ISSN 2395-1621

MULTIMODAL BIOMETRICS SYSTEM USING FINGERPRINT AND FACE

#1Miss. Tanuja Phadatare, #2DR. PROF. KANSE Y.K.

#1Department of Electronics, Dr. Babasaheb Ambedkar technological University, lonere, India.
[1]tanujaphadatare18@gmail.com

#2Department of Electronics, Dr. Babasaheb Ambedkar technological University, lonere, India.
[2]yuvraj.kanse@kbpcoes.edu.in

ABSTRACT

This article is an overview of a current multimodal biometrics research based on fingerprint and face recognition. This system is totally automated with a trained detection system for fingure print and face. It explains the pervious study for each modal separately and its fusion technique with another biometric modal. The basic biometric system consists of four stages: firstly, the sensor which is used for enrolment & recognition the biometrics data. Secondly, the pre-processing stage which includes the enhancement and segmentation of Region-Of-Interest ROI. Thirdly, features extracted from the output of the pre-processing and each modal of biometrics having different type of features. Fourthly, the matching stage is to compare the acquired feature with the template in the database. Finally, the database which stores the features for the matching stags. Multimodal is being gathered of various types of biometrics objects from the same human. In this paper, the biometric system gives an explanation for each model. Also, the modalities of biometrics are discussed as well as focused on two different modalities: fingerprint and face recognition.

Keywords: multimodal, ROI, fingerprint and face recognition, fusion

ARTICLE INFO

Article History

Received: 7th June 2019

Received in revised form :

7th June 2019

Accepted: 9th June 2019

Published online :

10th June 2019

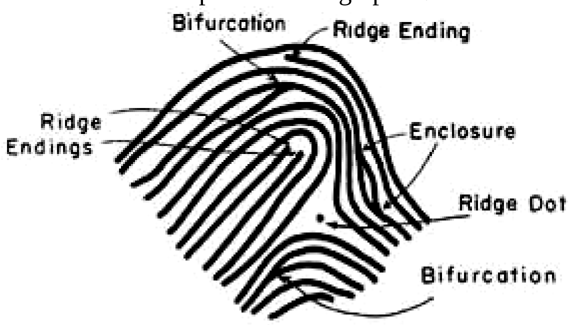
I. INTRODUCTION

Along various biometrics techniques in the past few decades, human-beings have been addicted to various technologies such as captured photos, scanned signatures, bar code systems, verification Id & so on. Also, Biometrics is one of the applications in Image processing. Biometrics refers to technologies that measure and analyse human body characteristics for the user authentication. The biometric authentication system based on two modes: Enrolment and Recognition. In the enrolment mode, the biometric data is acquired from the sensor and stored in a database along with the person's identity for the recognition. In the recognition mode, the biometric data is re-acquired from the sensor and compared to the stored data to determine the user identity. Biometric recognition based on uniqueness and permanence. The uniqueness means that there is no similarity of feature between two different biometrics data.

II. METHODOLOGY- FINGERPRINTS AND FACE RECOGNITION

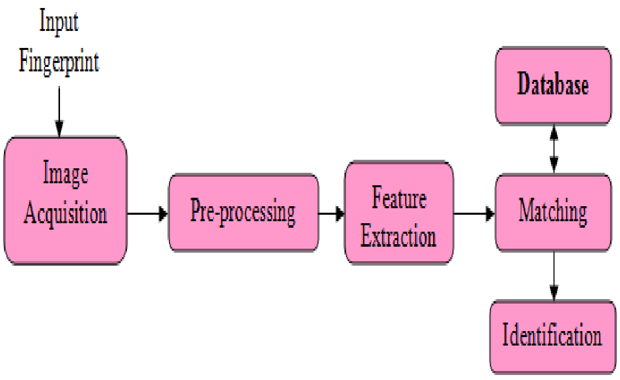
a) Fingerprints:

The fingertip surface consists of ridges and valleys. The ridge declare as black lines and the valleys declare as white lines (refer following Fig.) .The minutiae points are the points where the ridge structure changes such as bifurcation and end point. Every person has a unique fingerprint from any other person. The fingerprint identification is based on two basic assumptions which are Invariance and Singularity Invariance: means the fingerprint characteristics do not change along the life. Singularity: means the fingerprint is unique and no two persons have the same pattern of fingerprint.



