

# A Comparative Study of Pixel by Pixel and PCA Technique in Serial Multimodal Biometric

Pranali Nalange  
P.G. Student, Department of Computer Science  
P.E.S. College of Engineering  
Aurangabad (MH), India  
pranali.nalange91@gmail.com

Prof. M. M. Ambekar  
Associate Professor, Department of Computer Science  
P.E.S. College of Engineering  
Aurangabad (MH), India  
s\_manishak@yahoo.com

**Abstract**— In multimodal biometric technique two or more than two biometric traits are used. So in this, we use two biometric traits they are face and fingerprint. With the help of Pixel by Pixel and PCA technique we identified the user or calculate that the person is authorized or not. So in this paper we compared two techniques i.e. Pixel by Pixel and PCA technique.

**Keywords**- Multimodal biometric, Face, Fingerprint, PCA, Pixel by Pixel matching, serial mode of operation

\*\*\*\*\*

## I. INTRODUCTION

In this paper we use two biometric traits they are face and fingerprint as a multimodal biometric. We use serial mode of operation to identify the user. In serial mode there is no need of all traits every time. In this paper we take face as a weaker trait and fingerprint as a stronger trait. Generally weaker trait is easy to use because they are not required physical contact with sensor and stronger trait is hard to use because they required physical contact with sensor. So we use weaker trait (i.e. face) first and stronger trait (i.e. fingerprint) latter [1].

In serial mode of operation, if user identified successfully by the weaker trait i.e. by using face then there is no need to go for stronger trait i.e. fingerprints identification. If weaker trait fails to identify user then and only then user need to go for fingerprint (i.e. stronger trait) identification. That's why serial mode of operation is easy to use than parallel mode of operation in multimodal biometric [2].

## II. COMPARISON OF PIXEL BY PIXEL AND PCA TECHNIQUE

Firstly we calculate the result using pixel by pixel matching method and after that we calculate the result using PCA technique. So in this section we make comparison of these two techniques.

### A. Pixel by Pixel Matching Technique

Pixel by pixel matching technique in image processing is very easy technique to match two images and find that they are identical or not. For that purpose we have to match each and every pixel of both images i.e. input image and database image.

Each and every pixel having some attributes i.e. color of pixel, contrast, brightness, status, row number, Column number etc. Generally using all these or some of these attributes of pixel two images will be identified.

But this technique having drawback that drawback is we must have to use two images that will be identified in same dimension i.e. if we take input image in 180 X 200 in dimension then the database image must be in 180 X 200

dimension. Then and then only image will be identified properly.

If database image and input image dimensions are different then at that time we must have to preprocess the input image and convert it into the dimension which is having database image. Then and then only we will identify image.

In this experiment we calculate the result without preprocessing of images that's why we used same dimension images.

In this technique we match the each and every pixel of input image to the database image. If the pixel matching is higher than the 80% then the input image is matched with the database image i.e. person or user is authorized and if matching is less than 80% then input image is different than the database image i.e. person or user is not authorized.

### 1) Block diagram

First take face and fingerprint image of a person as an input. After taking input apply pixel by pixel algorithm on it and match that input image with the database image. After matching necessary output will be generated and according to that calculate the input image is match or not with database image.



Figure 1 Block Diagram for Pixel by Pixel Matching Technique

### 2) Modules

In this system there are three modules they are as follows

#### a) Input module

In this module we take input image of face and fingerprint of a person in digital form i.e. scanned format

#### b) Matching module

In this module, input image and database image will be matched using matching algorithm. For that purpose we use one threshold value. If the matching score is equal to or greater than threshold value then the match is successful or person is authorized. Otherwise if match score is less than threshold value, then the match is unsuccessful or person is unauthorized.

#### c) Output module

In this module necessary outputs will be generated

#### 3) Algorithm

The steps of pixel by pixel matching algorithm are as follows

Step 1: Take face and fingerprint images of person in digital form i.e. scanned format as an input.

