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Enhancing Palm Print Recognition System

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ABSTRACT

Automatic personal identification is an important component of security systems with many challenges and practical applications. The progress in biometric technology has led to the very rapid growth in identity authentication. In today's world, biometrics system is used almost universally for personal recognition. The palmprint is one of the most consistent physiological distinctiveness that can be used to differentiate among individuals. The stable line features or "palm lines," which are composed of principal lines and wrinkles, can be used to clearly describe a palm print and can be extracted in low-resolution images. The primary purpose of this dissertation is to develop a palmprint recognition system using minimum resources. Palmprint identification is implemented in MATLAB using three algorithms namely CLAHE for contrast stretching, Log Gabor Filter and Repeated line tracking methods for palmprint feature extraction. The paper also deals with the assessment of these techniques. All images in the data base are malformed to gray level images before processing. The experimental outcome expresses the feasibility of the proposed system.

Keywords

1. INTRODUCTION

Palm print recognition has substantial potential as a personal identification technique. Palmprints divide most of the discriminative features with fingerprints and, in addition, possess a lot larger skin region and other discriminative features like as principal lines. For access manage usages, scanning the palmprint is not only fast but also greatly acceptable for the public. Palmprint recognition also has a important role in forensic applications as about 30 percent of the latents improved from crime scenes are from palms [1].The human palm consists of two major features: flexion creases and friction ridges .Flexion creases are created due to the folding of the palm. The three most main flexion creases, termed major creases or principal lines, divide the palm into three sections: thenar, hypothenar, and interdigital (into Fig. 1). The palm also contains many slight creases, which are not as permanent as the major creases. Friction ridges are created as a effect of a buckling instability in the basal cell layer of the fetal epidermis [2]. In the past decades, 2D palmprint has become an essential complement in personal identification because of its advantages, such as non-intrusiveness, low cost, and constant structure features. The 2D palmprint recognition techniques can be classified into three types: coding-based, line-based and appearance-based techniques. 2D palmprint recognition has the following two drawbacks: ease to be counterfeited; and sensitive to illumination changes [3].

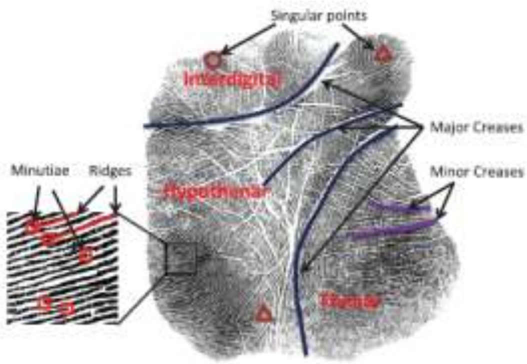

Figure 1 Crease and ridge features in a palmprint [2]

1.2 Problems in palmprint large-scale applications

1.2.1 Skin distortion Not like the finger tip, the palm contains many joints and its size is much larger. As a effect, distortion is quite familiar between different impressions of the same palm and is much more serious than the distortion of fingerprints. Fig. 2 gives an example of palmprints with distortion.

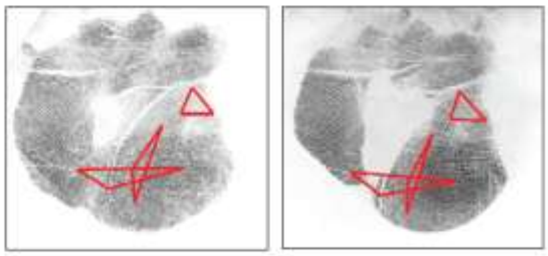

Figure 2 A pair of mated palmprints with large distortion, as defined by the corresponding triangles

1.2.3 Computational complexity Since palmprints in operational palmprint databases are usually not situated in a common coordinate system, minutiae matching algorithms have to aim all possible rotation and translation or all possible communication of minutiae. Since palmprints enclose much more minutiae than fingerprints, those identical algorithms which are essentially adapted from fingerprint matching algorithms are very ineffective in matching palmprints. For example, a well-known marketable matcher can execute more than 15,000 fingerprint matches per second, but just three palmprint matches per second [2].

