. First the principal lines of the palm are defined using their position and thickness. Principal lines are defined and characterized by their position and thickness. A set of directional line detectors is devised for principal line extraction. By using these detectors, the potential line initials of the principal lines are extracted and then, based on the extracted potential line initials, the principal lines are extracted in their entirety using a recursive process. The local information about the extracted part of the principal line is used to decide a ROI and then a suitable line detector is chosen to extract the next part of the principal line in this ROI. After extracting the principal lines, some rules are presented for palmprint classification. A. Kong and D. Zhang [2] have presented a novel feature extraction method, the Competitive Coding Scheme for palmprint identification. This scheme extracts the orientation information from the palm lines and stores it in the Competitive Code. An angular match with an effective implementation is developed for comparing Competitive Codes. Total execution time for verification is about 1s, which is fast enough for real-time applications. The proposed coding scheme has been evaluated using a database with 7,752 palmprint images from 386 different palms. For verification, the proposed method can operate at a high genuine acceptance rate of 98.4% and a low false acceptance rate of 3*10-6. Dai and Zhou [3] introduces high resolution approach for palmprint recognition with multiple features extraction. Features like minutiae, density, orientation, and principal lines are taken for feature extraction. For orientation estimation the DFT and Radon-Transform-Based Orientation Estimation are used. For minutiae extraction Gabor filter is used for ridges enhancement according to the local ridge direction and density. Density map is calculated by using the composite algorithm, Gabor filter, Hough transform. And to extract the principal line features Hough transform is applied. SVM is used as the fusion method for the verification system and the proposed heuristic rule for the identification system. Jiaa, Huanga and Zhang [4] and [5] have proposed palmprint verification based on robust line orientation code. Modified finite Radon transform has been used for feature extraction, which extracts orientation feature. For matching of test image with a training image the line matching technique has been used which is based on pixel-to-area algorithm. Zhang, Kong, You and Wong [6] have proposed Online Palmprint Identification. The proposed system takes online palmprints, and uses low resolution images. Low pass filter and boundary tracking algorithm is used in preprocessing phase. Circular Gabor filter used for feature extraction and 2-D Gabor phase coding is used for feature representation. A normalized hamming distance is applied for matching. J. You, W. Kong, D. Zhang, and K. Cheung[7] proposed a dynamic selection scheme by introducing global texture feature measurement and the detection of local interesting points. Our comparative study of palmprint feature extraction shows that palmprint patterns can be well described by textures, and the texture energy measurement possesses a large variance between different classes while retaining high compactness within the class. The coarse-level classification by global texture features is effective and essential to reduce the number of samples for further processing at fine level. The guided searching for the best matching based on interesting points improves the system efficiency further. W. Li, J. You, and D. Zhang[8], have proposed an effective indexing and searching scheme for an image database to facilitate fast retrieval when the size of a palmprint database is large. There are three key issues to be considered: feature extraction, indexing, and matching. In general, in an image database, the extracted features are often associated to the original images as indices. A search for the best matching is conducted in a layered fashion, where one feature is first selected to lead the search by reducing the set of candidates. Then other features are used to reduce the candidate set further. Such a process will be repeated until the final output is determined based on the given matching criteria. The selection of features plays an important role for efficient search. An effective feature selection scheme should exclude the most impossible candidates, compare easily, require small size of space for storage. Prasad, Govindan and Sathidevi[9], have proposed Palmprint

Authentication Using Fusion of Wavelet Based Representations. Features extracted are Texture feature and line features. In proposed system pre-processing includes low pass filtering, segmentation, location of invariant points, and alignment and extraction of ROI. OWE used for feature extraction. The match scores are generated for texture and line features individually and in combined modes. Weighted sum rule and product rule is used for score level matching. Cappelli, Ferrara, and Maio[9] proposed high resolution palmprint recognition system which is based on minutiae extraction. Pre-processing is formed by segmentation of an image from its background. To enhance the quality of image, local frequencies and local orientations are estimated. Local orientation is estimated using fingerprint orientation extraction approach and local frequencies are estimated by counting the number of pixels between two consecutive peaks of gray level along the direction normal to local ridge orientation. Minutiae feature is extracted in feature extraction phase. To extract the minutiae features contextual filtering with Gabor filters approach is applied. Minutiae cylinder code has been used for matching the minutiae features.A. Gyaourova and A. Ross[10] have proposed an indexing technique that can either employ the biometric matcher that is already present in the biometric system or use another independent matcher. Index codes are generated for each modality using the corresponding matcher. During retrieval, the index code of the probe is compared against those in the gallery using a similarity measure to retrieve a list of candidate identities for biometric matching. The proposed indexing technique on a chimeric multimodal database resulted in a reduction of the search space by an average of 84% at a 100% hit rate. The main factor for the amount of speedup during identification was the penetration rate of the indexing.

