ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

Multimodal Biometric Fusion

Aishwarya Kadam[1], Mitali Ghadi [2], Akshay Chavan[3], Prof.Priti Jawale[4]
BE Student[1, 2, 3], Assistant Professor[4]
Department of E&TC Engineering
Dr.D.Y. Patil Institute of Technology, Pimpri, Pune, India

Abstract:
In this paper mainly focused on Adding the security in the system by using biometric modal i.e. Fingerprint and Face detection, data is fused thus key(fused vector) is generated**.** People are becoming even more and more electronically connected with the rapid evaluation of information technology. As a result the ability to achieve highly accurate automatic personal identification is becoming more critical. Some systems are design for highly secured. This paper presents a review of a large number of techniques present in the literature for Feature extracting and Fusion of biometric data.

Keywords: Multimodal Boimetric, feature extraction, fusion

1. INTRODUCTION

The term biometric is derived from the Greek words bio, which means "life, and metric, which means "the measure of." Biometrics is the automated use of unique and measurable characteristics to establish or verify an identity based on some special biometric features derived from physiological and behavioral characteristics. Among the features measured are face, fingerprints, hand geometry, handwriting, iris, retinal, vein, and voice. They are the distinctive, measurable and naturally endowed characteristics used to label and describe individuals. Any of the human physiological or behavioral characteristics is a biometric provided it satisfies some criteria that include universality, uniqueness, permanence, collectability, performance, acceptability and circumvention [1] [2]. Biometric-based human identity management systems have emerged as reliable, secure and dependable solutions to these limitations and have been deployed in numerous government and private applications [3]. The term "multimodal "is used to combine two or more different biometric sources of a person (like face and fingerprint sensed by different sensors. Two different properties (like infrared and reflected light of the same biometric source, 3D shape and reflected light of the same source sensed by the same sensor) of the same biometric can also be combined. In orthogonal multimodal biometrics, different biometrics (like face and fingerprint) are involved with little or no interaction between the individual biometric whereas independent multimodal biometrics processes individual biometric independently. Orthogonal biometrics are processed independently by necessity but when the biometric source is the same and different properties are sensed, then the processing may be independent, but there is at least the potential for gains in performance through collaborative processing. In collaborative multimodal biometrics the processing of one biometric is influenced by the result of another biometric.[7] Multi-modal approach to human authentication and verification has been considered as the most reliable method for the elimination of these limitations. Multi-modal biometric systems integrate two or more types of biometric characteristics for consolidation and meeting stringent performance requirements. Most importantly, it is extremely difficult for an intruder to spool multiple biometric traits simultaneously[4][5][6]. In the identification mode, the system recognizes an individual by searching the templates of all the users in the database for a match. Therefore, the system conducts a one-to-many comparison to establish an individual's identity [12] Identification is a critical component in negative recognition applications where the system establishes whether the person is who he denies to be.[10]

2. RELATED WORK

[16]In this paper discussed various face detection and feature extraction techniques in face recognition. Both are the integral and important part of face recognition because face classification is totally dependent on these two. Template based methods are easy to implement but not represent global face structure. While color segmentation based methods used color model for skin detection with morphology operation to detect features. So different color model and illumination variation these factors can affect performance. Appearance based methods represent optimal feature points which can represent global face structure. Geometry based methods such as Gabor wavelet transform face feature extraction provide stable and scale invariant features. [17]In this paper proposed an efficient algorithm fingerprint recognition. The proposed technique is particularly effective for verifying low-quality fingerprint images that could not be identified correctly by conventional techniques. In iris recognition Log-Gabor filter is effective method than any other technique to extract feature from iris image capture. Finally fusion can be applied to enhance the performance of system and security level. Thus the individual scores of two traits, iris and fingerprint are combined at the matching score level to develop a multimodal biometric authentication system. [15]In this paper a model for fusion of the face and fingerprint multimodal system has been presented. SIFT has been used for feature extraction and image description of the face and fingerprint images. Finally, matching is done using KNN by comparing an image to images stored in the database. The Sum rule has been used to fuse the score at the match score level. The experiment result of the

