Homework 12, due November 27th, 11:59pm

November 14, 2019

1. Download the dataset `faces.zip` from Blackboard. It contains 2429 faces of size 19×19 pixels each, and `background.zip`, containing background samples somehow resembling faces. If there are any unreadable images, discard them.

a) Perform Principal Component Analysis on the faces. Discard the three largest eigenvalues and plot the graph of the remaining eigenvalues sorted in decreasing order. (1 point)

b) Plot a graph of the coordinates of the faces projected to the 2D plane generated by the eigenvectors corresponding to the second and third largest eigenvalues. (1 point)

c) On the same graph, display the coordinates of the projections from b) using one color (black) and the projections of the background patches on the same two eigenvectors using another color (e.g. red or light gray). Be sure to subtract the mean of the faces and project to the eigenvectors of the faces. (2 points)

d) Compute the distances of the faces and the background points to the plane from b). On the same graph, plot the computed distances (on the y-axis) vs the coordinates of the projections on the largest eigenvector (on the x-axis) for the faces and background patches using two different colors. (2 points)

e) Repeat point d) displaying the computed distances (on y) vs the coordinates of the projections on the second largest eigenvector (on x). (2 points)