

# Face Images Classification for Gender

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**Abstract—** *In this paper, we use Principal Component Analysis and Minimum Euclidean Distance Classifier for classification of face image for gender. Facial feature extraction by using Principal Component Analysis with eigenface approach is nothing but important information of face image which is collected by coding and decoding of face images that is used for recognition of face and classification of face images for gender. The face recognition accuracy is 85% and genderclassification accuracy is 98% for FEI face database of 100 RGB images.*

**Keywords—** *Facial feature extraction, PCA, Eigenvectors, Eigenvalues, Minimum Euclidean Distance Classifier, gender classification.*

## I. INTRODUCTION

The Face is the most important biometric trait because it is the most expressive part of human body. Face recognition is mostly used in biometrics for various applications such as in identification system, surveillance system, access control etc. This project is further extended to gender classification from face images. Now a days, gender classification from face images is popular area of research. Automatic recognition and classification of face images for gender is difficult task for machine. Gender classification is the binary classification problem because we have to classify the input image as that of male or female. The general steps carried out for every method are preprocessing, feature extraction and classification. There are many techniques for face recognition such as Principal Component Analysis, Linear Discriminant Analysis, Incremental Component Analysis, these are the linear techniques for face recognition. Kernel Principal Component Analysis and IsoMap are non lineartechniques[17]. To reduce the search time and search space of identification is the main objective of gender classification. The general steps carried out for every method are preprocessing, feature extraction and classification.

## II. LITERATURE REVIEW

Method proposed by SamarasenaBuchala et.al. [1] PCA encodes face image properties such as gender, ethnicity, age, and identity efficiently – the classification performances on all properties are reasonably high and much above chance levels. Different components of PCA encode different properties of faces. Very few components are required to encode properties such as gender, ethnicity and age and these components are predominantly amongst the first few components which capture large part of the variance of the data.

In 2005, Jain et.al [2] presented an approach using ICA and SVM. The experiment was done with different classifiers namely cosine classifier which find distance between two features lying on a hyper-sphere surface, linear discriminant classifiers that finds the projection of the input image maximizing the ratio between class scatter and within class scatter, and SVM which finds the maximal separating hyper plane between male and female features. The experiment was performed on 500 images from the FERET facial database which included 250 images of female and 250 images of male, and obtained an accuracy of 96% in ICA space.

ErnoMakinen and RoopeRaisamo [3] experimented on gender classification with automatically detected and aligned faces. The experiment was performed on IMM database and FERET database with four automatic alignment methods and four different gender classification methods. In Automatic alignment methods, three methods were based on Active Appearance Model and one based on profile alignment. The four Gender classification methods were used. The automatic face alignment methods did not increase the classification rate where as manual alignment increased the classification rate. The classification accuracy was dependent on face image resizing before or after alignment. The best classification rate was obtained with SVM using pixel based input images of size  $36 \times 36$ .

M. Saraswathi et.al.[4] experimented “Improving gender Recognition rate in face recognition system based on linear discriminant Analysis technique,” ORL face database is used for the experimentation. The female recognition rate is 72% and male recognition rate is 96.1%. For real time images recognition rate is 91.5%.

Md. Golam Moazzamet [5] proposed “Quantitative Analysis on Robustness of FLD and PCA-based Face Recognition Algorithms,” For face recognition PCA and FLD are used with the additive noise and rotation of images. Combination of both PCA and FLD gives better results.

F. SaeiManesh, M. Ghahramani, Y. P. Tan [6] experimented “Facial Part Displacement Effect on Template-based Gender and Ethnicity Classification”. By using automatically separated face regions using the modified Golden ratio mask the gender and ethnicity is classified. Facial parts are preprocessed with multiple base point photometric normalization to prevent facial parts displacement in the noted mask, due to different facial parts’ distances of people. SVM is employed as the classifier on the extracted Gabor features of each patch to get its confidence level. The final classification results are obtained based on the output of each patch decision using

the optimum decision making rule. Finally, using the most accurate normalization approach for each patch, 94% and 98% for gender and ethnicity respectively on a dataset composed of FERET and PEAL frontal face images.

Classification of Face Images Based on Gender using Dimensionality Reduction Techniques and SVM: Mannan et al. [7] In this paper they have present a new technique for the gender classification of any face images. In this they have used the dimensionality reduction techniques like Independent component analysis (ICA) and principal component analysis (PCA) along with Support vector machine (SVM). Here they have taken two databases, one for training and one for the testing. And they have done the experiments by varying the size of the database. With the different numbers of the images its performance is varying.The accuracy is more than 85%.

III. PROPOSED METHOD

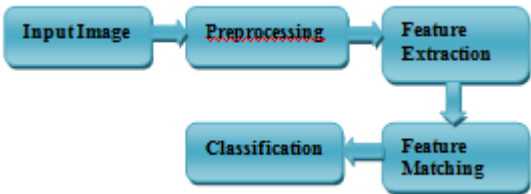


Fig. 1proposed method for gender classification

The stepwise detailed explanation of gender classification system is given below. These are the general steps for carried out gender classification from face images. As the proposed system for gender classification from face image is based on the face image. The input images that is database used for this project is FEI face database available for research work is collected from the internet.

