**Department of Electrical and Computer Engineering**

Homework Assignment No. 04:

**HW No. 04: Linear Discriminant Analysis**

submitted to:

Professor Joseph Picone

ECE 8527: Introduction to Pattern Recognition and Machine Learning

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# Task 1

The first of three tasks for this homework assignment was to plot all sets of data for visualization. The instructions state that all axes should have the same limits; however, different datasets have notably different limits for their data. Therefore, I have elected to use the same axes for data that comes from the same data set, but individual datasets will have their own axes to best visualize their datapoints. The first of these datasets was from dataset 8 and includes three subfolders: dev, eval, and train csv files.

All graphs from the same dataset are placed onto one single page to prevent confusion during comparison and any mismatching that may occur.

The code that was utilized to create these graphs worked by using a for-loop that created a dictionary of datasets. The titles were populated for each graph by using another dictionary and iterating through that via indexing of that dictionary.

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# Task 2

The goal for Task 2 was to complete the table below. For ease of reading, I have altered the values that I have calculated myself to be highlighted. Performing these calculations was relatively easy as we have performed a Quadratic Discriminant Analysis (QDA) in a past assignment and Linear Discriminant Analysis (LDA) is quite easy to implement. Conducting the Class-Independent Principle Component Analysis (PCA), however, took a bit more time to complete and implement successfully.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DS** | **System** | **Training Data** | **Train** | **Dev** | **Eval** |
| #08 | KNN | /train | 23.48 | 26.62 | 64.18 |
| RNF | /train | 29.23 | 29.45 | 59.77 |
| CI-PCA | /train | 0.3607 | 0.3685 | 0.3177 |
| QDA | /train | 0.4992 | 0.4978 | 0.4633 |
| LDA | /train | 0.3610 | 0.3608 | 0.4134 |
| CI-PCA | /train + /dev | 0.3607 | 0.3598 | 0.3301 |
| QDA | /train + /dev | 0.4993 | 0.4992 | 0.4633 |
| LDA | /train + /dev | 0.3610 | 0.3608 | 0.4134 |
| #09 | KNN | /train | 2.11 | 3.81 | 16.63 |
| RNF | /train | 2.06 | 3.82 | 18.32 |
| CI-PCA | /train | 0.9634 | 0.2798 | 0.9747 |
| QDA | /train | 0.9687 | 0.9713 | 0.9304 |
| LDA | /train | 0.9620 | 0.9144 | 0.9803 |
| CI-PCA | /train + /dev | 0.9475 | 0.9182 | 0.04115 |
| QDA | /train + /dev | 0.9715 | 0.9605 | 0.9668 |
| LDA | /train + /dev | 0.9620 | 0.9144 | 0.9803 |
| #10 | KNN | /train | 7.63 | 38.83 | 33.44 |
| RNF | /train | 2.15 | 39.74 | 33.28 |
| CI-PCA | /train | 0.5301 | 0.5270 | 0.4892 |
| QDA | /train | 0.8392 | 0.5524 | 0.6589 |
| LDA | /train | 0.5301 | 0.5534 | 0.4893 |
| CI-PCA | /train + /dev | 0.5282 | 0.5074 | 0.5092 |
| QDA | /train + /dev | 0.8503 | 0.8247 | 0.6530 |
| LDA | /train + /dev | 0.5301 | 0.5534 | 0.4893 |