

Homework 11, due April 6th, 11:59pm

March 30, 2022

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 face images. Discard the three largest eigenvalue 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 first and second principal component. (1 point)
- c) On the same graph, display the coordinates of the projections from b) using one color (red or light gray) and the projections of the background patches on the same two principal components (PCs) using another color (e.g. black). Be sure to subtract the mean of the faces and project to the PCs of the faces. (1 point)
- d) Compute the distances of the faces and the background points to the plane generated by the 15 largest PCs. On the same graph, plot the computed distances (on the y -axis) vs the coordinates of the projections on the first PC (on the x -axis) for the faces and background patches using two different colors. (2 points)
- e) On the same graph, plot the histogram of the distances obtained at d) for the faces in one color and for the background patches in another color. (2 points)