

A Survey on Finger Knuckle Print based Biometric Authentication

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Abstract— Nowadays biometrics based authentication could be a one amongst the necessary technology during this world. Authentication means whether that person is genuine or not. Based on this authentication so many physical and behavioural characteristics are used. Physical characteristics are face, fingerprint, iris, retina, palm print, finger vein and finger knuckle print and behavioural characteristics means that basic actions done by the person like voice, gait, ECG, EEG, keystroke, handwriting and lip movements. Based on this physical traits finger knuckle print is one of the most interest research arena of the researchers nowadays. Because it can be easily accessed, low cost devices are used to capture the image; it cannot be stolen by others, etc. In finger knuckle print based authentication we have got to survive such a lot of papers. Per this study the finger knuckle print encompasses a heap of deserves and limitations. To provide a comprehensive survey, this paper presents a summary of finger knuckle print biometric system, their applications and limitations.

Keywords— Biometrics, biological, behavioural, identification, techniques.

I. INTRODUCTION

Biometric means measuring and analyzing biological knowledge for the authentication or identification purpose. The word "biometric" is originated from the Greek words 'bios' (life) and 'metric' or 'metrikos' (measure), directly interprets into "life measurement". Biometrics encompasses two classes that are physiological and activity characteristic used for unambiguously associated to an individual. Physical characteristics embrace – Face, Fingerprint, DNA, Ear, Iris, Retina and Hand geometry and that they square measure related to the contour or measurements of the human body. Behavioral characteristics embrace – Signature, Voice and Gait and that they square measure related to the behavior or self-motivated measurements of an individual. Physical characteristics include – Face Fingerprint, DNA, Ear, Iris, Retina and Hand geometry and they are associated with the contour or measurements of the human body. Behavioral characteristics include – Signature, Voice and Gait and they are associated with the behavior or self-motivated measurements of an individual.

In olden days PIN, password, and secret code are used for authentication purpose, but it can be easily forgotten or stolen by others. Due to lack of demerits nowadays use only biometrics based authentication. It cannot be easily damaged, forgotten or stolen by others. But each biometric trait has its own merits and demerits. The finger prints are

easily changed by dummy fingers, vulnerability and it can't be accurately identified. Face recognition has a lot of occlusion problem. Iris has a same problem. Palm print is one of the best traits for authentication purpose but it can be take so much of spaces to store the data. Finger vein system for capturing that image is so difficult.

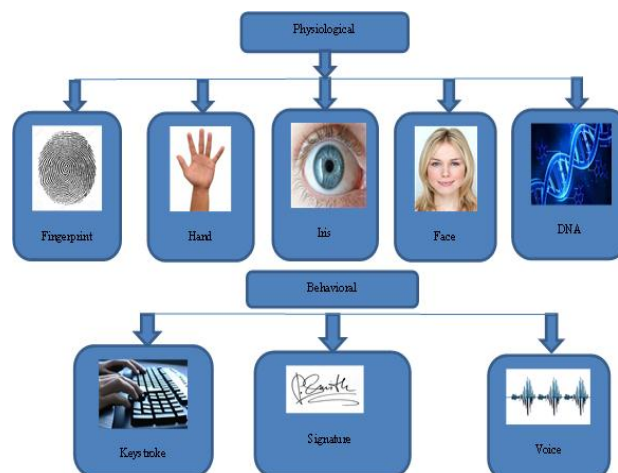


Figure 1. Categories of biometrics.

Based on this above demerits finger knuckle print is one of the easiest physical traits for authentication. Finger knuckle means it is an outside of the back surface of the

finger. It has a lot of lines and creases. FKP can be extracted from inner side or back side of finger surface. FKP is highly unique and makes the knuckle surface as a distinctive biometric identifier [1]. So we can easily take the image using low cost devices and cheap, easily identifies by the humans, there will be no tiredness to the user. Biometric systems are widely used in applications such as customs, security, prevention of cybercrime, and border control, healthcare, public aid/social benefits, passport, identity verification, immigration as well as commercial enterprises uses [2]. This paper is organized as follows. Section I Contains the Introduction of the work, Section II illustrates the Literature review, Section III provides a detailed overview on the proposed work, Section IV describes the methodology of proposed work, and the paper is concluded in section V.

II. LITERATURE REVIEW

In this section, we are presenting the research work of some distinguished authors within the same field and explaining a small depiction of various techniques used for finger knuckle print based authentication.

1. In the year 2016, Ajay Kumar et.al [3] have planned their work as an innovative method for personal identification using minor knuckle patterns. In this work segment the region of interest from the palm dorsal using segmentation algorithm and enhance the image due to illumination and matching the performance. Feature extractions are used by Local Feature Descriptor, Band Limited Phase Only Correlation, Ordinal Representation.

