UNIVERSITÄT ZU LÜBECK
INSTITUTE FOR ROBOTICS
AND COGNITIVE SYSTEMS

Artificial Intelligence II
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Daniel Wulff
wulff@rob.uni-luebeck.de

Exercise sheet 3

Submission deadline: 10:00, November 27, 2020

Task 1: Optimization and Maximum Margin (8 points)

Answer the following questions. Give reasons for your answers!

a) Imagine you have an algorithm for solving minimization problems. How can this algorithm be used to solve a maximization problem? (2 point)

b) How is the margin defined? What is a maximum margin seperating plane? (2 points)

c) Is it possible to find a maximum margin separating plane using Linear Programming (LP)? (2 points)

d) Is it possible to find a maximum margin separating plane using a Perceptron? (2 points)

Task 2: Separating planes is not about air traffic control (12 points)

Download the given MATLAB code snippets from the Moodle course.

- `maxMarg.m`

  `function [exitflag, w, d, margin, dists] = maxMarg( X, y )`

  For a given data point matrix **X** and a given vector of class labels **y** with $y_i \in \{-1, +1\}$, this function uses Quadratic Programming for finding the maximum margin separating plane between the linearly seperable data points of the two classes and returns the exitflag of MATLABs `quadprog` function, the weight vector **w**, the distance from the origin d, the margin, and the distances from each data point to the separating plane. Implement the needed functionality.

- `maxMargTest.m`

  This script tests your implementation. There are two test instances. The script generates two figures and some text output which will automatically be saved as PDF and TXT files. **Do not edit this script**.

Implement the missing functionality in `maxMarg.m`. Zip your implementation and the generated PDF and TXT files from the `maxMargTest.m` script and upload your archive to the Moodle course. Briefly discuss your results.
(12 points)