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To identify using minor finger knuckle patterns in verifying human identities

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Abstract -In human forensics and biometrics,automated biometrics identification using finger knuckle images has increasingly generated interest among researchers with emerging applications.The major finger knuckle patterns that are formed on the finger surface joining not only proximal phalanx middle but also phalanx bones, Prior efforts in the biometrics literature have only investigated. Which are formed on the finger surface joining distal phalanx as well as middle phalanx bones, this paper investigates the possible use of minor finger knuckle patterns. To improve the performance from the major finger knuckle patterns, the minor finger knuckle patterns can either be used as independent biometric patterns or employed. For region of interest segmentation, image normalization, enhancement, and robust matching to accommodate image variationsa completely automated approach for the minor finger knuckle identification is developed with key steps. For minor finger knuckle images from 500 different subjects, this paper also introduces a new or first publicly available database. To significantly improve the performance over the conventional finger knuckle identification, the efforts to develop an automated minor. A study on the stability of finger knuckle patterns from images acquired with an interval of 4–7 years, therefore, this paper also presents. To exploit finger knuckle patterns in forensics and biometrics applications, the experimental results and the images presented in this paper provide new insights on the finger knuckle pattern and identify the necessity for further work.

Keywords-Finger knuckle biometrics, major finger knuckle, minor finger knuckle, finger dorsal biometrics, knuckle segmentation, biometrics fusion.

I. INTRODUCTION

In human surveillance and image forensics,automated identification of humans using their unique anatomical characteristics has been increasingly investigated for their applications. Online and large scale identification automated personal identification have posed new challenges for the biometric technologies,emerging national ID programs that require accurate. To identify ∼1.2 billion population using ten fingerprints and two iris images, the unique identification project is one such ambitious project that aims. In acquiring the respective emodality, selectionof biometrics modalities in such large scale identification problems is not only limited by the individuality of the modality but also by the user-convenience. While acquiring the finger print images and with no additional inconvenience to the users, in this context, the finger-vein and finger knuckle images can be simultaneously acquired.

identification should also meet the requirements stipulated by courts to be deemed admissible, therefore any new biometric tube introduced. But often require reliable and repeatable measurements, such requirements can vary among different courtrooms.

In addition to their uniqueness, their stability over a reasonable time period should also be Established, it is therefore important that any new/potential biometric evidence to be admissible by court. To check the veracity of the questions and assertions that the stability of finger knuckle patterns, a preliminary study presented in this paper is motivated, especially for forensic and law-enforcement has never been explored/established. A normal human hand has four fingers each of which has 3 bone segments and 3 joints. The thumb has 2 bone segments and 2 joints. From a typical finger dorsal image, these segments are known as phalanges. The minor finger knuckle patterns do not appear to suffer from such problem,while in some humans the major finger knuckle pattern can be occluded by hair. For any possible suspect identification,there are several forensic images when only minor finger knuckle patterns/portions are visible. To improve the reliability and accuracy of conventional major finger knuckle based biometric identification, the matching results from the minor finger knuckle matching can also be employed.

II.LITERATURE SURVEY

2.1 System Overview

In our previous work we have recognized the person using palm print. Palm print recognition isone of the most promising biometrics, has received considerable recent biometric research interest. Among various palms print recognition techniques, coding based methods have been very successfuldue to their simplicity, high precision, small size of feature and rapidness for both feature extraction and matching.Palmprint identification has emerged as one of the popular and promising biometric modalities for forensic and commercial applications. Recent research on palm print recognition indicates that the orientation information of palm lines is one of the most promising features palmlines generally are considered as typical multistage features, where the principal lines could be analyzed at a lower resolution and the wrinkles should be extracted at a higher resolution. Theinner surface of the palm normally contains three axiom creases, secondary creases and ridges. The axiom creases are also called principal lines and the secondary creases are called wrinkles.

