International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 02, February-2019

A REVIEW ON IMPLEMENTATION OF BIOMETRIC KNUCKLE PRINT RECOGNITION

Utkrsh Kumar[1], Sandeep Monga[2]

[1]*Computer Science & Engineering, Oriental Institute of Science & Technology, Bhopal,*
[2] *Computer Science & Engineering, Oriental Institute of Science & Technology, Bhopal,*

Abstract: Researchers are always on the move to innovate something new from their side. Such a work by researchers in the field of biometrics has led to identify the finger knuckle print as a biometric trait with distinct features. There are certain biometric parts such as fingerprint, iris, palm print and now knuckle print. Knuckle contains rich texture that is distinct for each fingers it selves. Knuckle has potential information that can differentiate persons uniquely. System is intended to acquire the knuckle image and process it for data acquisition and generate code map. Code map is a template that localized in database and compare with input code maps. The objective of this paper is to review various existing systems and their methodologies where they are lacking and do not met the desirable precision along with minimal error rates. There are various methods through which a knuckle print authentication system can be developed such as Compound Local Binary Patterns, Gabor Filter, Wavelet Transform, Haar Wavelet, Sobel Edge Detection and many more. The paper intended to review these systems and their flaws.

Keywords: Biometric System, Knuckle Print, Feature Extraction, Gabor Filter, Haar Wavelet, Sobel, Local Binary Patterns.

1. INTRODUCTION

Biometrics claims to be a person's automated identification or verification, or some physical or behavioral symptoms associated with the person such as fingerprint, hand geometry, iris, retina, face, hand vein, face, thermo gram, signature By using, voice trail and other. Knockle Print Identity is one of the most important biometric techniques that has attracted significant attention lately. Everyone has unique knit-out prints. Specification of fingerprint is determined especially by local ridge characteristics and their relationships. Minutiae have two local ridges which are classified as follows:-

1) Ridge ending
2) Ridge bifurcation

A ridge is the end point where a streak suddenly ends. A ridge bifurcation is the point where a ridge is divided into branch [1] or diverges. Automatic fingerprint Print Match Depending on these local ridge characteristics and their relationships, depending on the personal identification. An important step in fingerprint matching is to automatically remove the minutiae from input knock-print images automatically and reliably. The result of minutia extract depends on the quality of the input nock-print images. In such situations, streaks can be easily detected and miniaturization can be located from thin streaks. Ridge structures are not always well-defined in poor-quality por-print images, so cannot be correctly detected.

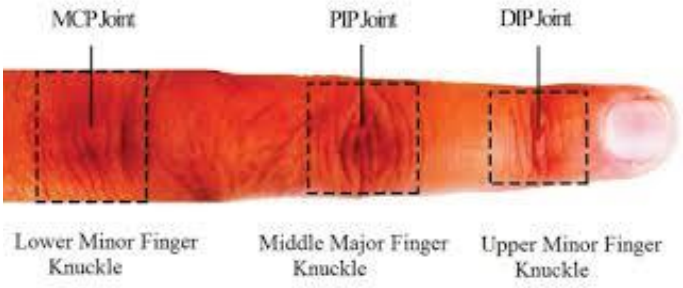

Figure 1.1: Knuckle Print [1]

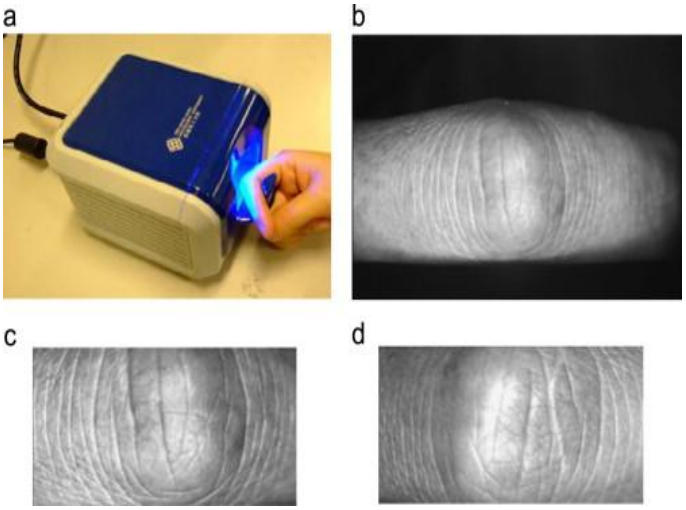

Figure 1.2: Knuckle Print Authentication System [2]

