1 Eigenfaces

Eigenfaces are an orthogonal basis set from which all the faces can be constructed. They are blurry depictions of faces that each highlight a certain type of feature. They are used in facial characterization and recognition applications.

The idea is that anyone's face can be reconstructed from a suitable linear combination of eigenfaces. Your face would be 7% Face A, 3.4% Face B, and so on, while someone else's face would have a different combination of those same eigenfaces.

Eigenfaces are constructed by training on a set of real faces. By matrix manipulation, it is possible to mathematically identify "features", and assign a strength level to each feature for a given face. The goal is to create the minimum number of eigenfaces that can adequately represent the entire training set (hence it is a type of Principal Component Analysis). If the training set is sufficiently diverse, the resulting set of eigenfaces should be able to represent all faces.

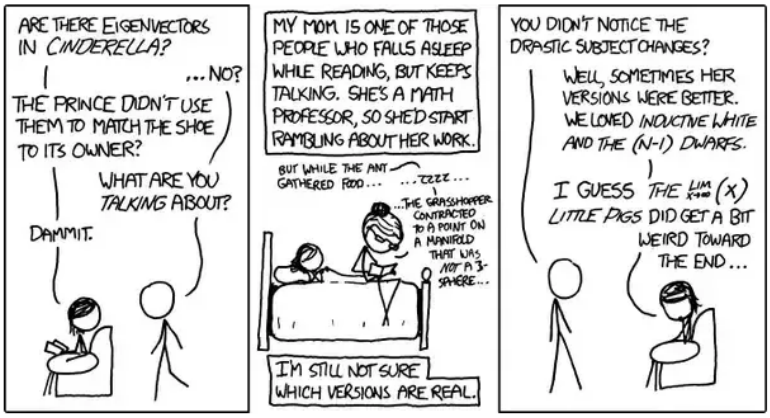

Figure 1

References

Face Recognition using eigenfaces technique:
`https://medium.com/@devalshah1619/face-recognition-using-eigenfaces-technique-f221d505d4f7`
`http://www.vision.jhu.edu/teaching/vision08/Handouts/case_study_pca1.pdf`
The figure 2 in next page gives the flowchart of the algorithm of eigenfaces:

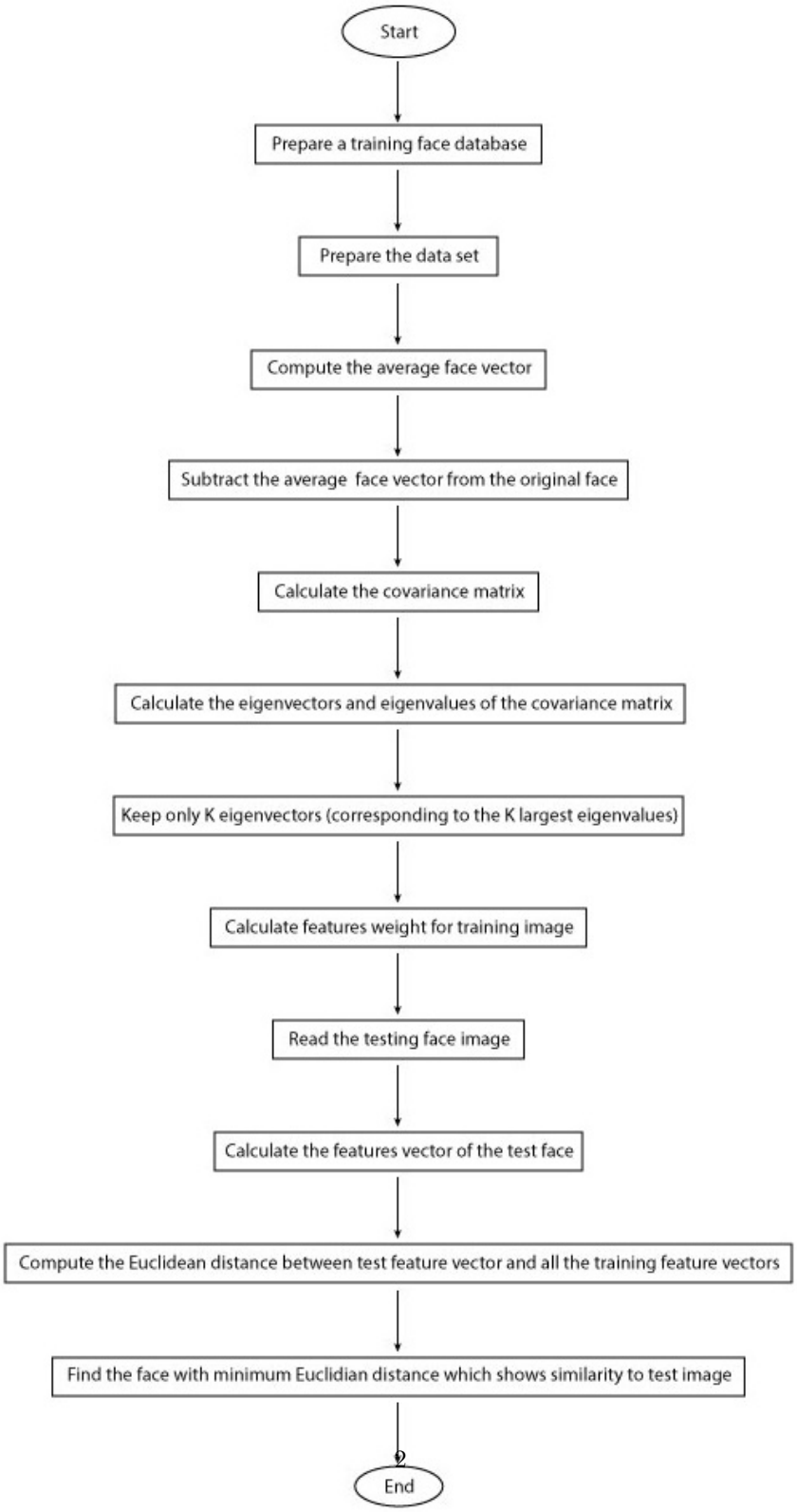
Start
Prepare a training face database
Prepare the data set
Compute the average face vector
Subtract the average face vector from the original face
Calculate the covariance matrix
Calculate the eigenvectors and eigenvalues of the covariance matrix
Keep only K eigenvectors (corresponding to the K largest eigenvalues)
Calculate features weight for training image
Read the testing face image
Calculate the features vector of the test face
Compute the Euclidean distance between test feature vector and all the training feature vectors
Find the face with minimum Euclidian distance which shows similarity to test image
End

Figure 2