

# Review- Challenges in Face Authentication using Extended Principal Component Analysis

Samarjeet Powalkar, Prof. Moresh M.Mukhedkar

VLSI & Embedded System  
Dr.D.Y.Patil college of Engg  
Pune, India  
samarjeetpowalkar@gmail.com

VLSI & Embedded System  
Dr.D.Y.Patil college of Engg,  
Pune, India  
moresh.mukhedkar@gmail.com

**Abstract-** As the word become moving towards the globalization in engineering techniques, the capacity and techniques establish an identity of individuals using face as a biometric has become a more important. This paper includes the face recognition using the Extended Principal Component Analysis (EPCA) algorithm. The proposed algorithm uses the concept of PCA and represents an extended version of PCA by using the LDA (Linear Discriminate Analysis) to deal with the problem of operating the multiple numbers of the training images in the database. The Extended version of PCA algorithm may be used in to the face identification for security purpose, criminal face recognition, surveillance authentication etc. The problems related to background, noise and occlusion, and finally speed requirements are also overcome by using this algorithm. This paper focuses on developing a face recognition system using an extended PCA algorithm. The proposed algorithm uses the concept of PCA and represents an improved version of PCA to deal with the problem of orientation and lightening conditions present in the original PCA. Never the less the PCA algorithm is outperforms correct and good result in the less amount of database.

**Keywords—** Face Recognition, Principal Components Analysis, Linear Discriminate Analysis,

PCA method is used and for the large data analysis the LDA method is used.

## I.INTRODUCTION

In recent years the security of different applications needs biometric systems [1] as the one of the authentication system. The Face Recognition is the one of the statistical and simple analytical authentication method which is used for correct and capacitive identifications of individuals. The appearance-based [2] methods is used for the detecting and extracting the future data from the image, we usually represent an image data in the vector form as(  $n \times m$  ) dimensional space. In practice these (  $n \times m$  ) dimensional spaces is too large to analysis. So we need to reduce the space for the mathematical analysis. To overcome the problem of large space for data extraction of the image, we are using the most commonly used methods that are: Principal Components Analysis (PCA)[3] [4] [5] and Linear Discriminate Analysis (LDA)[6] [7] . In this paper we have used the Principal Component Analysis (PCA) which is most popular and valuable method implemented by using the Linear Algebra analysis. The PCA method includes the extracting of the complex data of the image into reduced data form. The reduced data in the matrix form is called as the principal component. This reduced extracted data is frame worked under the linear algebra for the mathematical analysis for the recognition purpose.LDA is the best method for the feature selection than the PCA, which depends on the Linear Discriminate Analysis. Mostly with the practical approach of the both the algorithms, for the small data base analysis the

## II.EXISTING TECHNICS FOR FACE RECOGNIZATION

### A) Eigenfaces Recognition-

Eigenface [8] detection method is the method which mostly depends on the PCA (Principal Component Analysis) algorithm. In these method feature data selection process depends on the, complex data set is reduced in to the reduced data set. The PCA method is successfully used in practice for the reduction of the relevant data. These reduced data set is mathematically arranged by using the covariance matrix in linear algebra. These Eigen Vectors are called as the Principal Components for the reduction of data. The identity of trainee images is characterized by using the Eigen vector having the large Eigenvalue.Eigenface method is used mostly due to its easy practical approach for the mathematical analysis using the linear algebra. The mathematical analysis and implementation is explained by “Jonathon Shlens” in his paper. The implementation and the analysis of the PCA algorithm is also simple. The efficiency of the PCA algorithm is the reduced data set with the short span of time.

The disadvantage of this algorithm is due to the high sensitive to the different lightening conditions and varying position.

### B) Neural Network-

Neural Network technique [9] is used by the most of the applicants due to its accuracy than the other algorithms. Neural Network technique depends on the multiple pattern recognition method. In which the multiple complex faces of trainee images are extracted and used to pass through the different networks and nodes. The advantage of these technique is the pattern extraction by which, it is used in most of application such as the object recognition, character recognition, face recognition. A new class of pattern recognition is also appended with the face detecting algorithm that is Gabor Wavelet algorithm [10]. This gives a better result than the previous algorithm. Hybrid Neural network [11] is also the improved version of neural network algorithms.

#### c) Template Matching-

The Template Selection based face recognition is the widely used method. In this technique the proper template is extracted from the face and is used for further process. The complexity of this algorithm is more than the other algorithms due to the templates extraction problem. The complexity of this algorithm increases during the initial state of template detecting. Yegnanarayana (2007) he has worked on the template based algorithms to recognize the individual faces. method. The advantage of the template based algorithm is the user can take the image of templates from different angles as a multiple templates. Most of the authors used the four set of the templates that are nose, eye, mouth and whole face. The drawback of the template matching is the computational process of this algorithm is large process.

#### d) Geometrical Matching-

Geometrical extracted data matching techniques are based on the computation of a set of the mathematical geometrical features from the image of a face. The Geometric features are extracted in the matrix computation in the form of distance, edges; outline. that is the distance between two eyes or the outline of the eyes etc. For every image the geometric features will be different and are used for the feature extraction. By using this method we can extract the multiple features from the multiple orientations and can be used for the best match.

The disadvantage of current automated algorithms does not provide a high degree of accuracy and require considerable large computational time.

### III. PROPOSED TECHNIQUE

In practice to implement the PCA based algorithms are simple but the mathematical analysis of these systems is complex one. As in practical the PCA algorithm is used to reduce the complex data set of extracted data in to the reduced data set. But the no of data sets (Eigenvectors) operated by the PCA algorithm are less in number. To overcome this problem of the number of vectors sets that are going to be operated are increased by the method of Linear Discriminate algorithm [12]. Hence we can say that for the large number of images the LDA performs practically good than that of PCA algorithm.