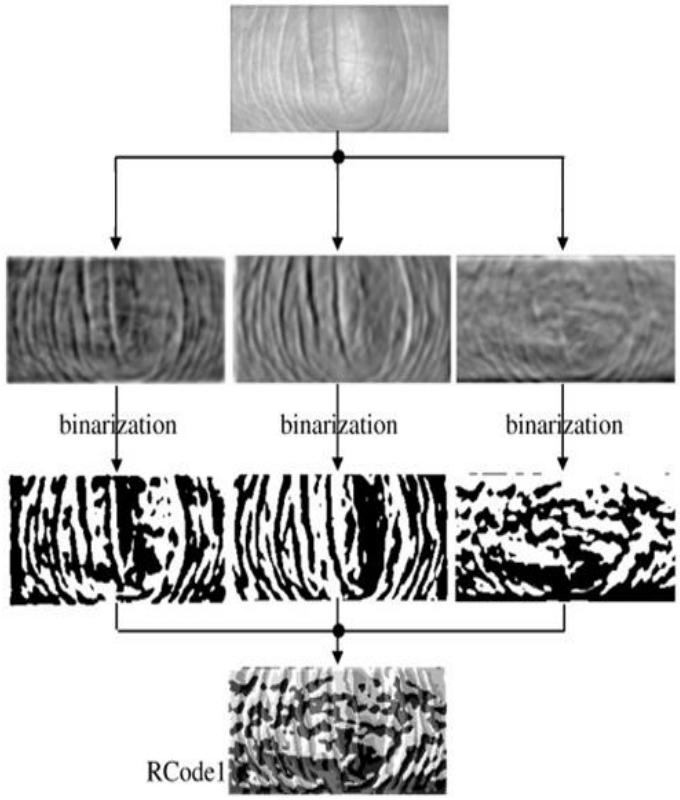

Figure 1.3: Conventional Knuckle Print Feature Extraction [3]

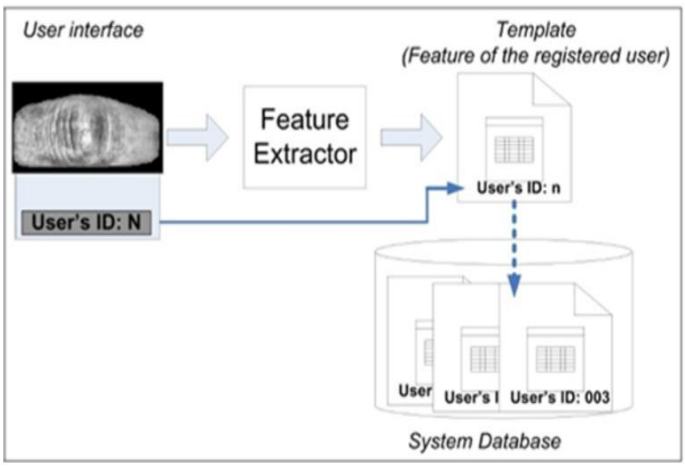

Figure 1.4: Enrollment [4]

