Class Exercises. Set 5

1. A simple linear SVM, with equation $f(x) = w^t x + b$, is trained on only two data points: $C_{+1} = [1, 1]^t$ and $C_{-1} = [-1, -1]^t$. The value of w that maximizes the width of the margin is used.

a. What is the value of w? (Express your answer as a two-element list.)

b. What is the margin width?

c. What is the value of $f([-6, 10]^t)$?

2. Consider a Support Vector Machine (SVM) classifier. State the truth or falsehood of the following statements:

a. Any SVM is a linear classifier in some space to which data points can be mapped.

b. The computational complexity of classifying a test point in SVM always linearly depends on the dimensionality of the feature space.

c. Any two-argument symmetric function, i.e., $K(x, y) = K(y, x)$, is a valid kernel function.

3. Consider now an SVM classifier using the Gaussian RBF kernel.

Prove that inner products between training patterns in feature space, computed with this kernel, are invariant to arbitrary translations and rotations of the set of training patterns in input space.

NOTE: a rotation of vectors **x** is always representable as a product R**x**, where R is an orthogonal matrix ($R^t=R^{-1}$).

4. In the code provided in a previous class, compare the performance of the linear, polynomial and RBF kernels.