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Feature Level Fusion Using Finger Knuckle Print Multi-Instance biometric

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Abstract - Biometric-based individual verification is receiving an extensive interest in the area of research due to its far above the ground applicability in a wide range of security applications. Among these, hand-based biometric systems are consider to be more successful in terms of precision and computational complexity. In hand-based biometrics, finger knuckle surface is considered as one of the rising potential biometric traits for individual verification. This is due to its constant and unique inherent patterns present in the external surface of the finger back knuckle region. Further, this finger knuckle has a elevated potentiality towards discriminating individuals with high precision. In this paper, we present a review of various system models that are implemented for personal authentication using finger knuckle biometrics. Furthermore, the challenges that could arise during the accomplishment of the large level real time biometric system with finger knuckle print are explored.
Keywords- Biometric, Finger Knuckle Print, Multi-Instance, Fusion, Authentication.

I. INTRODUCTION

Biometric deals with the authentication of individuals based on their physiological and behavioral characteristics. The Behavioral characteristics refer to the behavior of a person which includes typing rhythm, voice, gait, keystroke, signature etc and the Physiological characteristic refers to the feature or outline of individual body which includes finger print, iris, ear pattern, DNA, palm print, face etc. [1]



Fig. 1 Classification of Biometric System

Finger knuckle is the outer surface of finger, it is also known as dorsum of the hand. The inborn skin patterns of the outer surface in the region of the phalangeal joint of one's finger, has high capability to distinguish dissimilar individuals. [2] The reason to use FKP are due to its richness in texture features, readily ease of access, contact-less image acquirement, inconsistency to emotions and other behavioral aspects such as fatigue, convenience, universality, durability, measurability and identification in society. [3]

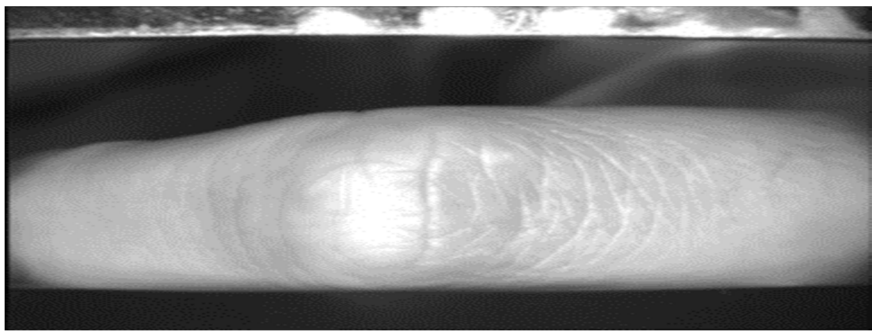


Fig. 2 Finger Knuckle Print

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II. SURVEY OF TECHNIQUES USED IN FINGER KNUCKLE PRINT RECOGNITION SYSTEM

The outer finger surface posses distinctive patterns that have been utilized in the individual identification. Over the past several years, there have been a number of researches done on Finger Knuckle Print Recognition based systems some of them are discussed below.

A. Morales et al. [4] this paper proposes a new approach for person verification using finger knuckle-prints. It applies a Gabor filter to enhance the FKP information and a scale invariant feature transform (SIFT) to extract the features.

1) Problem defined: FKP image patterns are often affected by problems such as noisy sensor data and variations in illumination.

2) Method: Here a two-step FKP person identifier system is proposed, which is: 1. to apply Gabor filtering to enhance the knuckle lines and 2. To work out the SIFT descriptors.

3) Conclusion: Results obtained provide improvements in the state of the art.

B. Harbi AlMahafzah et al. [5] this paper proposed the use of multi-instance feature level fusion as a means to improve the performance of Finger knuckle Print.

1) *Problem defined:* Single biometric does not ensure the desired reliable result.

2) *Method:* The Log-Gabor has been used as feature extraction algorithm. Four matching score normalization techniques experimentally evaluated to improve the performance fusions of different instances.

3) *Conclusion:* It gives better performance than single instances.

C. Shubhangi Neware1 et al. [6] this paper presents literature survey for an emerging biometric identifier, namely Finger Knuckle Print for personal identification.

1) *Problem defined:* User inconvience in providing biometric data.

2) *Method:* Knuckle Surface Identification includes- Finger image acquisition, Localization of Region of Interest, Extracting Segmented Finger Knuckle Image, Knuckle Image Enhancement, Knuckle Feature Extraction, Database Establishment, Feature Matching.

3) *Conclusion:* It is an efficient approach as it requires less computation and processing time.

D. Tharwat et al. [7] this paper proposes two multimodal biometric authentication methods using ear and FK images.

1) *Problem defined:* Biometrics data face the problems of noisy sensors data, non universality, and unacceptable error rates.

2) This paper proposes a multi-level fusion method at the image-level and the classification-level. The features are extracted from the fused images using different classifiers and then combine the outputs of these classifiers in the abstract, rank, and score levels of fusion.

3) *Conclusion:* the proposed authentication methods increase the recognition rate.

E. Abdallah Meraoumia et al. [8] FP and FKP images are integrated in order to construct an efficient multi-biometric recognition system based on matching score level and image level fusion.