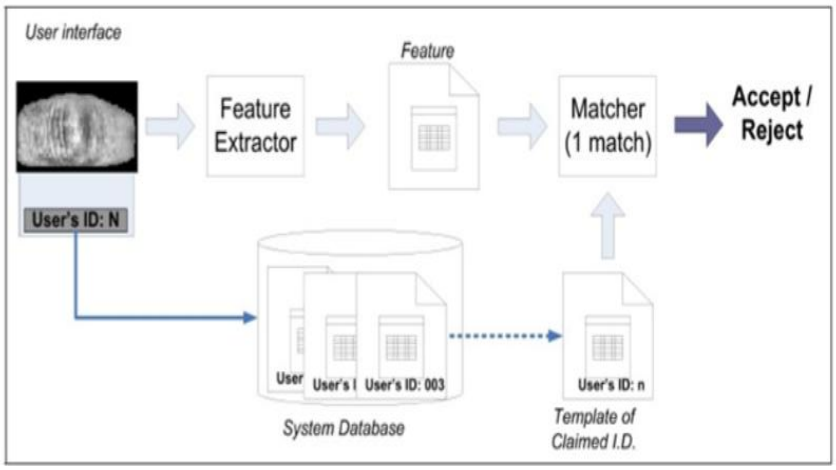

Figure 1.5: Verification [4]

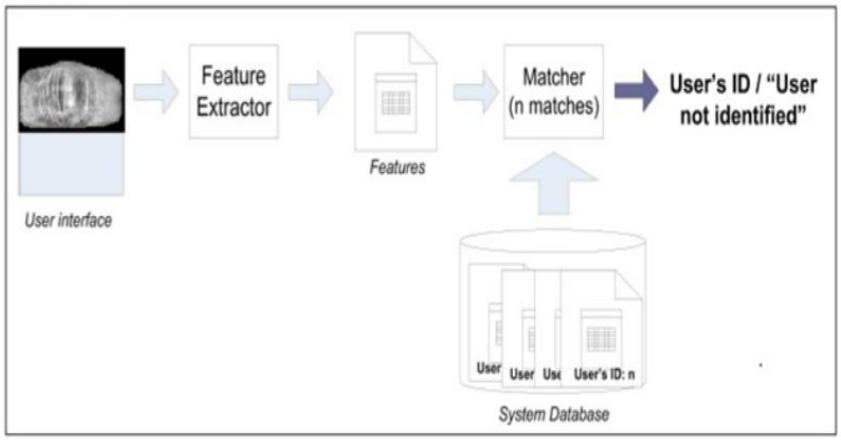

Figure 1.6: Identification [4]

2. RELATED WORKS

Iman Sheikh Oveisi et al. proposed a system which is based on Multimodal approach that combines two biometric system i.e. palm print and knuckle print using AdaBoost classifier. AdaBoost classifier is employed to address the problem of restricted number of training data in unimodal systems. System uses Dual Tree-Complex Wavelet Transform (DT-CWT) for feature extraction for both finger knuckle print as well as palm print. But combining two features raises two biometric level that may consumes computational time as well as the complexity level of acquisition [5].

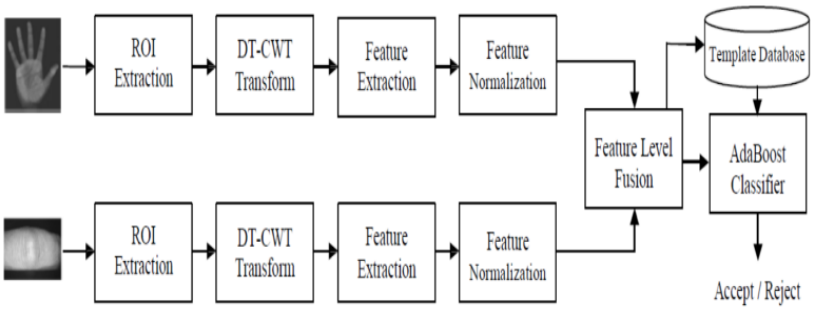

Figure 2.1: Multimodal Biometric System for Palm and Knuckle Print [5]

Wafa El-Tarhouni et al. proposed a system which is based on Local Binary Patterns that measures local binaries value of knuckle print texture and compare with the threshold value. Dynamic Threshold Completed Local Binary Patterns dTCLBP technique employs only sign and magnitude components, where the sign component is the same as the original LBP. Here the experiment has been conducted with PolyU database and precision has been achieved accordingly. The feature analysis is based on Linear Discriminant Analysis, Principal Component Analysis and Independent Component Analysis. The precisions have been calculated as 92.12 %, 93.03 %, 91.51 % and 92.02 for left index, left middle, right index and right middle finger respectively [6].