The axiom and the major secondary creases are formed between the third and fifth months of pregnancy and superficial lines appear after the birth. Although, the three major axioms are genetically dependent, most of other creases are not. Even identical twins have different palm prints [10]. These non-genetically deterministic and complex patterns are very useful in personal identification. Human beings were interested in palm lines for fortune telling long time ago. Scientists know that palm lines are associated with some genetic diseases including down syndrome,aarskog syndrome,Cohen syndrome and fetal alcohol syndrome. In palm print recognition the features used for matching are the principal lines and wrinkles. Actually, the outer surfaces of finger joints have even more obvious line features than the palm surface, while they have much smaller area than the palm surface. This motivates us to propose a new biometric technique which is the FKP, which refers to the image of the outer surface of the finger phalange joint Palm print recognition is one kind of biometric technology. A simple palm print biometric system has a sensor module, for acquiring the palm print, a feature extraction module for palm print representation and a matching module for decision making. A FKP-based biometric recognition is more recent biometric technology and it has attracted an increasing amount of attention. The image-pattern formation of a finger-knuckle contains information that is capable of identifying the identity of an individual. The FKP biometric recognizes a person based on the knuckle lines and the textures in the outer finger surface. These line structures and finger textures are stable and remain unchanged throughout the life of an individual. An important issue in FKP identification is to extract FKP features that can discriminate an individual from the other.

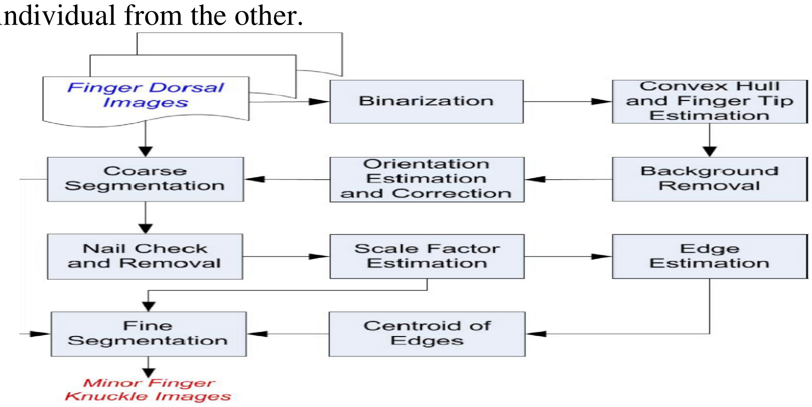

Fig. Automated segmentation of minor finger knuckle images from the finger dorsal images.

2.2Study of an Existing System

The finger surface posses unique patterns that have been utilized in the personal identification[9][10]. Woodard and Flynn [9] have examined the fine features of finger surface for its use inthe biometric system. Authors have presented promising results by using curvature and a shape based index from finger surface features extracted from finger images. For hand data collectionthe Minolta 900/910 sensor was used by author. However, the work detailed in does not exploitthe texture information that can be simultaneously extracted from the intensity images of hands.

Ribaric [5] and Fratric employed appearance based features from the finger and palm surface

images for personal identification. However, the authors in [5] have employed a scanner for imaging which is very slow and, hence, not suitable for online user authentication. S. Malassiotis - etal.[10]combines finger geometry features and color information to authenticate user hands in the cluttered background. The finger shape information is generally believed to be less discriminativeand only suitable for small scale user identification. Michael K.O. Goh and Connie Tee (2009)employed a bimodal palm and knuckle print recognition system using inner surface of palm and finger knuckle. Authors presented a palm print and knuckle print tracking approach to automatically detect and capture these features from low resolution video stream. No constraint is imposedand the subject can place his/her hand naturally on top of the input sensor without touching anydevice. The palm print and knuckle print features are extracted using Wavelet Gabor CompetitiveCode and Ridget Transform methods. Several decision level fusion rules are used to consolidatethe scores output by the palm print and knuckle print the work, detailed is promising but it relieson crease and wrinkle details on the palm side (inner surface) of the fingers which are quite limited.

Ajay Kumar and Ravikanth invest gates a new approach for personal authentication using fingerback surface imaging. Author uses texture pattern produced by the finger knuckle bending for

Identification as it is highly unique and makes the surface a distinctive biometric identifier. FingerGeometry features are also extracted from the same image at the same time and integrated to fur-their improve the user identification accuracy of such as Fingerprint Based Identity, Detection.Face Based Identity ,Detection. Face detection based Video Surveillance. Palm print detection. In our previous work we have recognized the person using palm print. Palm print recognition isone of the most promising biometrics, has received considerable recent biometric research interest.

