Homework 3: Extended Yale Faces B Database – Eigenfaces
DUE: Wednesday, May 27, 2020

Yale Faces B

Download two data sets (ORIGINAL IMAGE and CROPPED IMAGES)
Your job is to perform an analysis of these data sets. Please start with the cropped images and perform the following analysis.

1. Do an SVD analysis of the images (where each image is reshaped into a column vector and each column is a new image).

2. What is the interpretation of the $\mathbf{U}$, $\mathbf{\Sigma}$ and $\mathbf{V}$ matrices?

3. What does the singular value spectrum look like and how many modes are necessary for good image reconstructions? (i.e. what is the rank r of the face space?)

4. compare the difference between the cropped (and aligned) versus uncropped images.

Face Identification: see if you can build a classifier to identify individuals in the training set.

- **(test 1) Face Classification:** Consider the various faces and see if you can build a classifier that can reasonably identify an individual face.

- **(test 2) Gender Classification:** Can you build an algorithm capable of recognizing men from women?

- **(test 3) Unsupervised algorithms:** In an unsupervised way, can you develop algorithms that automatically find patters in the faces that naturally cluster?

NOTE: You can use any (and hopefully all) of the different clustering and classification methods discussed. Be sure to compare them against each other in these tasks.