Electrical & Computer ENGINEERING

ENERGY AND INFORMATION SEMINAR

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Monday, Oct. 27

Hamerschlag Hall Room 1107 at 12:30 p.m.

June Zhang

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Who are the More Vulnerable Agents in a Network?

June Zhang received her B.S. with Highest Honor in Electrical and Computer Engineering from the Georgia Institute of Technology and a M.S. in Electrical and Computer Engineering from Stanford University. She is currently a Ph.D. student in Electrical and Computer Engineering at Carnegie Mellon University.

She was a recipient of the Georgia Hope Scholarship and the National Science Foundation Graduate Research Fellowship. Her research interests are stochastic processes, network science, human computer interaction, and design methodology. She is currently very fond of koalas.

Who are the More Vulnerable Agents in a Network?

Epidemics over networks is frequently used as a model to understand how information/virus/rumors/ opinions/failures spread in networks. This type of process is challenging to study because the behavior of the system is dependent on both the topology of the network and on the dynamics of the process. We developed the scaled SIS (susceptible-infected-susceptible) process, an epidemics process over arbitrary network topology, which accounts for both spontaneous and neighbor-to-neighbor infection as well as healing. The scaled SIS process is modeled as a continuous-time Markov process for which we are able to derive its closed-form equilibrium distribution for any arbitrary network topology. The adjacency matrix that describes the underlying network is explicitly reflected in this distribution.

We use the equilibrium distribution to formulate the Most-Probable Configuration Problem, which solves for the network configuration (i.e., states of all the agents) with the maximum equilibrium probability. The agents who are infected in the most-probable configuration are therefore, more vulnerable to the epidemics than the agents who remain healthy. Even though this is a combinatorial optimization problem, we can exactly solve this problem in polynomial time for a range of infection/healing parameters. Lastly, we will show the connection between subgraphs in the network and the identity of these more vulnerable agents.

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