INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
(Volume2, Issue4)
Available online at: www.Ijariit.com

Authentication Using Finger Knuckle Print Techniques

*Sanjna Singla, **Supreet Kaur
**Department of Computer Science and Engineering,*
Punjabi University Regional Centre for Information Technology and Management, Mohali, Punjab, India
***Department of Computer Science and Engineering,*
Punjabi University Regional Centre for Information Technology and Management, Mohali, Punjab, India

Abstract— In this paper, a new approach is proposed for personal authentication using patterns generated on dorsal of finger. The texture pattern produced by the finger knuckle is highly unique and makes the surface a distinctive biometric identifier. Important part in knuckle matching is variation of number of features which come by in pattern form of texture features. In this thesis, the emphasis has been done on key point and texture features extraction. The key point features are extracted by SIFT features and the texture features are extracted by Gabor and GLCM features. For the SIFT and GLCM features matching process is done by hamming distance and for the Gabor features matching is done by correlation. The database of 40 different subjects has been acquired by touch less imaging by use of digital camera. The authentication system extracts features from the image and stores the template for later authentication. The experiment results are very promising for recognition of second minor finger knuckle pattern.

Keywords— finger knuckle recognition, texture features, biometrics

I. INTRODUCTION

The quick development in the exploit of e-commerce applications and penetration of information technology into the daily life needs consistent user credentials for efficient and secured access control. . These systems are becoming more convenient and user-comfortable with the preamble of peg-free and touch less imaging. The usage of these hand-based systems for large level individual confirmation needs additional hard work to explore additional features that can be simultaneously traced from the hand images. Verification is an essential element of individual relations with computers. Traditional means of authentication, primarily passwords and private recognition figures (PINs), have until recently dominated computing, and are likely to remain essential for the years to come. Biometrics is one of such strong authentication technologies.

Biometrics is an essential and broadly used class of techniques for identity authentication and access control. Biometrics is smart as they are natural properties of a person. They do not need remembered like passwords, and are not effortlessly lost or forged like identifying credentials. On the same time, biometrics is essentially noisy and exceptional.

A number of biometric aspects are in use in several applications. Each biometric attribute has its strengths and deficiency and the preference classically build upon on the application. The match between a biometric attribute and an application is determined depending on the characteristics of the application and the properties of the biometric attribute.

A characteristic biometric system is composed of two main modules:
1) Acquisition, this module is responsible for capturing a raw biometric trait by using a hardware device such as fingerprint reader or a camera. Moreover, it also disciple the raw data into digital information, which will be used in the next modules.

2) Feature extraction and matching, this module determines first whether the acquired biometric data achieved a minimum quality score. If it is not so, then the consumer will be asked to submit its biometric trait, which usually consist in an array of float figures. When such series is reserved in the system, it is commonly referred to as a template.

Benefits of Biometrics
1. The benefits of biometrics usage and deployment are derived from having a high degree of certainty regarding an individual's recognize.
2. The profit lead openly or indirectly to cost savings or to reduced risk of financial losses for a personality or organization.

Fingerprints are the ridge and furrow patterns on the tip of the finger and have been used comprehensively for individual credentials of people. Due to its criminal connotations, some people didn't feel comfortable in contributing their fingerprints for identification in civilian applications. On the other hand, since fingerprint-based biometric systems recommend positive identification with a very high degree of confidence, and condense hard state fingerprint sensors can be entrenched in various systems.

State-of-the-art in Fingerprint Identification
A number of systems exist for fingerprint verification as well as classification. Even though National Institute of Standards and Technology (NIST) provides a number of databases for performance evaluation and benchmark, many companies report results on their proprietary databases and, therefore, their results cannot be independently verified and compared.

Finger Knuckle Benefits
Three fundamental techniques are used in authentication mechanisms

- Resistant to criminal tampering: Because veins are concealed indoor the body, there is little threat of forgery or theft. Involves live body identification hence dead people finger will not be validated.

- High accuracy: The 'False Rejection Rate' (FRR) is less than 0.01% for the, the 'False Acceptance Rate' (FAR) is less than 0.0001% and the 'Failure to enrol' (FTE) is 0%.

- Unique and constant: Finger vein patterns are different even among identical twins and remain constant through the adult years.

- Contactless: The use of near-infrared light allows for non-invasive, contactless imaging that ensures both convenience and cleanliness.

