Comparative Study of FAST, MSER, and Harris for Palmprint Verification System

Satya Bhushan Verma, Saravanan Chandran

Abstract—Palmprint based biometric systems are growing in security systems because of its higher accuracy and its working speed. The FAST, MSER, and HARRIS, are mainly used for image mosaic, pattern recognition, image retrieval, and many other applications in image processing. In this paper, comparative study of FAST, MSER, and HARRIS, for Palmprint verification is carried out. The feature of Palmprint is extracted using three different methods FAST, MSER, and HARRIS, and the Palmprint verification and comparison is performed. The HARRIS detects most number of points than others. The MSER detects lesser points and FAST detects the least number of points in palmprint images. But the FAST takes lesser time for matching and MSER takes more time for matching compared with other two methods.

Index Terms—Biometrics, Palmprint, FAST, HARRIS, MSER, Pattern Recognition

1 Introduction

Biometric is the science of calculating and analyzing physiological and behavioural data. Biometrics recognition systems use behavioural and physiological data for validation [15]. The fingerprint, iris, face, palmprint, ear etc. are classified as physiological characteristics and signature, gait, keystroke etc. are classified as behavioural characteristics [13]. These behavioural and physiological characteristics are unique and can successfully apply for biometric applications.

The security systems based on password are widely used for information protection, but the passwords need to remember. The password based system identify only who use this password not identifying the person. Security system also, certain patterns such as alphabets, numbers and special characters and minimum length of 8 characters are insisted while creating new password and such passwords are difficult to remember. Biometric verification system is a method for identifying the template by matching with the previously stored template in the database. It measures a difference between the inputs to the previously stored templates from database and calculates some matching scores. Then it makes a decision on the basis of an assumed threshold value.

Palmprint identification has emerged as one of the popular and promising biometric modalities for forensic and commercial applications. Palmprint features are considered promising in identify people [16]. Palm is an inner surface of a hand and a palm contains three types of lines that are flexion creases, secondary creases, and ridges figure 1. The flexion creases are known as principal lines and secondary crease are called as wrinkles.

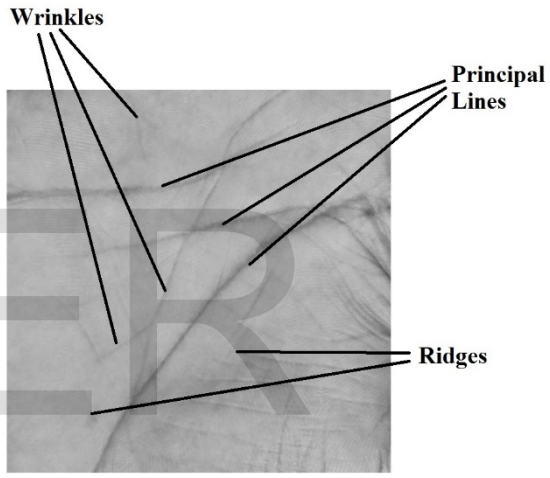

Fig.1. The Line Patterns on the Palm Print

Nowadays, there is high demand for touch-less biometrics due to various social and hygienic issues, Fig. 1 is the example of line pattern on the palm print. The biometric system based on palm print gives many benefits than the other biometric system, like it success fully works in lower dimension imaging, has a low cost, having stable structural feature, enhances fast feature extraction, higher accuracy rate, and great user adequacy.

2 Related Works

A.H. M. Al-Melali et al. proposed a fast personal palmprint authentication based on 3-D multi wavelet transformation [1]. In that paper they used 3-D discrete multi wavelet transformation as feature extractor and a probabilistic artificial neural network as a classifier. They tested and evaluate their proposed method upon 240 palmprint images. They achieved 100% recognition rate.