Step 2: Match each and every pixel of input image with the database image

Step 3: Matching percentage is displayed

Step 4: Generated output i.e. matching percentage decides image is match or not.

#### 4) Performance analysis

For processing purpose we have used FacePix [3] database for face images and CASIA [4] database for fingerprint images. We have used five persons sample for identification. We take five face images and five fingerprint images of a particular person for training set and testing set respectively. Therefore total 50 face images and 50 fingerprint images are taken for experimental purpose. Without preprocessing of images we directly apply pixel by pixel matching algorithm. The results in experimentation are as follows [5].

TABLE 1 EER, FAR, FRR FOR RECOGNIZER IN PIXEL BY PIXEL METHOD

| Trait       | Algorithm      | FAR(%) | FRR(%) | EER(%) |
|-------------|----------------|--------|--------|--------|
| Face        | Pixel by pixel | 1.89   | 2      | 0.945  |
| Fingerprint | Pixel by pixel | 0.76   | 1.58   | 0.48   |

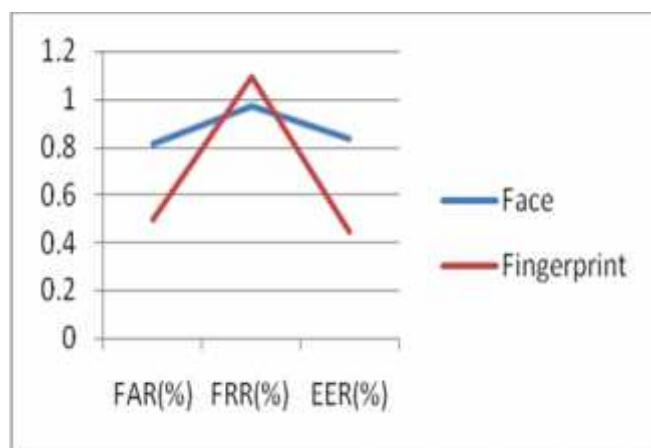


Figure 2 EER Graph for Each Biometric Trait in Pixel By Pixel Method

### B. Principal Component Analysis (PCA) Technique

PCA is an effective technique for extracting features from high dimensionality (HD) data set and has been popular to reduce dimensionality. It can also be used to identify patterns in data or image, and explicit the data in such a way as to focus on their similarities and differences [6].

PCA is also known as discrete Kosambi-Karhunen-Loeve transform (KLT), Hotelling transform, proper orthogonal decomposition (POD), singular value decomposition (SVD), eigen value decomposition (EVD), factor analysis, Eckart-Young theorem, Schmidt-mirsky theorem, empirical orthogonal function (EOF), empirical eigenfunction decomposition, empirical component analysis, quasiharmonic modes, spectral decomposition, and empirical modal analysis [7].

#### 1) Block diagram

First take face and fingerprint image of a person in digital form i.e. scanned format as an input. After taking input filter that images i.e. preprocess the input image. After filtering extract the required features from image and match that features with the database image. If the matching value is greater than the threshold then the image will be match.



Figure 3 Block Diagram for PCA Technique

#### 2) Modules

In this system there are five modules. They are as follows

##### a) Input module

In this module we take input image of face and fingerprint of a person in digital form i.e. scanned format

##### b) Image filtering module

In this module image is filtered i.e. preprocessed for the matching purpose

##### c) Feature extraction module

In this module necessary features are extracted from the image

##### d) Matching module

In this module, input image and database image will be matched using matching algorithm. For that purpose we use one threshold value. If the matching score is equal to or greater than threshold value then the match is successful or person is authorized.

##### e) Output module

In this module necessary outputs will be generated

#### 3) Algorithm

For matching purpose we use PCA algorithm. The steps of the process are as follows

Step 1: Take face and fingerprint image of a person in digital form i.e. scanned format as an input.  
Step 2: Filtering the input image  
Step 3: Extract the required feature from the input image  
Step 4: Match that features with the database image  
Step 5: Generated output decides image is match or not i.e. person is authorized or not.

