

# Homework 4

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Due February 23, 2010

## 1 2-SVM

The 2-SVM algorithm is a method for supervised binary classification. Given a training set  $(x_i, y_i)_{i=1, \dots, n}$  of training patterns  $x_1, \dots, x_n$  in a space  $X$  endowed with a positive definite kernel  $K$ , and a set of corresponding labels  $y_1, \dots, y_n \in \{-1, 1\}$ , it solves the following problem:

$$\min_{f \in H_K} \left\{ \frac{1}{n} \sum_{i=1}^n L(f(x_i), y_i) + \lambda \|f\|^2 \right\},$$

where  $\|f\|$  is the norm of  $f$  in the RKHS  $H_K$  of the kernel  $K$ , and  $L$  is the *square* hinge loss function:

$$L(u, y) = \max(1 - uy, 0)^2.$$

Write the primal and dual problems associated to the 2-SVM, and compare the result with the SVM studied in the course.