Distributionally Robust Chance Constrained Kennel-based Support Vector Machine

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Abstract

In this presentation, we report using kernel-based SVM for nonlinear binary classification with uncertainty involved in the input data specified by the first- and second-order moments. To achieve a robust classifier with small probabilities of misclassification, we investigate a distributionally robust chance-constrained kernel-based SVM model. Since the moment information in the original problem may become unavailable in the feature space via kernel transformation, we develop a data-driven approach utilizing empirical moments to provide a second-order cone programming (SOCP) reformulation for efficient computation. To speed up the required computations for solving large-size problems in higher dimensional space and/or with more sampling points involved in estimating empirical moments, we further design an alternating direction multipliers-based algorithm for fast computations. Extensive computational results support the effectiveness and efficiency of the proposed model and solution method. Results on public benchmark datasets without any moment information indicate that the proposed approach still works and, surprisingly, outperforms some commonly used state-of-the-art kernel-based SVM models.

About the Speaker

Shu-Cherng Fang holds the Walter Clark Chair and University Alumni Distinguished Graduate Professorship at North Carolina State University. He is also Honorary University Chair Professor at Tsinghua University in Beijing, Fudan University in Shanghai, Northeastern University in Shenyang, Shanghai University in Shanghai, National Chiao Tung University in Hsinchu and National Tsing Hua University in Taiwan. Before joining NC State, Professor Fang was Distinguished Member of Technical Staff and Supervisor at AT&T Bell Labs, and Department Manager at the Corporate Headquarters of AT&T Technologies.

Professor Fang has published over two hundred fifty refereed journal articles. He authored the books of Linear Optimization and Extensions: Theory and Algorithms (Prentice Hall 1993, with S. C. Puthenpura), Entropy Optimization and Mathematical Programming (Kluwer Academic 1997, with J.R. Rajasekera and H.-S. Tsao), Linear Conic Programming: Theory and Applications (Science Press 2013, with Wenxun Xing), and Introduction to Linear Conic Optimization (Tsinghua Press 2020, with Wenxun Xing). He is currently serving on the editorial boards of twenty some scientific journals in the general area of Operations Research and Industrial Engineering. He is also the Founding Editor-in-Chief of Fuzzy Optimization and Decision Making.

Professor Fang has graduated quite a few PhD students at NC State. He has won many awards and has been listed in several major biographic references. Professor Fang's research interests include Linear and Nonlinear Programming, Fuzzy Optimization and Decision Making, Soft Computing and Machine Learning, Logistics and Supply Chain Management.

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