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Fusion of Iris and Palmprint Traits for Human Identification

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Abstract:

Biometrics deals with identification of individuals based on their biological or behavioral characteristics. Iris recognition is one of the newer biometric technologies used for personal identification. [1] This paper presents biometrics based Iris and palm print recognition system. Human iris is one of the most reliable biometric because of its uniqueness, stability and non-invasive nature. In this paper, an iris recognition system is presented with several steps. First, image pre-processing is performed. Then features are extracted from the iris image using Ridge Energy Detection Algorithm (RED) by filtering the normalized iris region. Finally two Iris Codes are compared and human identification is done. Palm print images are enhanced using preprocessing techniques such as morphological operations. The feature extraction technique of Harris feature extraction algorithm is used to extract features. These techniques are more reliable and faster than traditional techniques used. Experimental results shown recognition rate of 100% for iris and 100% for palm print. This implies that the proposed methodology has better performance and is more reliable over the techniques proposed and used earlier.

Keywords **— RED, Iris recognition, Pupil localization, Iris localization, Identification, Normalization, Harris features, Euclidean.**

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I. INTRODUCTION

Biometrics can be employed on various traits like fingerprint, palmprint, handgeometry, iris, face, voice, signature, etc which are unique for every individual hence are referred as strong authentication mode[3]. Many comparisons are required for this system Biometrics is of three modes i.e. unimodal biometrics which can identify individual by using single trait. Second is bimodal biometrics in which identification is done with fusion of two modalities and the other is multimodal biometrics which uses combination of multiple traits for identification purpose of human.
Iris is the most unique feature of everyone; after DNA, astwins have different iris patterns, too. Even right and left irises of each one are different[5]. The identification based on iris pattern has some advantages, which are:

1) Iris is a highly protected, internal organ of the eye
2) Iris is visible from a distance
3) Iris patterns possess a high degree of randomness
4) Changing the size of the pupil confirms natural physiology
5) Limited genetic penetrance
6) Iris is stable throughout life[6]

The palm is the inner surface of a hand between the wrist and the fingers. The palm has unique features and provides a larger area so the more distinctive features can be generated to improve the performance of recognition system. There are different features that exist on a palm such as principle line, wrinkle line, delta point. The feature of palmprint is quite stable and specific because there is a little change in a long time. They can only be generated from a high resolution image, hard to be faked [4].

II. RELATED WORK

In 2003, Wai Kin Kong, David Zhang*, Wenxin Li, [8] proposed Palmprint feature extraction using 2-D Gabor filters and hamming distance method. In 2005, Teddy Ko [9] proposed Multimodal Biometric Identification for Large User Population using Fischer discriminant analysis and Nueral Network. In 2008, V C Subbarayudu and Munaga V N K Prasad [10] proposed a Multimodal Biometric System using score level fusion of palm and iris images by using 2-D log Gabor filters for feature extraction. V. C. Subbarayudu, et al [11] proposed general working of multimodal biometrics system with Iris and Palmprint and fusion is done at the matching score level by Sum Rule technique with recognition rate is 96.6%. Using Fingerprint, Face and Iris Recognition In 2011, Aly I. Desoky et al [7] proposed an iris recognition algorithm in which a set of iris images of a given eyes are fused to generate a final template using the most consistent feature data. Fan Yang et al [12] fingerprint, palm-print and hand-geometry are combined for person identity verification. Wavelet transform to extract the features from fingerprint and palm-print is used and hand-geometry feature (such as width and length) is extracted after the pre-processing phase. Feature level fusion and match score fusion together for identity.The weight values are calculated based on total minimum error. i.e. For weight1- 0.75,weight2- 0.25. X. Wu., et al [13] proposed a palm print recognition system by extracting features using Sobel operators and using Hidden Markov Models (HMM) as classifiers. Ajay Kumar, et al [14] attempts to improve the performance of palmprint-based verification system by integrating hand geometry features. These features are then examined for their individual and combined performances. The recognition rate is 98.3%. K. Ito, et al [15] suggested Multi-scale wavelet decomposition of palmprint images and using mean of each wavelet sub-block has been suggested. M. Wang, et al [16] proposed 2D PCA and 2D LDA over conventional PCA have been reported to be better for Palmprint recognition. Gawande, et al [17] used log Gabor filter can be used to extract the feature vectors from both Iris and Fingerprint and then they are concatenated. The phase data from 1 D log Gabor filters is extracted and quantized to four levels to encode the unique pattern of Iris and Fingerprint into bitwise biometric template. Hamming distance (HD) is used to generate a final match score. Cheng Lu, et al [18] suggested idea which utilizes two or more individual modalities, like face, ear, and fingerprint, to improve the recognition accuracy by new dimensionality reduction method called Dimension Reduce Projection (DRP). The recognition rate is 95.8%. Anil K. Jain, et al [19] given an overview of biometrics, emerging biometric technologies and their limitations, and examines future challenges. S. Palanikumar, et al [20] presented approach for enhancing International Journal of Computer Applications (0975 – 8887) Volume 95– No. 12, June 2014 27 palmprint image. The enhancement is based on curvelet which preserves the fine features without noise. The result gives high PSNR (Peak Signal-to-Noise Ratio) value for the Curvelet method. i.e. 38.1047. D. Y. Liliana, et al [21] studied about biometrics of palm for identification system using block-based line detection for palm print feature extraction process, and chain code solved the hand geometric feature extraction. We combined those two respective features and recognized it using Dynamic Time Warping (DTW) method which was able to measure the distance between two different features. The accuracy rate is 89%. Gawande, et al [22] gives use of the log Gabor filter to extract the feature vectors from both Iris and Fingerprint and then they are concatenated. Finally the phase data from 1 D log Gabor filters is extracted and quantised to four levels to encode the unique pattern of Iris and Fingerprint into bitwise biometric template. Hamming distance (HD) is used to generate a final match score. Experimental results was verified on database of 50 users accounting to FAR = 0% and FRR = 4.3%. M. Dale, et al [23] presented palm texture using transform features and hand geometry features are represented as distances between different boundary points. The final decision is made by fusion at decision level. And accuracy rate is 99.5%. Bhawna Chouhan ,Shailja Shukla[24] presented Analysis of

