上海交通大学自动化系
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系统控制与信息处理教育部重点实验室
Key Laboratory of System Control and Information Processing, Ministry of Education

学术报告会

时　间：5月17日（周五）11:00-12:00

地　点：电院群楼2-406会议室

Multimarginal optimal transport for ensemble estimation and sensor fusion

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Abstract:

The optimal mass transport problem is a classical problem in mathematics, and dates back to 1781 and work by G. Monge where he formulated an optimization problem for minimizing the cost of transporting soil for construction of forts and roads. Historically the optimal mass transport problem has been widely used in economics in, e.g., planning and logistics, and was at the heart of the 1975 Nobel Memorial Prize in Economic Sciences. In the last two decades there has been a rapid development of theory and methods for optimal mass transport and the ideas have attracted considerable attention in several economic and engineering fields. These developments have lead to a mature framework for optimal mass transport with computationally efficient algorithms that can be used to address problems in the areas of systems, control, and estimation.

The first part of the talk we review the area and consider examples where the optimal mass transport is used as a distance measure for image classification, robust system identification, and CT imaging. In the second part of the talk we consider large optimization problems where the optimal mass transport cost is used for state estimation and information fusion. More specifically, we consider multi-marginal problems where only partial information of each marginal is available, which is a setup common in many inverse problems in, e.g., imaging and spectral estimation. By considering an entropy-regularized approximation of the original transport problem, we propose an algorithm corresponding to a block-coordinate ascent of the dual problem, where Newton's algorithm is used to solve the sub-problems. In order to make this computationally tractable also in a large-scale settings, we utilize tensor structures in the problem. As illustrating examples, we apply the resulting method to tracking and barycenter problems in spatial spectral estimation. In particular, we show that the optimal mass transport framework allows for fusing information from different time steps, as well as from different sensor arrays. Furthermore, we show that by incorporating knowledge of underlying dynamics in tracking scenarios, one may arrive at accurate spectral estimates, as well as accurate reconstructions of spectra corresponding to unobserved time points.

Biography:

Johan Karlsson received an M.Sc. degree in Engineering Physics from KTH Royal Institute of Technology in 2003 and a Ph.D. in Optimization and Systems Theory from KTH in 2008. From 2009 to 2011, he was with Sirius International, Stockholm; and from 2011 to 2013 he was working as a postdoctoral associate at the Department of Computer and Electrical Engineering, University of Florida. From 2013 he joined the Department of Mathematics, KTH, as assistant professor and since 2017 he is working there as an associate professor. He has been the main organizer of several workshops, in particular for establishing collaborations between the academia and the industry. His current research interests include inverse problems and methods for large-scale optimization for applications in remote sensing, signal processing, and control theory.