To overcome all the drawbacks of above works developed by many authors, here we supposed to introduce a highly secured biometric authentication system with palm print using UDBW transform and Morphological ROI extraction.

III. PROPOSED METHOD

Here in this section, we described the proposed palm print authentication model using hybrid process and UDBWtransform. Fig shows that the proposed model for palm print authentication, in which we had three modules:

a. Registration process
b. Testing and
c. Palm matching

3.1. Registration

In this module input palm image will be registered by applying region of interest with morphological operation there by calculate the distance transform and then extracting the low level features using 3-level UDBW transform. After getting the UDBW coefficients, statistical computation will be done by taking the mean and variance of the decomposed coefficients. Then all the statistics will be stored in a vector to make a train feature vector.

3.1.1. Morphological Operation

Binary images may contain numerous imperfections. In particular, the binary regions produced by simple thresholding are distorted by noise and texture. Morphological image processing pursues the goals of removing these imperfections by accounting for the form and structure of the image.

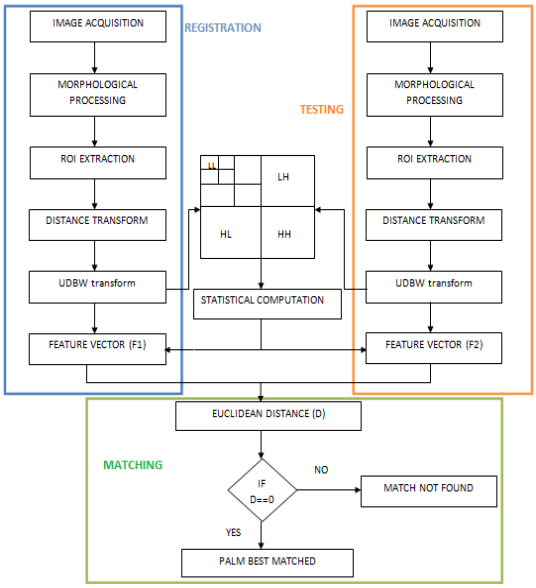


Fig1. Flow chart of proposed palm print authentication system

3.1.2. ROI extraction

Region of interest is a selected samples subset within a dataset distinguished for a particular purpose.This can be used in many applications such as medical imaging, the tumor boundaries may be defined on an MR or CT image for measuring of its size. The endocardial border may be defined on an image, perhaps during different phases of the cardiac cycle, for example end-systole and end-diastole, for the purpose of assessing cardiac function. In geographical information systems (GIS), a ROI can be taken literally as a polygonal selection from a 2D map. In computer vision and optical character recognition, the ROI defines the borders of an object under consideration.

3.1.3. Distance Transform

The distance transform is an operator which can only be applied to binary images. It results in a gray level image which looks like same as input image, except that the gray level intensities of points inside foreground regions are changed to show the distance to the closest boundary from each point.

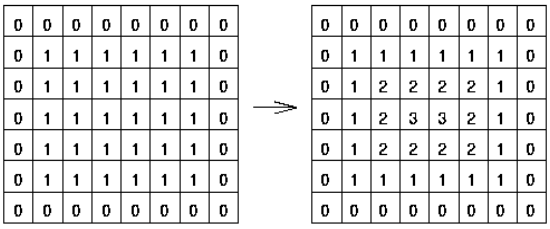


Fig2. Example of distance transform with chessboard metric

3.1.4. UDBW Transform

Un-decimated biorthogonal transform is well used for multi resolution analysis due to its multi scaling functionality i.e., two scaling functions to generate wavelet filter banks for decomposition and reconstruction separately. It will give more effective decomposition coefficients due to its multi scaling property.

In the case of orthogonal, we have one hierarchy of approximation spaces $V_{j-1} \subset V_j \subset V_{j+1}$ and an orthogonal decomposition

$V_{j+1} = V_j \oplus W_j$ (1)

which leads us to use two filter sequences h_n and g_n for decomposition and reconstruction. Hence, we need to construct two different wavelet functions and two different scaling functions.

Let$f_k, g_k \in H. if \langle f_j, g_k \rangle = \delta_{jk}$ Then we will say that the two sequences are biorthogonal.

