Machine Learning
TP3: Support Vector Algorithms

September 27, 2023

1. Solve the following items:

   a) Construct a set 'TP3-1' of linearly separable examples at < 2 (e.g., randomly generate points in [0, 5]x[0, 5] such that they belong to two linearly separable classes 1 and ÿ 1). Use a simple step perceptron to separate the ensemble linearly. Is the separation hyperplane optimal? Justify the answer.

   b) Obtain the optimal hyperplane from the hyperplane obtained with the perceptron simple.

   c) Construct the set 'TP3-2' in an analogous way to how you constructed the set 'TP3-1' but this time include some examples that are misclassified near the separating hyperplane. Use a simple perceptron to separate the two classes. Comment on the results.

   d) Use SVM to classify both set 'TP3-1' and set 'TP3-2'. Compare the results with those obtained in points a) and c).

2. Color Image Segmentation:

Consider the image cow.jpg and the sample images: cow.jpg, sky.jpg and grass.jpg corresponding to the classes within the image "cow", "sky" and "pasture", respectively.

   a) Build a data set for training, indicating for each sample what class belongs.

   b) Randomly divide the data set into two sets, one for training and one for a test one.

   c) Use the SVM method to classify the pixels of the test set, training with the training set. Use different cores and different values of the C parameter and those of each core. Construct the confusion matrix for each case.

   d) What is the core that gives the best results? Think of a theoretical justification for the answer.

   e) With the same already trained method, classify all the pixels of the image.

   f) With the same already trained method, classify all the pixels of another image.