

A Review on Biometric Finger Knuckle-Print based Authentication System

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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. The motive of this paper to review most recently implemented systems on the basis of methodology which has been used by several researchers. Paper is also intended to acquire comparison over methods and results. There are several researches have been done till now, some of them are based on binary localization that may easily affected by the luminance. The most common filter which is generally used by researcher is Gabor filter which allows enhancing image as per the signal to noise ratio. But if an image is getting manipulated then it may lose originality that affects accuracy. If a system has false acceptance rate then the precision does not follow ideal system. System should have zero false acceptance and high false rejection rate along with true acceptance. Precision is based on high quality feature extraction that could be made by some image enhancement techniques.

Keywords— *Knuckle-Print, SURF, Gabor Filter, Biometric and Binary Localization.*

I. INTRODUCTION

Biometric system is employed for distinguishing and confirmatory individuals supported their physiological characteristics like fingerprint, face, palm print, iris, inner knuckle print and etc. or behavioral characteristics like voice, expressive style, and gait. Biometrics system could be a sturdy for authentication. Iris and finger knuckle print come beneath physiological characteristics. The 3 main aspects in victimization bioscience are individuality, universality and permanency. Bio science system has 2 modals specifically unimodal and multimodal. Unimodal system uses single attribute whereas in multimodal system quite 2 traits were used. A number of the hand primarily based bioscience are hand geometry, palm print and etc. however they didn't offer abundant information once range of the user will increase. All the performance can't be obtained from one biometric

system. Though multimodal bioscience system provides glorious security, besides it's high matching accuracy. The limitation of unimodal system were reduced by victimization multimodal systems although the unimodal system has some benefits it's to suffer some issues like screeching knowledge, lack of individuality, non-universality, spoof attacks and contains a height error rates in their use. Biometric measurements area unit are immensely used for recognizing individuals. These measures area unit are normally utilized in security systems that typically enable or deny AN action to a user depending on the end result of the popularity. As usual in computer systems, the collected and analyzed knowledge are separate samples, that in terms suppresses the standard of the popularity. Therefore, flaws area unit definitely gift in these systems. However, reducing it at the most would guarantee more reliable recognitions.



Fig. 1. Knuckle Print [1]

II. RELATED WORK

A. Related Works

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 [2].

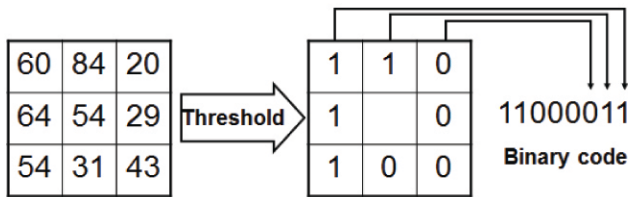


Fig. 2. Binary Coding [2]

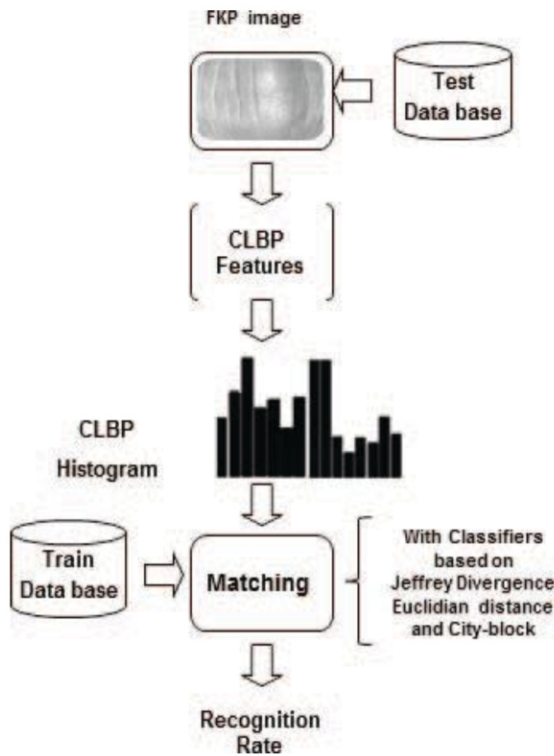


Fig. 3. CBLP Based System [2]

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 [3].

