CS1675: Homework 6

Due: 11/1/2018, 11:59pm

This assignment is worth 30 points.

In this assignment, you will implement an SVM using the Matlab function `quadprog`. The most useful resource are the handwritten notes and **the recitation on Oct. 26**.

Part I: SVM via quadratic programming (20 points)

Examine the Matlab function <u>quadprog</u>. It can be used train an SVM (find the optimal **w**). Consider the input variables `H, f, A, b, Aeq, beq, lb, ub`. How should you set each of them so that the quadratic program that is solved is the solution to an SVM? How would you compute the weight vector **w** from the output of `quadprog`?

With these answers in hand, your next task is to implement an SVM using a call to `quadprog` with appropriately set input parameters. Write a `function [y_pred] = svm_quadprog(X_train, Y_train, X_test, C)` that "trains" an SVM i.e. obtains the solutions for the alpha weights using `quadprog`, then computes the weight vector **w** from these. It should also compute a prediction on the test set, using the test features and the weight vector.
The inputs to this function are:

- an NxD feature matrix `X_train` where N is the number of training instances and D is the feature dimension,
- an Nx1 label vector `y_train` for the training instances,
- an MxD feature matrix `X_test` where M is the number of test instances, and
- a scalar `C`, denoting the misclassification cost in an SVM.

The output is:

- an Mx1 predicted label vector `y_pred` for the test instances.

Part II: Testing your SVM (10 points)

Now test your SVM on the Pima Indians dataset from HW4. Reuse your KNN test script, but instead of testing different values of K or the bandwidth, test different values of C (e.g. $0.0001, 0.001, 0.01, 0.1$, and 1). Name your adapted script `svm_classification.m`. Plot the performance of your SVM with the values of C on the x-axis, and the corresponding accuracies on the y-axis. Include the figure in a report file.

Important: Make sure to convert the ground-truth labels of 0 to -1. Then your predicted values should also be only -1 or 1.

Submission: Please include the following files:

- `svm_quadprog.m`

- svm_classification.m
- report.pdf