

- c) What would be the classification of the same point $(1.3 \ 0)^T$ if we use a Bayes classifier along with a kernel density estimation. (Assume $P(C_1) = P(C_2) = 0.5$, assume an independent Gaussian kernel function and take $h = 0.75$).

(10 points)

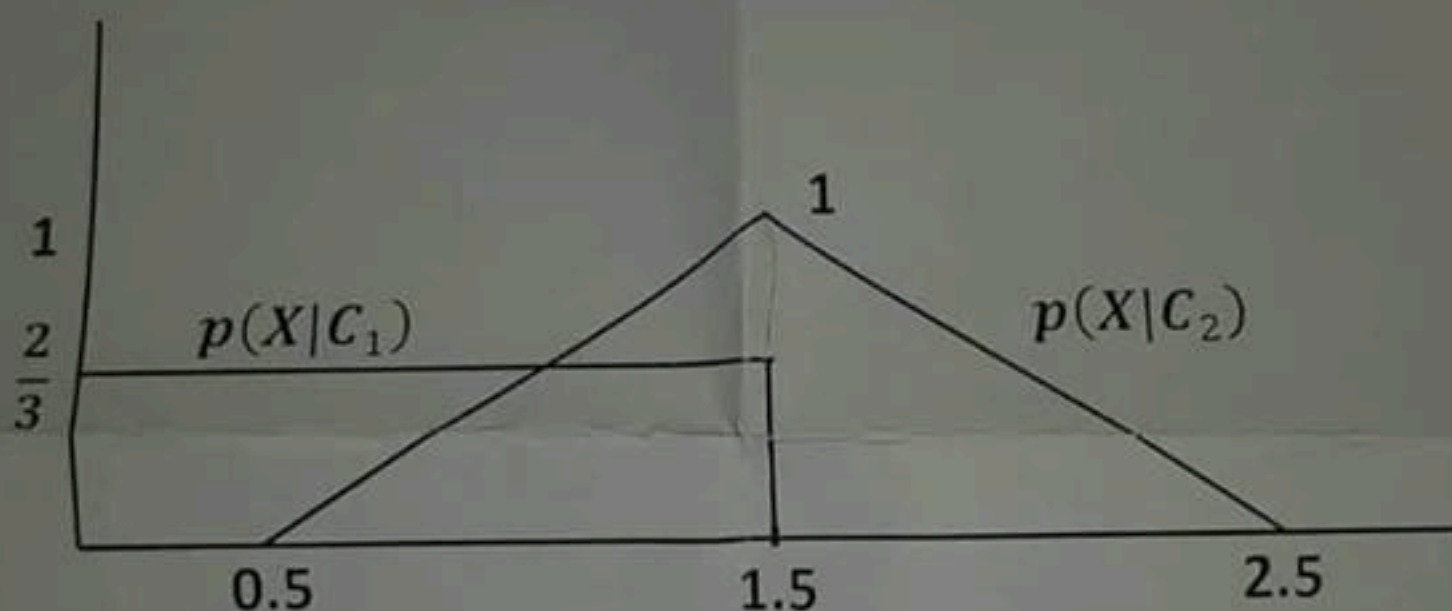
10. Consider the one-dimensional two-class classification problem, where we assume that $P(C_1) = 0.25$ and $P(C_2) = 0.75$. The class conditional densities are shown in the figure below:

- a) Plot the decision regions and the decision boundaries for the Bayes classifier.

(10 points)

- b) Find the classification error for the Bayes classifier.

(10 points)



11. Consider a two-dimensional two-class classification problem, where the class-conditional densities are given by:

$$p(\underline{X}|C_1) = 0.5 \frac{1}{2\pi} e^{-\frac{((x_1+1)^2 + (x_2+1)^2)}{2}} + 0.5 \frac{1}{2\pi} e^{-\frac{((x_1-1)^2 + (x_2-1)^2)}{2}}$$

$$p(\underline{X}|C_2) = 0.5 \frac{1}{2\pi} e^{-\frac{((x_1-1)^2 + x_2^2)}{2}} + 0.5 \frac{1}{2\pi} e^{-\frac{(x_1^2 + (x_2-1)^2)}{2}}$$

Assume that $P(C_1) = P(C_2) = 0.5$.

- a) Sketch the approximate decision boundary
b) The classification regions for the Bayes classifier

(10 points)

(10 points)

Name:

1. State the difference between supervised learning and unsupervised learning? (5 points)
2. State the difference between classification and regression problems. Give examples. (4 points)
3. What is the feature space? and how decision regions are constructed? (3 points)
4. Compare minimum distance classifier to K-nearest neighbor classifier? (5 points)
5. Why are Bayes classifiers considered as optimum classifiers? and what are the necessary conditions for that? *exact prob. den.* (5 points)
6. State the steps of the Sequential Forward Selection (SFS) Algorithm and give examples. (10 points)
7. What is the intuition behind classifiers combination? Give examples on possible ways of combination? *possible ways* (5 points)
8. Discuss the main idea of the AdaBoost classifier? *K=1* (10 points)
9. Consider the following problem:
Class 1 patterns: $(1 \ 1.5)^T, (1.5 \ 0.7)^T, (1.5 \ 1)^T$
Class 2 patterns: $(0 \ -1)^T, (0.1 \ 0.3)^T, (1.2 \ 0)^T$
 - a) Assume that we would like to use the minimum distance classifier. What would be the classification of the following pattern $(1.3 \ 0)^T$? What would be the classification is we use K-nearest neighbor classifier where $K = 3$. (5 points)
 - b) Compare between the results obtained in (a). (2 points)