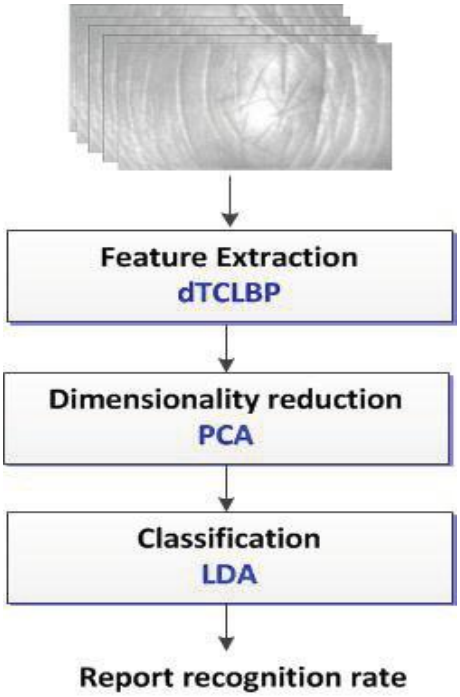

Figure 2.3: System Overview [6]

Walairach Nunsong et al. proposed a system which is based on Fractal Dimension using Gabor filter. Feature extraction is based on Gabor filter grabbed through eight orientations of knuckle print. It covers the upper surface of the finger knuckle skin patterns that possess wrinkles of tilted knuckle. System possesses 96.49 % of accuracy that is an average precision rate of right index, right middle, left index and left middle finger [7].

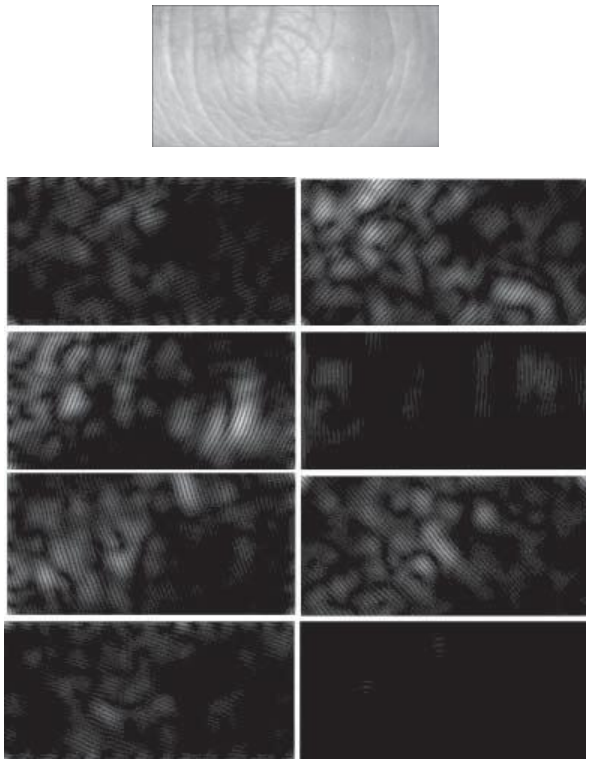

Figure 2.5: Gabor features extracted from the original FKP [7]

E. O. Rodrigues et al. proposed a system which is based on Sobel filter and Similarity measures. Sobel is an edge detection technique that finding edges or lines from finger knuckle and preprocess for noise reduction if it contains. System is intended to capture the knuckle print from folded knuckle that forms less creases or principal lines which results low feature extraction [8].

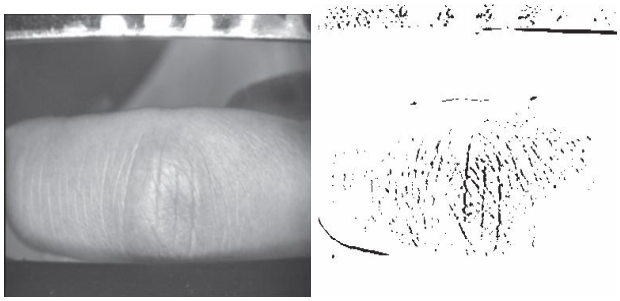

Figure 2.5: Sobel Filter [8]

