T-61.231 Principles of Pattern Recognition

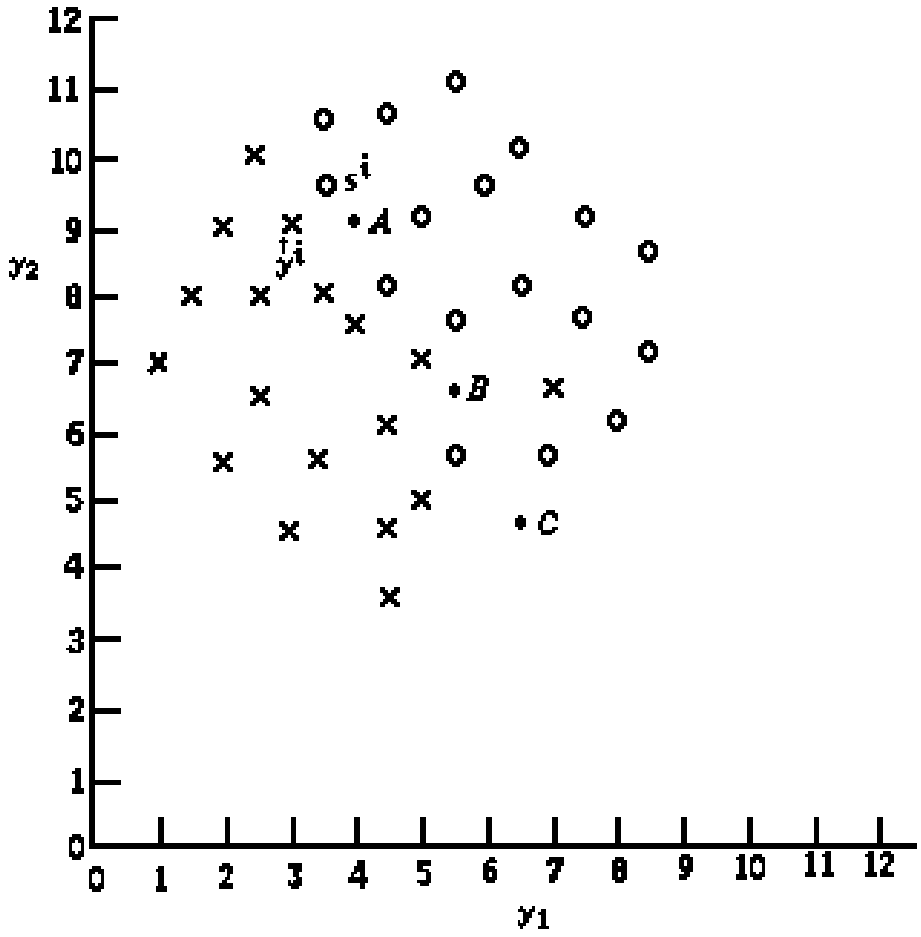
Exercise 3: 7.10.2002

1. Formulate a one-dimensional Parzen estimate for density function p_y from given samples

$$y^{(i)} : 2.5, 2.8, 3.4, 4.2, 4.5, 4.7, 5.2, 5.6, 7.5$$

   Use a rectangular window function.

2. Classify points A, B and C in figure using the 5-nearest neighbour classification rule and an Euclidean distance function.



3. Applying the nearest neighbour classification rule for two classes (figure), decision regions and boundary are received for these classes. If $\mathbf{y}^{(i)}$ are sample vectors from class 1 and $\mathbf{s}^{(i)}$ sample vectors from class 2, then according to the definition any point $\hat{\mathbf{y}}$ lying in the boundary satisfies the equation

$$\min_i d(\hat{\mathbf{y}}, \mathbf{y}^{(i)}) = \min_i d(\hat{\mathbf{y}}, \mathbf{s}^{(i)})$$

Assume distance function to be Euclidean.

a) What is the equation for a decision boundary in a small region near the boundary if constant vector $\mathbf{y}^{(i)}$ is nearest to the boundary from class 1 and $\mathbf{s}^{(j)}$ is constant vector nearest to the boundary from class 2?

b) Draw a perfect decision boundary for classes in figure.

c) Find those sample vectors, whose extraction doesn't change the decision boundary.