Multimodal Biometrics Image Processing And Detection Techniques

R. Sasikala[1], N.Habibunnisha[2], Dr. D. Nedumaran[3]
[1, 2, 3] Central Instrumentation & Service Laboratory,
University of Madras, Guindy, Chennai-600025, Tamil Nadu, India

Abstract- *In the modern world, security is one of the important issuesand is often provided by many modes of electronic security modalities viz., ID-cards, passwords and pin numbers. But these kinds of securities are easily misled, misused, forgotten and stolen. In order to provide improved security features, one of the important tools to ascertain the security level is by way of using Biometrics characteristics for identification or verification purposes. This paperpresents the multimodal human identification concepts employing palm print, eye, and fingerprints. Initially, the images were pre-processed and applied wavelet transform to remove the unwanted portion of images and then features were extracted. For feature extraction, Edge detection, Laplacian filter and Corner detection methods were employed. The extracted features were stored in a local database for matching, identification and verification purposes. All the algorithms were developed and tested in the MATLAB R 2013a version. The results obtained from this study are encouraging and gives some hope for the implementation of multimodal biometrics for future security applications.*

Keywords- Palm print, Fingerprint, Eye, Discrete Wavelet transform, Image enhancement, Laplacian Filter, Minutiae Extraction, Detection Techniques.

I. INTRODUCTION

Biometrics plays an important role for personal identification and recognition. In biometrics, an individual's unique physical and physiological traits are collected using electronic device and extracted the vital features using software for confirming the identity of the particular person. Image processing is a vital tool to improve the accuracy and reliability of the human identification using various biometric modalities such as fingerprint, palm print and eye. Further, the feature extraction and matching approaches can be effectively accommodating the potential image deformations, translational and rotational variations by matching scores.

II. PREPROCESSING TECHNIQUE

In the proposed biometric technique, the following important image processing and feature extraction steps are employed and are summarized below.

A. Converting Raw Image To Grey Scale Image

The raw image consists of primary colors, which requires complex computational process to obtain the required results. Primary colors have their own characteristics that require long process as well as time consuming computations. To tackle these problems, the grey scale image has been used in this work. In the grey scale image algorithm, the color image will have shades of grey without colors.

B. Region of Interest (ROI)

The input hand images had to pass through series of pre-processing steps to get palm-print region of interest. The region of interest contains three principal lines, wrinkles and ridges. Principal lines are called the heart line, the head line and the life line.

C. Discrete Wavelet Transform (DWT)

The Discrete wavelet transform (DWT) is an established technique and has been used in many image processing applications such as digital watermarking, Content-Based Multimedia Information Retrieval (CBMIR) systems, medical image processing and GPS satellite image acquisition.

D. Feature Extraction

The main goal is to extract the existing features of the palm vein pattern from an image and the extracted feature will be used for matching. If the image is an enrolled sample, the features are saved in a training database for later matching. Once the features are extracted and they are compared with the original image stored in the database and based on that comparison a decision will be taken.

(i) Shape Feature Extraction

It is essential to locate the endpoints of each principle line for some palm and eye print identification and verification systems. Palm and eye print consists of lots of ridges and fine wrinkles formed in various directions, lengths and thicknesses. These shape features are used for palm and eye matching. The length and thickness varies for each image in the database. Figures 8 and 9 show the shape feature extraction on palm and eye images, respectively.

(ii) Texture Feature Extraction

Texture provides a high-order description of the local image content. The texture feature extraction is flexible, so that a class of equivalent textures can be generated by using similar primitives in similar relationships.

E. Removal of Noise

Noise is the result of errors in the image acquisition process that result in pixel values that do not reflect the true intensities of the real scene. Wiener filter is used to remove noise. The goal of the Wiener low-pass filter is to filter out high frequency noise that has corrupted a signal.

F. Histogram Equalization

The histogram equalization method increases the contrast level of images and particularly when the usable data of the image is represented by close contrast values.

G. Image Enhancement

The images employed in this work were acquired under near-infrared illumination (NIR), therefore the images generally appeared to be darker with low contrast.

H. Extraction of Shape Using Canny Edge Detection

The most common method in edge detection is Canny edge detection. The steps involved in Canny edge detection are smoothing, finding gradient, non-maximum suppression, double thresholding, edge tracking by hysteresis.

I. Laplacian Edge Detection

Laplacian is widely believed as being unable to represent edges well and as being ill-suited for edge-aware operations like edge-preserving smoothing and tone mapping. These methods have demonstrated successful results and they come at the price of additional complexity, often accompanied by higher computational cost or the need to post-process the generated results.

J. Fingerprint Thinning And Minutiae Extraction

Most of the human visible biometric traits tend to change with age, whereas fingerprint biometrics is relatively persistent, economical and efficient than the other biometrics.

K. Matching Process

In this paper, the palm, eye and minutiae of fingerprint image features are extracted and added to get a single template for improving the accuracy in the identification of the individual. Matching is a post-processing method and can be performed by the following three detectors viz., HARRIS Feature Detector, MINEIGEN Feature Detector, and Features from Accelerated Segment Test (FAST) Detector.

III. POST PROCESSING TECHNIQUE

(i) Harris Feature Detector

After completing the pre-processing methods, the multi-model images were added to form a single image. After the storage of the multi-model images in the database, matching process is performed with the help of MATLAB GUI (Graphic User Interface). The Harris corner detector for matching process (image NOT MATCHED), that means both the images are different, if both images are same person's palm, eye and fingerprint images, so the message box displayed the message as "MATCHED".