statistical feature extraction for Iris Recognition System using Laplacian of Gaussian filter with 97% accuracy. R.Gayathri, P.Ramamoorthy [25] proposed Feature Level Fusion of palmprint and Iris using KNN classifier & The experimental results demonstrated that the proposed multimodal biometric system achieves a recognition accuracy of 99.2% and with false rejection rate (FRR) of = 1.6%. Chinni. Jayachandra, H.Venkateswara Reddy [26] presented Iris Recognition based on Pupil using Canny edge detection and K-Means Algorithm. Himanshu Srivastava [27] presented a review on Personal Identification Using Iris Recognition System.

III. PROPOSED METHOD

The proposed method includes various steps such as image acquisition of user from sensor, pre-processing operation to enhance the quality of image and feature extraction process to identify the features of an image. Finally, matching is done on the basis of specific features with database image and decision is made for identification.

The figure 1 shows the block diagram of biometrics identification system.

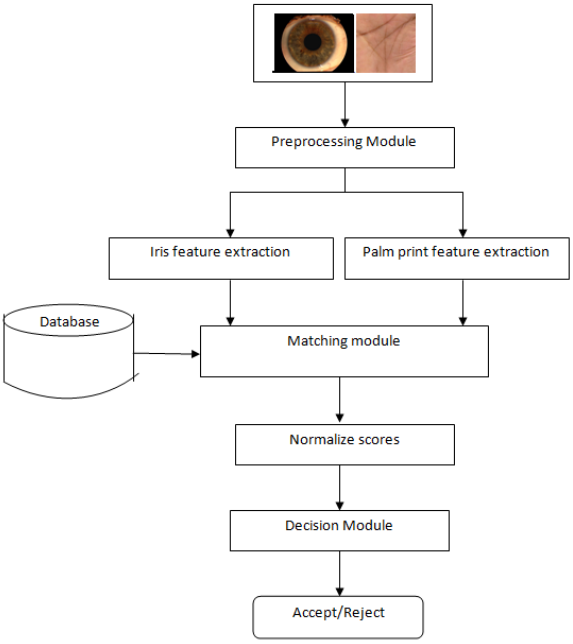

Fig. 1 : Block Diagram Of Biometrics System

IV. IMAGE ACQUISITION

A. *Image acquisition*

Iris images

For extraction of iris images CASIA iris database is used. We used total of 42 iris images of 42 different subjects from CASIA database.

Palmprint images

We used KVKR Multimodal Biometrics database. For extraction of palmprint images whole handgeometry images are employed. Palmprint images are taken from the center of rectangle that can enclose the whole area of interest in palm. These center coordinates are used to extract a square palmprint region of fixed size. We used total 112 images of palmprint from database 8 images for left and right hand of subjects. Hence 16 images of every subject.

B. *Pre-processing techniques*

Pre-processing of Iris images

For iris images we first converted the colored image into a grayscale image. Then image enhancement is done.

Pre-processing of Palmprint images

For palmprint images we used centre region of handgeometry images of specific size. These images are also colour images and we convert them firstly into greyscale images. Then image enhancement is done using some morphological operations.

C. *Feature extraction*

Feature extraction of Iris images

For iris images, after enhancement the iris is segmented into its polar coordinates. Then template generation is done by using directional filtering i.e. Horizontal & Vertical filtering techniques.

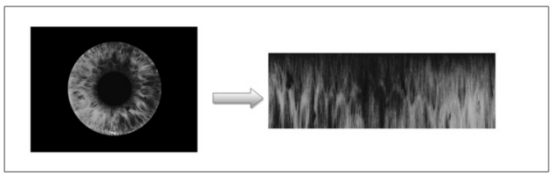

Fig 2: Segment iris into polar coordinates

Fig. 2: Segment iris into polar coordinates

Here the directional filtering is done after getting its polar coordinates. Then both the filtered images are compared with count of features and then the maximum directional features are considered as the final template. This template is then matched with the input image. If feature count of input image is very less then input image does not match and if feature count is near to the sample then it is matched after comparing it with all the remaining samples. Following table shows results of some samples of iris images.

