Programming Assignment 02: PCA (50 points)

In this assignment you will work with Principal Component Analysis algorithm. The provided python file has a function PCA that you need to finish implementing and use it to reduce the dimensionality of the MNIST dataset.

1. Implement PCA function, use the slides and the comments in the code for help.
2. Select only images of digit 3 from the dataset, compute PCA with dimensions 2, 8, 64, 128, 784. Select one of the images, compute the five PCAs on it and then reconstruct the image. Plot the original image and the 5 reconstructed images.
3. Select a set of 100 images of digit 3. This is going to be use test set. Compute PCA on
   1. all images of digit 3 over the rage of dimensions from 10 to 784 with step 10
   2. all images of digits 3 and 8 over the rage of dimensions from 10 to 784 with step 10
   3. all images of digits 3, 8 and 9 over the rage of dimensions from 10 to 784 with step 10

You will end up with quite a few mu and W outputs, save them

1. Compute average reconstruction error for the test set for each of the PCA outputs computed in the previous step. Produce three plots showing how the error depends on the dimensionality, for cases a, b, and c. Plot the error curves on the same plot. How can you explain the plots?

Submit

Code as .py file, Plots and Conclusions in a PDF document