CS282K: Numerical Methods for Scientific Computing and Machine Learning

Homework 6

Issued: **October 9**
Due: **October 20 (11:59PM, Beijing time)**

Please submit the PDF file of your solution to the "Drop Box" on Sakai.

Problem 1: Linear Classifier

Build a support vector machine (SVM) without regularization to classify two classes: "A" and "B":

$$f(x, y) \approx a \cdot x + b \cdot y + c = \begin{cases} \geq 0 & (Class\ A) \\ < 0 & (Class\ B) \end{cases}. \tag{1}$$

The following table lists six sampling points that you should use to train the classifier.

x	–1	–2	1	1	1	2
y	1	1	3	–1	–2	–2
Class Label	A	A	A	B	B	B

Write your MATLAB code to train the classifier. You can use the MATALB function quadprog() to solve the nonlinear optimization problem and determine the coefficients *a*, *b* and *c* in (2). Plot the classification boundary *f*(*x*, *y*) and print out the coefficients that you find. Submit them along with your MATLAB code.

Problem 2: Unconstrained Quadratic Programming

Apply Gradient method to solve the following optimization problems. Show your equations to calculate the solution *x* for the first three iterations.

$$\min_{x_1, x_2} \quad x_1^2 + x_2^2 \quad where \quad x_1^{(0)} = 1 \quad and \quad x_2^{(0)} = 1 \tag{3}$$

$$\min_{x_1, x_2} \quad x_1^2 + x_1 x_2 + 2x_2^2 \quad where \quad x_1^{(0)} = 1 \quad and \quad x_2^{(0)} = 1 \tag{4}$$

$x_1^{(0)}$ and $x_2^{(0)}$ represent the initial starting point.