1) *Problem defined*: Use of uni-modal biometric systems will suffer from problems like noisy sensor data, non-universality, lack of distinctiveness of the biometric trait, and spoof attacks.

2) *Method:* MACE method is used for matching. The *FKP* and *FP* images are used as inputs of the matcher modules. The outputs of the matcher modules (*Peak* or *PSR*) are combined using the concept of data fusion at matching score level.

3) *Conclusion:* The obtained experimental results show that the combination of FKP and FP modalities performs best, in both fusion techniques, and is much better than person recognition using only single modality.

III. PROBLEM DYNAMIC

Following Problems were recognized while reviewing the earlier work done on Finger Knuckle Print Recognition System [9], [10]. Single biometric does not ensure the preferred reliable outcome.

A. *Difficulty in recognizing FKP Images.*

1) In FKP False Rejection Rate and False Acceptance Rate is a huge problem.

2) FKP image patterns are often exaggerated by problems such as noisy sensor data and variations in illumination.

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3) FKP data face the problems of non universality and unacceptable error rates.

IV. CONCLUSION

The use of finger knuckle images can help to significantly improve the performance, can achieve a desired balance between verification accuracy and verification speed, provides high level security with less EER. Finger Knuckle Print Recognition based on Multi-instance Fusion of local feature sets shows a reliable recognition rate, provides better performance than single instances, and requires less computation and processing time.

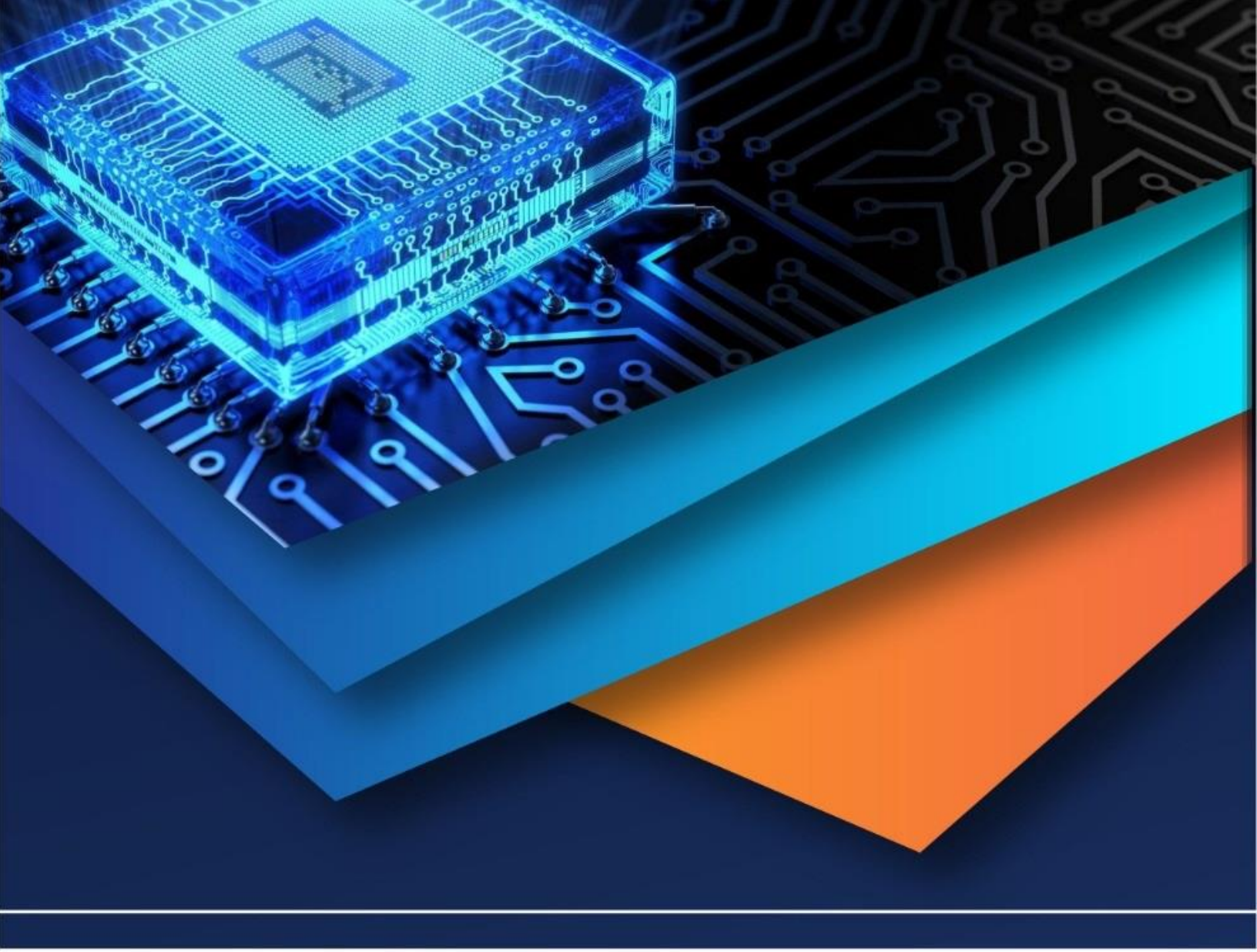
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