Chin-Chuan Han et al. [4] presented a paper of personal verification system which was based on the palmprint features. They extracted the ROI from palm image, and then extracted the

- *Satya Bhushan Verma is currently pursuing PhD in Computer Science from National Institute of Technology, Durgapur, West Bengal, India. E-mail: satyabverma1@gmail.com*
- *Saravanan Chandranhas completed Ph.D. from Department of Computer Applications, National Institute of Technology, Tiruchirappalli, in 2009. He is currently working as Assistant Professor at the National Institute of Technology, Durgapur, IndiaE-mail: dr.cs1973@gmail.com*

Palmprint features from ROI. They used three type of grid size that was 32 X 32, 16 X 16, and 8 X 8 in ROI and the Mean value of grid was the considered as the feature value. At last they used multiple templates matching scheme and used BPNN technique for verification.

Saravanan Chandran and Satya Bhushan Verma presented a palmprint verification system based on using shock filter, SIFT, I-RANSAC and LPD [11]. They used Shock filter in pre-processing stage. Then extracted features using SIFT. Moreover, they refined SIFT feature by using I-RANSAC and Local Palmprint Descriptor (LPD). They observed pre-processed image gives better matching score than without pre-processing. IIT Delhi and CASIA palmprint database used for the performance evaluation.

J. Matas et al. proposed a paper on Robust Wide Baseline Stereo from Maximally Stable Extremal [8]. They used MSER and found correspondences between a pair of images from the different viewpoints. They the introduction of MSERs, robust matching of local features and the use of multiple scaled measurement regions

Badrinath G. S. et al. proposed a palmprint verification system using SIFT feature [3]. They used SIFT operator for feature extraction. They used IITD and PolyU palmprint database for experiment. They found 99.67% accuracy in IITD database and 94.42% accuracy in PolyU database.

Ming Chen et al. proposed a palmprint recognition algorithm which is based on Harris synthetically method [9]. In that algorithm first, they use Harris to detect the corner point set. Then they applied distance and orientation features to interconnect the corner points with the lines and enhance the outcome. Moreover, fuzzy blocks using for increasing the matching probability in palmprint recognition algorithm. They used PolyU palmprint database for performance evaluation. They resulted 0.30% EER and this algorithm takes 3.5ms for Palmprint matching.

Satya Bhushan Verma et al. proposed a paper Analysis of SIFT and SURF Feature Extraction in Palmprint Verification System, in this paper give comparison of performance of SIFT and SURF feature extraction in palmprint verification [12]. They resulted SURF provided higher accuracy than the SIFT feature extraction and it take less time for verification of two palm.

Anne Wincy and G. C. Chandran, proposed a palmprint scheme by using PCF and SURF feature [2]. Firstly they applied preprocessing in segmented palmprint images. Then they extract feature by using Phase-Correlation Function (PCF) and matched with database. Further the applied Speeded Up Robust Features (SURF) extraction and matching. They used Hong Kong PolyU palmprint database. They achieved EER 6.488%.

My-Ha Le et al. proposed a paper of analysis of the SIFT features and the Harris features [10]. They shows SIFT involves four steps these are scale-space extrema detection, accurate keypoint localization, orientation assignment, and the keypoint descriptor. They used Harris corner detection and extract the points. Then they make compare between SIFT and Harris features. They resulted Harris corner features extraction have taken less time than SIFT features and Harris corner features has low correctness and robustness than SIFT features.

3 Experiment and Analysis

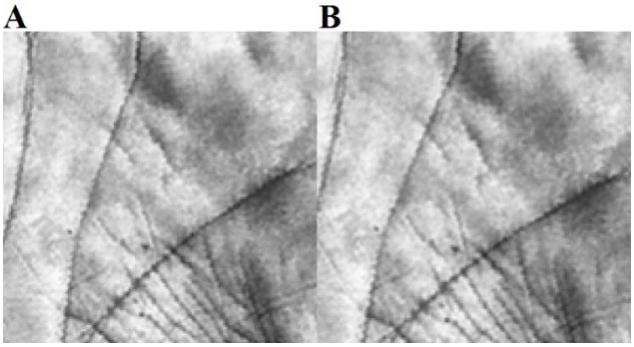

Fig.2. Segmented palmprint images of same hand A and B

FAST Feature Extraction: FAST algorithm is used to classifying the point of interest in image and proposed by The E. Rosten and Drummond [5, 6]. A point of interest in image is a pixel which has a distinct position and can be robustly identified. Point of interest has high local content and they would be ideally repeatable between two different images. Finding the point of interest in image used in various applications in computer vision such as image matching, pattern recognition, tracking etc.

