Problem assignment 6

Due: Thursday, March 15, 2018

In this assignment we continue our investigation of the “Pima” dataset. As in the previous assignment, you can download the dataset (pima.txt) and its description (pima desc.txt) from the course web page. In addition to the complete dataset pima.txt, you have pima train.txt and pima\_test.txt you will need to use for training and testing purposes.

Problem 1. Support vector machines

Support vector machines represent yet another technique one can apply to the problem of binary classification. The idea is to find the hyperplane that separates the examples in two classes the best. The best hyperplane is defined in terms of the maximum margin. The learning problem reduces as usually to optimization, in this case, a quadratic optimization problem.

There is a number of implementations of SVM algorithms with better or worse running time performances. Here we use a Matlab code implementing SVM solver for the linear decision boundary proposed by *O.L. Mangasarian and D. Musicant*. The paper describing this method can be downloaded electronically at: <http://www.ai.mit.edu/projects/jmlr/papers/volume1/mangasarian01a/html/>

The SVM solver is in files ***svml.m*** and ***svml\_itsol.m*** that can be downloaded from the course web page.

***svml­­\_itsol.m*** is a slightly modified version of the original program by O.L. Mangasarian and D. Musicant. To run it you call ***svml.m*** that takes care of **converting outputs from 0,1 class labels to -1,1** (!!!) and sets other parameters of the Lagrangian SVM.

Part a. Use the ***svml*** code to learn the weights w and b (bias) of the linear model on the training set. Assume the cost for crossing the boundary (a paramater of the svml procedure) is 1.

Part b. Write and submit a function apply ***svlm(x, w, b)*** that takes an input vector x, and paramaters w, and b of the liner SVM and outputs the class decision (use 0 and 1) for the input x.

Briefly, the class is 1 if w \*x + b > 0, and 0 otherwise.