Finding the Graph of Cascades and Games

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Epidemic cascades, and games, are two different but popular models for social network phenomena. A growing body of work has focused on inferring how these processes evolve, as a function of the graph structure of the network. This talk considers the inverse problem: if we do not know the graph of the network, can we infer it by observing the states/actions of the users?

We present three results. First we show that if we have access to the exact time evolution of each node, then the global max-likelihood graph learning problem decouples into n local problems - one for each node - for a general class of causal network processes than includes both epidemics and games. We then present two results characterizing the sample complexity (ie number of observations) required to learn the graph- one for when user states correspond to an epidemic, and one for when user states follow best-response game dynamics. In both cases, we show that if each user's state/action is directly affected by that of only a few others, it is possible to learn the graph with sample complexity that is logarithmic in network size.

The talk draws from several disciplines, but will be self-contained.