

Optimization and Learning with Kernel Methods

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Kernel methods is a new generation of learning algorithms that use techniques from optimization, statistics and functional analysis. These algorithms are different from earlier techniques used in machine learning such as Artificial Neural Networks (ANNs) since their training can be cast as a convex optimization problem. Support vector machines (SVMs), a class of kernel methods, will be discussed and several optimization formulations related to SVM problems both for classification and regression will be investigated. First we deal with precise data and then expand in problems where the data have uncertainties described by hyperspheres or hyperrectangles. Our formulations are based on semi-definite programming and second order cone programming models. Applications related to classification of gene-expression and weather data will be discussed.