Steps to carried out gender classification

A. Image Preprocessing:

Pre-processing reducesvariations like illumination, poses and inaccuracies. ManyClassifiers are sensitive to variations. To reduce this sensitivity some pre-processing steps are performed. Some basic Pre-processing steps are involved in this experiment are.

- Resizng :An RGB color image consist of red, green and blue components of an RGB image at a specific spatial location. Resizing returns image that has the number of rows and columns specified by [256 256].imresize computes the number of rows or columns automatically imresize preserve the image aspect ratio.
- Color Conversion :When the image is in gray scale we can easily apply computational techniques

- Converting the image in vector form:A column vector is generated for the grayscale image or for each individual plane in the new colour space for scanning of image.

In this research work the FEI face database is used which is shown below in Fig. 2. The face image databases is used, If test image is given as input and we have to identify an input image and classify it into a category of male or female.



Fig. 3 FEI Face Database (Total 100 Images)

In Fig. 4shown below colour image has been taken and then resizing that image to [256 256] which is shown in Fig. 5, then converting it into a gray scale image, shown in Fig. 6 because we can easily apply the computational techniques when the image is a gray scale image as compared to color images.

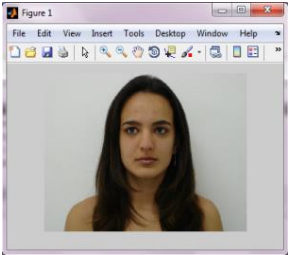


Fig. 4 Input Colour Image

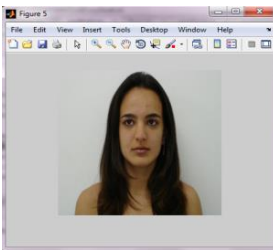


Fig. 5 Resized image

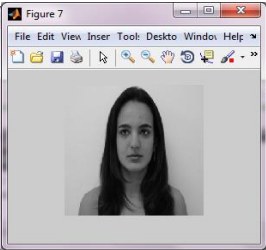


Fig. 6 Gray scale image

B. Feature Extraction:

In this project, we not exactly extract the facial features but by coding and decoding the face image collect the important information of the face image. This information is used to for the classification of face image for gender. Which may or may not be similar to the facial features such as, eyes, nose, mouth, etc.

PCA with eigenface approach is used to reduce dimensionality of the face image. Because small number of eigenfaces or eigenvectors that is principal components can represent the whole database.

C. Classification Steps of proposed system:

1. The image is first represented as a vector. By joining serially the columns of training set images the matrix is formed.

$$x = [x_1 x_2 \dots x_n],$$

where  $x_i$  is the  $i^{\text{th}}$  column vector representing the  $i^{\text{th}}$  training image.

2. Then calculate the mean of the all face images Avgf.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

3. subtract this mean image from all training images.

$$x - \bar{x}$$

4. Convert the all difference images into single images.

$$A = [x - \bar{x}, \dots, x_n - \bar{x}]$$

5. Calculate the Eigenvalues and Eigenimages of the vector A by using single value decomposition(SVD). Select the best 20 eigenvectors which represent the whole database. These eigenfaces are shown in Fig. 7 below.



Fig. 7 Eigenface image of selected image

The Fig.8 shows the eigenvalues in graphical form. The eigenvalues are calculated from eigenvectors. These eigenvalues are in decreasing order. Therefore the curve is exponential.

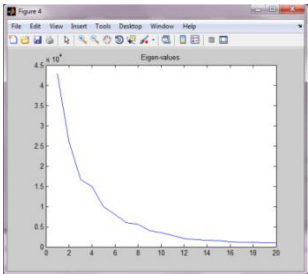


Fig. 8 Eigenvalues in graphical form

6. Calculate the weight vector of each image. Then calculate weight the mean weight for single class of image.

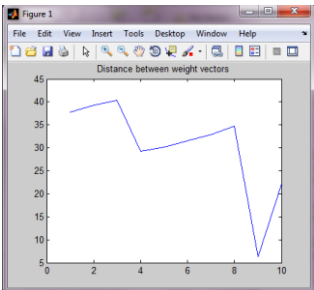


Fig. 9 Distance between weight vector

7. Then image to be recognized is given as input image.

8. Weight of the input image is calculate. This weight of input image is subtracted from mean of every image class and weight vectors of each class is calculate.