1.3 Palm Print Recognition system

A palmprint recognition system generally contains of five parts: palmprint scanner, preprocessing,matcher,feature extraction, and a database illustrated in Fig3[7]

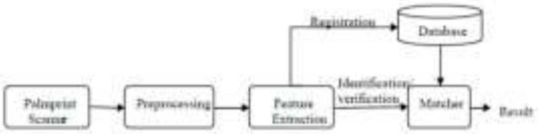

Figure 3 Matcher and a database illustrated [7]

1.4 Need For PalmPrint Technology Palmprint is preferred compared to other methods such as fingerprint or iris because it is distinctive, simply captured by low resolution devices as well as contains additional features such as principal lines. Iris input devices are exclusive and the method is intrusive as people might fear of adverse effects on their eyes. Fingerprint identification requires elevated resolution capturing devices and may not be suitable for all as some may be finger lacking. Palmprint is therefore suitable for everyone and it is also non-intrusive as it does not require any private information of the user. Palmprint images are captured by acquisition module and are fed into recognition module for verification.

-> Compared with face recognition palmprint is hardly affected by age and accessories.
-> Compared with fingerprint recognition palmprint images enclose more information and needs only low resolution image capturing devices which minimizes the cost of the system.
-> Compared with iris recognition the palmprint images can be captured without intrusiveness as people might panic of adverse effects on their eyes and cost effective.
Hence it has become an important and quickly developing biometrics technology over the last decade. Limited work has been reported on palmprint identification and confirmation, despite the importance of palmprint features. The system functions by prognostic palmprint images onto a feature space that spans the considerable variations among known images [10].
1.5 Security and Privacy: Biometric systems are vulnerable to several attacks including re-play, database and brute-force attacks[13] Compared with verification, union and identification, there has been little research on palmprint security. Connie et al. united pseudo-random keys and palmprint features to produce cancelable palmprint representations. They claim that their method can realize zero equal error rates. However, they assume that the pseudo-random keys are never lost and shared and based on this supposition report zero equal error rates for dissimilar biometric traits .Sun et al. apply watermarking techniques to bury finger features in palmprint images for protected identification . Wu et al use palmprint for cryptosystem. Though some security issues have been addressed, it is still not much. For example, liveness detection has not been well studied. A fake palmprint can be found in Potential solutions of liveness detection include infrared and multiple spectrum approaches . Biometric traits include information not only for personal identification but also for other applications. For example, (DNA) deoxyribonucleic acid and retina can be used to diagnose diseases. Palmprints can also specify genetic disorders. Most previous medical research related to the palm has concentrated on irregular flexion creases, the Simian line and the Sydney line .About 3% of normal population has abnormal flexion creases. Medical researchers also find out the connection between density of secondary creases and schizophrenia. To protect private information in palmprints, databases hoard encrypted templates because the line features can be reconstructed from raw templates. Both customary encryption techniques and cancelable biometrics can be used for encryption [13].

2. RELATED WORK

The research work performed in this area by different researchers is presented as follows:

Jifeng Dai et al. in (2011) [1] Palmprint is a promising biometric feature for use in access control and forensic applications. earlier research on palmprint recognition mainly concentrates on low-resolution (about 100 ppi) palmprints. But for high-safety applications (e.g., forensic usage), high-resolution palmprints (500 ppi or higher) are vital from which more useful information can be extracted. In this paper, author proposes a novel identification algorithm for high-resolution palmprint. The major contributions of the proposed algorithm include the following: 1) use of multiple features, that is, minutiae, density, orientation, and principal lines, for palmprint recognition to considerably improve the matching performance of the predictable algorithm. 2) Design of a quality-based and adaptive orientation field assessment algorithm which performs better than the existing algorithm in case of regions with a huge number of creases. 3) Use of a original fusion scheme for an identification application which performs better than conventional union methods, e.g., weighted total rule, SVMs, or Neyman-Pearson rule. moreover, analyze the discriminative power of different feature integration and find that density is very useful for palmprint identification. Experimental results on the database consisting 14,576 full palmprints show that the projected algorithm has achieved a good performance. In the case of confirmation, the recognition system’s (FRR) False Rejection Rate is 16 percent, which is 17 percent lower than the best presented algorithm at a False Acceptance Rate (FAR) of 10_5, while in the recognition experiment, the rank-1 live-scan limited palmprint recognition rate is improved from 82.0 to 91.7 percent**.**