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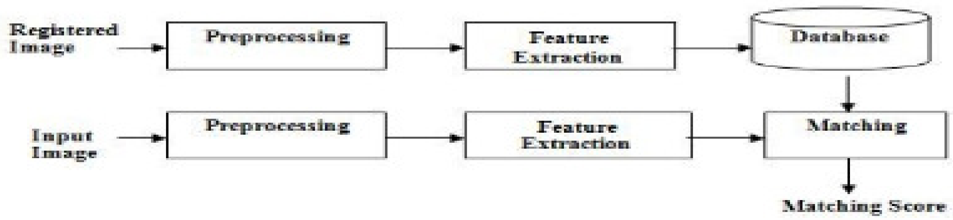


Fig .Flow diagram of biometric recognition system

2.3Comparisonof Existing System with Proposed System

Biometrics is a technique used to provide unique individual characteristics of a human being. The centroid value of the group is given by clustering method which reduces the numberof points of a system. Project proposes a new technique named as biometric clustering systemto merge the above two process to provide authentication for individuals. This paper proposes anovel method to combine the SIFT algorithm with clustering to find the output values of knuckleprint in the bit format. In Existing system consists of two process i.e. enrollment and verification phase.Combination of simultaneously acquired minor finger knuckle pattern and major fingerknuckle pattern images can achieve significant improvement in performance, which is not possible by using major finger knuckle images alone as in the literature, if input image is not clear or damaged then it will not give correct result.

In proposed system a new user authentication system using finger-back surface imaging is inves-tigated. The proposed system employs Peg-free imaging and develops a robust approach adaptedto the resulting hand-pose variations and problems due to the appearance of the rings. An important aspect of our approach is the simultaneous extraction of finger-geometry features whichare employed to achieve further performance improvement. The details of the imaging setup areprovided in that, The image contours extracted from the acquired images are used for image normalization and the extraction of region of interest (ROI) is detailed ,while the extraction of fingergeometry features is the automated extraction of four hand fingers and then the knuckle regionimages is illustrated This also considers two different methods of extracting knuckle regions and details the problem due to finger rings. The analysis of knuckle texture images using appearancebased techniques which is includes the details on the combination of matching scores from fourknuckles.

The use of finger knuckle print as biometric identifier has generated increasingly interest in theliterature. Woodard and Flynn successfully demonstrated the use of 3D finger dorsal images for personal identification. This work essentially exploits common curvature patterns on the 3D finger surface and quantifies them into various shape indexes for the matching of patterns.[7]the likelihood of employing minor finger knuckle images for the recognization investigated by this paper. The coarse to fine segmentation strategy developed in this paper has been quite self made because ithas been able to achieve higher matching accuracy [8] details an online system using the handdorsal surface images which can exploit the finger knuckle patterns from the multiple fingers and also their geometrical shape characteristic feature at the same time. Accurate and concurrent results were found out with different fusion of basic techniques as Principal Component Analysis (PCA), Linear DiscriminateAnalysis (LDA) and Independent Component Analysis (ICA). Due to finger rings and black backgroundovercome problem by this system. The drawback of this method is the speed of workingis less as it uses scanner for imaging.[11] In this paper they work on a new method of phase to enhance the performance of finger vein recognization system. The projected system at the same time acquires the finger vein and print low resolution images of finger and finally combines these two evidencesemploying a novel score level combination strategy. They implemented and investigated two new scorelevel combos, i.e., holistic and nonlinear fusion, and relatively assess them with additional wellliked score level fusion approaches to establish their effectiveness in their projected system in thispaper they work on FKP recognition based on Band Limited Phase Only Correlation (BLPOC).POC is one of an imaging matching technique using the phase components in 2D DCT of given images .BLPOC is a modified version of POC.BLPOC is dedicated to evaluate similarity between images, in order to handle the nonlinear deformation of FKP images. This paper gives detail of the developmentof a smart phone based online system to automatically identify a person by using person fingerknuckle image. The 1D log-Gabor filter to extract the finger knuckle templates whichare matched using Hamming distance doned by this paper..The limitation with this system is that for accurate fingerknuckle detection, the acquire image background should be largely uniform as the backgroundnoise would inuence the auto finger detect capability. There are different edge detection methods, to detectedges in knuckle image, are employed in system. The Artificial neural network play a important rolefor classifying the knuckle surface.