(ii) MINEIGEN Feature Detector

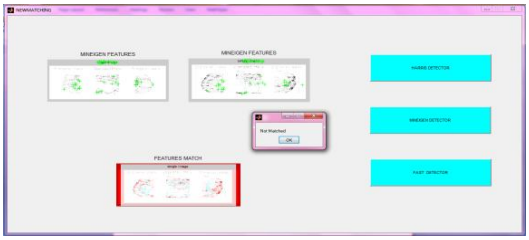
MINEIGEN **(**MINimum EIGEN) value algorithm was developed by Shi and Tomasi to find feature points. A score is calculated for each pixel, and if the score is above a certain value, the pixel is marked as a corner. The two images are from different candidates the MINEIGEN feature detector applied and the results are shown in the massage box as "NOT MATCHED". If both the original and testing images are taken from the same candidate, therefore, the massage box displayed as "MATCHED".

(iii) Features from Accelerated Segment (Fast) Detector

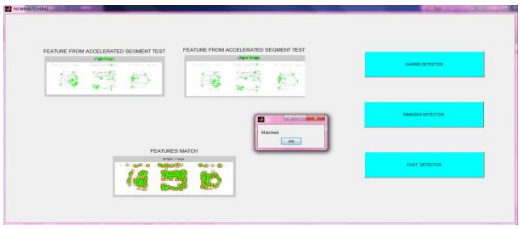
FAST was originally developed by Edward Rosten and Tom Drummond. It is a corner detection method and is used to extract feature points to track and map objects in many computer vision tasks.It is faster than other extraction methods like SIFT, SUSAN.FAST corner detector detects whether the persons are same or different [9]. The FAST Feature Detector matching process, after completing the corner detection the

massage box shows that the images are NOT MATCHED. The FAST Feature Detector matching process, after finishing the corner detection process the massage box shown that the images are MATCHED.

Harris corner detector result of non-matched images



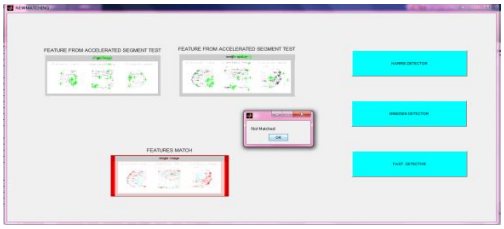
MINEIGEN Feature Detector result of non-matching images



FAST Feature Detector result of matched images

Harris corner detector result of matched images

MINEIGEN Feature Detector result for matched images



FAST Feature Detector result of non-matched images

IV. CONCLUSION

In this work, the multiple human identification and recognition system were implemented via the hybrid techniques using the established pre-processing methods. All the image processing algorithms were developed in MATLAB environment and tested on human palm; eye and fingerprint sample images collected locally and created a database. Overall, the proposed methods improved the quality of the images substantially, that is evident from better matching scores and lesser execution time than the traditional techniques.

REFERENCES

[1] X. Y. Jing, F. Wu, Z. Li, R. Hu and D. Zhang, "Multi-Label Dictionary Learning for Image Annotation," in IEEE Transactions on Image Processing, vol. 25, no. 6, pp. 2712- 2725, June 2016.

[2] P. Supraja, T. Aruna., “Biometric Detection In Fingerprint Iris and 2D Face Using Hybrid of IQA and SIFT”,International Journal of Innovative Research in Electronics and Communications (IJIREC), Vol. 2, Issue 8,2015.

[3] Anil K. Jain, Fellow, IEEE, Arun Ross, Member, IEEE, and Salil Prabhakar, Member, IEEE., “An Introduction to Biometric Recognition”, IEEE Transactions On Circuits And Systems For Video Technology, Vol. 14, No. 1, January 2004.

[4] Ms. Kavita H. Waghmode, Dr. Prof. P.K. Ajmera., “Image Quality Assessment For Biometric Detection: Application to Iris, fingerprint, and Face Recognition”, International Journal of Innovations in Engineering Research and Technology (IJIERT), Vol. 2,Issue 2 February 2015.

[5] Pradnya M. Shende, Dr.Milind V. Sarode, Prof. Mangesh M. Ghonge., “A Survey Based on Fingerprint, Face and Iris Biometric Recognition System, Image Quality Assessment and Fake Biometric”, International Journal of Computer Science and Engineering Technology (IJCSET), Vol. 4, Issue 4,April 2014.

[6] Ali Mohsin Al-juboori1., Wei Bu1., Xingqian Wu1 and QiushiZhao1.,“Palm Vein Verification Using Gabor

Filter", International Journal of Computer Science Issues(IJCSI), Vol. 10, Issue 1, No 1, January 2013.
[7] SasanGolabi, SaiidSaadat, Mohammad SadeghHelfroush, and AshkanTashk ., "A Novel Thinning Algorithm with Fingerprint Minutiae Extraction Capability", International Journal of Computer Theory and Engineering, Vol. 4, No. 4, August 2012.
[8] Shi, J., and C. Tomasi, "Good Features to Track," *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*,June 1994.
[9] Harris, C., Stephens, M., "A combined corner and edge detector", AlveyVision Conference, 1988.
[10] E. Rosten and T. Drummond, "Machine learning for high speed corner detection", in 9thEuropean Conference on Computer Vision, Vol. 1, 2006.
[11] https://in.mathworks.com/help/matlab/