CS771: Machine learning: tools, techniques, applications
Assignment #3: SVMs, Kernels, Neural nets

Due on: 21-10-2013, 23.59 12-10-2013
MM:200

In this assignment you have to use the satellite image data set from:
http://www.csie.ntu.edu.tw/ cjlin/libsvmtools/datasets/multiclass.html#satimage

1. The data set has separate training, validation and test sets. Merge the training and validation sets into a single training set. Be careful to normalize all data (both training and test) before building and testing a classifier.

   Assume we want to separate class 6 from the remaining 5 classes - a binary classication problem. Use SVMs combined with polynomial kernels to build a classifier. Find 5-fold cross validation error for degree 1, 2, 3 polynomials and study its variation with the penalty parameter C (keep other parameters of polynomial kernels in libsvm at default values, if you plan to use libsvm) by plotting error with C. Report the best value of the trade-off constant C measured on the test set.

   Report the number of support vectors that lie on the margin planes in each case.

   There are multiple SVM implementations available. You can use any one you find convenient. Some implementations are named below:

   - The libsvm Java package from:http: //www.csie.ntu.edu.tw/ cjlin/libsvm/#java.
   - The builtin SMO algorithm in Weka.
   - The Weka SVM where libsvm has been integrated with Weka. It is available at: http://www.cs.iastate.edu/ yasser/wlsvm/.
   - Any other you find useful.

   [40, 40, 25=105]

2. For the same dataset as above use a 3-layer neural network classifier to give the six class labels to items in the test data set. Use the validation data set to decide when you will stop training the neural network. Experiment with different number of neurons in the hidden layer and report error rates in each case. Use the previously obtained error rates to give the best estimate of the number of neurons that should be there in the hidden layer.

   [70+25=95]