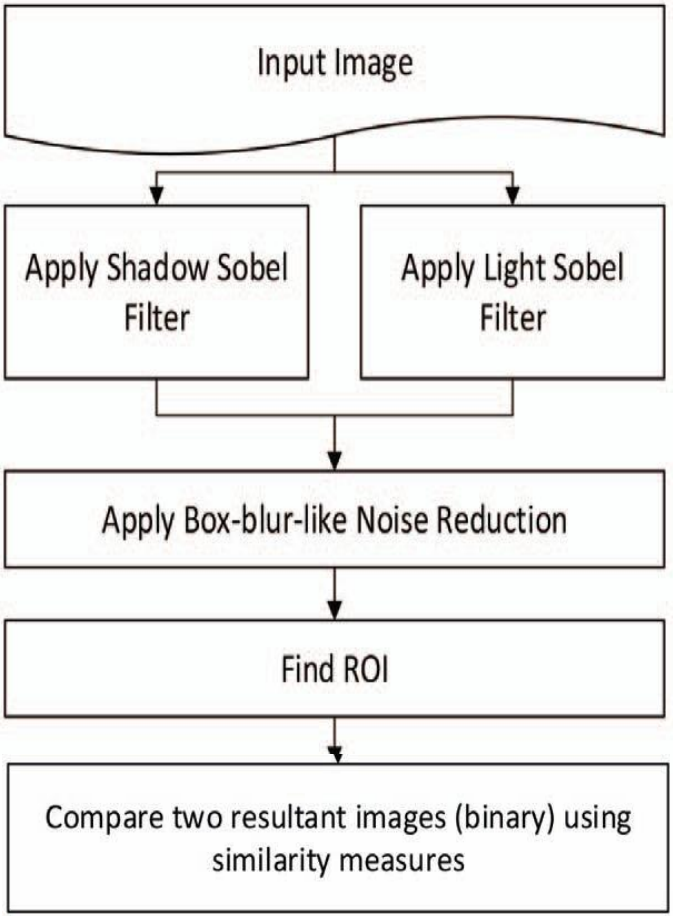

Figure 2.5: Proposed Methodologies [8]

Farzam Kharaji Nezhadian et al. proposed a system which is based on inner knuckle print instead of outer one. In this system the inner surface of finger has been used authentication that may possess less features or texture. Gabor wavelet filter has been used for enhancing the inner knuckle print and feature extraction has been done using K-Nearest neighbor fuzzy classifier. Forward Feature Selection is an algorithm that pertain scores as per the features matched and return result accordingly. Wavelets are powerful tools that generally used for feature extraction in the field of authentication that deals with horizontal, vertical and diagonal matrix. Inner knuckle print contains very less feature as compare to the outer most knuckle of a finger [9].

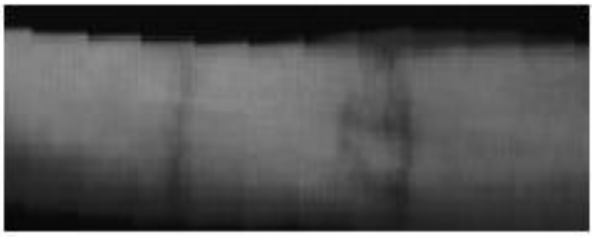

Figure 2.6: Inner Knuckle Print [9]

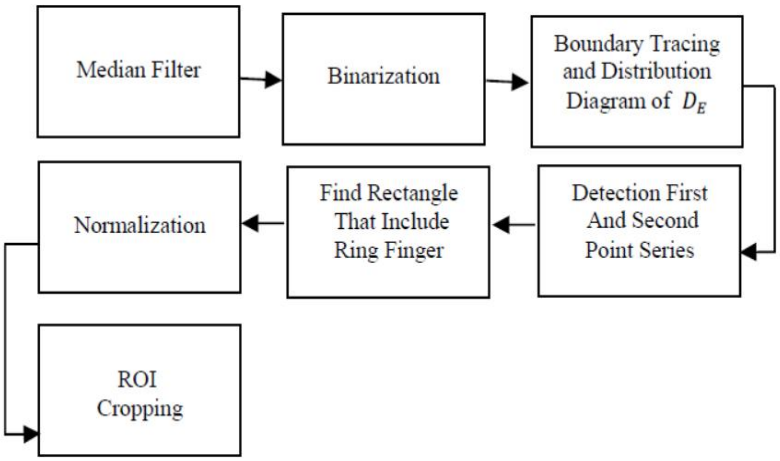

Figure 2.7: Feature Extraction [9]