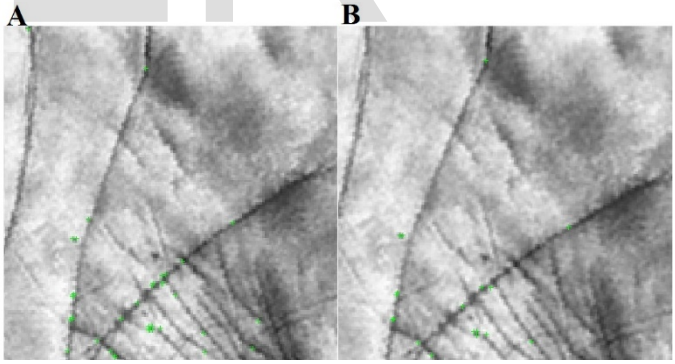

Fig.3. FAST feature points in hand A, and B

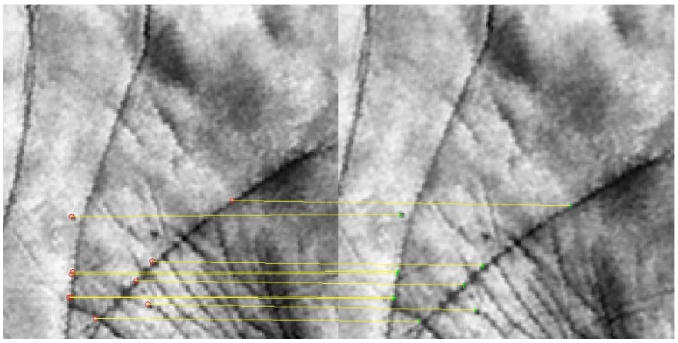
Fig.4. FAST feature matching between A and B

MSER Feature Extraction: Maximally Stable External Regions (MSER), in computer vision, maximally stable extremal regions (MSER) are used as a method of blob detection in images. This technique was proposed by J. Matas et al. to find correspondences between image elements from two images with different viewpoints [8]. This method of extracting a comprehensive number of corresponding image elements contributes to the wide-baseline matching, and it has led to better stereo matching and object recognition algorithms.

