Thesis: Mechanism Design and Modeling to Analyze Complex Social Systems for Public Policy

Abstract: The rapid progress in Artificial Intelligence research in the last few decades has given us new tools to simulate complex systems instead of traditional analytical tools which might be reductive and too simplistic. They provide opportunities to model large systems with multiple agents and rules and minimal assumptions. In a world where AI is increasingly proliferating almost every sphere of our lives, there are important consequences for decision-makers on designing systems that are efficient, well-defined, and fair. My main goal will be to examine some of the ways AI can be used to simulate complex social systems. In addition, I will analyze some of the key principles like fairness, efficiency, cooperation, and privacy that may potentially influence mechanism design.

I will illustrate how these principles may be integrated into the design of complex systems by proposing three versatile models that can be applied to a variety of real-life scenarios. First, I will consider an agent-based model that can be used to model complex systems involving the bilateral exchange of resources between agents. Next, I will discuss a GAN-based mechanism that can be used for sequential imputation tasks. I will discuss how this can be useful in designing privacy-preserving recommender systems. Finally, I will examine a mathematical model that can be used to evaluate the efficacy of mobile health applications

Committee:

- Professor Liang Zhao, mentor, Lehman College
- Professor Victor Pan, Lehman College
- Professor Feng Gu, College of Staten Island

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- Professor Delaram Kahrobaei, University of York