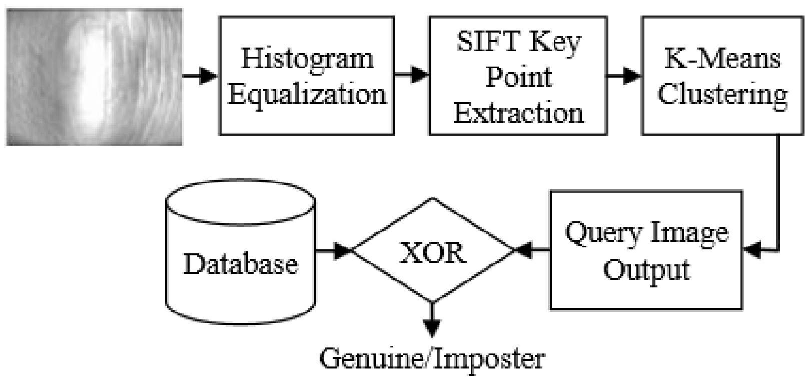
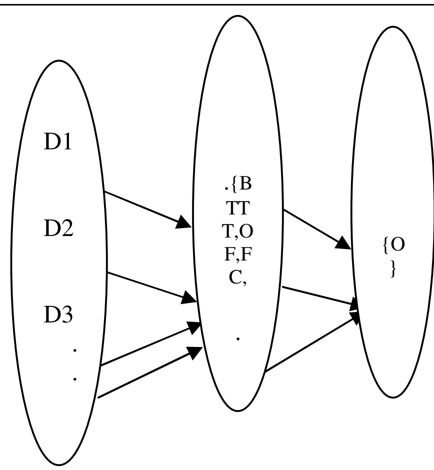


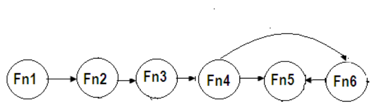
Fig. Finger knuckle print-Verification phase

A handful work of researches have been presented in the literature for the human authentication using multimodal biometrics system. A brief review of some recent researches is presented here. Kakadiaris etal. Presented 3D face recognition in the presence of facial expressions: An annotated deformation of model point of view. In that paper, they presented the computational tools and a hardware prototypefor 3D face recognition. Full automation was provided through the use of advanced multistagealignment algorithms, resilience to facial expressions by employing a deformable model frameworkand invariance to 3D capture devices through suitable preprocessing steps. In addition, scalabilityin both time and space was achieved by converting 3D facialscanned into compact metadata. In their system, they gained a rank-one recognition rate of 97.8 percent for an identification scenarioand an equal error rate of 1.2 percent for a verification scenario on a database of 415 subjects and1,386 total probes. The set of ensuing match scores was used as an index code. The indexcodes of multiple modalities were then integrated using three different fusion techniques in orderto further improve the indexing performance. Experiments on a chimeric face and finger printbimodal database indicated a 76% decreasing rate in the search space at 100% hit rate. Nageshkumaret al. proposed a new and efficient secure multimodal biometric fusion using palm print and faceimage. Biometrics based personalidentification was regarded as an effective method for automatically recognizing, with a high confidence aperson's identity. In that paper, they have proposed the authentication approach for a multimodal biometric system identification using two traits i.e., face detect and palm print detect. This system was designed for application, in that training datacontains a faceand palm print. The palm print and face features increased robustnessof the person authentication by integrating. The final decision was made by fusion at matching score level architecture in which features vectors was created independently for query measurement purpose and thencompared to the enrolment template, which was stored during database preparation phase.

III. Mathematical Model

sr. No.	**Description**	**UML design observations**
1.	**Problem description**	
	1) Finger Image Acquisition 2) Localization of Region of Interest 3) Extracting Segmented Finger Knuckle Image 4) Knuckle Image Enhancement 5) Knuckle Feature Extraction Let the system be described by S, S={D,BT,OF,FC,PE,LDBA,O}	Where S: is a System. D : is set of Datasets BT:Finger Image Acquisition OF: Localization of Region of Interest FC:Extracting Segmented Finger Knuckle Image PE: Knuckle Image Enhancement LDBA: Knuckle Feature Extraction O:Output.
2.	**Activity**	
	D={d1,d2,…….dn} LD={Dictionary} Y={ BT,OF,FC,PE,LDBA} Z={O}	D : is set of Datasets LD: Set of Localized Dictionary. Y: Set of System Modules. Z: Output.
3.	**Vein Diagram**	
		D : is set of Datasets BT : Finger Image Acquisition OF: Localization of Region of Interest FC : Extracting Segmented Finger Knuckle Image PE: Knuckle Image Enhancement LDBA: Knuckle Feature Extraction O:Output.

4.	State diagram	



D : is set of Datasets
Fn1: Finger Image Acquisition
Fn2: Localization of Region of Interest
Fn3: Extracting Segmented Finger Knuckle Image
Fn4: Knuckle Image Enhancement
Fn5: Knuckle Feature Extraction
Fn6:Output.