II. LITERATURE REVIEW

Livia C. F. Araujo [1]: This paper uses a static keystroke dynamics in user confirmation. The inputs are the main down and up times and the key ASCII codes apprehend although the user is typing a string. Four component (key code, two keystroke latencies, and key duration) were investigated and seven experiments were enforced adjoining these components. The outcomes of the experiments were assess with three types of user: the legitimate, the impostor and the observer impostor users. The best outcomes were attained employing all components, retrieving a false rejection rate of 1.45% and a false acceptance rate of 1.89%. This perspective can be used to enhance the usual login-pass-word substantiation when the password is no more a secret. This paper organizes with the use of four elements to validate users.

Kumar and Ravikanth [2]: They prompt a brief investigation on acquirement and removal of knuckle points from the dorsal part of the hand. They employ a low cost and simple-to-use imaging system using a digital camera (Canon Powershot-A620) for attainment of hand dorsum. The accomplished hand image is then used to compute knuckle points as a region of interest (ROI). The PCA, LDA and ICA component are extracted from knuckle points to show its competency on IIT database.

Woodard and Flynn [3]: Author have first analysed finger back surface for personal validation. They handle Minolta 900/910 sensor for achievement of 3D finger back surface. Their effort verifies the exclusivity of finger back surface as a probable biometric trait. Nevertheless, their work has not wholly dedicated to knuckle points and they employ complete finger back surface in recognition Moreover, the use of Minolta 900/910 raises the all costs and pre-processing of 3D finger surface expand the time difficulty of the framework which limits its usage for online biometric applications.

Kumar and Zhou [4]: Their imaging set up can importantly minimize the pre-processing size by taking into account only finger part for knuckle removal. They suggest an integration of orientation and magnitude as knuckle component and also analysis diversity of other textural component like comp code, ordinal code, RLOC and BOCV in correlation. The four knuckle points employ in their work are: left index, right index, left middle and right middle from the two hands. They also explained the fusion of these knuckle points with the use of sum and min score level fusion rules.

Shoichiro Aoyama et al [5]: This paper describes a Finger-Knuckle-Print (FKP) classification algorithm with the use of BLPOC based local block matching. The phase information obtained from 2D Discrete Fourier Transform (DFT) of images consists of important information of image demonstration. The phase-based image matching, specifically BLPOC-based image matching is efficiently practical to image approval tasks for biometric discovery uses. To calculate the matching score, the demonstrate algorithm enhance the global and local deformation between FKP images with the use of phase-based organization same and the BLPOC-based local block matching, likewise. Investigational approximate by using the PolyU FKP database reveals the competent identification presentation of the suggested algorithm correlated with the state-of-the-art conventional algorithms.

Georgios Goudelis et al [6]: Many body parts, personal features and signalling techniques have currently been optional and used for biometrics systems: faces, eyes, fingers, ears, teeth, typing styles, veins, voices, signatures and gaits. A constantly growing number of biometric methods raised in order to fulfil the distinct kinds of demands in the market.

Every technique prompt a number of benefits correlate to the others as each technique has been established to subserve distinct kinds of needs. Nevertheless, there is still no technique able to totally convince the existing security needs. This is the reason why researchers constantly drive their efforts to newer techniques that will deliver a higher security stage. In this paper, the promising biometric modalities are prompted.

Karbhari Kale et al [7]: Dorsum of the hand can be very valuable in personal identification but yet it has not that much widespread attention. By scan of dorsum hand, two biometric traits can be achieved finger-knuckle and finger nail. This paper appears a perspective to integrate Finger-knuckle and finger-nail features. Finger-knuckle components are separate with the use of Mel Frequency Cepstral Coefficient (MFCC) method and the components of finger-nail are obtained from second level wavelet decomposition. They adjoined these components with the use of elements level fusion and feed forward back-propagation neural network for categorization. The presentation of the system has been tested on our own KVKR- knuckle database that involves 100 subjects' dorsal hands. Evaluation outcomes prove that expansion increase in training set gives increased enforcement rate. The best performance of the suggested system reaches up to 97%.

Shubhangi Neware et al [8]: The texture paradigm generated by the finger knuckle bending is highly novel and makes the surface a different biometric identifier. This paper prompts literature survey and categorization technique for a promising biometric identifier, namely Finger-Knuckle-Print (FKP), for personal recognition. The FKP component obtained is done with the use of Principal Component Analysis (PCA) technique. Also Knuckle categorization with the use of nearest mean classifier is suggested in this paper. The experimental outcomes from the suggested perspective are emerging and confirm the usefulness of this perspective for personal classification.

