Support Vector Machine with Pinball-loss and its Algorithms

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To pursue the insensitivity to noise and the stability to re-sampling, a new type of support vector machine (SVM) has been established via replacing the hinge loss in the classical SVM by the pinball loss and was hence called a pin-SVM. The classical SVM is to maximize the distance between two sets, while pin-SVM is related to quantile distance, which follows that the performance for noise can be improved. We also discuss the solving algorithms for pin-SVM. Specifically, the dual problem of pin-SVM is a quadratic programming problem with box constraints, for which the sequential minimal optimization technique is applicable. Meanwhile, the optimal solution with the respect to tau, which reflects the quantile value, is a piecewise linear path. Motivated by the piecewise linearity, a traversal algorithm is established as well. With the help of this algorithm, a suitable tau could be found. Good statistical properties of pin-SVM and the effective algorithms together make pin-SVM a promising tool in pattern recognition.