#### 4) Performance analysis

For processing purpose we have used faces94 [8] database for face images and FVC2002 DB1\_B [9] database for fingerprint images. We have used three persons sample for identification. We take five face images and five fingerprint images of a particular person for training set and testing set respectively. Therefore total 30 face images and 30 fingerprint images are taken for experimental purpose. After taking input first we preprocess the input image after that extract the features and match that features with the database image. The results in experimentation are as follows.

TABLE 2 EER, FAR, FRR FOR RECOGNIZER IN PCA METHOD

| Trait       | Algorithm | FAR(%) | FRR(%) | EER(%) |
|-------------|-----------|--------|--------|--------|
| Face        | PCA       | 0.81   | 0.97   | 0.835  |
| Fingerprint | PCA       | 0.5    | 1.09   | 0.45   |

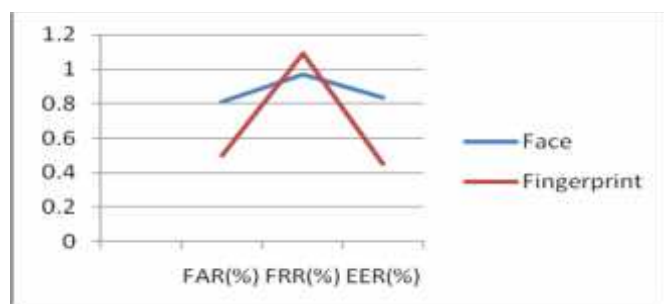


Figure 4 EER Graph for Each Biometric Trait in PCA Method

### III. RESULT

By observing values from the table 1, table 2 and analyzing figure 2, figure 4, we conclude that EER for face is 0.9 and EER for fingerprint is 0.48 by using pixel by pixel technique [5] and EER for face is 0.835 and EER for fingerprint is 0.45 in PCA technique.

Lower the value of EER better the biometric system

### IV. CONCLUSION

There are so many techniques available for identification of biometric traits. Two of them are pixel by pixel and PCA (Principal Component Analysis) technique. After comparing the results by implementing two techniques, we find out that for identification of biometric traits i.e. face and fingerprint PCA is an effective method than pixel by pixel method as EER for two biometric modalities is lower in PCA Method.

### REFERENCES

- [1] Qing Zhang, Yilong Yin, De-Chuan Zhan, and Jingliang Peng, "A Novel Serial Multimodal Biometrics Framework Based on Semisupervised Learning Techniques" IEEE Transactions on Information Forensics and Security, Vol. 9, No. 10, October 2014
- [2] Zahid Akhtar, Giorgio Fumers, Gian Luca Marcialis, Fabio Roli, "Evaluation of serial and parallel multibiometric systems under spoofing attacks"
- [3] Web site - <https://cubic.asu.edu/content/facepix-database>
- [4] Web site - <http://biometrics.idealtest.org/dbDetailForUser.do?id=7>
- [5] Pranali Anant Nalange, Prof. Manisha Madhukar Ambekar, "Identification of Face and Fingerprint Using serial Multimodal Biometric Technique" International Journal of Pure and Applied Research in Engineering and Technology ISSN – 2319-507X volume 4 (9): 1236-1243, 2016
- [6] M.N.Shah Zainudin., Radi H.R., S.Muniroh Abdullah., Rosman Abd. Rahim., M.Muzafar Ismail., M.Idzdihar Idris., H.A.Sulaiman., Jaafar A. "Face Recognition using Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA) " International Journal of Electrical & Computer Sciences IJECS-IJENS Vol:12 No:05
- [7] Web site: [https://en.wikipedia.org/wiki/Principal\\_component\\_analysis](https://en.wikipedia.org/wiki/Principal_component_analysis)
- [8] Web site - <http://cswww.essex.ac.uk/mv/allfaces/faces94.html>
- [9] Web site - <http://bias.csr.unibo.it/fvc2002/download.asp>