Arulalan. V et al. proposed a combinational biometric system of two traits Iris and Finger knuckle print; it means that the score will be captured on the basis of two distinct features. Here Haar Wavelet has been used for Iris feature extraction and Linear Discriminant Analysis for finger knuckle print. Combining two biometric features do not met the desirable system because single system should be liable to attain the true acceptance and false rejection instead of combining two biometric systems. Two levels verification always return an ideal authentication but the complexity level of attaining the feature become higher and computational time get increases [10].

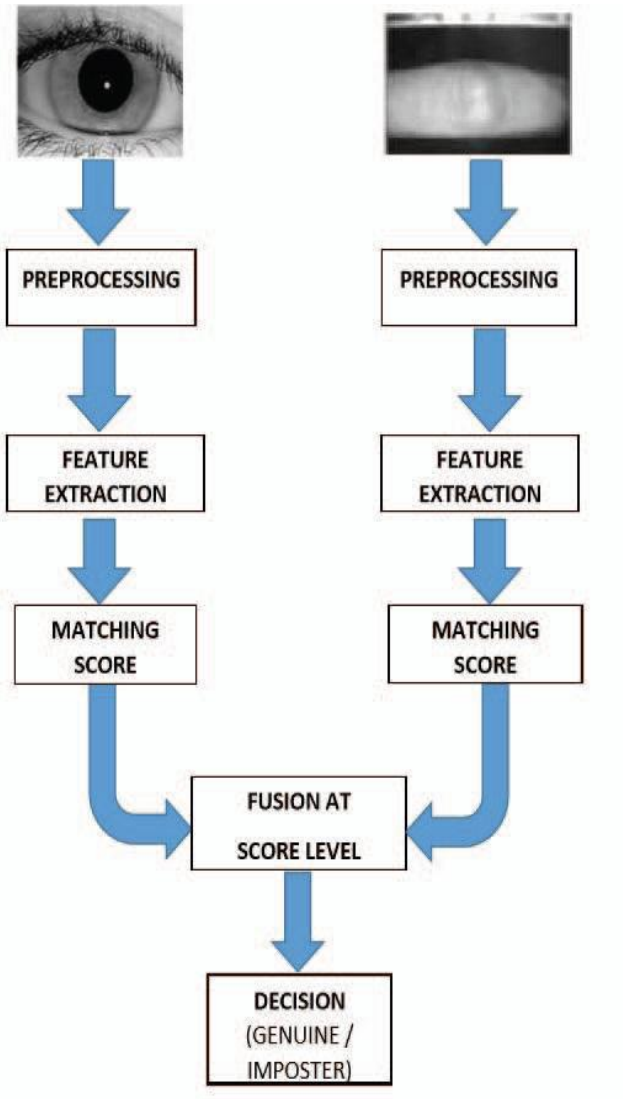

Figure 2.8: Multimodal Biometric System [10]

Jooyoung Kim et al. proposed a finger knuckle print system based on difference between the images with respect to the Euclidean distance comparison. Here the difference image operation has been performed to enhance the knuckle-print lines on the image matrix. The difference operation has been achieved by shifting the complete image by one to many pixels followed by a subtraction operation between two images. Subsequently, features are extracted by transforming the disparity image into frequency domain using a discrete Fourier transform. Finally, matching is achieved through the Euclidean distance between the extracted features of input image and the stored one [11].

