Dissertation Defense

Centrality measures and contagion on temporal networks

Isabel Chen
Emory University

Abstract: The objective of this dissertation is to study the relationship between network-based centrality measures and epidemic outcome. Determining the key players in contagion processes can inform disease-prevention strategies. We analyze a time-stamped, person-to-person contact network based on human mobility movements within a busy, urban hospital. Movement patterns identified a small number of locations as hubs of activity. Linear algebraic techniques were used to compute a recently proposed temporal centrality measure applied to the empirical network; comparisons with traditional centrality measures were performed to determine if the inclusion of temporal information provides additional insights. Linear regression techniques were employed to describe the relationships between the quantities of interest. We find that while temporal centrality can at times identify key players not captured by traditional measures, it does not necessarily outperform non-temporal measures with respect to predicting epidemic outcome. Strategic removal of connections between highly central nodes resulted in an exponential decrease in the structural connectivity of the network, but this did not translate to a reduction in epidemic outcome. We conclude that contagion on temporal networks is extremely robust to changes in the network, and while network-based centrality can help to identify key players in an epidemic process, more work needs to be done to build an epidemic-containment strategy based on the information afforded by network-based analyses.

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Advisor: Michele Benzi

Mathematics and Computer Science
Emory University