Now, our aim is to build two sets of wavelets

$\psi_{j,k} = 2^{\frac{j}{2}}\psi(2^j x - k)$ (2)

$\tilde{\psi}_{j,k} = 2^{\frac{j}{2}}\psi 2^j x - k$ (3)

To do so, we need four filters$g, h, \tilde{g}, \tilde{h}$ i.e., two sequences to be act as decomposition sequences and two sequences as reconstruction sequences. For example, if $c_n^1$is a data set, it will be decomposed as follows:

$c_n^0 = \sum_k h_{2n-k} c_k^1$ (4)

$d_n^0 = \sum_k g_{2n-k} c_k^1$ (5)

And the reconstruction is given by

$c_l^1 = \sum_n \tilde{h}_{2n-l} c_n^0 + \tilde{g}_{2n-l} d_n^0$ (6)

We can achieve perfect reconstruction by following some conditions given below:

$g_n = (-1)^{n+1}\tilde{h}_{-n}, \tilde{g}_n = (-1)^{n+1} h_n$

$$\sum_n h_m \tilde{h}_{n+2k} = \delta_{k0}$$

Now consider that $\phi(x)$and $\tilde{\phi}(x)$ are two scaling function with their own hierarchy of approximation spaces, then we will generate function of wavelet in a method of analogous to the orthogonal case. We now define the scaling function as follows:

$\phi(x) = \sum_n \sqrt{2} \sum_n h_n \phi(2x - n)$ (7)

$\tilde{\phi}(x) = \sqrt{2} \sum_n \tilde{h}_n \phi(2x - n)$ (8)

So, finally the bi-orthogonal wavelet functions can be defined as follows:

$\psi(x) = \sqrt{2} \sum_n g_n \phi(2x - n)$ (9)

$\tilde{\psi}(x) = \sqrt{2} \sum_n \tilde{g}_{n+1} \tilde{\phi}(2x - n)$ (10)

3.2. Testing

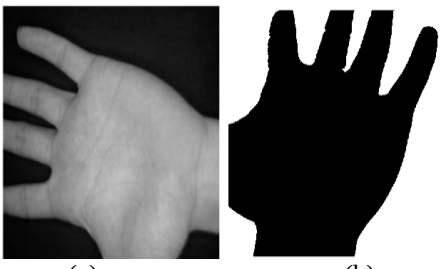
The second module in the proposed system is testing process which includes that the database palm image will be selected for testing with the registered palm image by applying morphological processing; ROI extraction, distance transform and UDBW transform there by calculating the statistics to get the test feature vector.

3.3. Matching Process

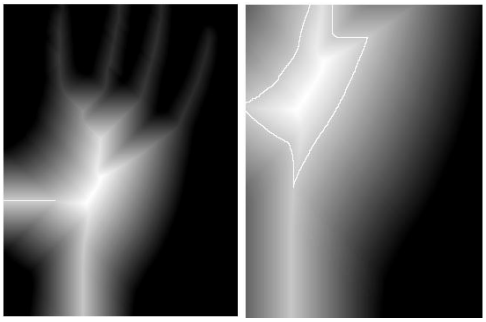
In this step, Euclidean distance will be calculated between both the feature vectors i.e., train and test to obtain the most matched image that is stored in database to found that whether authorized person's identification is available or not. If the distance is zero then the person will be identified otherwise it displays that the match not found.

IV. SIMULATION RESULTS

Experimental results have been done in MATLAB 2014a version with various palm images by using proposed palm print identification model with high security. We achieved 100% accuracy and more efficiency with the proposed model. Fig1 shows that the original palm image for registration process described in section 3.1, 3 (a) shows the original palm image, 3(b) shows it's binary image with morphing, 3(c) shows that the distance transformed image of a binary image and finally 3 (d) is a registered palm print for authenticating a person for authorization into a particular task.



(a) (b)



(c) (d)

Fig3. (a) original palm image for registration (b) morphed image (c) distance transformed image and (d) registered palm image