Shubhangi Neware, Dr. Kamal Mehta and Dr. A.S. Zadgaonkar [9]: The texture pattern generated by the finger knuckle bending is very unique. In this paper, literature survey has been done on finger knuckle-print (FKP) for individual identification. Different edge detection methods Sobel, Canny and Robert are employed to detect edges in knuckle.

Lin Zhang and Hongyu Li [10]: Biometrics validation is a successful technique for automatically observes a person's identity with high confidence. It is well predictable that in biometric systems component obtained and illustration are key discussions. Between several elements obtained and representation strategy, coding-based techniques are most powerful because they have the merits of high accuracy, compactness, robustness high matching speed and however they have been approved in many distinct kinds of biometric structure, alike palmprint, and finger-knuckle-print based ones. Hence, how to develop a good coding strategy is still an open

problem. Currently, studies in image processing and applied mathematics have shown that local image elements can be well obtained with Riesz transforms in a unified structure. However, in this paper they suggest to employ Riesz transforms to encode the local paradigm of biometric images. Particularly, two Riesz transforms on the basis of coding mechanism, i.e. RCode1 and RCode2, are suggested. They both use 3-bits to symbolize each code. RCode1 and RCode2 are methodically classify and correlated with the other 3-bit coding technique on a palmprint database and a finger-knuckle-print database. Experiments prove that the suggested technique especially RCode2, could attain quite identical confirmation accuracies with the state-of-the-art technique (CompCode) although they require much less time at the elements obtained stage, which provide them prominent candidates for time critical uses.

Mrs. S.S. Kulkarni, Dr.Mrs. R.D.Rout [11]: This paper supplies a notion about the different biometrics modality for substantiation. Most of the famous biometrics modalities are offered in market. The majority of the biometrics technology delivers strongest proof of the physical presence of a person. Privacy and safety are one of the most significant limitations in existing biometrics. The efforts are paying attention to choose different modality (FKP) for the safe storage and substantiation of the biometric template. This paper focal point is on the distinctive feature of the FKP modality. The main aim of the proposed system is to deliver high level security with less EER.

III. Experimental Results

Gabor features matching: In this features find out knuckle image texture in form of texture and then matching the distribution by correlation and generate the ROC or area under curve between hit

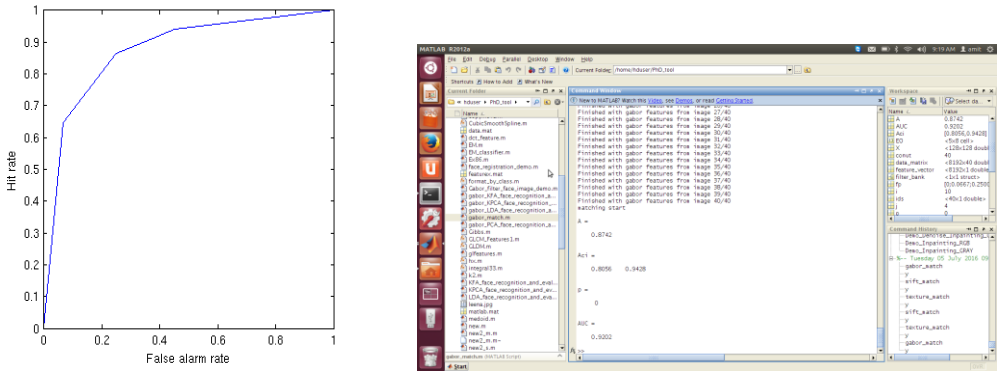


Figure 3.1: Gabor feature matching ROC Curve and screen shot of accuracy

rate and false rate with 92% accuracy and 87.23% AUC this show texture feature is important for knuckle matching above two figure show ROC and accuracy. In Gabor feature accuracy of matching is high because it match the sin wave pattern which is less overlapped with other images and give distinguish correlation difference by other features

GLDM and GLCM features matching:

In this features find out GLDM and GLCM features image texture in form of texture and then matching the distribution by hamming matching and generate the ROC or area under curve between hit rate and false rate with 86.02% accuracy and 77.23% AUC this show texture feature is important for knuckle matching below two figure show Roc and accuracy. GLDM and GLCM features which indicate texture features of probability density function which more overlapped than gabor feature so its accuracy is less than gabor matching.