#### 1) Principal Component Analysis (PCA)

Before we start the approach to our discussion of Extended Principal Component Analysis first we will see how the PCA algorithm is actually analysed by using linear algebra. As we know that the PCA based algorithms are used for the reduction of the extracted data. [12]

#### Mathematical analysis of PCA algorithm-

- 1) Consider a set X, which is  $(n \times m)$  matrix of extracted data from the image which we have to minimize.
- 2) Suppose we have used the linear algebra to transform the matrix by using linear transformation method

$$Y = PX$$

Where,

Y is the linear transformed matrix of size  $(n \times n)$

Then we have to project the original data set X on the columns of P,  $P = [P_1, P_2, \dots, P_n]$

- 3) The column matrix P will be the new basis for the original data set X, that is also called as Principal Component Analysis.
- 4) As we have to reduce the extracted data, to that we have to find the covariance matrix,  $C_y$
- 5) Now our task is to correlate the Y that is linear transformed matrix with the  $C_y$ , for the recognition purpose.
- 6) The selection of the  $C_y$  (covariance matrix) depends on following conditions
  - i) The selection of covariance matrix  $C_y$ , is such that the linear transformed matrix Y should be a diagonal matrix to minimize the illumination effect.
  - ii) The covariance matrix is selected in such way that the, it should have the maximum eigenvalue.

#### 2) LDA (Linear Discriminate Analysis)

LDA [13] is basically used for the large set of data. The database should be composed of the large number of data set of each one of the trainee set. The every image should have the different facial characteristics and the illumination conditions. LDA method is practically depends on the classification of the specific characteristics. These specific characteristics are grouped under the class. Linear Discriminate analysis is also known as fisher's discriminate analysis and it searches for those vectors in the underlying space that best discriminate among classes.

#### Mathematical analysis of LDA algorithm-

- 1) The data is extracted by using the different class and stored into a class (C1) and class (C2).
- 2) Find the mean for each one of the above class. That is M1, M2 respectively.
- 3) Find the covariance matrix for the above class, that is C1, C2 respectively.
- 4) Calculation of scattered matrix
  - i) Within class scattered matrix-  $C_1 + C_2$
  - ii) Between class scattered matrix-  $(M_1 - M_2)(M_1 - M_2)$
- 5) Calculate the mean of all classes

6) Obtain the LDA projections by using the linear algebra analysis to calculate the solution for eigenvalues.

## REFERENCES

- [1] Anil K. Jain, "An Introduction to Biometric Recognition". 2004, IEEE Transactions on Circuits and Systems For Video technology vol 14, No. 1, January 2004
- [2] Thomas Heseltine, Nick Pears, Jim Austin, Zezhi Chen "Face Recognition: A Comparison of Appearance-Based Approaches". 2003 Proc. VIIth Digital Image Computing: Techniques and Applications, Sun C., Talbot H., Ourselin S. and Adriaansen T, 10-12 Dec. 2003
- [3] Keun-Chang Kwak, "Face Recognition Using an Enhanced Independent Component Analysis Approach". 2007, IEEE Transactions on Neural Networks, Vol. 18, No. 2, March 2007
- [4] Vinay Rishiwal, Ashutosh Gupta, "Improved PCA Algorithm for Face Recognition", Special section for proceeding of International e-Conference on Computer Engineering (IeCCE), Vol (2), Issue (1), January 2012. 55-59
- [5] Aleix M. Martõñez, Avinash C. Kak, "PCA VERSUS LDA", IEEE Transactions On Pattern Analysis And Machine Intelligence, Vol. 23, No. 2, February 2001
- [6] Aleix Wei-Shi Zheng, Jian-Huang Lai, And Pong C. Yue, "Ga-Fisher: A New LDA-Based Face Recognition Algorithm With Selection Of Principal Components" IEEE Transactions On Systems, Man, And Cybernetics—Part B: Cybernetics, Vol. 35, No. 5, October 2005
- [7] Satonkar Suhas S.1, Kurhe Ajay B.2, Dr.Prakash Khanale B., "Face Recognition Using Principal Component Analysis and Linear Discriminates Analysis on Holistic Approach in Facial Images Database" IOSR Journal of Engineering, Vol. 2, Issue 12 (Dec. 2012), ||V4|| PP 15-23
- [8] Rajesh Kumar Gupta, Umesh Kumar Sahu, "Real Time Face Recognition under Different Conditions" International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 1, January 2013
- [9] Henry A. Rowley, Shumeet Baluja, and Takeo Kanade, "Neural Network-Based Face Detection" Rowley, Baluja, and Kanade: Neural Network-Based Face Detection, January 1998
- [10] Benoît Duc, Stefan Fischer, "Face Authentication With Gabor Information On Deformable Graphs" IEEE Transactions On Image Processing, Vol. 8, No. 4, April 1999, Vol. 23, No. 2, February 2001
- [11] Sangeeta N. Kakarwal, Ratnadeep R. Deshmukh, "Hybrid Feature Extraction Technique for Face Recognition" (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 3, No.2, 2012
- [12] Aleix M. Martõñez, Avinash C. Kak, "PCA VERSUS LDA" IEEE Transactions On Pattern Analysis And Machine Intelligence, Vol. 23, No. 2, February 2001
- [13] Vinay Rishiwa, Ashutosh Gupta, "Improved PCA Algorithm for Face Recognition" World Applied Programming, Vol (2), Issue (1), January 2012. 55-59