Machine Learning

V. Adamchik CSCI 567 Spring 2019

Discussion 8 University of Southern California

Lagrange Multipliers

SVM

Problem 1

Solve the following nonlinear optimization problem using Lagrange multipliers:

$$\max(x\,y)$$

subject to

$$x^2 + 4\,y^2 = 8$$

Problem 2

Consider the following problem:

$$\min(x^2/2)$$

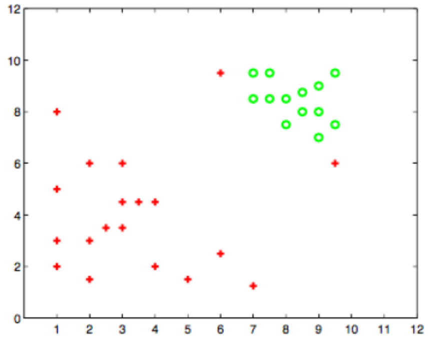
subject to

$$x \geq 0 \text{ and } 2x \leq 3$$

Write down the dual problem.

Problem 3

Assume that we are training an SVM with a quadratic kernel. You are given the following data set. The slack penalty C will determine the location of the separating hyperplane.



a) Where would the decision boundary be for very large C?

b) What if C is very small?

c) Draw a data point which will not change the decision boundary for large C.

d) Significantly change the decision boundary.

Problem 4

Which of the following about SVM is true?

(A) Support vectors are training points that are misclassified.

(B) Support vectors are training points that are not on the learned hyperplane.

(C) Removing examples that are not support vectors will not affect the final hyperplane.

(D) Only misclassified training points could be support vectors, but not all of them are.

Problem 5

Consider the soft margin SVM with the hinge loss.
What is the relation between leave-one-out error (LOO) and the number of support vectors (SV)? Assume N is the size of the training data.

Problem 6

Consider the soft margin SVM with the hinge loss.
What is the behavior of the width of the margin as $C \to 0$?