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Real Time Palm Recognition: Review and comparisons of Various Techniques

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ABSTRACT: In this 21st era, the palm print is a new and emerging biometric feature for personal recognition as it provides various advantages over other biometric system. An individual can be identified effectively with the help of palm print. This paper discuss various research activities introduced which rectifies the difficulties faced in various palm print recognition stages like palm image acquisition, image processing, palm feature extraction and palm recognition. This paper also discusses various algorithms used for palm feature detection with openCV.

KEYWORDS: Biometric, Acquisition, Recognition, Palm print, PCA

1 INTRODUCTION

In the applications like online banking, airport security, time and attendance control, access to restricted areas, personal identification number or identity cards are used. However these types of identity recognition methods have serious disadvantages, as they become less and less secure in a world of identify theft and terrorism. Therefore biometric identification systems which ensures reliability and is highly resistant to the mentioned risks should be implemented.

1.1 DEFINITION AND CONCEPT OF BIOMETRICS

Biometrics is automated method of recognizing a person based on a behavioral or physiological characteristic. The behavioral category includes the movement of the human, such as hand gesture, speaking style, signature etc. The physiological category includes the human traits such as hand shape, palm print, eyes, veins, etc. The uniqueness of an individual ensures reliability and is highly resistant to brute force attacks. Biometric systems are superior because they provide a nontransferable means of identifying people. Nontransferable means it cannot be given to another individual so nobody can get around the system and they personally have to go through the control point. This is much better than conventional security methods such as password, personal identification numbers (PIN). The measurement of these traits helps in authentication using the biometric systems.

1.2 DEFINITION AND CONCEPT OF PALM RECOGNITION SYSTEM

One of the most successful biometric systems is the palm print recognition system which recognizes a person on the basis of the palm print of that person. It is reliable due to the fact that the print patterns of each and every person are always unique. The ridge structure is permanent which is formed at about the thirteenth week of the embryonic development. This formation gets completed by the eighteenth week therefore even the monozygotic twins have unique palm prints.

Palm print is preferred compared to other biometric methods, because it is distinctive, easily captured by devices as well as contains additional features such as principal lines, wrinkles (secondary lines) a fingerprint in that it also contains other information such as texture, indents and marks which can be used when comparing one palm to another. Palm print contains fixed line structure, low intrusiveness and requires low cost capturing device, low resolution imaging. Thus palm print recognition is a very interesting research area. Therefore it has become an important and rapidly developing biometric

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technology in last decade. A lot of work has already been done in this field, but there is still a lot of scope to make the systems more efficient and reliable.

In a practical biometric system, there are a number of other issues that should be considered, including: Performance, which refers to the achievable recognition accuracy and speed, the resources required to achieve the desired recognition accuracy and speed, as well as the operational and environmental factors that affect the accuracy and speed; acceptability, which indicates the extent to which people are willing to accept the use of a particular biometric identifier (characteristic) in their daily lives, circumvention, which reflects how easily the system can be fooled using fraudulent methods.

The major steps in palm print recognition are Image acquisition, pre-processing, Feature extraction, Database and Matcher shown in following figure.

