In The Name of Allah

Pattern Recognition (Spring 2024)

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Homework #3: Feature Extraction

Due Date: 1403.02.21

Consider MNIST dataset consist of two sets digits images: train and test.

Principle Component Analysis(PCA)

Use only the training set to perform this part.

a) Develop PCA takes X(DxN) return Y(dxN) (d is the number of features selected by the PCA algorithm).
b) Propose a suitable d using proportion of variance (POV) =95%.
c) Develop PCA reconstruction takes Y_{PCA}(dxN) and return $\hat{X}$ (DxN).
For different values of d= {1, 2, 3, 4, …, 784} reconstruct all samples and calculate the average mean square error (MSE). Plot d (x-axis) versus MSE (y-axis). Discuss about the results.
d) Reconstruct 10^{Th} sample and show it as a 'png' image for d= {1, 10, 50, 250, 784}. Discuss about the results.
e) For different values of d={1,2,3,…,784} plot d (x-axis) versus eigenvalues (y-axis). Discuss about the result.

Note:

- You are not allowed to employ any available codes from **others** or **on the internet**.
- Prepare a report in PDF format including the figures, answer to the questions and discussions mentioned in the homework.
- Make a folder including your report and your codes (Note that your code is needed to be self-comment)
- Submit all things in a zipped folder named as "YourNameYourFamily - Practical"+ "Exercise Number"+"Student Number".rar

Good Luck