Jifeng Dai et al. in 2012 [2] During the past decade, many efforts have been made to use palmprints as a biometric modality. However, most of the existing palmprint identification systems are based on encoding and matching creases, which are not as reliable as ridges. This impacts the use of palmprints in large-scale person identification applications where the biometric modality needs to be distinctive as well as insensate to changes in age and skin conditions. Recently, several ridge-based palmprint identical algorithms have been projected to fill the gap. Major contributions of these systems comprise reliable orientation field evaluation in the presence of creases and the use of multiple features in matching, while the matching algorithms considered in these systems simply follow the matching algorithms for fingerprints. However, palmprints vary from fingerprints in numerous aspects: 1) Palmprints are much larger and thus contain a large number of details, 2) palms are more deformable than fingertips, and 3) the quality and discrimination power of different regions in palmprints vary considerably. As a result, these matchers are unable to appropriately handle the distortion and noise, despite intense computational cost. Motivated by the matching strategies of human palmprint experts, author developed a novel palmprint detection system. The main contributions are as follows: 1) Statistics of major features in palmprints are quantitatively study, 2) a segment based matching and fusion algorithm is proposed to deal with the skin distortion and the unstable discrimination power of different palmprint regions, and 3) to reduce the computational complication, an orientation field-relayed registration algorithm is designed for registering the palmprints into the same coordinate scheme before matching and a cascade filter is built to reject the nonmated gallery palmprints in early stage. The projected matcher is tested by matching 840 query palmprints against a gallery set of 13,736 palmprints. Experimental results show that the projected matcher outperforms the existing matchers a lot both in matching accuracy and speed.

Jinrong Cui et al. in 2011 [3] As a significant biometric technique, 3D palmprint substantiation is better than 2D palmprint authentication in some aspects. Previous work on 3D palmprint recognition has concentrated on two aspects: (1) extracting the texture and line features with the binary image of 3D palmprint; (2) extracting the orientation features using the Gabor filter and aggressive code. In this paper author extract, for the first time, the 3D palmprint features via the appearance-relayed linear discriminant analysis (LDA) method. The appearance-based LDA method can extract the global algebraic features of the biometrics. These textures have been proven to have strong discriminability. Author also investigated the relationship among the recognition accuracy and the resolution of the 3D palmprint image. The experimental results show that the 3D palmprint images by resolution 16_16 and 32_32 are better for 3D palmprint recognition. The experiment results also show the probability of our method.

Mojtaba Darini et al. in 2015 [4] Palmprint recognition has been in the center of biometric research over the last ten years. Identifying a being or authenticating a person has been most vital course and mandatory in several real time applications for safety reasons. For example logging into a computer system, accessing an ATM machine, room entering etc. Are some of the valid time applications require authentication of people. Simple and cost effective verification systems are working relayed on password, pin number, etc. For authenticating people, significant places or serious applications require biometric verification where the authentication failure rate is very less and simple to use. Also, forging the biometric system is greatly complicated. Palmprint is out of the biometric used in authenticating people. Palmprint detection has been study more than fifteen years. There are several palmprint verification systems have been developed by various scientists.

