Session 1: Optimization Methods
11:40 – 12:00, 14th, July

Coordinate Descent Algorithm for Ramp Loss Linear Programming Support Vector Machines

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In order to control the effects of outliers in training data and get sparse results, Huang et al. proposed the ramp loss linear programming support vector machine (ramp-LPSVM). This combination of l1 regularization and ramp loss not only limits the effects of outliers with a maximal penalty, but also leads to the sparsity of parameters in decision functions. However, due to its non-convexity, the computational cost to achieve a satisfying solution is often expensive. In this presentation, by exploiting the theoretical properties of ramp-LPSVM, we propose a modified coordinate descent algorithm (CDA). CDA is an efficient algorithm for multi-variable optimization problems, which optimizes one single entry of the independent variable each time. In this way, a multi- variable problem is reduced to a series of one-variable subproblems. Besides, such subproblems of ramp-LPSVM also enjoy piecewise linearity. Considering the special form of ramp loss functions, we propose an efficient algorithm to deal with its non-convexity and make it applicable to large-scale ramp-LPSVM problems. In addition to the theoretical analysis on convergence of the modified coordinate descent algorithm, numerical experiments have also been carried out on benchmark data sets. The results confirm its outstanding performances in classification accuracy, computational efficiency and capability of dealing with large-scale problems.