Fingerprint image showing different ridge features

© 2019, IERJ All Rights Reserved



Fundamental Steps of Fingerprint Recognition System

i) Image Capture or Image Acquisition stag

The Image Acquisition stage is the process to obtain images by different ways. There are two ways to capture fingerprint image; online and offline. In the online fingerprint identification the optical fingerprint reader is used to capture the image of fingerprint. The size of fingerprint image will be 260*300 pixels. The offline fingerprint identification is obtained by ink in the area of finger and then put a sheet of white paper on the fingerprint and finally scans the paper to get a digital image.

ii) Image Pre - processing Stage

The pre-processing stage is the process of removing unwanted data in the fingerprint image such as noise, reflection etc. The fingerprint image pre-processing is used to increase the clarity of ridge structure. There are many steps for doing this process such as Image Segmentation, Binarization, Elimination of noise, smoothing and thinning. The propose of all these steps is to enhanced fingerprint image at the time of enrolment.

iii) Feature extraction stage

The feature extraction process of fingerprint image applied on the output of pre-processing stage. The process of feature extraction depends on set of algorithms; A fingerprint feature extraction program is to locate, measure and encode ridge endings and bifurcations in the fingerprint. For extracting the features from the fingerprint image, a popular method is minutiae extraction. Minutiae extraction algorithm will find out the minute points from the fingerprint and then map their relative placement on the finger.

iv) Matching stage-

The matching stage is the process to compare the acquired feature with the template in the database. In other words the process of matching stage is to calculate the degree of similarity between the input test image (for user when he wants to prove his/her identity) and a training image from database (the template which created at the time of enrolment).Matching can be done in three methods: hierarchical approach which employs simple but computationally effective features to retrieve a subset of templates in a given database. This approach increases matching speed at the cost of accuracy, classification: Classification approaches assign a class to each biometric in a database.

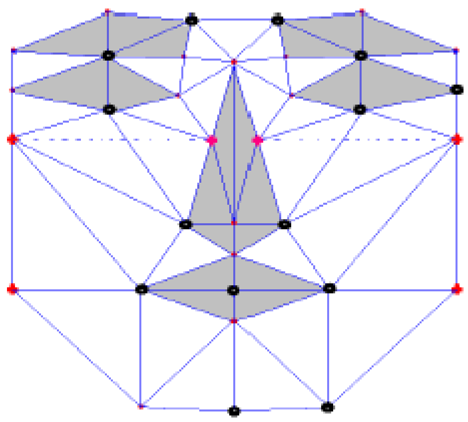
b) Face:

Face recognition is the popular way for the humans to recognize each other. The face is the front part of a head from chin to the forehead. Face recognition can be used in surveillance application because the face is one of the few biometric traits that can be recognized by people at distance.

Face recognition is one of the most intensively studied topics in computer vision and pattern recognition. Facial expression, which changes face geometry, usually has an adverse effect on the performance of a face recognition system. On the other hand, face geometry is a useful cue for recognition. Taking these into account, we utilize the idea of separating geometry and texture information in a face image and model the two types of information by projecting them into separate PCA spaces which are specially designed to capture the distinctive features among different individuals.

1) Face mask

The idea of using a mask for registration in a face recognition system is not new. For example, uses a 3D mask to register the frontal view with the profile view. Some existing masks, such as, are well designed for fitting deformable surface according to muscle actions. However, when working with planar face images, it is hard to achieve a good registration for all the densely placed vertexes. Besides, although quad-based masks make morphing flexible, triangulated masks are advantageous in texture mapping. Consequently, we use a simplified and triangulated mask, as shown in Fig. 6. On this mask, the grey triangles correspond to regions of the eyebrows, eyes, nose and mouth. They are intentionally set to smaller sizes so as to capture more detailed features. This mask contains only 34 vertexes and 51 triangles, which will be denoted by v and t, respectively.



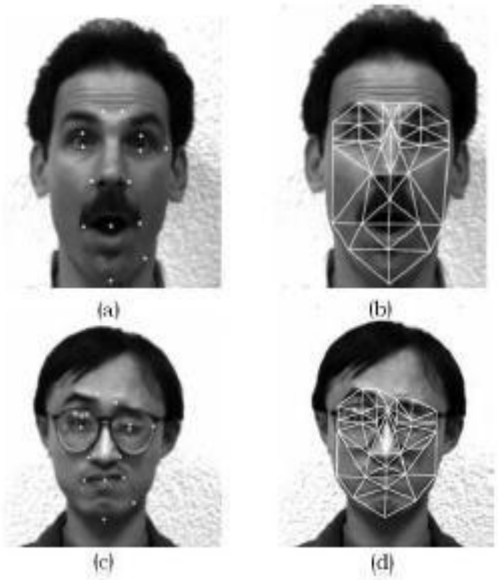
Face mark

2) Mask fitting and warping:

Given a testing face, we first fit the mask onto it, by manually selecting 14 markers to register important face features. These markers are shown as the dark dots in Fig. 7. Then, all the other vertexes on the mask can be fitted using

© 2019, IERJ All Rights Reserved

the symmetry and common knowledge of face structures. Following gives two examples of such a registration process.