K.Y. Rajput et al. in 2011 [5] In today's world, biometrics system is used almost universally for the security and personal recognition. The palmprint is one of the most consistent physiological characteristics that can be used to distinguish among individuals. The primary purpose of this paper is to current a palmprint recognition system using minimum resources. The system is constructing by means of the transforms used in image processing. Palmprint identification is implemented using three algorithms namely (KFCG) Kekre's Fast Codebook Generation (DCT) Discrete Cosine Transform and Fourier Descriptors (FD). The paper also deals with the assessment of these techniques. All images in the data base are malformed to gray level images before processing.

Sneha M.Ramteke et al. in 2013 [6] Biometrics is the study of programmed methods for recognizing a person based on his corporeal or behavioral characteristic. Biometric systems can be splited into two categories- recognition systems and verification systems. Biometric palmprint has received broad attention from researchers. It is well-known for several advantages like as stable line features, low-resolution imaging, low-cost capturing gadget, and user-friendly. In the field of personal authentication using the palmprint as a biometric trait has concerted on enhancing exactness yet resistance to attacks is also a centrally significant feature of any biometric security system. This paper provides an summary of current palmprint research, describing in image acquisition, preprocessing, feature extraction, palmprint connected fusion and security and accuracy about palmprint system.

Saroj Kumar Panigrahy et al. in 2008 [7] As our everyday life is receiving more and more computerized, automated security systems are getting more and more importance. Today most personal banking errands can be performed over the Internet and soon they can also be performed on mobile devices like as cell phones and PDAs. The main task of an automated security system is to verify that the users are in fact who they state to be. There are three major methodologies when performing this verification. The security system could ask the user to present some information known only to the user, it could ask the user to provide something only the user has access to or it could recognize some sort of trait that is unique for the user. Of course, some sort of grouping of these methodologies is also possible.

David Zhang et al. in 2003 [8] Biometrics-based personal identification is termed as an effective method for automatically recognizing, with a high confidence, a person's identity. This paper presents a new biometric method to online personal classification using palmprint technology. In contrast to the presented methods, our online palmprint identification system implies low-resolution palmprint images to attain effective personal identification. The system contains of two parts: a novel device for online palmprint image acquisition and an competent algorithm for fast palmprint recognition. A strong image coordinate system is defined to assist image alignment for feature extraction. In totaling, a 2D Gabor phase encoding scheme is proposed for palmprint feature extraction and representation. The experimental outcome express the feasibility of the proposed system.

3. PROPOSED WORK

a. Problem Formulation

Biometrics has been used for personal authentication and security over the last hundred years. Most commonly used biometric trait used is fingerprints. The other traits used are iris, face and voice. Fingerprint and iris require high resolution image acquiring devices which makes them costly. Face and voice tends to change with age and physical conditions of the person. Fingerprint and iris use high resolution images so there processing speed is slow for real time applications and also more storage space is required. But these biometric systems were either expensive or their performance was not up to the mark. This motivated me to work on biometric system which is well balanced in terms of cost and performance and palmprint recognition system provide both these features.

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b. Proposed Work

We propose a palm print authentication model which consists the following phases:ImageAcquisation , Clahe Segmentation, Normalization and orientation, Feature extraction, Matching or verification, chain code. Segmentation involves segmenting the palm area which contains the desired information from the input image. This will be the area of the palm containing the principle lines. When palm print images are captured, the position, direction, and amount of stretching of a palm may vary so that even palm prints from the same palm may have little rotation and translation. Hence palm print images should be oriented and normalized. When the image has been normalized and oriented properly the features to be used for authentication and matching have to be extracted. We will be using various filters for feature extraction. After extracting the features to avoid the losing the details of the palm line structure, these irregular lines are represented by their chain code. To match the palm lines, a matching score is defined between two palm prints according to the points of their palm lines.

