MACHINE LEARNING

ASSIGNMENT 1

QUESTION 4

(a)

In implementing GDA assuming (1 for Alaska and 0 for Canada)

$\sum 1$ and $\sum 0$ are Covariance Matrices for Class 1 and Class 0 respectively.

For LDA assuming $\sum 1 = \sum 0$

mu0

0.7515
-0.6817

mu1

-0.7515
0.6817

sigma

0.4252 -0.0222
-0.0222 0.5253

(b)

Refer figure in the last.

(c)

Since the Covariance Matrix of both the classes is assumed to be equal, we get a linear separator

$$(x-\mu_1)^T \sum -1\,(x-\mu_1) - (x-\mu_0)^T \sum -1\,(x-\mu_0) = 2\log(\frac{1-\emptyset}{\emptyset})$$

Refer figure in the last.

(d)

If each target class has its own covariance matrix then the boundary obtained is quadratic

μ_1 *and* μ_0 *remain the same.*

sigma0

0.4727	0.1088
0.1088	0.4094

sigma1

0.3778	-0.1533
-0.1533	0.6413

The quadratic equation is give as:

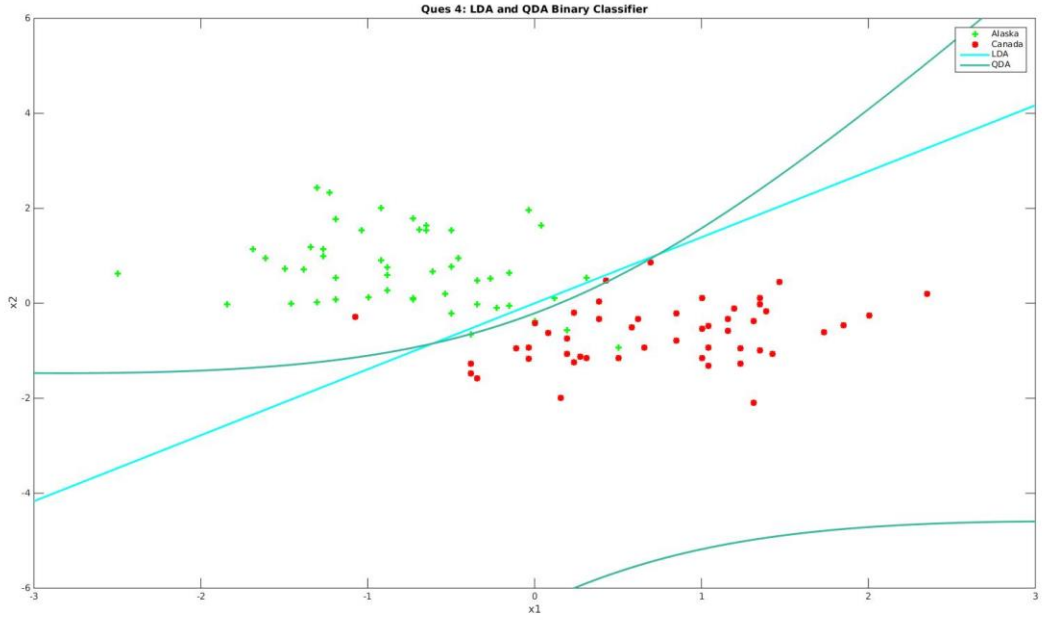
$$(x - \mu_0)^T {\sum_0}^{-1} (x - \mu_0) - (x - \mu_1)^T {\sum_1}^{-1} (x - \mu_1) = 2\log(\frac{1-\emptyset}{\emptyset}) + \log(\frac{|\sum_1|}{|\sum_0|})$$

(e)

The Quadratic plot obtained is : refer figure in the last.

(f)

Linear Discriminant analysis can only learn linear boundaries, while QDA can learn quadratic boundaries and is therefore more flexible. QDA, because it allows for more flexibility for the covariance matrix tends to fit the data better than LDA, but then it has more parameters to estimate.


Ques 4: LDA and QDA Binary Classifier
Alaska
Canada
LDA
QDA
x1
x2
6
4
2
0
-2
-4
-6
-3
-2
-1
0
1
2
3