CPTS 570 Machine Learning, Fall 2016
Homework #6
Due Date: Dec 12 in EME 133

NOTE 1: Please use a word processing software (e.g., Microsoft word or Latex) to write your answers and drop a printed copy in my office (EME 133) during class time (10:35 to 11:50am) on Dec 12.

NOTE 2: Please ensure that all the graphs are appropriately labeled (x-axis, y-axis, and each curve). The caption or heading of each graph should be informative and self-contained.

1. (**100 points**) Automatic hyper-parameter tuning via Bayesian Optimization. For HW2, you tuned the hyper-parameters of SVM classifier learning via grid search. For this homework, you need to use BO software to perform hyper-parameter search.

   Download and install the LibSVM software: http://www.csie.ntu.edu.tw/c̃jlin/libsvm/

   You are provided with a training set, and testing set of multi-class classification examples (Please use *only the first fold data* from the first homework). Please divide the training data into sub-train (80 percent) and validation (20 percent) for your experiments. You will run the LibSVM software on the training data to answer the following questions.

   Using a Gaussian kernel (-t 2 option), find the best hyper-parameters for SVM training. There are two hyper-parameters: C parameter (-c option) and γ parameter (-g option). C and γ can take any value between 10^{-4} and 10^{4}.

   You will employ Bayesian Optimization (BO) software to automate the search for the best hyper-parameters by running it for 50 iterations. Plot the number of BO iterations on x-axis and performance of the best hyper-parameters at any point of time (performance of the corresponding trained SVM classifier on the validation data) on y-axis.

   Additionally, list the sequence of candidate hyper-parameters that were selected along the BO iterations.

   You can use one of the following BO softwares or others as needed.
   Spearmint: https://github.com/JasperSnoek/spearmint
   SMAC: http://www.cs.ubc.ca/labs/beta/Projects/SMAC/