# Gender Classification using Linear Discriminant Analysis (LDA)

Mayank Wadhawan, Student, UFID - 59148122

***Abstract*— In recent years, there has been significant advancement in face detection because of development of fast algorithms. The shape of face can now be extracted and therefore gender, age and ethnicity classification can now be done accurately. In order to perform gender classification, we would have to learn discriminative features of men and women. In this project, I will use linear discriminant analysis (LDA) and implement fisher faces method to perform gender classification. I will determine the recognition rate and point out the cases where there was an erroneous classification. I will also analyze and compare results of gender classification using eigenfaces and fisher faces. Additionally, I will compare their recognition rate. Gender classification has many applications in Human Computer Interactions and can be used in targeted advertisement for men or women.**

## I. Introduction

Linear discriminant analysis (LDA) is used in pattern recognition and machine learning to separate two or more classes of objects. LDA is similar to Principal Component Analysis (PCA) and factor analysis in the sense that they search for linear combination of variables which best explains the data. LDA models the differences between the classes of data. Whereas, PCA does not model differences in class. Factor analysis doesn't build the features on similarities, it does that based on differences.

Set of eigenfaces can be developed using PCA (Principal component analysis) on a collection of images of different people. Eigenfaces created are in a light/dark areas in a pattern. Since these are just values, therefore eigenfaces use less space. Facial recognition was one of the main reasons behind the creation of eigenfaces. Face recognition is performed by comparing characteristics of a person's face to known individuals. The training process in facial recognition using eigenfaces is automatic and once eigenfaces of database is calculated, face recognition can be performed in real time. Eigenfaces has advantages like speed and efficiency over other techniques. However, this method is very sensitive to lighting and it doesn't provide useful information about actual face. Hence, eigenfaces method might not suitable for gender classification. The fisher faces method has class specific linear projection and therefore is much better suited for the gender classification. It has much higher recognition rate than eigenfaces.

## II. Project Plan

### *A. Collecting relevant information*

I will read reputed journals, research papers and textbooks for information pertaining to this project. I will read information related to Linear Discriminant Analysis and fisher faces method. I will also study facial recognition method using Principal Component Analysis. Additionally, I will read and understand information related to eigenfaces.
*I will finish this task by 19th March.*

### *B. Implementation Stage*

(1) I will complete the implementation of gender classification using LDA. I will use fisher faces method to do this.
*I will finish this by 3rd April.*

(2) I will determine the recognition rate of gender classification and make changes in the code if necessary.

*I will finish this by 6th April*

(3) I will compare the results of recognition rate of gender classification using fisher faces and eigenfaces.
*This will be done by 10th April.*

### *C. Result Analysis*

This stage involves analyses of results determined from implementation stage. I will determine the reason behind different recognition rates of different methods.
*This must be completed by 16th April.*

### *D. Final Changes*

I will determine if any final changes are required in the project. If there are contradiction with known concepts, then I will analyze the results determine the reason behind it.
*I will finish this by 20th April.*

### *E. Final Report and Demo video creation*

In this stage, I will create the final report, powerpoint presentation and create a video explaining the approach used and final results.
*I will complete this stage by 25th April.*

## Acknowledgment

I would like to thank Dr. Dapeng Oliver Wu for his help in selecting project topic and for information provided on his website.

## References


[1] https://en.wikipedia.org/wiki/Linear_discriminant_analysis

[2] Peter N. Belhumeur, Joao~ P. Hespanha, and David J. Kriegman. Eigenfaces vs. Fisherfaces: Recognition Using Class Specific Linear Projection

[3] Juwei Lu *, K.N. Plataniotis, A.N. Venetsanopoulos. Regularization studies of linear discriminant analysis in small sample size scenarios with application to face recognition

[4] Jun Liu, Songcan Chen∗, Xiaoyang Tan. A study on three linear discriminant analysis based methods in small sample size problem

[5] Wenyi Zhao, Arvindh Krishnaswamy, Rama Chellappa, Daniel L. Swets, John Weng. Discriminant Analysis of Principal Components for Face Recognition

[6] A. Hossein Sahoolizadeh, B. Zargham Heidari, and C. Hamid Dehghani. A New Face Recognition Method using PCA, LDA and Neural Network

[7] M. Sharkas, M. Abou Elenien Arab Academy for Science and Technology - AAST, Egypt. Eigenfaces vs. Fisherfaces vs. ICA for Face Recognition; A Comparative Study

[8] Erno Ma¨ kinen and Roope Raisamo. Evaluation of Gender Classification Methods with Automatically Detected and Aligned Faces

[9] B. Moghaddam ; Mitsubishi Electr. Res. Lab., Cambridge, MA, USA ; Ming-Hsuan Yang. Gender classification with support vector machines

[10] Matthew Turk and Alex Pentland. Eigedces for Recognition