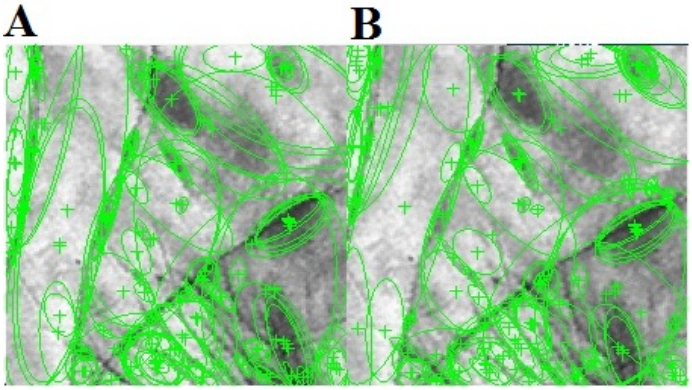

Fig.5. MSER feature points in hand A and B

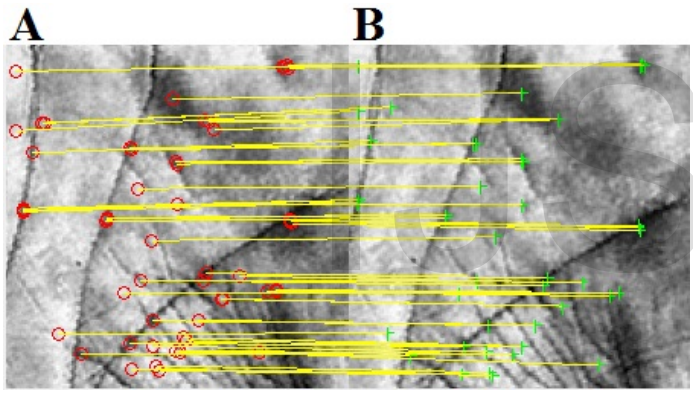

Fig.6. MSER Feature matching between hand A and B

Harris Feature Extraction: The Harris corner detector was introduced for finding the corners in any image [13]. The main idea behind the Harris corner detection is the corner like as auto-correlation of an image patch. Assumed a window which slides over an image patch, if that image patch is continuous or "smooth", then there will be not changed intensity in the window. If image has an edge, then there will be no changes in the intensity in window along the path of edge. If there is a corner is, then there will be high intensity changes in the window irrespective of the path.

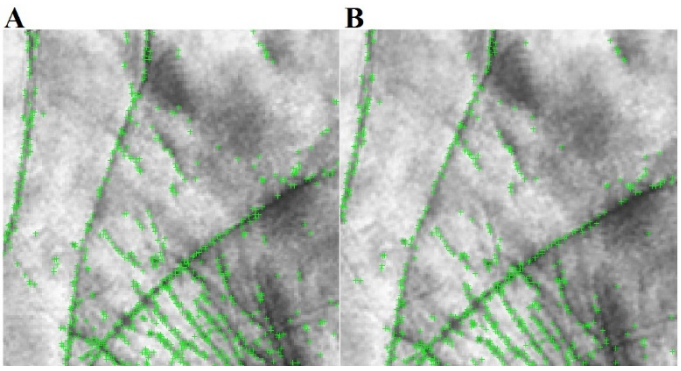

Fig.7. Harris Feature points in hand A, B

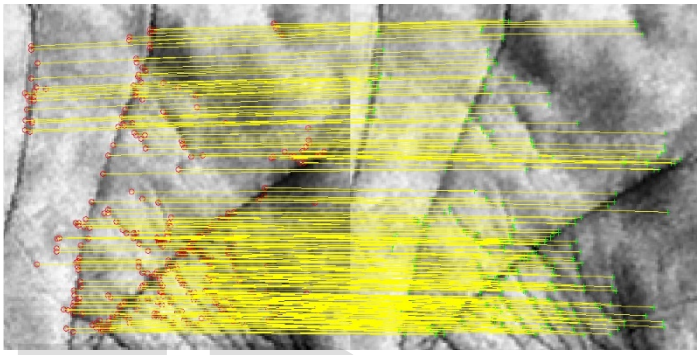

Fig.8. Harris feature matching between hand A and B

Experimental results and discussion: The segmented images of IITD palmprint database is used for the experiment [7]. In this paper we presented the comparison of FAST, Harris, and MASER feature extraction method. The following table 1 shows the comparison between these feature extraction methods in palmprint verification system. The following table 1 shows the comparison of FAST, Harris and MSER feature extraction in different parameters. In the hand A he total 74 points detects by using FAST feature extraction, Harris detects 289 points and MSER detects 128 points in the same image. In hand B total 51 feature points detect by using FAST feature extraction, Harris detects 263 points and MSER detects 127 points in the same image. When we matched these images hand A, B by using FAST method then 10 points matched, by using Harris method total 95 points matched and using MSER method total 55 points matched. The proposed comparison was carried out by using MATLAB 2015a on the system having i3, 2.1 GHz processing with 4 GB RAM.

TABLE 1. COMPARISON TABLE OF FAST, MSER, AND HARRIS

Sr. No.	Feature Extraction Method	FAST	MSER	Harris
1	**Total number of Points detected in hand A**	74	128	289
2	**Total number of Points detected in hand B**	51	127	263
3	**Total matched points between hand A and B**	10	55	95
4	**Time for matching in seconds**	0.420	0.479	0.468

4 CONCLUSION

In this presented paper, the comparative study of feature extraction in three different methods for the feature extractor and descriptor such as FAST, MSER, and HARRIS in palmprint verification is carried out. The FAST, MSER, and HARRIS is mainly used for image mosaic, pattern recognition, image retrieval, and many other applications in image processing. The FAST feature extraction detects 74 points, MSER detects 128 points, and Harris detects 289 points in to the hand A image. The FAST feature extraction detects 51 points, MSER detects 127 points, and Harris detects 263 points in to the hand B image. When we matched these images then 10 points matched by FAST, 55 points matched by MSER, and total 95 points matched by Harris. The HARRIS detect most number of points than others, then MSER detect and FAST detect the least number of points in palmprint images, but the FAST feature extraction takes less time for matching and MSER takes more for matching with the compare of other two methods.

