Homework Set 3, CPSC 8420, Spring 2022

Last Name, First Name

Due 03/31/2022, Thursday, 11:59PM EST

Problem 1

Given data-points $\{\{1,3\},\{2,5\},\{3,4\},\{4,3\},\{5,2\},\{5,1\}\}$.

1. Please scatter-plot each data point within one figure (you can use Matlab, Python or any other programming language).
2. Now if we want to reduce the dimension from 2 to 1 by PCA, please determine the projection line which crosses the origin (please plot the line based on the scatter-plot figure above).
3. Assume the first 4 data points belong to one class, while the rest 2 belong to the other. Now if we want to reduce the dimension from 2 to 1 by LDA, please determine the projection line which crosses the origin (you are expected to plot the line based on the scatter-plot figure).

Problem 2

Given positive data-set $\{\{1,1\},\{2,2\},\{2,3\}\}$, as well as negative data-set $\{\{3,2\},\{3,3\},\{4,4\}\}$, please determine the decision boundary when leveraging k-NN where $k=1$ and $k=3$ respectively.

Problem 3

Given X, Y, Z, now please follow the idea/method used in LDA/PCA to find the best solution to:

$$\begin{aligned} &\underbrace{arg\ max}_{a,b} \quad a^T Z b \\ s.t. \quad &a^T X a = 1,\ b^T Y b = 1 \end{aligned} \tag{1}$$