PART A

In this first part of the assignment, you will have to implement a facial recognizer based on principal component analysis. In order to build this classifier, you will have access to a frontal facial image dataset. The teacher has kidnapped part of this dataset to evaluate your classifier.

a) Build a function that implements the Principal Component Analysis. This function takes as input a set of observations and returns the mean of these observations, the matrix P containing the eigenvectors and a vector D containing the variance explained by each principal axis. It is only allowed to use the function eigen.

b) Built a classifier (function) that takes as input an image and an object with the parameters of the classifier. Internally, the function uses a k-nn classifier and the PCA representation of the images. If the person in the image belongs to the database, it returns the person's identifiers. Otherwise it returns 0. In order to build this, you will need to consider:

1. The percentage of the variance retaining by the PCs
2. The number of neighbors of the k-nn
3. The similarity metric
4. The threshold to determine when the person belongs to the database

c) Explain how you have determined the previous parameters

d) Repeat b) but using the initial image representation instead of the principal component representation. Based on your results, decide if you prefer to use the principal component representation or the original representation and justify your decisions.

PART B

In this second part of the assignment, you will have to implement a facial recognizer based on Fisher discriminant analysis. In order to build this classifier, you will have access to a frontal facial image dataset. The teacher has kidnapped part of this dataset to evaluate your classifier.

a) Build a function that implements the Fisher Discriminant Analysis. This function takes as input a set of observations and returns the mean of these observations, the matrix P containing the eigen vector of the appropriate matrix and a vector D containing the variance explained by each fisher discriminant. It is only allowed to use the function eigen.

b) Built a classifier (function) that takes as input an image and an object with the parameters of the classifier. Internally, the function uses a k-nn classifier and the Fisher discriminant analysis representation of the images. If the person in the image belongs to the database, it returns the person's identifiers. Otherwise it returns 0. In order to build this, you will need to consider:

1. The percentage of the variance retaining by the Fisher discriminant dimensions
2. The number of neighbors of the k-nn
3. The similarity metric
4. The threshold to determine when the person belongs to the database

c) Explain how you have determined the previous parameters.

Both in part A and B your function will be tested in an external dataset