



General Information:

Exercises (1 SWS): Tue 12:15 – 13:45 (0.154-115) and Fri 08:15 – 09:45 (0.151-115)
Certificate: Oral exam at the end of the semester
Contact: peter.fischer@fau.de, shiyang.hu@fau.de

Support Vector Machine & Constrained Optimization

Exercise 1 In this exercise, you will create a *Support Vector Machine* (SVM) classifier for a two-class problem. We perform classification in the original feature space (i.e. you don't need to apply kernel functions to lift the features into a space of higher dimensionality). Also, we solve the optimization in the primal form. For non-linear optimization, we suggest to apply the Matlab function `fmincon`, which provides the constrained optimization algorithm that is required to optimize the hyperplane. The caller to this function has to provide a handle to the objective function and a linear system of inequalities.

- (a) Implement the SVM with hard margin constraints.
- (b) Extend your implementation with soft margin constraints.
- (c) Visualize the decision boundary of the SVM with hard/soft margin constraints for different training sets.

Exercise 2 Find the largest rectangle that can be inscribed in the ellipse $x^2 + 2 \cdot y^2 = 4$. In this example, it is sufficient to consider rectangles which are centered at the origin.

- (a) What is the area of such rectangles? Formulate the constrained optimization problem.
- (b) Solve using the Lagrange multiplier method.