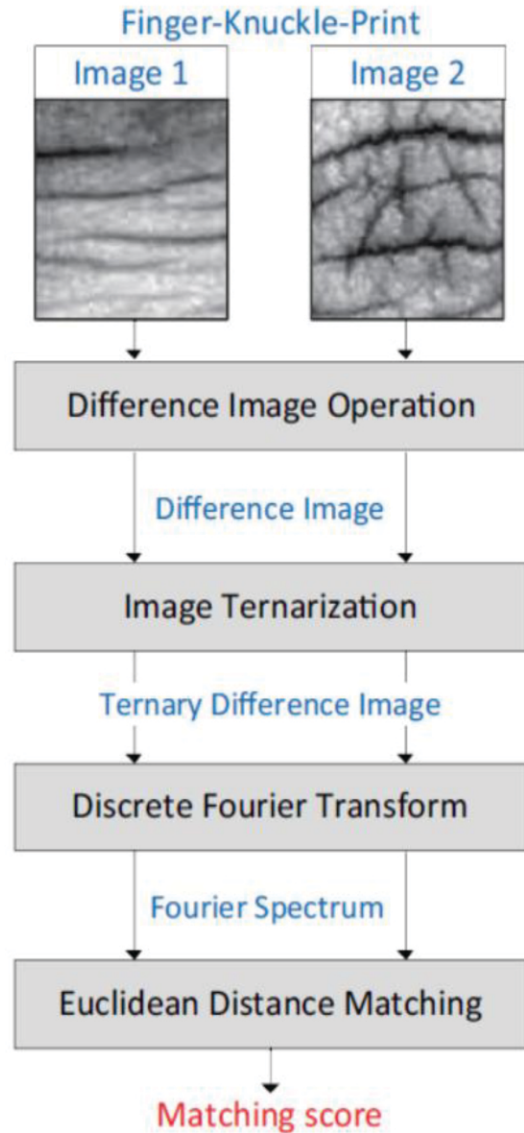


Fig. 4. Overview of System [3]

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 [4]. 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 [5].

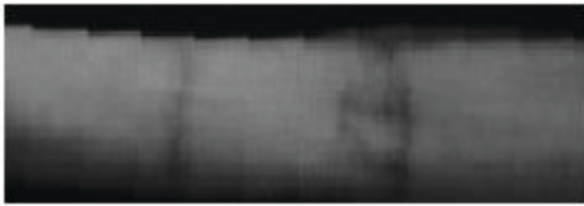


Fig. 5. Inner Knuckle [5]

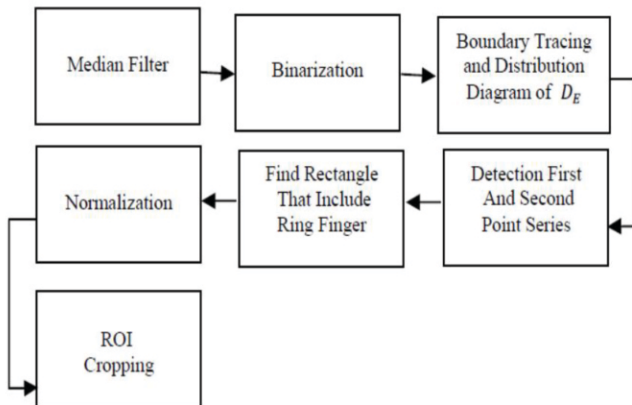


Fig. 6. Feature Extraction [5]

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 [6].

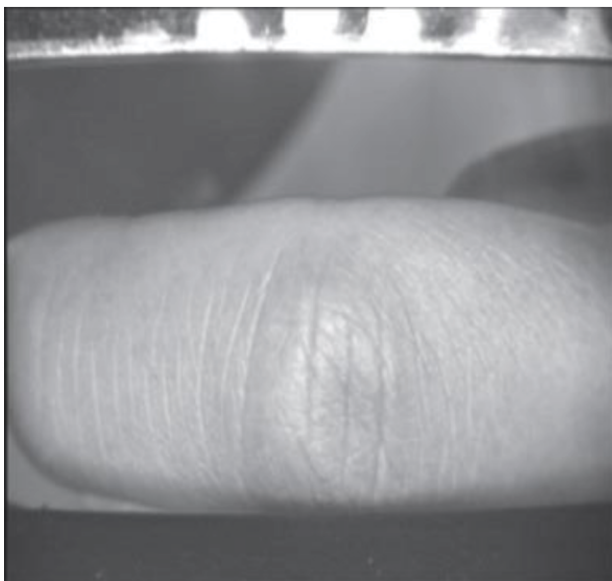


Fig. 7. Without Filter [6]

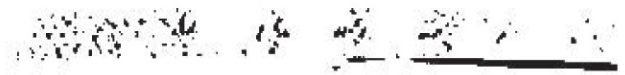


Fig. 8. Sobel Filter [6]