9. By using the weight vector we can find the minimum distance of training images.

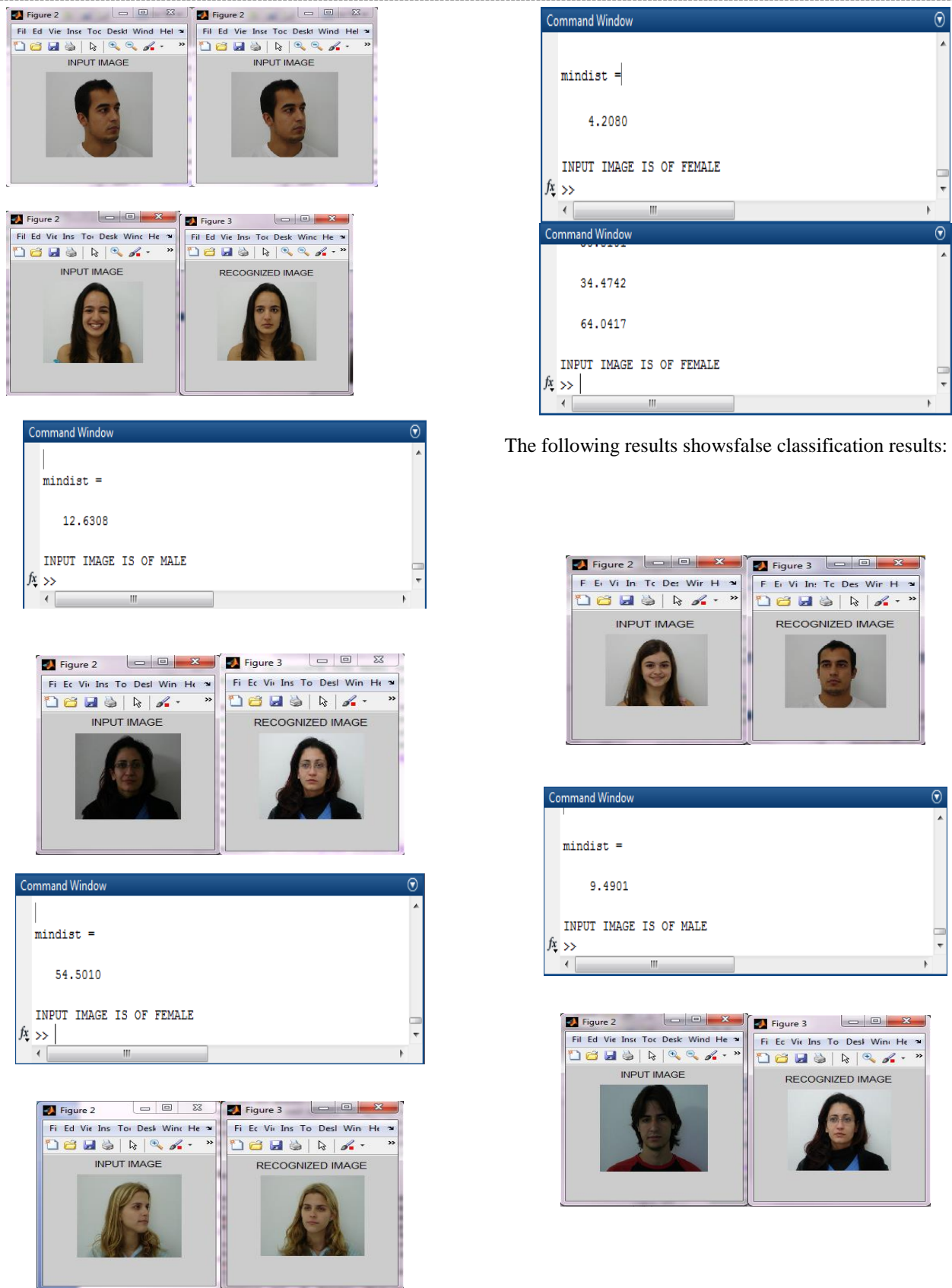
10. Then find minimum distance weight vector of input image.

11. Distance of distance of input weighted vector matched with distance of weighted vectors of training images.

12. If minimum distance of input image is matched with any any one class of female database then input image is female. And if minimum distance of input image is matched with any one class of male database then input image is male.

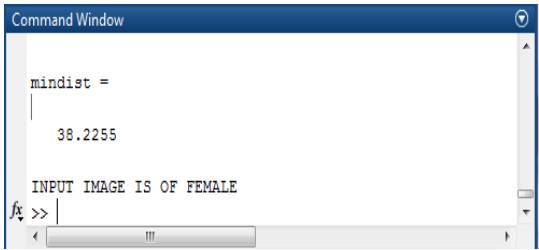
IV. EXPERIMENTAL RESULTS

The following results shows correct Recognition and classification results with variation in pose, expression, lighting condition etc.



The following results showsfalse classification results:





[6] F. SaeiManesh, M. Ghahramani, Y. P. Tan, “Facial Part Displacement Effect On Template based Gender and Ethnicity Classification,” IEEE International Conference of Control, Automation, Robotics and Vision, pp. 1644-1649, 2010.

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TABLE I EXPERIMENTAL RESULTS

Classification Methods	FEI face Database	Number of correctly Recognized and Classified Images	
		Recognition	Classification
PCA+ Minimum Distance Classifier	Female (Out of 50)	49	49
	Male (Out of 50)	36	49
	Total	85	98
	Accuracy %	85%	98%

V. CONCLUSIONS

In this project, gender classification from facial image is carried out. And Principal Component Analysis is used for feature extraction and minimum Euclidean distance classifier for the gender classification system. The proposed method is successfully recognize the face and classify the gender of the input face image in the different illumination and variation in pose. In this project, the database which contains different expressions is not used only neutral and smiling expression faces are present in the database which is used in this research. In future, we can use database of different expression of male and female for gender classification.

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