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Person Identification with Biometrics Palmprint using Harris Features

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Abstract

In ever changing, dynamic global setup there is ever growing need to identify individuals. In these circumstances, biometrics provides best security solution. Traditional biometrics are not 100% able to achieve correct recognition and may lead to security gaps. Palmprint is extension to traditional biometrics. To resolve the issues with traditional biometrics the author has proposed new algorithm for Palmprint recognition and uses palmprint features for subject identification. This paper explains Harris Features technique implementation for Palmprint feature extraction and provides significance of methodology used. This algorithm achieved 99.11% recognition rate with higher accuracy.

Keywords

Palmprint, strong authentication, Harris features, etc.

I. Introduction

Security in networked society is achievable with reliability in the personal authentication and use of technology solutions which can give faster recognition. The biometrics, are time invariant, easy to acquire, and unique for every individual. This feature of uniqueness leads to strong authentication which can be achieved by various traits like fingerprint, palmprint, handgeometry, iris, face, voice, signature, etc. which are useful in various applications such as physical access control, security, monitoring whereas traditional password based security system as it is not proper practice each time to remember long passwords and thus password based authentication system is referred as weak authentication mode [1]. The biometric authentication system have become very popular because it uses behavioural and physiological characteristics to uniquely identify the individual [2]. Palm biometrics are represented by the information presented in a friction ridge impression. This information combines ridge flow, ridge characteristics, and ridge structure of the raised portion of the epidermis. The data represented by these friction ridge impressions allows a determination that corresponding areas of friction ridge impressions either originated from the same source or could not have been made by the same source. The important characteristics for palms is uniqueness and permanence, due to this palmprint have been used for long time a trusted form of identification [3]. However, palm recognition has been slower in becoming automated due to some restraints in computing capabilities and live-scan technologies [4]. The palmprint is highly unique, time-invariant as they are not changing regularly over the age [5]

Palmprint is categorized into 4 parts i.e, Upper Palm, Thenar, Lower Palm, Hypothenar. Palmprint is composed of multiple distinguishing features, viz. principal lines, wrinkles, minutiae, delta points, etc. In this paper, authors have used delta points, which are corner points detected on palm, extracted as palmprint features for experiment.

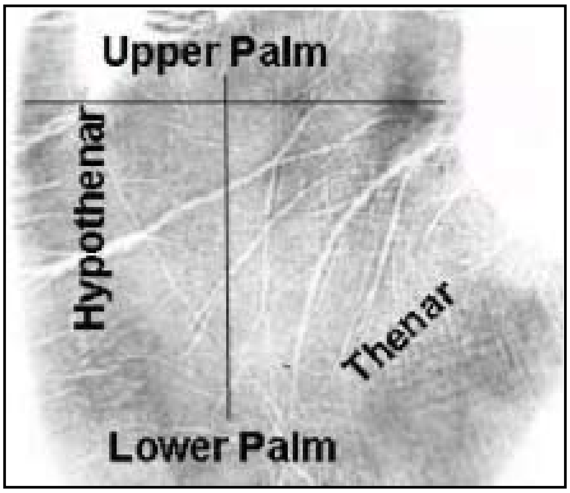

Fig. 1: Palmprint Structure

This paper further includes different sections. The Section II gives idea about Literature survey, section III includes proposed methodology, section IV gives Experiments & Results, Section V includes conclusion.

II. Literature Survey

Antonia Azzini et. al. [1] given idea about using a fuzzy control system to manage a multi-modal authentication system, checking the identity of a user during the entire session. The first biometric acquisition takes matching score 0.725 and the second biometric acquisition takes score 0.4860. Slobodan Ribaric et. al. [2] gives a bimodal biometric verification system for physical access control based on the features of the palmprint and the face, palm matching is based on the adapted HYPER method and for face the K–L transform is used for matching. Bimodal system can achieve an EER (equal error rate) of 3.08% for T=0.748 and the minimum TER (total error rate) = 5.94% for T = 0.8. Peter et al. and Ajay Kumar et. al. [3,4] 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%. In [5] Swapnali et al. gives palmprint recognition system based on FAST feature algorithm and handgeometry recognition with region properties algorithm achieving recognition rate 92%. K. Ito et.