ADVANTAGES:

- 1.This work is completely automated.
- 2.It is used for large variations in the images.
- 3.500 subjects are used to test.

DISADVANTAGES:

1. Large illumination variations in indoor and outdoor environment.
2. Segmentation process of the image is very poor.
3. The matching accuracy of the second minor knuckle images are very low-level.
4. The overall image accuracy is poor.
5. In this work only used very small number of testing finger knuckle images.

2. kamyuncheng et.al [4] presented their paper providing a contactless finger knuckle identification using smartphones. This work median filtering was used to eliminate the noise in the image, canny edge detection used for detection and log-gabour filter find the feature extraction of the images.

ADVANTAGES:

- 1.It is used to smart phones to identify the person.
2. It is a very advance method.

DISADVANTAGES:

- 1.Noise removal is very difficult one.
2. The segmentation accuracy is low.

3. Ajay kumar et.al, 2014 [5] described their proposed work as an Importance of being unique from finger dorsal pattern. This paper describes feature extraction using local binary patterns, improved local binary patterns, and band limited phase only correlation and 1D log-Gabor filter based matchers.

ADVANTAGES:

1. This method can easily identify the minor finger knuckle pattern, performance also good.

DISADVANTAGES:

1. Accurate segmentation algorithm is very essential.
2. Large intra class variations under different image conditions.
3. Small number of test samples only used.
4. This work needed so many statistical analysis and results.

4. Ajay Kumar et.al, 2012 [6] has suggested a method for processing minor knuckle print identification for biometric authentication. Coarse segmentation is method used for segmentation.

ADVANTAGES

1. This work easily identifies the major and minor pattern.

DISADVANTAGES:

1. Efficient segmentation algorithm is very important.
2. Minimum number of images only used.

5. Zahra.s.shariatmadar et.al, 2013 [7] has explained their work as one of the ways to efficient finger knuckle print recognition using bio-hasing methods.

ADVANTAGES

1. In this work using combined methods so the noise and dimensionality is easily reduced.

DISADVANTAGES

1. It is expensive and computational complexity is over.
2. The number of sub windows is very high level.

6. shoichiro aoyama et.al, 2013 [8] authors proposed their work deals with finger knuckle print recognition using that phase based local block matching. It is an efficient algorithm compare than other existing convolution algorithm.

ADVANTAGES

1. In this work using PolyUFKP database so the recognition rate is high.

DISADVANTAGES:

1. In this work used only 2 fingers instead of using multiple fingers the performance will be improved.

7. Jialiang peng et.al, 2013 [9] authors have projected a feature fusion of finger biometrics. In this work Multi model feature fusion using canonical correlation analysis.

ADVANTAGE

1. Execution time is very low and it takes less memory space to store all the features.

DISADVANTAGES

1. In this work only considered same traits of fingers only.
2. In case there is any problem in physical trait the total system will be failure.

8. Ming Liu et.al, 2014[10] authors illuminated their work as a new approach for inner knuckle print recognition used derivative line detection method. Image distortion problem is easily solved by the above algorithm.

ADVANTAGE

1. The execution time is too low and inner knuckle prints are easily recognized using combine techniques.

DISADVANTAGES

1. Noise remove is an important work. So the image quality is sometimes poor.
2. Efficient matching algorithm is required.

9. Abdallah Meraoumia et.al, 2011[11] authors offered work as a fusion based multimodal system. Hamming distance is used to find out the measure of the distance of the traits in score level fusion.

ADVANTAGE

1. The matching recognition rate is high.

DISADVANTAGES

1. Large size of database is needed.
2. Matching algorithm will be improved for better recognition.

10. Necla Ozkaya et.al, 2014[12] defined their proposed work as a common vector based finger knuckle recognition. Discriminative common vector and hamming distance are used to matching accuracy.

ADVANTAGES

1. Recognition rate is high.
2. In this work used FKP public databases.

DISADVANTAGES

1. It is used only with the small sized databases. So it is not used for large size data.
2. The training the database is very essential because certain variations in finger bending and certain diseases.

11. k.usha et.al, 2015[13] have explicated the work as fusion of geometric and texture feature based authentication. This work finds out distal phalanx region of FBKS.

ADVANTAGE

1. The accuracy level and matching criteria is good.

DISADVANTAGES

1. It is combined geometric and texture features. The following techniques have some drawbacks such as lower degree of discrimination and inaccurate authentication of the large population.

2. Performance degradation, when the image captured is poor quality.

12. Michael et.al, 2010[14] clarified work in bimodal recognition system. Ridglet transform used to score level fusion.

ADVANTAGE

1. EER is very low.

DISADVANTAGES

1. It is used for only semi-controlled environment only. Further investigation needed to other type of environment.
2. More tests will be required.

