Decentralized control of a stochastic multi-agent service system with Privacy-Preserving Data Analysis*

J. George Shanthikumar

Krannert School of Management

Purdue University

June 1, 2015

Abstract

Consider a stochastic decentralized multi-agent service system consisting of a pricing and a service agent, where the pricing agent dynamically controls the customer arrival rate and the service agent controls the rate at which customers are processed. With the aid of transfer/revenue sharing contracts, we show that this integrated problem can be decoupled into a dynamic pricing problem for the pricing agents and a service rate control problem for the service agent, and contracts can be specified such that decentralized agent level optimization delivers centrally optimal policies. This property is shown to be robust to misspecification by each of the agents of the impact of other agent on the system and does not require any of the agents to reveal private information (demand models, etc.). An iterative algorithm for computing centralized contracts will also be presented and shown to converge to the optimal contract. A key feature of this algorithm is that its implementation does not require agents to reveal private information. Time permitting, extensions to other stochastic dynamic resource allocation problems, such as dynamic routing in multi-server system, optimal coordination of decentralized agents in supply chains and coordination of airline alliances, will also be discussed.

* This talk is based on joint work with Huaning Cai (Canadian Pension Plan Investment Board, Toronto), Annabelle Feng (Krannert School of Management, Purdue University), Peng Li (Credit Suisse, New York), and Andrew Lim (NUS, Singapore; UC, Berkeley).