

**CS 530**  
**Assignment 5**  
**Due: October 11**

1. Consider a 2-dimensional, 2-class problem where the patterns are normally distributed with the same covariance matrix and equiprobable classes.

$$\Sigma = \begin{vmatrix} 2 & 0 \\ 0 & 2 \end{vmatrix}$$

and the mean vectors are:

$$\mu_1 = \begin{vmatrix} 1 \\ 1 \end{vmatrix} \quad \mu_2 = \begin{vmatrix} 3 \\ 2 \end{vmatrix}$$

- (a) Find the decision boundary between the two classes.  
 (b) Find the probability of an error.

2. For the previous problem, assume that the classes have different covariance matrices:

$$\Sigma = \begin{vmatrix} 2 & 1 \\ 1 & 4 \end{vmatrix}$$

$$\Sigma_2 = \begin{vmatrix} 4 & 0.5 \\ 0.5 & 1 \end{vmatrix}$$

and find the decision boundary between the two classes.

3. For the previous problems, assume that both classes have the same covariance matrix:

$$\Sigma = \begin{vmatrix} 2 & 1 \\ 1 & 4 \end{vmatrix}$$

and the a priori probabilities  $P_1 = 0.25$  and  $P_2 = 0.75$  and find the decision boundary.

4. For the previous problem, assume the following loss values:

$$\lambda_{11} = \lambda_{22} = 0$$

$$\lambda_{12} = 0.5$$

$$\lambda_{21} = 2.5$$

and determine the decision boundary.