proposed system has also been tested against the face and the fingerprint unimodal system and it has been established that the multimodal system performs better than the unimodal system with an accuracy of 92.5%, FRR of 7.5% and FAR of 3.75%. [18]In this paper presents an overview of multimodal biometrics, challenges faced by multimodal biometric system. It also discuss their applications to develop the security system for high security areas. We also discuss the application of biometric systems and their advantage over unimodal biometric system. Biometrics permits unmanned access control. Biometric devices, typically hand geometry readers, are in office buildings, hospitals, useful for high-volume access control. [19]In this paper reviewed a large number of techniques described in the literature to extract minutiae from fingerprint images. The approaches are distinguished on the basis of several factors like: the kind of input images they handle i.e. whether binary or gray scale, techniques of binarization and segmentation involved, whether thinning is required or not and the amount of effort required in the post processing stage, if exists. Bulow quality fingerprint images need preprocessing to increase contrast, and reduce different types of noises as noisy pixels also generate a lot of spurious minutiae as they also get enhanced during the preprocessing steps. [6]In this paper disused on the motivations, methodologies, strengths and weaknesses of the physiological and bhavioural modes for human identity management had been presented. The integration, fusion and evaluation strategies for multi-modal approach to human identity management are also presented. Multi-modal biometric systems have performed well in addressing the problems of unimodal systems by combining information from different sources and improve the systems performance, raise the scope, discourage spoofing, and promote indexing. Improved performance has been noticed with uncorrelated traits and integration of parameters that are users specific in multimodal systems.

3.PROPOSED METHODOLOGY

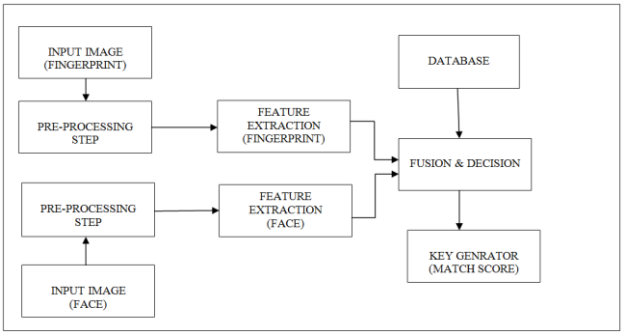

Figure.1. Block Diagram

3.1Feature Extraction module

At feature extraction module features are extracted from different modalities after preprocessing. These features yields a compact representation of these traits or modalities and these extracted features are then further given to the fusion module for comparison.

3.1.1Kernel PCA:-

KPCA method allows a linear PCA method to nonlinear dimensionality reduction. Since PCA works on linear fashion, non-Gaussian distributed data causes PCA to fail, and also non-parametric, Kernal PCA extends PCA into nonlinear and parametric. It also fit for non-Guassian dataset. The KPCA is extended from PCA method to represent nonlinear mappings in a higher dimensional feature space. The KPCA is used for the nonlinearity of face recognition problem by using a nonlinear kernel function then a dimensional reduction is performed. The images are first transformed from image space into a feature space. In the feature space, the variety of the data become simple.[11]

3.1.2.Feature Extraction Minutae:-

The third process is the pre-processing feature extraction process. In feature extraction phase, features of image are extracted such as Ridges, valleys, minutiae and singular points (loops, core, whorls and delta). These features are helpful for unique identification or verification of an individual. The features obtained from captured images are stored in database for further process of matching.[13] An accurate representation of the fingerprint image is critical to automatic fingerprint identification systems, because most deployed commercial large-scale systems are dependent on feature-based matching (correlation based techniques have problems as discussed in the previous section). Among all the fingerprint features, minutia point features with corresponding orientation maps are unique enough to discriminate amongst fingerprints robustly; the minutiae feature representation reduces the complex fingerprint recognition problem to a point pattern matching problem. In order to achieve high accuracy minutiae with varied quality fingerprint images, segmentation algorithm needs to separate foreground from noisy background which includes all ridge-valley regions and not the background. Image enhancement algorithm needs to keep the original ridge flow pattern without altering the singularity, join broken ridges, clean artifacts between pseudo-parallel ridges, and not introduce false information. Finally minutiae detection algorithm needs to locate efficiently and accurately the minutiae points.[19]