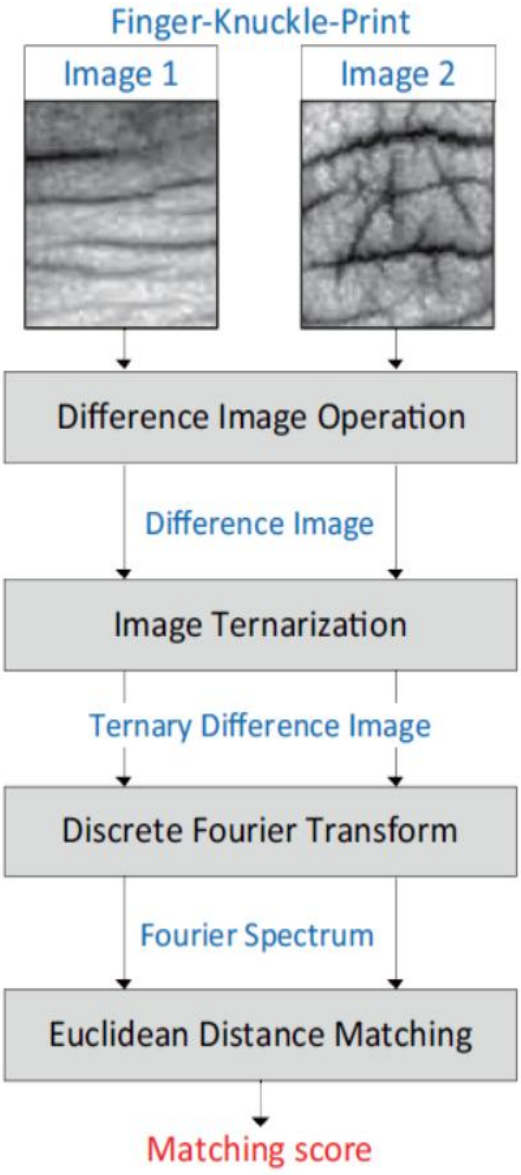

Figure 2.9: Overview of a System [11]

Amine AMRAOUI et al. proposed a concept of Compound Local Binary Patterns (CLBP) where patterns are extracted by encoding all corresponding to a neighbor of local neighborhood in order to construct the compound and robust feature. System uses PolyU database for storing binary templates that intended to compare while authentication. Author used distance based classifier for reducing the computational time. The accuracy trails to 98.71 % for authenticating the legitimate and illegitimate users [12].

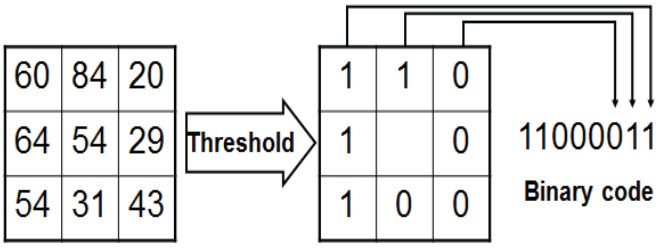

Figure 2.10: Local Binary Patterns [12]

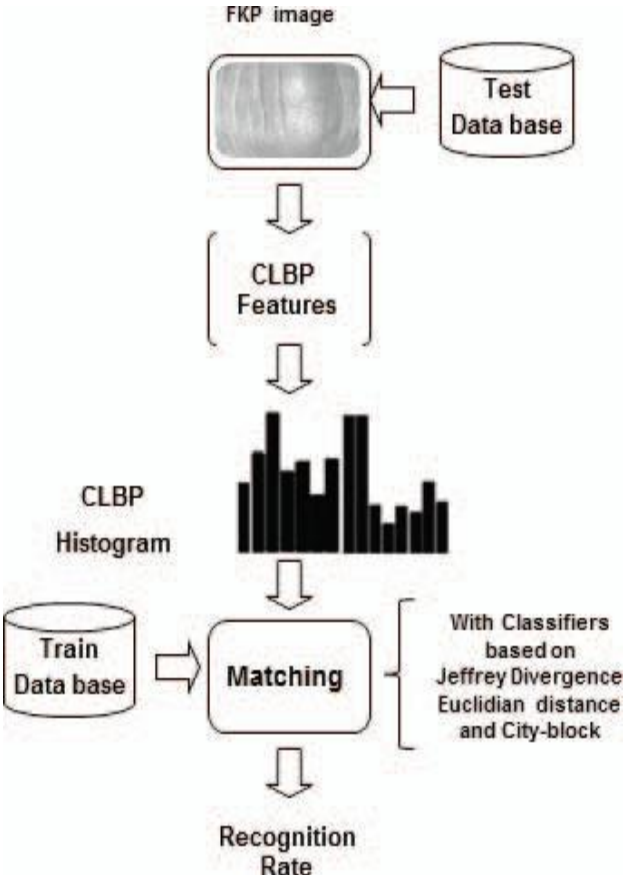

Figure 2.11: CBLP based System [12]