al. [6] suggested Multi-scale wavelet decomposition of palmprint images and using mean of each wavelet sub-block. In [7] M. Wang et. al. proposed 2D PCA and 2D LDA over conventional PCA which have been reported to be better for palmprint recognition. In [8] Nicolas Tsapatsoulis et. al. presented an identification and authentication system based on hand geometry which used POLYBIO hand database. The recognition rate is 95%.
In [9] S. Palanikumar et .al. presented approach for enhancing 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. In [10] Ashutosh Kumar et. al. suggested the new approach where the palmprint images are mapped to Eigen-space and a robust code signature is generated from different camera snapshots of the same palm to incorporate tonal and lighting variations. To enable real- time identification, the signature is represented by a low dimensional feature vector to reduce computational overheads. Overall accuracy rate is 98.7%.

III. Proposed methodology

The following block diagram shows basic workflow of the proposed system.

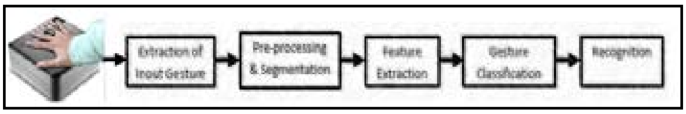

Fig. 2: Block Diagram of Proposed System

1. Image Acquisition

We used KVKR Multimodal Biometrics database. Total 112 images of palmprint from database of 7 subjects having 8 images for left and right hand of each subject i.e 16 images of every subject.

2. Extraction of Palmprint images

For extraction of palmprint images whole hand 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 400*400 pixel.

3. Preprocessing techniques

For palmprint images we used center region of handgeometry images of specific size. These images are also colored images and firstly they were converted into grayscale images. Then specific threshold value is set for images for further processing.

4. Feature Extraction

For palmprint we extracted features such as corners points in grayscale images with the Harris - Stephens Feature algorithm to find feature points. Then from these corner points we extract strongest point descriptors. These corner points are common for both images in the form of Index Pair with value of total number of Index Pairs in images. The identification criteria used in this research is that greater the value of index pair indicates that the images belongs to same subject and smaller value of index pair shows that the images belongs to different subject. The descriptors are extracted feature vectors and their corresponding locations, from a binary or intensity image. The function derives the descriptors from pixels surrounding an interest point. These pixels represent and match features specified by a single-point location. Each single-point specifies the centre location of a neighbourhood.
The method used for descriptor extraction depends on the class of the input points such as SURFpoints, MSERobjects, cornerPoints. Harris-Stephen algorithm uses parameters as image, name and its scalar threshold value in the range (0, 1). Name is MinQuality i.e. Minimum accepted quality of corners. It specifies that the detector must use a 1% minimum accepted quality of corners within the designated region of interest. It also represents a fraction of the maximum corner metric value in the image. Larger values can be used to remove erroneous corners. The default value is 0.01. A standard threshold value used in this experiment is 0.031 because at this particular threshold value we get maximum number of matching index pairs in images.
In this research work Total 112 images of palmprint are used from database. The 8 images for left and 8 images right hand of subjects. Hence 16 images of every subject from KVKR Multimodal Biometrics database. Out of total 112 samples of 7 subjects the total 98 images used as training samples and remaining 14 samples are used as testing samples for left and right hand.
Firstly, the count of matching corner points for all samples is calculated for every subject. The same procedure is repeated for all samples of all subject for left and right hand. Afterwards the sum is calculated for all samples for every individual subject. The table 1 shows that sum of matching corner points of every sample of every individual subject for left hand.

Table 1: Sum of matching corner points of every subject of Left Hand

	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Sub7
	Class1	Class2	Class3	Class4	Class5	Class6	Class7
Subject1	73	0	1	0	1	0	1
Subject2	2	60	1	1	3	0	1
Subject3	7	8	85	2	9	0	7
Subject4	3	6	0	303	2	1	1
Subject5	1	3	5	3	46	0	4
Subject6	2	2	5	1	3	18	4
Subject7	4	7	5	0	9	1	54

Similarly, the table 2 shows that sum of matching corner points of every sample of every individual subject for Right hand.