3.2.Fusion Module

Biometric evidence in a multibiometrics system can be fused at several different levels. The fusion can be divided into the following main categories:- Prior to matching fusion, fusion occurs before matching of biometrics is done. This includes the following fusion levels:- sensor level fusion and feature level fusion. After matching fusion, fusion is done after the fusion of biometric data. This includes the following fusion levels:- match score level fusion, rank level fusion and decision level fusion[14] [15]

3.2.1.Fusion at the matching scores level:

Each system provides a matching score indicating the proximity of the feature vector with the template vector. These scores can be combined to assert the veracity of the claimed identity. Techniques such as logistic regression may be used to combine the scores reported by the two sensors. Fusion at matching level normalizes scores of matchers to same domain using mechanisms such as Min Max, which maps score values to [0, 1], or Quadric-Line-Quadric function, which tries to separate the genuine and impostor score distributions. Then it may use one or more of following approaches for the actual classification [8] Fixed rules, such as simple sum, maximum unimodal score, and minimum unimodalscore. Trained rules, such as Support Vector Machines, Fisher's Linear Discriminate, Bayesian Classifier,

Multi-Layer Perceptron, and Decision Trees [9]. Adaptive rules, such as assigning less weight to modalities that are disadvantaged by the current environment.[10]

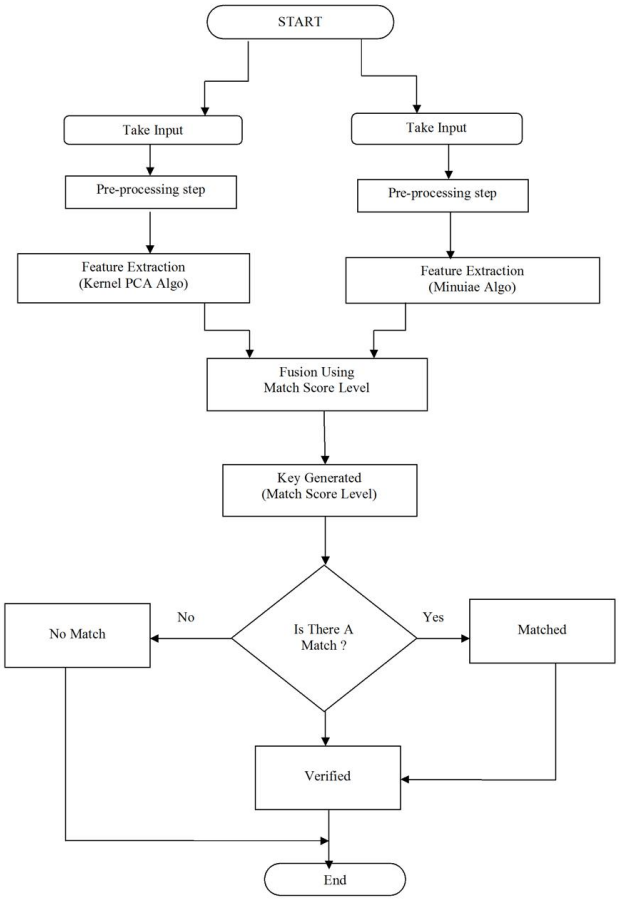

Figure.2.Flow Chart

III .RESULT

The experimental results of the proposed approach are presented in this section. The designed proposed system is experimented with the Matlab (Matlab7.4). The proposed approach is tested with different sets of input images. For every input fingerprint image, the extracted minutiae points and every input face image the extracted KPCA point.

