

## Lab 9 Principal Component Analysis

Principal components analysis (PCA) is a dimensionality reduction technique that allows to compress high-dimensional data sets into very low dimensions.

For this lab, you may only use NumPy and Matplotlib.

Requirements:

Plot the 2000 MNIST digit images in Lab 8 to the 2 and 3 dimensional spaces respectively after applying PCA. Also show how much variances of the data have been explained by the principal components.

Sketch of the PCA algorithm:

- Center your data
- Compute the covariance matrix of centered matrix
- Eigenvalue decomposition of covariance matrix
- Project data into the low-dimensional space. Generate 2-d and 3-d figures by plotting the images into the 2-d and 3-d principal component spaces.