Fitting masks. (a), (c): manually placed markers (white dots); (b), (d):fitted masks.

After warping, expressioned faces have been morphed to have the same geometry as the reference face. After warping, the resulting face will have the same geometry as the reference face. Consequently, the warped face may appear similar to the reference face if their skin textures are close to each other. However, the testing face may belong to another individual whose face geometry differs greatly from that of the reference face. This implies that face geometry carries valuable information. To characterize this, we select the inner angles of each triangle on the fitter mask as a descriptor of its geometry. In addition, this descriptor is invariant under uniform scaling, translation and rotation, which can be caused by inaccurate calibration. These angles are arranged into an angle vector xang, denoted by:

Xang = [_1 _2 _3 . . . _151 _152 _153] T

where _1 to _3 belong to the first triangle, _4 to _6 belong to the second triangle, etc. There are altogether 51 triangles, yielding a total of 153 angles for each mask. We record the geometric change during the warping process. As the mask of an expressioned face is warped, its angle vector changes. We calculate a vector Xres to record this angle change, referred to it as angle residual hereafter, given by Xres = Xe ang – Xr ang. (2) where Xe ang and Xr ang are the angle vectors of the expressioned face and the reference face, respectively. To compare with typical face recognition methods, we first use Eigenface to recognize the original faces without warping. To align the faces, we manually pick the nose tip. A 150 × 150 square centered at the nose tip is cut off and taken as the aligned face. Our current mask fitting scheme is based on 14 manually picked markers. The usage of markers makes the system less automatic and likely to cause error. Considering that there are existing methods on automatic face feature registration, the combination of our method with these automatic registration algorithms will further highlight the advantages of our method.

III. Conclusion

In this paper, for fingerprint recognition, we presented Fingerprint matching using FRMSM and Face recognition using Face Mask Method. The pre-processing of the original fingerprint involves image binarization, ridge thinning, and noise removal. Fingerprint Recognition using Minutia Score Matching method is used for matching the minutia points. The proposed method FRMSM gives better FMR values compared to the existing method. The reliability of any automatic fingerprint recognition system strongly relies on the precision obtained in the extraction process. Extraction of appropriate features is one of the most important tasks for a recognition system.

For Face Recognition, we constructed three PCA spaces separately modeling face texture, intrinsic geometry and expression information by fitting a generic mask and warping the texture. Based on a combination of texture and appropriately defined geometric attributes, superior recognition performance can be achieved. After face recognition, expressions can be quantitively modeled, enabling our system to classify expressions as well. Our current mask fitting scheme is based on 14 manually picked markers. The usage of markers makes the system less automatic and likely to cause error. Considering that there are existing methods on automatic face feature registration, the combination of our method with these automatic registration algorithms will further highlight the advantages of our method. Multimodal biometric systems elegantly address several of the problems present in unimodal systems. By combining multiple sources of information, these systems improve matching performance, increase population coverage, deter spoofing, and facilitate indexing. Various fusion levels and scenarios are possible in multimodal systems. Fusion at the match score level is the most popular due to the ease in accessing and consolidating matching scores. Performance gain is pronounced when uncorrelated traits are used in a multimodal system. Incorporating user-specific parameters can further improve performance of these systems. With the widespread deployment of biometric systems in several civilian and government applications, it is only a matter of time before multimodal biometric systems begin to impact the way in which identity is established in the 21st century.

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

ACKNOWLEDGEMENT

An acknowledgement section may be presented after the conclusion, if desired.

REFRENCES

[1] MAMATA S.KALAS, “REAL TIME FACE DETECTION AND TRACKING USING OPENCV”, International Journal of Soft Computing and Artificial Intelligence

[2] Lorenzo Luciano and Adam Krzy˙zak, "Automated Multimodal Biometrics Using Face and Ear", Research Gate

[3] Sonam Shukla, Pradeep Mishra, "A Hybrid Model of Multimodal Biometrics System using Fingerprint and Face as Traits", International Journal of Soft Computing and Engineering (IJSCE) 2012 .

[4] Mouad. M. H. Ali & A. T. Gaikwad, "Multimodal Biometrics Enhancement Recognition System based on Fusion of Fingerprint and PalmPrint: A Review", Global Journal of Computer Science and Technology 2016.

© 2019, IERJ All Rights Reserved