3. PROBLEM IDENTIFICATION

There are some flaws in previously proposed systems that pertain precision rate of the systems because local binary patterns easily affected by the bright luminance and features get distorted. Enhancing image may suffer distortion that directly connected to the feature which knuckle image contains. Combining two biometric systems is not a solution or enhancement towards knuckle print based authentication system or knuckle feature extraction.

4. CONCLUSION & FUTURE SCOPE

As per the survey takes place on various researches made in the field of Knuckle Print Authentication System, there are different methods implemented by the researchers with certain modification to create an authentic system. Most of the systems are based on Local Binary Patterns which may easily affected by bright luminance, Gabor filter which may distort the sensitivity of image that causes knuckle print distortion. In future an ideal system can be represented with effective approach that can possess minimal error rate along with high precision. So, a system is required which can efficiently.

References

[1] https://dl.acm.org/citation.cfm?id=2938727&dl=ACM&coll=DL
[2] https://www.sciencedirect.com/science/article/pii/S092523121400054X
[3] https://www.sciencedirect.com/science/article/pii/S0262885612001734
[4] https://docplayer.net/74386286-Finger-knuckle-print-based-recognition-system-using-lbp-and-surf-salil-kumar-verma-1-maitreyee-dutta-2.html
[5] I. S. Oveisi and M. Modarresi, "A feature level multimodal approach for palmprint and knuckleprint recognition using AdaBoost classifier," *2015 International Conference and Workshop on Computing and Communication (IEMCON)*, Vancouver, BC, 2015, pp. 1-7.
[6] W. El-Tarhouni, L. Boubchir and A. Bouridane, "Finger-Knuckle-print recognition using dynamic thresholds completed local binary pattern descriptor," *2016 39th International Conference on Telecommunications and Signal Processing (TSP)*, Vienna, 2016, pp. 669-672.
[7] W. Nunsong and K. Woraratpanya, "An improved finger-knuckle-print recognition using fractal dimension based on Gabor wavelet," *2016 13th International Joint Conference on Computer Science and Software Engineering (JCSSE)*, Khon Kaen, 2016, pp. 1-5.

[8] E. O. Rodrigues, T. M. Porcino, A. Conci and A. C. Silvah, "A simple approach for biometrics: Finger-knuckle prints recognition based on a Sobel filter and similarity measures," *2016 International Conference on Systems, Signals and Image Processing (IWSSIP)*, Bratislava, 2016, pp. 1-4.

[9] F. Kharaji Nezhadian and S. Rashidi, "Inner-knuckle-print for human authentication by using ring and middle fingers," *2016 2nd International Conference of Signal Processing and Intelligent Systems (ICSPIS)*, Tehran, 2016, pp. 1-6.

[10] V. Arulalan and K. S. Joseph, "Score level fusion of iris and Finger knuckle print," *2016 10th International Conference on Intelligent Systems and Control (ISCO)*, Coimbatore, 2016, pp. 1-6.
doi: 10.1109/ISCO.2016.7727006

[11] J. Kim, K. Oh, A. B. Teoh and K. Toh, "Finger-knuckle-print for identity verification based on difference images," *2016 IEEE 11th Conference on Industrial Electronics and Applications (ICIEA)*, Hefei, 2016, pp. 1073-1077.

[12] A. Amraoui, Y. Fakhri and M. A. Kerroum, "Finger knuckle print recognition system using compound local binary pattern," *2017 International Conference on Electrical and Information Technologies (ICEIT)*, Rabat, 2017, pp. 1-5.