REFERENCES

[1] A. H. M. Al-Helali, W. A. Mahmmoud, H. A. Ali, A Fast personal palmprint authentication Based on 3d-multi Wavelet Transformation, Transnational Journal of Science and Technology, edition vol.2, No.8, September 2012.

[2] Anne Wincy and George Chellin Chandran, Palmprint Recognition using PCF and SURF, International Journal of Advanced Research in Computer Science and Software Engineering, V 3, I 10, p996-1001, October 2013.

[3] Badrinath G. S., Phalguni Gupta, Palmprint Verification using SIFT features, First workshops on image processing theory, tools and applications, pp 1 – 8. ISSN 978-1-4244-3321-6, NOV. 2008.

[4] Chin-Chuan Han, Hsu-Liang Cheng, Chih-Lung Lin, and Kuo-Chin Fan, Personal authentication using palmprint features," Pattern Recognition, vol. 36, 36, pp. 371–381, 2003.

[5] Edward Rosten and Tom Drummond, "Machine learning for high speed corner detection," in 9th Euproean Conference on Computer Vision, vol. 1, pp. 430–443, 2006.

[6] Edward Rosten and Tom Drummond, Fusing points and lines for high performance tracking. In 10th IEEE International Conference on Computer Vision. Volume 2., Beijing, China, Springer. 1508-1515, 2005.

[7] IIT Delhi Touchless Palmprint Database version 1.0, http://www4.comp.polyu.edu.hk/~csajaykr/IITD/Database_Palm.htm.

[8] J. Matas, O. Chum, M. Urban and T. Pajdla. Robust Wide Baseline Stereo from Maximally Stable Extremal Regions, BMVC, 2002. doi:10.5244/C.16.36.

[9] Ming Chen, Yi-min Chen, Shi-hua Huang, Zheng-wei Yao, A Palmprint Recognition Algorithm based on Harris Synthetically Method, Second International Symposium on Intelligent Information Technology Application, IEEE, 2008

[10] My-Ha Le, Byung-Seok Woo, and Kang-Hyun Jo, A Comparison of SIFT and Harris Conner Features for correspondence Points Matching. 17th Korea-Japan Joint Workshop on Frontiers of Computer Vision (FCV), IEEE, 1 – 4, Feb 2011

[11] Saravanan Chandran and Satya Bhushan Verma, Touchless Palmprint Verification using Shock Filter, SIFT, I-RANSAC, and LPD, IOSR Journal of Computer Engineering, Volume 17, Issue 3, PP 01-08, 2015.
DOI: 10.9790/0661-17330108

[12] Satya Bhushan Verma and Saravanan Chandran, Analysis of SIFT and SURF Feature Extraction in Palmprint Verification System, International Conference on Computing, Communication and Control Technology (IC4T), IEEE, pp. 27-30, 11-12 November, 2016.

[13] S. Argyropoulos, D. Tzovaras, D. Ionnidis, M.G. Stintzis, A channel coding approach for human authentication from gait sequences, IEEE, Transactions on Information Forensics and Security 4 (3) (2009)

[14] wikipedia, "corner detection",< http://en.wikipedia.org/wiki/Corner_detection > ,accessed 21 OCT 2016.

[15] Wikipedia, the Free Encyclopedia. <http://en.wikipedia.org/wiki/Biometric>.

[16] W. Shu, D. Zhang, Automated personal identification by palmprint, Optical Engineering, 37(8), 2359–2362, August,1998