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ECE 1395 – Dr. Dallal

Homework Assignment #6

3/23/23

**Question 0: Data Preprocessing**

**Part a**

Size of X\_train\_1: (40, 4)

Size of X\_train\_2: (42, 4)

Size of X\_train\_3: (43, 4)

**Question 1: Naïve-Bayes Classifier**

**Part a**

| | Feature 1 | Feature 2 | Feature 3 | Feature 4 |

| | Mean | Stdev | Mean | Stdev | Mean | Stdev | Mean | Stdev |

|---------|---------|---------|---------|---------|---------|---------|---------|---------|

| Class 1 |-0.955036|0.3770712|0.9008879|0.8781435|-1.283352|0.0899142|-1.235616|0.1403439|

| Class 2 |0.0195521|0.5851605|-0.710571|0.7013402|0.2517313|0.2641113|0.1414381|0.2350211|

| Class 3 |0.9222009|0.7661662|-0.163552|0.7674648|1.0342280|0.3145550|1.0900789|0.3759288|

**Part b**

Accuracy: 0.88

**Question 2: Max Likelihood and Discriminant Function for Classification**

**Part a**

Size of Sigma\_1: (4, 4)

Size of Sigma\_2: (4, 4)

Size of Sigma\_3: (4, 4)

Snapshot of covariance matrix for class 1:

[[0.1458284 0.26818473 0.00325823 0.01093794]

[0.26818473 0.79090889 0.01216345 0.03357229]

[0.00325823 0.01216345 0.00829186 0.0035682 ]

[0.01093794 0.03357229 0.0035682 0.02020147]]

Snapshot of covariance matrix for class 2:

[[0.35076435 0.21090408 0.12086883 0.07852627]

[0.21090408 0.50387511 0.0974818 0.10099519]

[0.12086883 0.0974818 0.07145612 0.04965294]

[0.07852627 0.10099519 0.04965294 0.05658212]]

Snapshot of covariance matrix for class 3:

[[0.35076435 0.21090408 0.12086883 0.07852627]

[0.21090408 0.50387511 0.0974818 0.10099519]

[0.12086883 0.0974818 0.07145612 0.04965294]

[0.07852627 0.10099519 0.04965294 0.05658212]]

**Part b**

Size of u1: (4,)

Size of u2: (4,)

Size of u3: (4,)

Snapshot of mean vector for class 1:

[-0.95503645 0.90088791 -1.28335256 -1.23561636]

Snapshot of mean vector for class 2:

[ 0.01955215 -0.71057179 0.25173138 0.1414382 ]

Snapshot of mean vector for class 3:

[ 0.922201 -0.16355204 1.03422804 1.09007893]

**Part c**

Accuracy: 0.96

The accuracy of the MLE based classifier is higher than the naive classifier. This can be explained by the use of the covariance matrix in the MLE classifier which is able to capture dependent features better than the naive classifier which assumes independence between features.