Machine learning

(16) Support vector machines

Study questions

1. Define the notion of a training data set.
2. Write down the definition of a linear discriminant function.
3. Write down the definitions of the decision boundary and decision regions induced by a linear discriminant function.
4. State three geometric relationships between a linear discriminant function's hyperplane and its weight and bias parameters.
5. Write down the definition of a hyperplane margin.
6. Write down the definition of a support vector.
7. Define the concept of equivalent hyperplanes.
8. Write down the definition of the canonical hyperplane.
9. Write down the definition of a linearly separable and a non-linear separable training set.
10. Write down the nonlinear constrained optimization problem corresponding to support vector machine training for maximum margin classification in the linearly separable case.
11. Write down the nonlinear constrained optimization problem corresponding to support vector machine training for soft margin classification in the not necessarily linearly separable training case.
12. What do the slack variables in soft margin support vector machine training quantify?
13. What does the C parameter in soft margin support vector machine training quantify?

Exercises (Theory)

1. Rewrite support vector machine training for maximum margin classification in its dual Lagrangian form.
2. Rewrite support vector machine training for soft margin classification in its dual Lagrangian form.

Exercises (Programming)

1. Create a training data set by sampling from two Gaussian distributions.
2. Train a maximum margin support vector machine using the training data set and cvxopt.solvers.qp.
3. Test the generalization accuracy of the trained support vector machine.