



FACULTY MENTOR

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PROJECT TITLE

Data-driven Agent-based Simulation of Multilayer Networks

PROJECT DESCRIPTION

Agent-based simulations (ABS) are a powerful tool to analyze how individual decisions and interactions between autonomous agents in networked systems will lead to the emergence of different system outcomes. For instance, ABS has been used to study the spread of infectious diseases or the spread of (mis)information in social networks. However, existing ABS has some drawbacks: (1) most of the existing tools are theoretically-backed but not data-driven, and (2) they excel at simulating interactions on one network but don't provide the option of simulating multilayer network interactions (i.e., scenarios in which networks of networks interact), and (3) do not incorporate complex models of human behavior (e.g., game-theoretical models).

This project seeks to advance existing software packages to introduce these capabilities. It will start with a literature review to familiarize students with the concepts of ABS, multilayer networks, and game theory, as well as with existing ABS software packages (e.g., in Python) and programs (e.g., netlogo). Each student will then work on introducing one of extensions (1) or (2) or (3) in these existing tools. Time permitting, these will be combined to run numerical experiments (built on and validated with real-world datasets) studying the spread of a disease and/or the spread of (mis)information over multiple interconnected networks.

This project can accommodate both remote and in-person students.

INTERNS NEEDED

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PREREQUISITES

- Programming (preferably in Python).
- A background in mathematical optimization is required for the student interested in the sub-project on incorporating game-theoretical models in ABS; preferred but not required for other subprojects.