5.	**Functional Dependencies**	

	Fn1	Fn2	Fn3	Fn4	Fn5	Fn6
Fn1	0	1	0	0	0	0
Fn2	0	1	0	0	0	0
Fn3	0	0	1	0	0	0
Fn4	0	0	0	1	0	0
Fn5	0	0	0	0	0	0
Fn6	0	0	0	0	1	0

Fn1: Finger Image Acquisition
Fn2: Localization of Region of Interest
Fn3: Extracting Segmented Finger Knuckle Image
Fn4: Knuckle Image Enhancement
Fn5: Knuckle Feature Extraction
Fn6:Output.

IV.RELATED WORK

The finger surface possess unique patterns that have been utilized in the personal identification. Woodard and Flynn have examined the fine features of finger surface for its use in the biometric system. Authors have presented promising results by using curvature and a shape based index from finger surface features extracted from finger images. For hand data collection the minolta 900/910 sensor was used by author. However, the work detailed in does not exploitthe texture information that can be simultaneously extracted from the intensity images of hands.ribaric and fratric employed appearance based features from the finger and palm surface images for personal identification. However, the authors in have employed a scanner for imaging which is very slow and, hence, not suitable for online user authentication. s. malassiotis etal.combines finger geometry features and color information to authenticate user hands in the cluttered background. The finger shape information is generally believed to be less discriminative and only suitable for small scale user identification . Michael know. Go and Connie tee (2009)employed a bimodal palm and knuckle print recognition system using inner surface of palm and finger knuckle. Authors presented a palm print and knuckle print tracking approach to automatically detect and capture these features from low resolution video stream. No constraint is imposed and the subject can place his/her hand naturally on top of the input sensor without touching any device. The palm print and knuckle print features are extracted using wavelet Gabor competitive code and ridged transform methods. Several decision level fusion rules are used to consolidate the scores output by the palm print and knuckle print the work, detailed is promising but it relies on crease and wrinkle details on the palm side (inner surface) of the fingers which are quite limited. jay Kumar and Ravikanth investe gates a new approach for personal authentication using finger back surface imaging. Author uses texture pattern produced by the finger knuckle bending for identification as it is highly unique and makes the surface a distinctive biometric identifier.Fingergeometry features are also extracted from the same image at the same time and integrated to further improve the user identification accuracy of such as Fingerprint Based Identity, Detection.FaceBased Identity,Detection.Face detection based Video Surveillance. Palm print detection.

V. CONCLUSIONS AND FURTHER WORK

This paper has successfully investigated the possibility of employing minor finger knuckle images for the biometric identification. The coarse-to-fine segmentation strategy developed in this paper has been quite successful as it has been able to achieve higher matching accuracy. The experimental results illustrated in this paper, on the database of 503 subjects, can achieve promising performance from only using contactless minor fingerknuckle images. The experimental results reported in this paper also suggest that the simultaneous use of major and minor finger knuckle images can help to significantly improve the performance that may not be possible by using either minoror major finger knuckle images alone.

Two finger joints, i.e., PIP and DIP joint as have significant backward motion and therefore require some mechanism to prevent dislocation and sublimation. Such mechanism is anatomically built in fingers and consists of combination of bony restraints, ligaments, extensor tendinousattachments and biomechanical action of muscles. Therefore the knuckle patterns, which are formed due to stress or folding pattern of (additional) dorsal skin at PIP and DIP joints, closely reflect anatomy of his/her fingers. This paper has also detailed a preliminary but first promising attempt to ascertain stability of finger knuckle patterns. However the use of only major knuckle patterns, small number of subjects, and lack of systematic evaluation in various age groups reflects narrow focus on this topic in this paper. Availability of such images acquired after an interval of 4–7 years in public domain will serve as useful evidence to favorably argue on suspects/offenders for forensic and law-enforcement applications.

The finger dorsal images employed this paper were acquired in single session and therefore conclusions on the accuracy points towards the uniqueness of major/minor fingerknuckle patterns in the given database rather than on testability of such patterns with time. Prior efforts in the literature have shown the stability of major finger knuckle features by employing two session database, in an interval of 4–6 weeks, to ascertain the stability their stability in respective duration. Lack of any long interval study on the stability and individuality of finger knuckle patterns has cautioned the use of finger knuckle images foray commercial applications and therefore there is pressing need for systematic/scientific study in this area. Accurate segmentation of stable major and minor finger knuckle regions is significantly important as it can control the achievable identification accuracy from the finger dorsal images. Therefore further efforts are required to develop accurate segmentation algorithms which can also address common imaging challenges from less-constrained finger imaging, i.e., off-axis view, poor contrast, motion blur, defocusing, over-saturation, and occlusion. Individual error rates.

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