EPSTEIN INSTITUTE SEMINAR ISE 651

FINDING OPTIMAL POLICIES FOR LARGE POPULATIONS: AN APPLICATION TO EPIDEMIC CONTROL

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ABSTRACT

The COVID-19 pandemic showed us that regulators need to find optimal mitigating policies for a large population of interacting agents who optimize their own objectives in a game theoretical framework instead of following these policies perfectly. However, it is well known that finding an equilibrium in a game with a large number of agents is a challenging problem because of the increasing number of interactions among the agents, and adding a principal to the game escalates the challenges further. In this talk, in order to approximate the game between the principal and the large number of agents, we consider a Stackelberg mean field game model, motivated by the modeling of the epidemic control in large populations. The agents play a non-cooperative game in which they can control their transition rates between states to minimize an individual cost. The principal can influence the resulting Nash equilibrium through incentives to optimize her own objective. Later, we propose an application to an epidemic model of SIR type in which the agents control their interaction rate, and the principal is a regulator acting with non-pharmaceutical interventions. To compute the solutions, we propose an innovative numerical approach based on Monte Carlo simulations and machine learning tools for stochastic optimization. Finally, we briefly discuss another game formulation for a continuum of non-identical players evolving on a finite state space where their interactions are represented by a graphon. (Joint work w/ A. Aurell, R. Carmona, M. Lauriere.)

SPEAKER BIO

Gökçe Dayanıklı is an Assistant Professor at the University of Illinois Urbana-Champaign, Department of Statistics. Before joining UIUC, she was a term assistant professor of Statistics at Columbia University. She completed her Ph.D. in Operations Research & Financial Engineering at Princeton University where she was awarded the School of Engineering and Applied Sciences Award for Excellence. During Fall 2021, she was a visiting graduate researcher at the Institute for Mathematical and Statistical Innovation (IMSI) to participate in the "Distributed Solutions to Complex Societal Problems" program. Her research interests are theory and applications of Mean Field Games & Control, Stackelberg Games, and Graphon Games and numerical approaches to these problems.

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