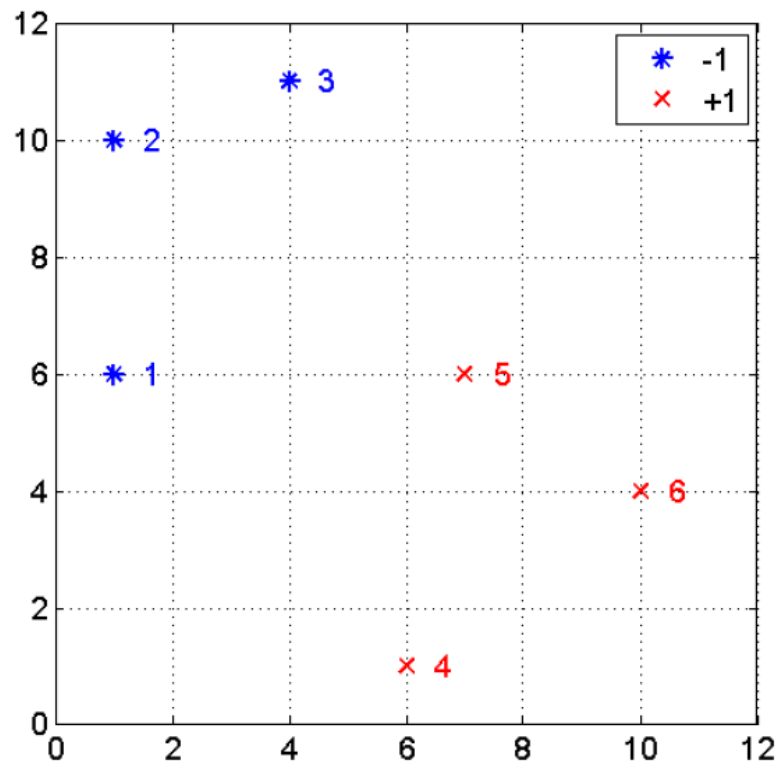# Supervised Learning

1 SVM

The two following classes are given:

$$\{[1,6],[1,10],[4,11]\} \text{ with } y_k = -1$$
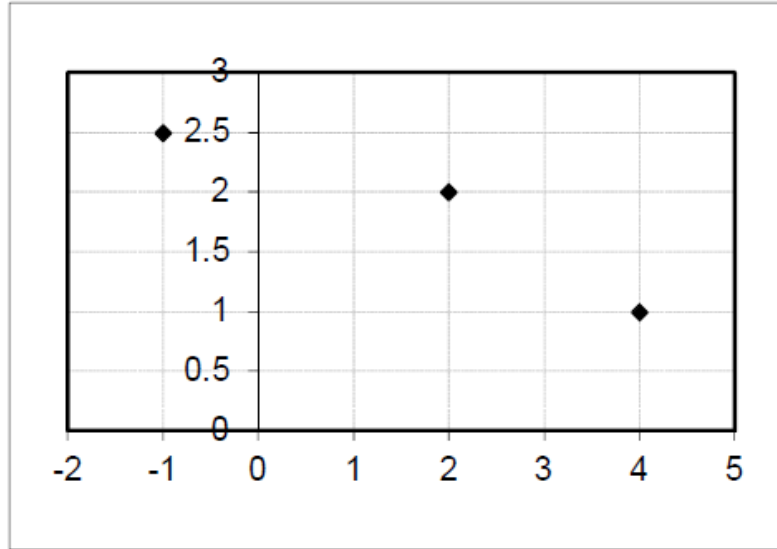$$\{[6,1],[7,6],[10,4]\} \text{ with } y_k = 1$$

a. What is the linear SVM classifier? What are the support vectors?

b. The optimal values of the dual problem are: $a = [0.0356, 0, 0.04, 0, 0.0756, 0]$. Match these values to the given vectors.

c. Calculate the margin.

2 Regression

We are given with following learning set:

$$\{x_i, y_i\}_{i=1}^3 = \{(-1.2, 5), (2, 2), (4, 1)\}.$$

a. What is the linear regression model for this learning set? Calculate the optimal adequate parameters.

b. What is the second order polynomial model for this set? Calculate the optimal adequate parameters.

c. What is the third order polynomial model for this set? Is there a single solution in this case? Calculate the optimal adequate parameters for the case where $w_0 = 0$ and $w_2 = 0$. Which of the solutions is preferred?

d. Calculate the optimal parameters of the following model:

$$\hat{f}(x) = \sum_{m=1}^{3} w_m \phi_m(x)$$
$$\phi_m(x) = e^{-\frac{(x-\mu_m)^2}{\sigma_m}}$$

The adequate vectors are:

$$\bar{\mu} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}, \bar{\sigma} = \begin{pmatrix} 1.5 \\ 1 \\ 1 \end{pmatrix}$$

e. What is the empirical error for each of these models?