Table 2 : Sum of matching corner points of every subject of Right Hand

	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Sub7
	Class1	Class2	Class3	Class4	Class5	Class6	Class7
Subject1	20	0	0	0	0	0	0
Subject2	3	157	0	1	1	0	2
Subject3	0	0	50	0	0	0	0
Subject4	0	5	0	149	0	0	0
Subject5	0	0	6	0	53	0	0
Subject6	0	0	0	2	0	29	0
Subject7	0	0	0	0	0	0	208

The table 3. shows no of matching samples of each subject with every other subject of left hand. It is easily visible that the test sample belonging to the particular subject having large number of

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matching corner points with training sample of same subject and vice versa. Here, according to subject number researcher made the groups referred as class which represents the particular subject.

Table 3 : Left Hand

	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Sub7
	Class1	Class2	Class3	Class4	Class5	Class6	Class7
Subject1	7	0	1	0	1	0	1
Subject2	2	7	1	1	2	0	1
Subject3	4	5	6	2	5	0	7
Subject4	1	6	0	7	2	1	1
Subject5	1	2	3	2	6	0	3
Subject6	2	2	4	1	2	5	2
Subject7	2	6	3	0	3	1	7

Similarly, table 4 shows no. of matching samples of each subject with every other subject of right hand.

Table 4. Right Hand

	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Sub7
	Class1	Class2	Class3	Class4	Class5	Class6	Class7
Subject1	5	0	0	0	0	0	0
Subject2	2	7	0	1	1	0	2
Subject3	0	0	6	0	0	0	0
Subject4	0	4	0	7	0	0	0
Subject5	0	0	4	0	7	0	0
Subject6	0	0	0	2	0	7	0
Subject7	0	0	0	0	0	0	7

IV. Experiments and Results

In palmprint we used 112 images for 7 subject with 8 samples for left and right hand each. Out of 112, we used 98 for training and remaining 14 for testing matrix. 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 both images contains maximum no of matching corner points in common called as index pair. 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. The resultant matrix contains total no of index pairs for each pair of tested image samples. This test gives appropriate idea about the test sample belongs to which subject. Afterwards this matrix for further analysis and ease of use is reduced to the classification matrix which contains the total no of samples correctly classified in particular class for each subject and 'x' entry indicates that no match in corresponding class. The table 5 shows classification matrix for palmprint samples.

Table 5 : Classification Matrix

	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Sub7
	Class1	Class2	Class3	Class4	Class5	Class6	Class7
Subject1	16	x	x	x	x	x	x
Subject2	x	16	x	x	x	x	x
Subject3	x	x	15	x	x	x	x
Subject4	x	x	x	16	x	x	x
Subject5	x	x	x	x	16	x	x
Subject6	x	x	x	x	x	16	x
Subject7	x	x	x	x	x	x	16

The table 6. shows recognition rate of palmprint samples. It shows total number of samples correctly classified out of 16 samples for every subject. Out of total 112 samples 111 samples are correctly classified for each hand. The recognition rate is 99.11%.

Table 6. Recognition rate for palmprint samples

Sub	Total no of sample tested	Correct classified	Miss Classified	RR
Sub1	16	16	0	99.11%
Sub2	16	16	0	
Sub3	16	15	1	
Sub4	16	16	0	
Sub5	16	16	0	
Sub6	16	16	0	
Sub7	16	16	0	

The misclassification of sample is due to poor quality of images. This drawback can be resolved by using high quality of sensor in further study in this research area.

V. Conclusions

This research work gives the significance of new approach Harris Features algorithm for palmprint recognition. The results clearly indicates accuracy of algorithm. The maximum samples are classified correctly hence high true positive rate is achieved. The recognition rate is 99.11%. The result also shows the methodology giving least false acceptance rate (FAR) and false rejection rate (FRR) which is rare in unimodal biometrics scenario. It is also helpful in reducing overhead of fusion as it gives highest recognition rate.

VI. AcknowledgEment

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