Introduction to Optimization
MS&E 111/ENGR 62, Autumn 2008-2009, Stanford University
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Lab 3. Lab date - 10/17/08

Problem 1   The US Secret Service wishes to create a computer program that classifies dollar bills as being either real or counterfeit. The program will do this by evaluating each bill based on two easily measurable characteristics: (1) the bill thickness and (2) the watermark intensity.

You are given the following "training" data:

Bill Type	Thickness	Watermark Intensity
real	4.5	7.6
real	3	8.7
real	2.5	5
real	5	7.9
fake	5.3	8
fake	7	12
fake	5.5	3
fake	5.6	2

Provide a hyperplane that linearly separates the two bill types (if possible). If this is not possible, give the hyperplane parameters that minimize the "violation extent." How could the Secret Service use this result in their program?

Problem 2 (Adapted from VRM 3.13)   In the early 1900s, Edgar Anderson collected data on different types of irises to study how species evolve to differentiate themselves in the course of evolution. A selection of his data is in the file iris.xls, which can be found on the course web page.

Is the iris versicolor data linearly separable from the other species data? If so determine parameters (x and α) for a separating hyperplane. If not, determine parameters for a hyperplane that minimizes the violation metric discussed in class, and determine the number of misclassifications resulting from this hyperplane.