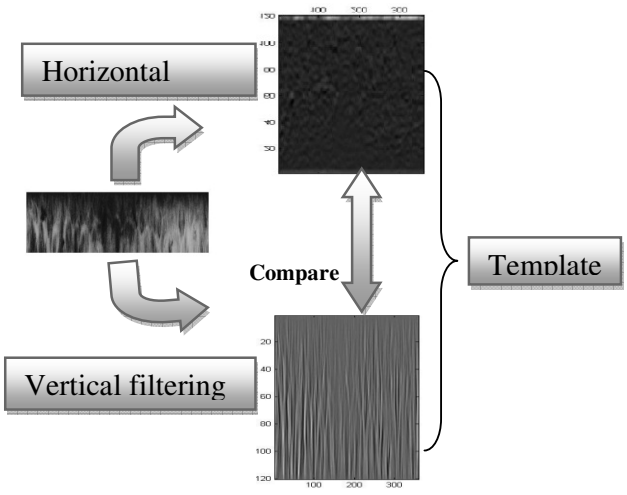

Fig. 3: Template Generation (Directional filtering)

TABLE 1: FEATURE MATRIX FOR IRIS IMAGES

	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	sample 7
sample 1	2262	11325	12746	20287	20385	20082	19441
sample 2	12347	6118	12313	19914	20278	20149	19836
sample 3	11943	6922	6169	20402	20684	20389	20362
sample 4	20306	19917	19986	2253	15979	14148	20413
sample 5	20379	20552	20719	15766	3064	10669	19950
sample 6	19924	20105	19802	13911	11769	4858	20141
sample 7	19654	20313	20878	20583	19937	19868	2893

Feature extraction of Palmprint images

For palm print we extracted features such as corners points in grayscale images with the Harris feature extraction algorithm to find feature points.

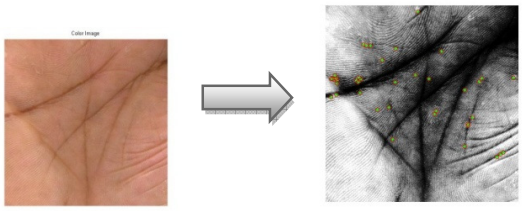

Fig 4: Feature (Corner) points of palmprint

Corner detection is an approach used within computer vision systems to extract certain kinds of features and infer the contents of an image. A corner can be defined as the intersection of two edges. Here the corner points are considered as the features of palmprint image. Then Pair wise distance between two sets of observations is calculated using Euclidean distance method. The distance between the same samples is observed with 0 values. And if the distance value is greater then it does not match. Following table shows results of the distance matrix for some samples of palmprint images.

TABLE 2: DISTANCE MATRIX FOR PALMPRINT IMAGES

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7
Sample 1	0	7.81025	9.055385	78.54935	268.1679	304.8688	127.7693
Sample 2	7.81025	0	5	71.7844	264.0928	302.5921	120.9049
Sample 3	9.055385	5	0	74.72617	259.9461	297.8741	123.6487
Sample 4	78.54935	71.7844	74.72617	0	274.6125	328.8662	49.24429
Sample 5	268.1679	264.0928	259.9461	274.6125	0	81.02469	287.8142
Sample 6	304.8688	302.5921	297.8741	328.8662	81.02469	0	350.4112
Sample 7	127.7693	120.9049	123.6487	49.24429	287.8142	350.4112	0

Following table 3 & table 4 shows the recognition rate of iris and palmprint images respectively.

TABLE 3: RECOGNITION RATE FOR IRIS SAMPLES

Test	Total number of samples	Correct classified	Miss classified	RR
Iris images	42	42	0	100%

TABLE 4: RECOGNITION RATE FOR PALMPRINT SAMPLES

Test	Total number of samples	Correct classified	Miss classified	RR
Palmprint images	112	112	0	100%

We test at least two images at a time for palm. By comparing results of these two images we can easily recognize the particular subject. If the image sample belongs to same person then the both image contains maximum no of matching corner points in common. If the images doesn't belongs to same person then they have no matching points in common or negligible matching points in common. We can compare the test image against no of images at the same time with this process.

TABLE 5: OVERALL RECOGNITION RATE FOR IRIS AND PALM

Test	Total number of samples	Correct classified	Miss classified	RR
Iris images	42	42	0	100%
Palmprint images	112	112	0	100%

V. CONCLUSION

The results clearly indicate the significance of the method used in this research work. This paper presents a novel idea about person identification based on iris and palmprint images. This work is more reliable because it gives faster results as compared to traditional biometric techniques. For iris, because of RED algorithm the prominent features were identified easily from the iris image and directional filtering made it easy for matching & identification. So achieved 100% results. For palmprint a relatively new technique of Harris corner detection algorithm is used which gives corner points in a palmprint image. These corner points are matched using Euclidean distance method. Hence the success rate is 100% in palmprint images.

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