Exersices for linear classifiers

Exersice 1: Consider the following data points $[1,\ 0]^T$, $[1,\ 1]^T$, $[0,\ 1]^T$, $[0,\ 0]^T$. The first two of them stem from class ω_1 $(+1)$, while the remaining stem from class ω_2 (-1).

- Use the perceptron algorithm (with $\rho = 1$) to determine a linear classifier for the problem.
- What would be the behavior of the perceptron algorithm if $[1,\ 0]^T$, $[0,\ 1]^T$ were stem from class ω_1 $(+1)$ and $[0,\ 0]^T$, $[1,\ 1]^T$ were stem from ω_1 $(+1)$?

Exersice 2: Consider the following data points $[1,\ 1]^T$, $[-2,\ -1]^T$, $[-1,\ -2]^T$, $[-3,\ -3]^T$, $[-1,\ -1]^T$, $[1,\ 2]^T$, $[2,\ 1]^T$, $[3,\ 3]^T$. The first four of them stem from class ω_1 $(+1)$, while the remaining stem from class ω_2 (-1).

- Determine the optimal linear classifier with respect to (a) the sum of squares error criterion and (b) the mean squared error criterion. Comment on the resulting classifiers
- For each classifier, classify the points $[0,\ 0]^T$, $[1,\ 0]^T$ and $-1,\ 0]^T$.

Exersice 3: Consider the following data points $[1,\ 1]^T$, $[-1,\ 1]^T$, $[-1,\ -1]^T$, $[1,\ -1]^T$. The first two of them stem from class ω_1 $(+1)$, while the remaining stem from the class ω_2 (-1).

- Determine the optimal support vector machine (SVM) classifier.
- Classify the points $[0.5,\ 0]^T$ and $[0,\ -0.5]^T$.