

Problem set 2

Classification algorithms

Excercise 1

In the lecture we saw how Perceptron updates the weights and the threshold if it misclassifies a positive object (i.e. when $y = +1$). Conduct a similar analysis when the algorithm misclassifies a negative instance (i.e. when $y = -1$).

Excercise 2

Provide a geometric interpretation for the update rule in Perceptron when a negative instance is mistaken to be positive (in the lecture we considered the case when a positive instance is mistaken to be positive).

Excercise 3

Let us consider the loss function $(y - \bar{W}^T \bar{X})^2$. Given a train dataset $D = \{(\bar{X}_i, y_i)\}_{i=1}^N$, we define the loss of classifying an instance (\bar{X}_n, y_n) by $y_n - \bar{W}^T \bar{X}_n)^2$. Here, $y_n \in \{1, -1\}$ is the target label of the instance \bar{X}_n . Answer the following questions.

1. Compute the derivative of the loss function w.r.t W .
2. Write the gradient descent rule for obtaining a new vector $\bar{W}^{(t+1)}$ from the current weight vector $\bar{W}^{(t)}$ after observing a train instance (\bar{X}_n, y_n) . Assume step-size to be γ .