13. Gaurav Jaswal et.al, 2017[15] clarified their work as Deep Knuckle Revealing human identity.

ADVANTAGE

1. The CRR (99.39%), EER (0.92%) and Computation time is 756.82ms.

DISADVANTAGES

1. It has been observed that transverse features are not useful and robust in FKP based recognition system.

2. In this work the additive technique is used for noise removal but based on this noise removal the noise level is not degraded.

Based on this study the research work has a lot of drawbacks such as indoor and outdoor illumination is over, occlusion problem is high, accurate segmentation algorithm is required, time and space complexity is more, only small number of samples are used from the databases, fusion of feature and score level is difficult. To overcome of these issues, we have to great our proposed work.

III. PROPOSED WORK

In our proposed work, we have to create an innovative finger knuckle point based authentication system. In this work, first we have to capture the finger knuckle image from the database or image acquisition device, after that we will do some pre-processing operations on the image because some noise is in that image. In case not remove the noise from that image definitely the output is not good. So that outcome of the recognition system is failure. So in our work noise removal and image enhancement is an important pre-processing step. After the pre-processing step we have to segment the region of the knuckle image by using efficient segmentation algorithm. Next the features are extracted from the segmented image and then it is stored into the database for tanning purpose. Finally the efficient classification algorithm is used to classify the results.

IV. METHODOLOGY

In our proposed work, we have to used different types of steps are used for finger knuckle print authentication system. They are

Preprocessing:

In finger knuckle print authentication system preprocessing is a very important step. In preprocessing step is mainly used to remove the noise from the image because the images are captured by varying conditions such as dark room, over light, etc., so noise removal is an essential thing. Noise removal is nothing but some unwanted pixels are removed from the image. In this preprocessing step we have used Gaussian filter for noise removal. So the output of the preprocessing step is good.

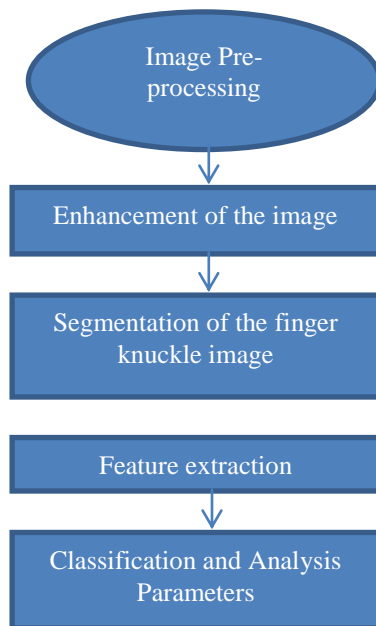


Figure 2. Proposed Methodology.

Enhancement of the image:

After pre-processing step the image enhancement is a very important step for finger knuckle print system. Image enhancement means to enhance the image for image quality. Nowadays quality of an image is a must. In case it fails in image enhancement step for capturing the image the overall output the image quality also poor. To enhance the image we have to use various enhancement algorithms in our work.

Segmentation of the finger knuckle region:

Segmentation means to segment exact region of the finger knuckle print. This is much needed step for authentication process. In our proposed work we have to use efficient segmentation algorithm for segmentation. Accurate segmentation algorithm very needed for this work.

Feature Extraction:

Feature extraction step is to select the exact features from those images. The features are mainly used for tanning and matching purpose of the authentication system. This is a very crucial step.

Classification and performance analysis:

Finally those extracted features are stored up into the database and a suitable classification technique is used to classify the data and image purpose for the testing and training images. The proposed method will be compared with the existing algorithm on the scale of True negative, true positive, false negative and false positive, precision, recall, F-score, sensitivity, specificity and accuracy.

V. CONCLUSION AND FUTURE SCOPE

In our proposed work, we have to create a finger knuckle print system for authentication process. In this finger knuckle print based authentication system and it overcomes the drawbacks of the above existing work and this finger knuckle print based authentication system will provides better image quality, good segmentation accuracy and the recognition rate also will increase. The existing work use only small number dataset for identification and verification purpose but in this work will use more samples for large populations. This work will implement in Matlab tool. So work will provide more Authentications for finger knuckle print. In future work the multimodel is very essential one because unimodel systems have a lot of drawbacks. The finger knuckle systems with any other physiological or behavioural traits are will provides more authentication.

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Ms.L. Sathiya received his B.Sc Computer Science Degree in Government Arts College for Women, Pudukkottai in 2010. She got M.Sc Computer Science Degree from H.H. The Rajah's College, Pudukkottai in 2013 respectively. She also received M.Phil Degree in Alagappa University, Karaikudi in 2014. She is doing Ph.D Degree in Computer Science, Department of Computer Applications, Alagappa University, Karaikudi, Tamil Nadu, and India. His research interest includes Image Processing, Biometrics based Security and Pattern Recognition.



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