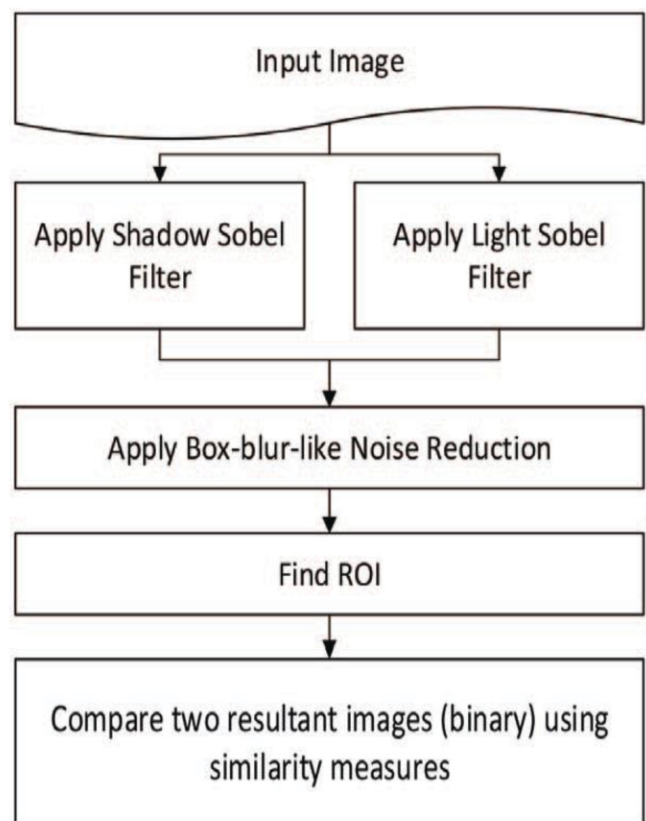


Fig. 9. Methodology [6]

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].

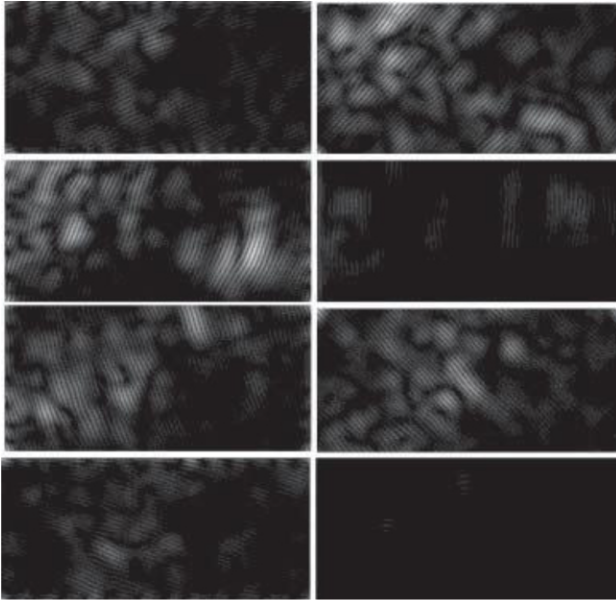


Fig. 10. Gabor features extracted from the original FKP [7]

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 [8].

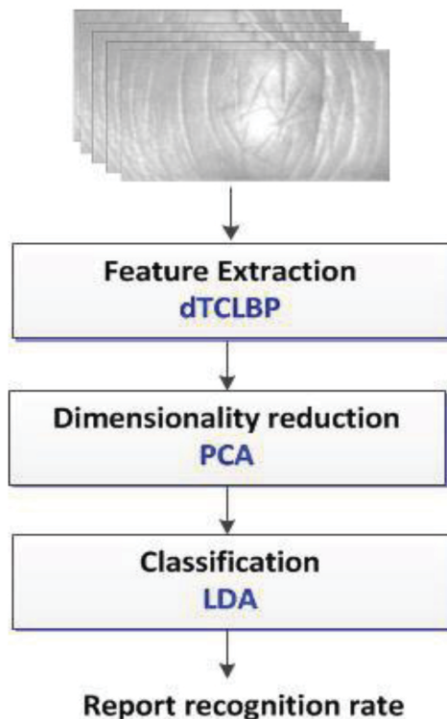


Fig. 11. System Overview [8]

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 [9].

III. CONCLUSION & FUTURE SCOPE

Thus the survey of all these systems concluded at a point that a lot of researches have been done in order to enhance the security of authentication system w.r.t. critical feature extraction and matching. Most of the systems are based on local binary patterns that may easily affect by luminance and reflects inaccurate results. Gabor filter is generally used for enhancing image quality and brightness that may possess distorted knuckle print. A system is required which emits high precision with minimal false rate. In future an enhanced system can be developed that may have zero false acceptance rate along with high true acceptance.

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