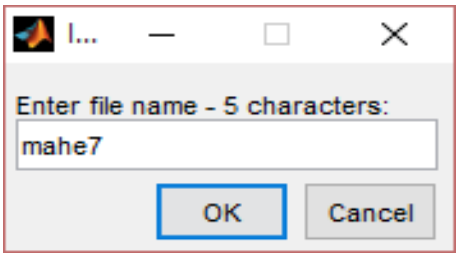


Fig4. Message box for saving the registered palm filename with mahe7

Fig5. distance transform of a test image

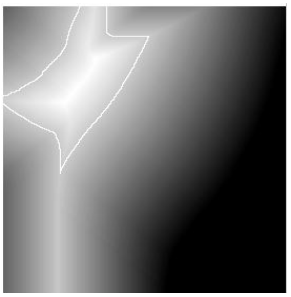


Fig6. Registered palm print of a test image

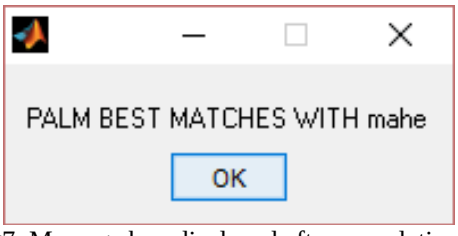
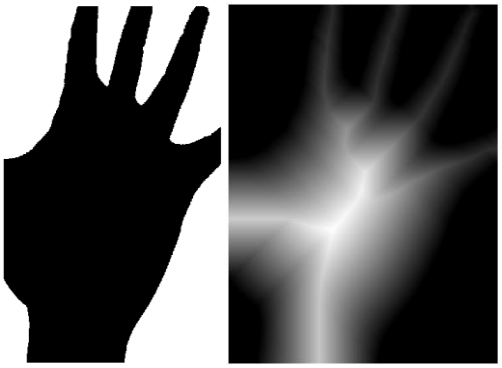
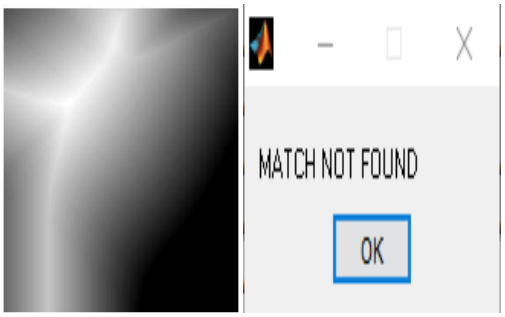


Fig7. Message box displayed after completion of test and matching process

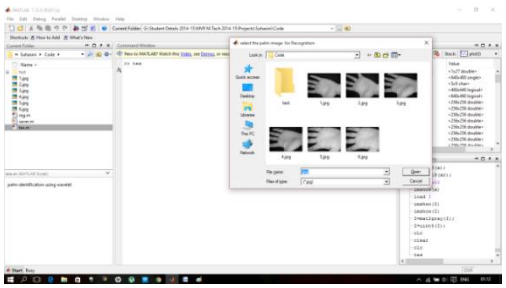


(a) (b)

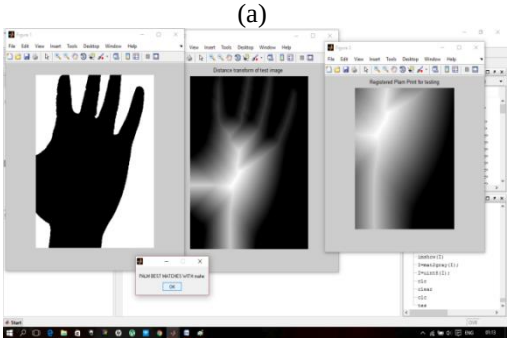


(c) (d)

Fig.8un saved file from data base (a) binary image (b) distance transform (c) registered palm print and (d) message box after testing with data base files



(a)



(b)

Fig.9 screen shots of test image 4.jpg which has been saved with a specific file name in database

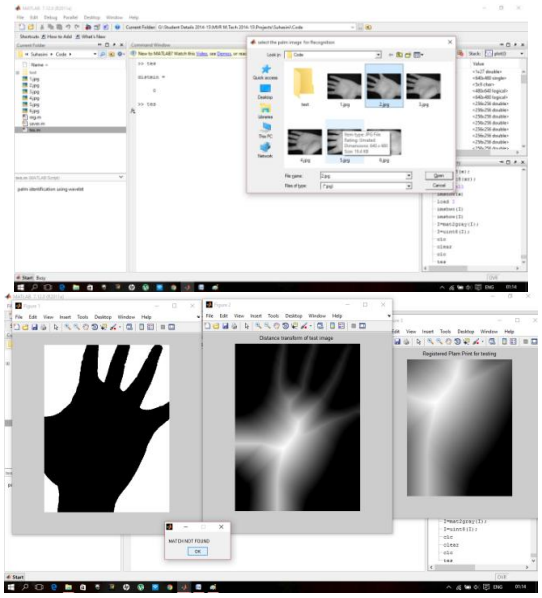


Fig.10 screen shots of test image 2.jpg which has not saved with a specific file name

V. CONCLUSIONS

Here, we introduced a novel and highly secured biometric authentication model with palm print identification system using morphological ROI extraction with distance transform and un-decimated biorthogonal wavelet transform. Due to its multi scaling functionality, two different wavelet filter banks will be used to extract the features of distance transformed image to obtain the most effective feature factor for comparing with a test feature vector. The proposed model has proven that it has achieved 100% accuracy with several test images from the database.

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