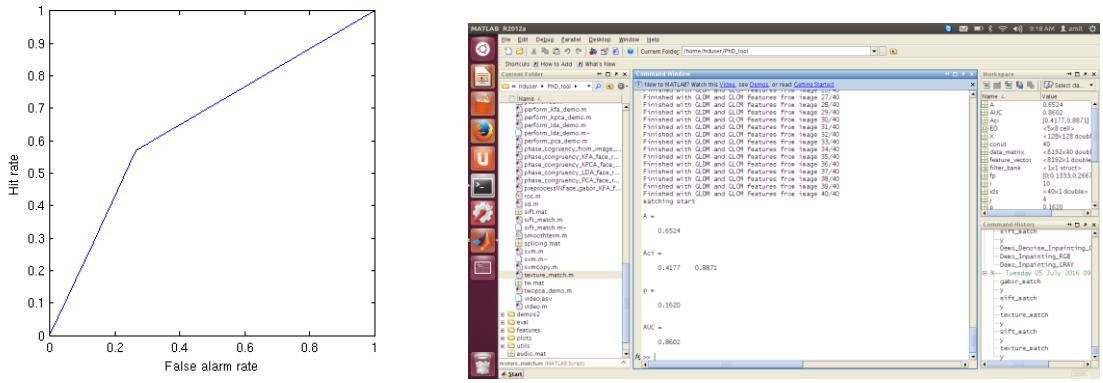


Figure 3.2: GLDM feature matching ROC Curve and screen shot with accuracy

SIFT Features:

In this features find out SIFT features image key point features in form of texture and then matching the distribution by hamming matching and generate the ROC or area under curve between hit rate and false rate with 86.02% accuracy and 77.23% AUC this show texture feature is important for knuckle matching below two figure show Roc and accuracy.

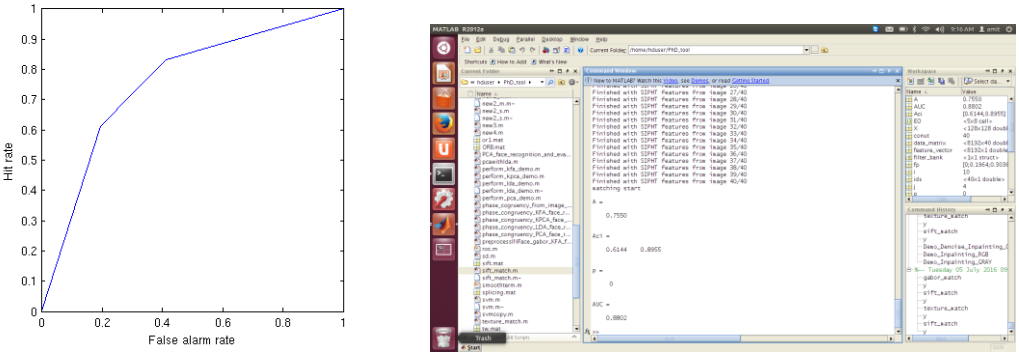
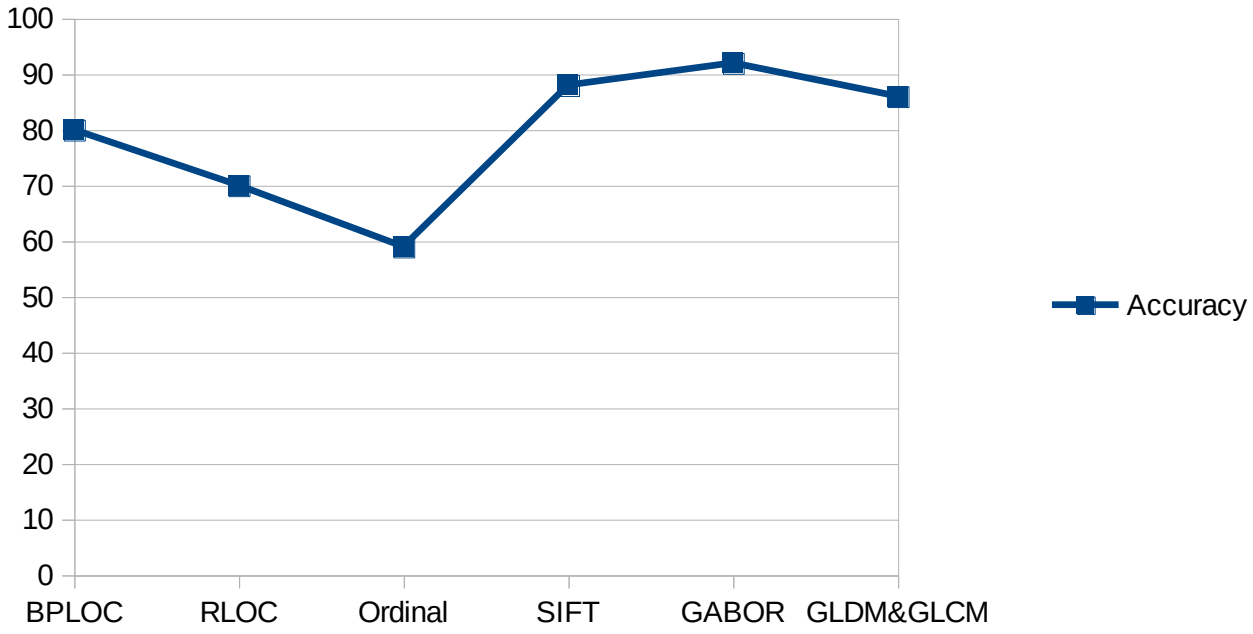


