

Statistical Machine Learning Seminar

Hosted by Department of Mathematical Sciences

- Date: Tuesday, March 1, 2016
- Time: 12:00-1:00
- Room: WH-100E
- Speaker: Wenbo Wang (Mathematical Sciences)
- Title: RE: Multicategory Angle-based Large-margin Classification and Reinforced SVM

Abstract

Large-margin classifiers are popular methods for classification. Among existing simultaneous multicategory large-margin classifiers, a common approach is to learn k different functions for a k -class problem with a sum-to-zero constraint. Such a formulation can be inefficient. We propose a new multicategory angle-based large-margin classification framework. The proposed angle-based classifiers consider a simplex-based prediction rule without the sum-to-zero constraint, and enjoy more efficient computation. Many binary large-margin classifiers can be naturally generalized for multicategory problems through the angle-based framework. Theoretical and numerical studies demonstrate the usefulness of the angle-based methods.

The Support Vector Machine (SVM) is a very popular classification tool with many successful applications. It was originally designed for binary problems with desirable theoretical properties. Although there exist various Multicategory SVM (MSVM) extensions in the literature, some challenges remain. In particular, most existing MSVMs make use of k classification functions for a k -class problem, and the corresponding optimization problems are typically handled by existing quadratic programming solvers. In this paper, we propose a new group of MSVMs, namely the Reinforced Angle-based MSVMs (RAMSVMs), using an angle-based prediction rule with $k - 1$ functions directly. We prove that RAMSVMs can enjoy Fisher consistency. Moreover, we show that the RAMSVM can be implemented using the very efficient coordinate descent algorithm on its dual problem. Numerical experiments demonstrate that our method is highly competitive in terms of computational speed, as well as classification prediction performance. Supplemental materials for the article are available online.

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