Figure.3.Input Image

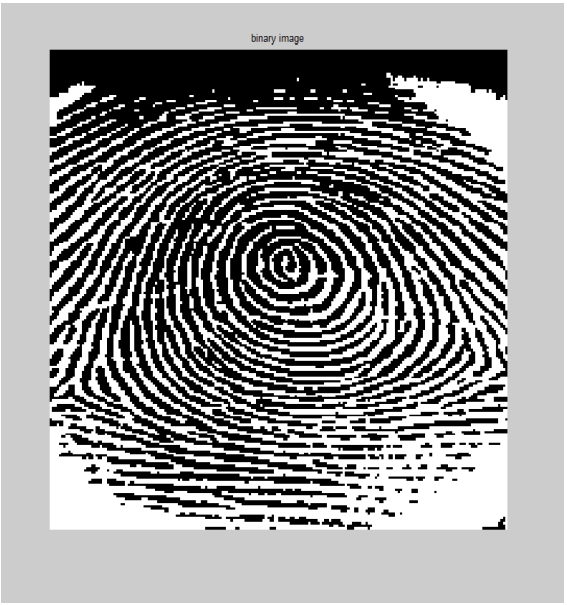

Figure.4. Binary Image

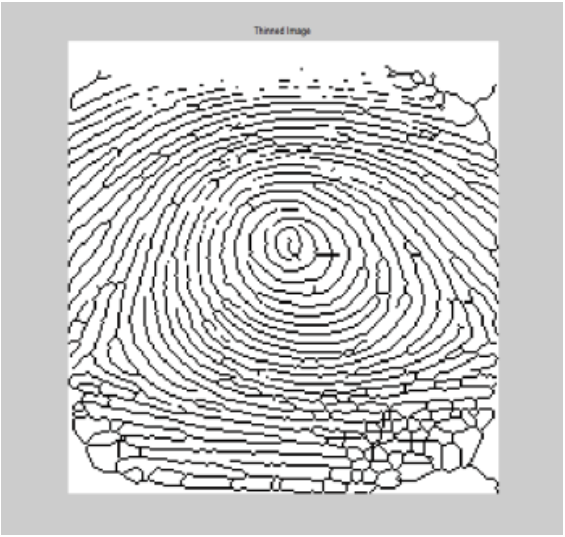

Figure.5.Thinned Image

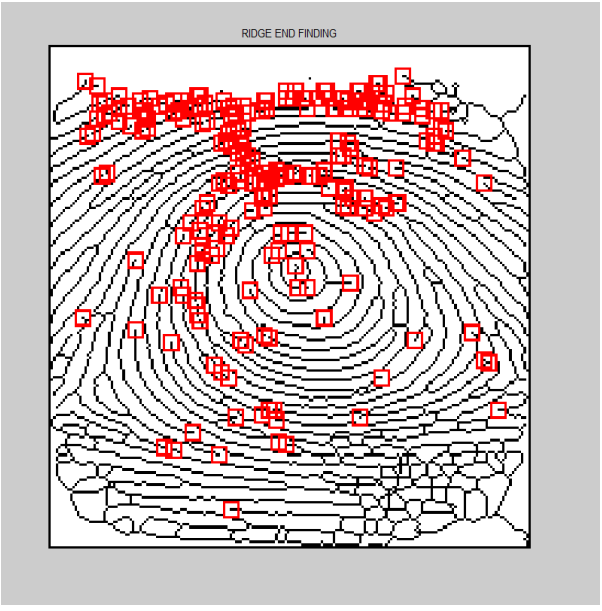

Figure.6. Ridge end finding

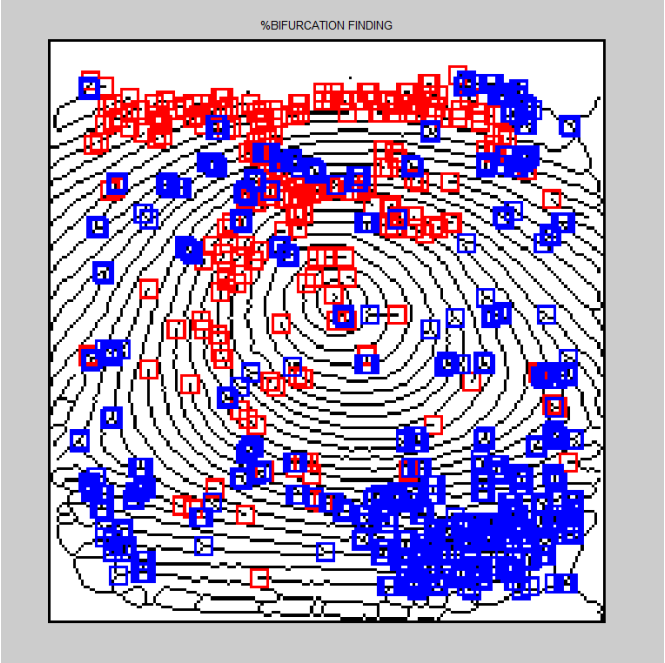

Figure.7. Bifurcation Image

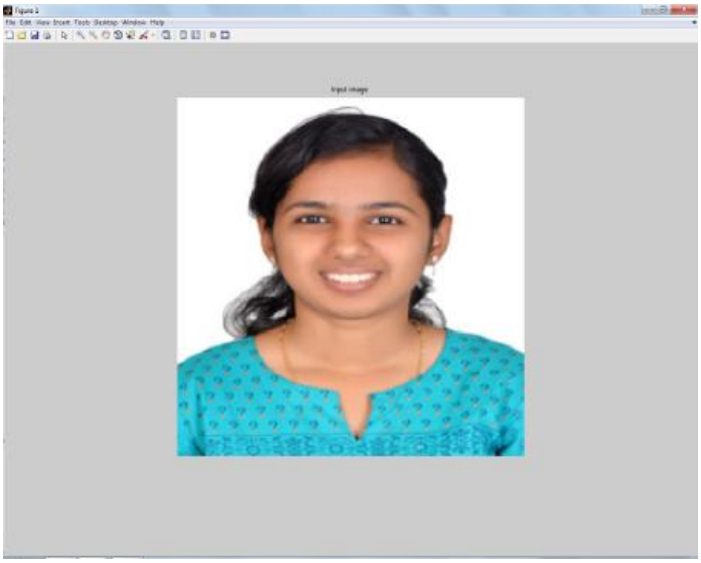

Figure.8. Input Image

Figure.9. Gray scale Image

Figure.10. Binary Image

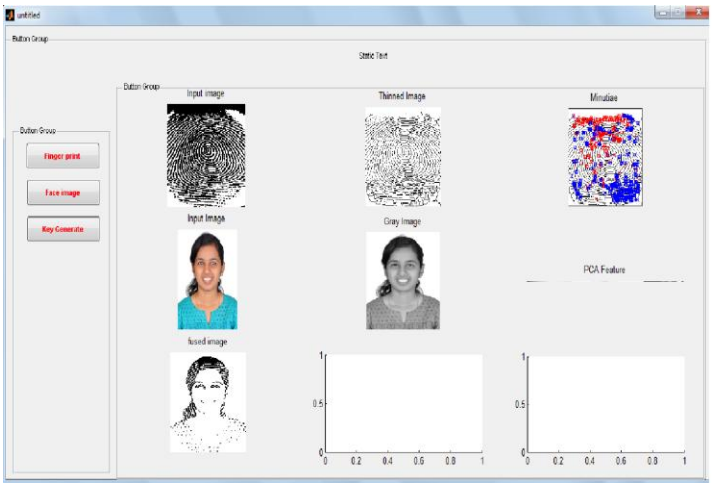

Figure.11.Output GUI Image

4. CONCLUSION

Biometric system using face recognition and fingerprint identification was designed and implemented. It was tested with different face and fingerprint images. It has been observed that fusion at the match score level is the most popular fusion method owing to the fact that it is easier to access and combine matching scores. This study represents a facial and fingerprint detection and recognition model with different windows working in parallel and independently. This paper presents an overview of multimodal biometrics, and challenges faced by system .It also discuss their applications to develop the security system for high security areas. Whereby, most of the biometric methods are also secure, professional and provides very accurate authentication process, but sometime they need extra tools which are required extra cost. The integration, fusion and evaluation strategies for multi-modal approach to human identity management are also presented. We hope that this system provides some additional security into the field of biometric module and contributes to the development of the field .The matlab code was developed and it may solves the problem. Future work is focused on trust in these electronics transaction will be essential to healthy growth of global economy. Cryptography algorithm perform against

general database and studying the required modifications to make algorithm robust with any images.

5. REFERENCES

[1]. M. Soltane and M. Bakhti, "Multi-Modal Biometric Authentications: Concept Issues and Applications Strategies, International Journal of Advanced Science and Technology, Vol. 48, 2012

[2]. A. K. Jain, S. Prabhakar, and S. Chen, "Combining multiple matchers for a high security fingerprint verification system," Pattern Recognition Letters,Vol. 20, pp. 1371–1379, 1999.