4. RESULTS AND ANALYSIS

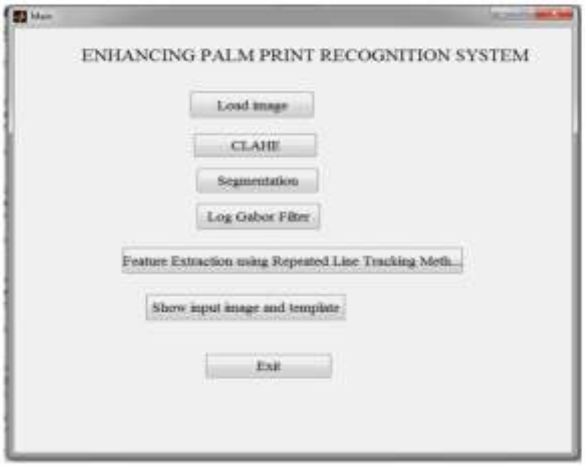

Figure 4 Main Menu

Figure 5 Open Palmprint image

Figure 6 Original Palmprint image

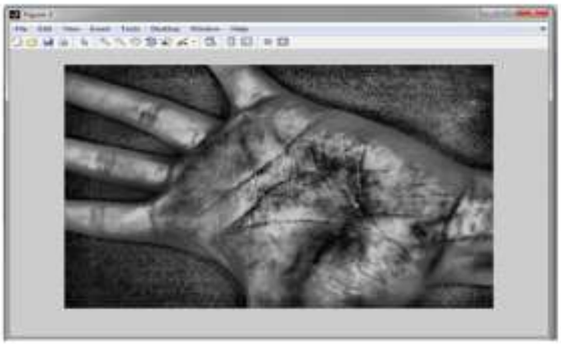

Figure 7 Enhanced image after applying CLAHE

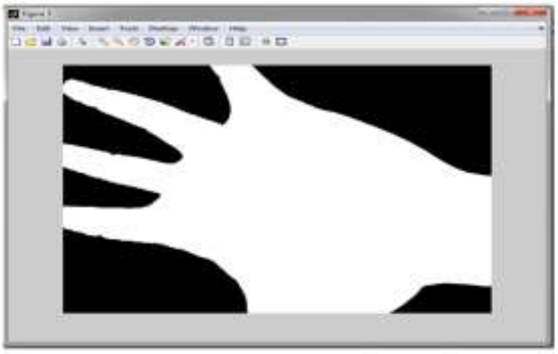

Figure 8 Segmented Palmprint image

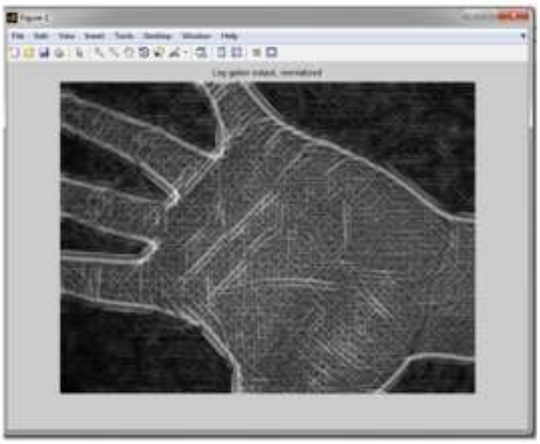

Figure 9 Enhancement after applying log gabor filter

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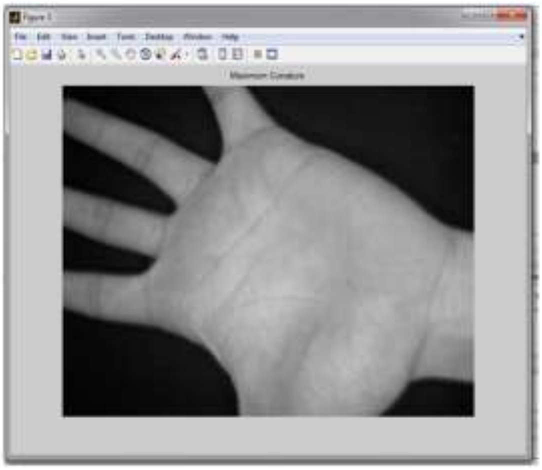

