Multi-Agent Queueing Network: Coordination with Learning

Abstract: We study decentralized control of a Jackson network consisting of a pricing agent who controls the exogenous arrival process, and service agents who control the service rate at each station. The system operates under the collection of decentralized control policies determined within informational silos. The control policy of each agent is obtained by optimizing a stochastic model of her own operations that accurately captures her impact on the system but may misspecify the impact of other agents. We show that agents can be coordinated with a transfer price mechanism to achieve optimal centralized efficiency, even when local models are misspecified, and propose a multi-agent reinforcement learning (MARL) algorithm for computing the optimal transfers in a fully decentralized fashion. Our RL algorithm is shown to converge to the optimal transfer mechanism and the sample complexity for computing the ϵ-optimal transfer is given.