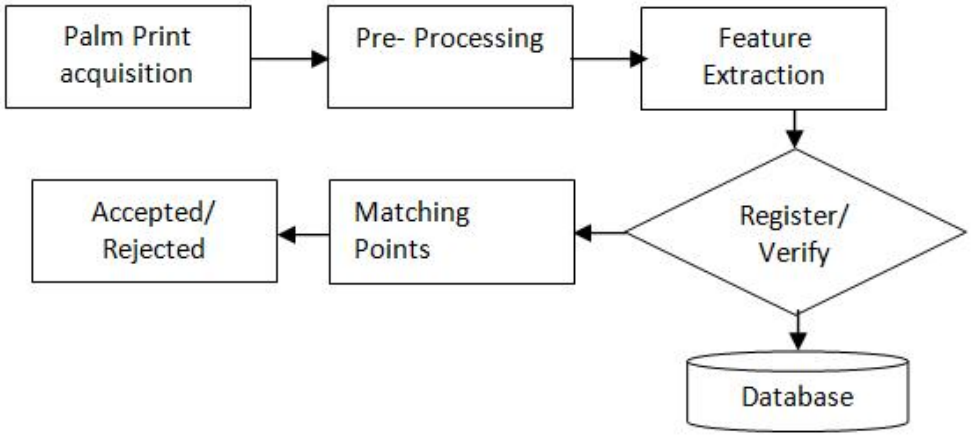

Fig. 1. Block Diagram of Palm Print Recognition

Following section explains each block in fig.1 in brief.

a) Palm Print acquisition:

In this step, image of palm print is first capture with the help of different types of capturing devices discussed in following section. The captured image may contain noise, which can decrease the quality of the image and can affect the rate of performance of palm print recognition system directly [1].

b) Pre-Processing

In this step, noise if present in the captured palm print image can be removed with the help of low pass filter.

c) Feature Extraction

After pre-processing on the captured image, its features are extracted like minutia, principal lines eigen vectors etc.

d) Register/Verify and Matching Points

Register creates the new database for the image and verify verifies the matching of the image features with already existing database. Verify determines the degree of similarity of recognition template with master template [1]. Various approaches are used for matching and discussed in following section.

e) Accepted/ Rejected

Finally, the degree of similarity of recognition decides whether the palm print image is recognized or not.

This paper analyzes the already existing systems and thereby proposes a new approach.

2 LITERATURE SURVEY

In this section review of various traits for biometric technologies are discussed.

2.1 SURVEY BASED ON VARIOUS BIOMETRIC TECHNOLOGIES

Based on seven biometric identifiers, a comparison of various biometric techniques is done by [3]. The following table 1 shows the comparison of various biometric techniques based on universality, distinctiveness, permanence, collectability, performance, acceptability, and circumvention as low(L), medium(M) and high(H).

The following comparison shows that the palm print recognition system gives more reliable, distinctive and high performance results.

Table 1. Comparisons of various Biometric technologies based on perceptions of the authors [3]

Biometric Identifier	Universality	Distinctiveness	Permanence	Collectability	Performance	Acceptability	Circumvention
DNA	H	H	H	L	H	L	L
Ear	M	M	H	M	M	H	M
Face	H	L	M	H	L	H	H
Facial Thermogram	H	H	L	H	M	H	L
Fingerprint	M	H	H	M	H	M	M
Gait	M	L	L	H	L	H	M
Hand geometry	M	M	M	H	M	M	M
Hand vein	M	M	M	M	M	M	L
Iris	H	H	H	M	H	L	L
Keystroke	L	L	L	M	L	M	M
Odor	H	H	H	L	L	M	L
Palmprint	M	H	H	M	H	M	M
Retina	H	H	M	L	H	L	L
Signature	L	L	L	H	L	H	H
Voice	M	L	L	M	L	H	H

2.2 SURVEY BASED ON PALM PRINT ACQUISITION DEVICES

There are various palm print acquisition devices used by various researchers like CCD based palm print scanners, digital cameras, video cameras, digital scanners etc. CCD based palm print scanners have pegs for guiding the placement of hands. Fig.2 shows CCD based palm print scanner. CCD camera contains of a set of optical components which work together to obtain the data from the palm. Digital scanner takes more time to scan the palm image and hence cannot be used in real time applications. Images captured with digital and video cameras may contain distortions and might cause recognition problem as they collect images in uncontrolled environment. Fig.3 shows the palm images taken from CCD based palm print scanner and digital camera.