[3]. S. S. Yadav, J. K. Gothwal , R. Singh, "Multimodal Biometric Authentication System: Challenges and Solutions", Global Journal of Computer Science and Technology, Vol. 11, No. 16, 2011.

[4]. K. Pellerin, Increasing Accuracy in Multimodal Biometric Systems, GIAC Security Essentials Certification (GSEC), 2004

[5]. N. Khatoon, M. K Ghose, "Multimodal Biometrics: A Review", International Journal of Computer Science and Information Technology & Security, Vol. 3, No.3,2013

[6]. Iwasokun G. B., Udoh S. S &Akinyokun O. K, "Multi-Modal Biometrics: Applications, Strategies and Operations", Global Journal of Computer Science and Technology: G Interdisciplinary Volume 15 Issue 2 Version 1.0 Year 2015

[7]. Prof. Vijay M. Mane, Prof. (Dr.) Dattatray V. Jadhav, Review of Multimodal Biometrics: Applications, challenges and Research Areas" International Journal of Biometrics and Bioinformatics (IJBB), Volume 3, Issue 5

[8]. R. W..Frischholz and U. dieckmann, Feb.2000 Bioid: A multimodal biometric identification system, IEEE Computer Society, pp. 64-68,. Name Stand. Abbrev., in press.

[9]. A. Kumar et. al., 2003 Person verification using palmprint and handgeometry biometric, proc. *Fourth Int. Conf. AVBPA, pp.668-678*.

[10]. Almas M. N. Siddiqui, RupaliTelgad and Prapti D. Deshmukh, "Multimodal Biometric Systems: Study to Improve Accuracy and Performance", International Journal of Current Engineering and Technology, Vol.4, No.1 (Feb 2014)

[11]. Mohammad MohsenAhmadinejad, Elizabeth Sherly, "A Comparative Study on PCA and KPCA Methods for Face Recognition, International Journal of Science and Research (IJSR),Volume 5 Issue 6, June 2016

[12]. S. Prabhakar and A. K. Jain, 2002 Decision-level fusion in fingerprint verification, Pattern Recognition, vol. 35, no. 4, pp. 861–874

[13]. Gurpreet Singh and Vinod Kumar, Review On Fingerprint Recognition: Minutiae Extraction and Matching Technique, International Journal of Innovation and Scientific Research, ISSN 2351-8014 Vol. 10 No. 1 Oct. 2014, pp. 64-70

[14]. Ghayoumi M., "A review of multimodal biometric systems: Fusion methods and their applications" IEEE/ACIS 14th International Conference Computer and Information Science (ICIS), Las Vegas, 2015 ,pp. 131 - 136

[15]. Grace Wangari Mwaura, Prof. Waweru Mwangi, Dr. Calvins Otieno,"Multimodal Biometric System:- Fusion Of Face And Fingerprint Biometrics At Match Score Fusion Level", INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 6, ISSUE 04, APRIL 2017

[16]. Urvashi Bakshi, Rohit Singhal,"A SURVEY ON FACE DETECTION METHODS AND FEATURE EXTRACTION TECHNIQUES OF FACE RECOGNITION" International Journal of Emerging Trends & Technology in Computer Science ,Volume 3, Issue 3, May-June 2014

[17]. P. D. Garje, Prof. S. S. Agrawal, "Multibiometric Identification System Based On Score Level Fusion", IOSR Journal of Electronics and Communication Engineering (IOSRJECE) ISSN: 2278-2834 Volume 2, Issue 6 (Sep-Oct 2012), PP 07-11

[18].Taruna Panchal, Dr. Ajit Singh,"Multimodal Biometric System", International Journal of Advanced Research in Computer Science and Software Engineering", Volume 3, Issue 5, May 2013

[19]. Roli Bansal, Priti Sehgal and Punam Bedi, "Minutiae Extraction from Fingerprint Images - a Review", International Journal of Computer Science Issues, Vol. 8, Issue 5, No 3, Sep