Figure 10 Maximum Curvature

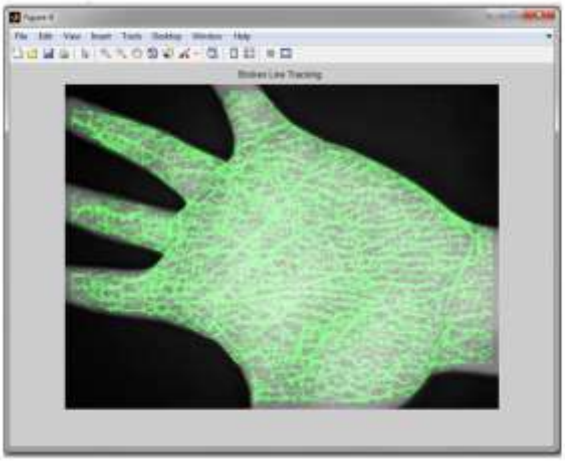

Figure 11 Broken Line Tracking

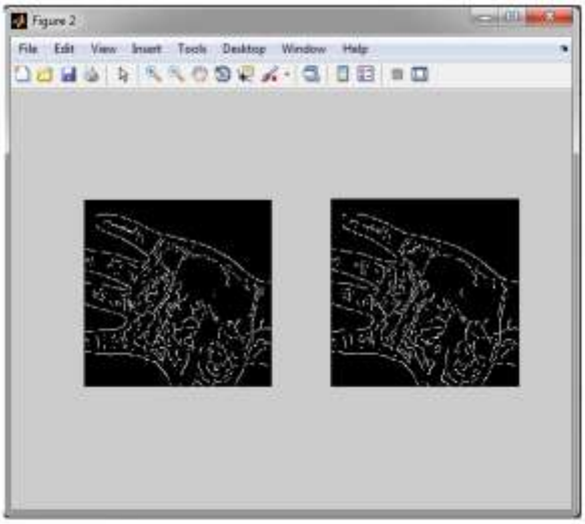

Figure 12 Input image and Template

Year	Technique	Accuracy (%)
2010	Symbolic Aggregate approximation	98
2013	Phase Symmetry	100
2016	Proposed Technique	100

Table 1 Comparison of various palmprint recognition techniques

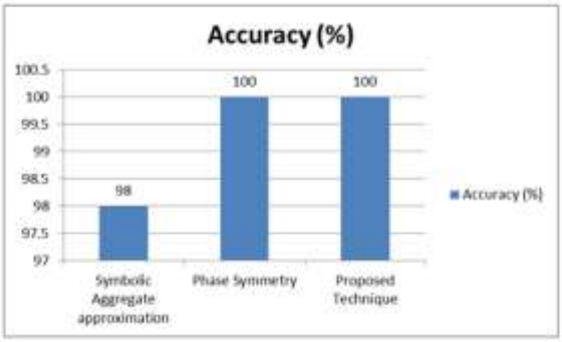

Figure 13 Comparison of various palmprint recognition techniques

CONCLUSION AND FUTURE SCOPE

Palmprint authentication is a means of personal confirmation that uses unique palmprint features. Palmprint is produced by only scanning the user's palm on the platform of the scanner when scanning is performed. So, it is subjected to diverse physical disturbances such as variable size, noise and orientation, which will degrade the confirmation process. Therefore image pre processing plays an significant role in palmprint recognition. Pre processing is a technique of aligning diverse palmprint images, obtaining coordinate systems and to segment the central region for feature extraction. The projected algorithm focuses on CLAHE for contrast stretching, Log Gabor Filter and Repeated line tracking methods for palmprint feature extraction. The approach is tested over a data set of 50 images and seen to provide 100% recognition accuracy. More research should be placed into security and privacy issues. Some issues in using palmprints for personal identification have not been healthy addressed. For instance, we know that ridges in palmprints are steady for a person's whole life but the steadiness of principal lines.

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