SUPPORT VECTOR MACHINES LABORATORY EXERCISE

In this exercise you will predict the winner of a duel of two robots in a duel, which is a binary classification problem. In order to do so, you must run at least 1,000 battles where one of the robots starts at the center of a 500x500 pixel battlefield with a fixed orientation, and the other robot is placed in a position chosen at random over the battlefield, with an orientation also chosen at random. For each battle you must find out which robot won.

This way you generate at least 1,000 samples where the input a vector (x,y,alpha) with the initial position (x,y) and orientation (alpha) of the second robot, and the output is the winning robot (a class label with two possible values). Then you split the set of available data into a training set with 90% of the samples and a test set with the remaining 10% of the samples. A Support Vector Machine (SVM) can be used to solve this classification problem. First a SVM is trained with the training set. Then the SVM is tested with the test set, and the accuracy (fraction of correctly predicted test labels) is obtained. The classification can be said to be good if the accuracy is substantially higher than the proportion of samples which belong to the majority class. You can try different SVM parameters to see which ones achieve the best accuracy.

The more training samples you collect, the better the classification performance should be. The input values must be normalized to lie in the interval of real numbers [0,1] prior to presentation to the SVM.

In order to check that your classification system is well designed, you can repeat the classification with different training/test splits, and see the average accuracy and the standard deviation of the accuracy.

Tentative schedule:

Laboratory session 1: develop a program which collects the training data for the neural network, i.e. it should run at least 1,000 battles and prepare the input and output patterns for the SVM.

Laboratory session 2: show the results of the previous session to the teacher, and use a SVM to predict the winner of a duel given the initial position of the second robot.

Laboratory session 3: present the final result to the class with the help of a slide show, and do a practical demonstration of the software (maximum 10 minutes overall). All the materials (slide show and source code) must be submitted to the associated virtual campus task.