Figure 3.3: SIFT feature matching ROC Curve and screen shot of Accuracy

In table 3.1 show comparison of existing method with BPLOC, RLOC and Ordinal features with Gabor feature with its maximum accuracy,

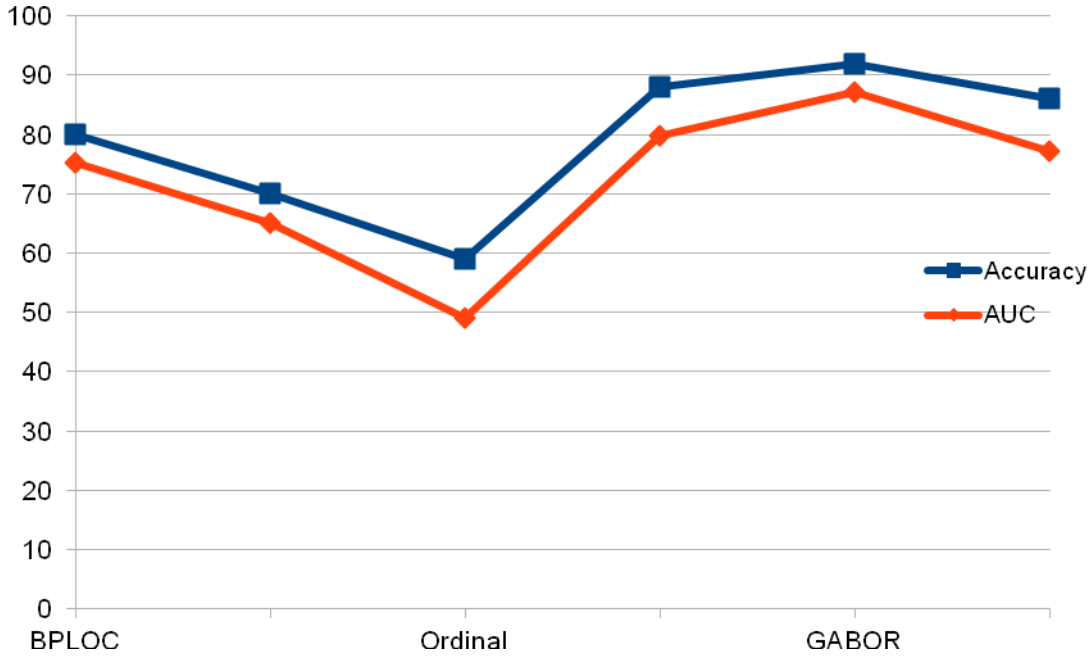
Table 3.1: Comparison of Existing and Proposed Method

Feature	Accuracy	AUC
BPLOC	80	75.23
RLOC	70	65
Ordinal	59	49
SIFT	88.02	79.82
GABOR	92	87.23
GLDM & GLCM	86.02	77.23



Below graph comparsion among the existing and proposed technique , which show in old techniques features is highly overlapped , so biometric confuse and make not as much hit as proposed method becaucse proposed method define the pattern of features and existing method represent the geometry, so it is highly overlapped accuracy reduce.

Graph 3.1 Accuracy comparison between existing and proposed method



Graph 3.2: Accuracy comparsion between existing and proposed method

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