Fig. 2. CCD based palm print scanner

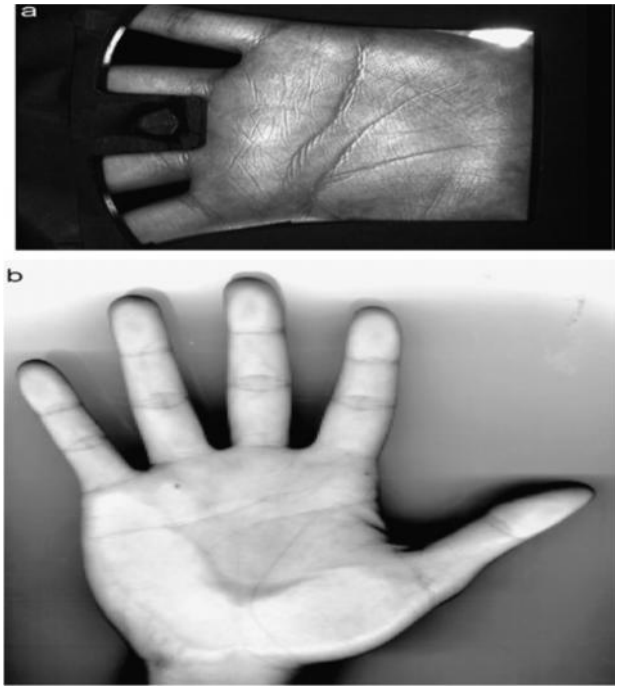

Fig. 3. Palm images a) By using CCD based scanner
b) By using digital camera

2.3 SURVEY BASED ON FEATURE EXTRACTION ALGORITHMS

In last few years various algorithms are developed by researchers to obtain reliable palm print recognition. G. Lu, D. Zhang and K. Wang [2] has proposed palm print recognition by means of Eigen palms features, where original image of palm print is altered into the feature space i.e. Eigen palm with the aid of K-L transform. Euclidean distances classifier is used for harmonizing of recognition template and master template.

Cappelli, Ferrara, and Maio [3] proposed high resolution palmprint recognition scheme which is based on minutiae extraction. Pre-processing is done by segmentation of an image from its background. To improve the quality of image, local frequencies and local orientations are evaluated. Local orientation is estimated via fingerprint orientation extraction approach and local frequencies are anticipated by counting the number of pixels amid two consecutive peaks of Gray level along the direction normal to local ridge orientation. Minutiae feature is taken out in feature extraction phase. Contextual filtering with Gabor filters approach is applied to extract the minutiae attributes.

The captured image can be deformed due to large number of creases on palm print Dai, Feng, Zhou [8] introduced a segment-based palmprint matching and fusion algorithm, where whole palmprint image is separated into different regions and then every region is separately matched to deal with the distortion. The similarity of two palm prints is computed by fusing the similarity scores of dissimilar segments using a Bayesian framework. Dai, Feng, Zhou [4] also introduced an orientation field-based registration algorithm which is used to reduce the computational complexity.

2.4 SURVEY BASED ON PALM PRINT APPEARANCE

Appearance based method is also called Sub-spacing based approach in which the entire palm image is considered as a vector with pixel intensities as its components, This vector is usually subjected to different transformations in order to select a small feature set suitable for recognition. Earlier approaches usually used fixed transforms, such as Fourier transform [5], while the newer approaches tend to use transformations which maximize some criterion function on the training data in order to select the best features. These transformations include principal component analysis (PCA) [6], [7] linear discriminant analysis (LDA) [9] and independent component analysis (ICA) [10]. Lu et al. [11] are among the first to propose the use of PCA in the palmprint recognition. It finds a set of orthogonal basis vectors. It describes the major variations among the training images. The bases have the same dimension as the original images and are like palmprint in appearance, they are also called eigenpalms. PCA can only separate pair-wise linear dependencies between pixels. It reduces the dimensionality.

3 CONCLUSION

By comparing various existing algorithms and techniques, we concluded that a palm recognition system which consists of image capturing with digital camera is the best suited biometric application in which fearture extraction algorithm is based on extracting features for palm region as image and creating xml file for eigen vectors of palm. For the same PCA algorithm can be used. It should be noted that variation of illumination of different palm-print images of the same person may affect their similarity. Therefore, prior to feature extraction, an illumination adjustment step is included in the proposed algorithm. After feature extraction, a harr classifier compares two palm-print features and a database can be used to store registered templates and also for verification purposes.

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