Benchmarking Measures of Network Influence

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Abstract

Identifying key agents for the transmission of diseases (ideas, technology, etc.) across social networks has predominantly relied on measures of centrality on a static base network or a temporally flattened graph of agent interactions. Various measures have been proposed as the best trackers of influence, such as degree centrality, betweenness, and k-shell, depending on the structure of the connectivity. We consider SIR and SIS propagation dynamics on a temporally-extruded network of observed interactions and measure the conditional marginal spread as the change in the magnitude of the infection given the removal of each agent at each time: its temporal knockout (TKO) score. We argue that the exhaustive approach of the TKO score makes it an effective benchmark measure for evaluating the accuracy of other, often more practical, measures of influence. We find that none of the common network measures applied to the induced flat graphs are accurate predictors of network propagation influence on the systems studied; however, temporal networks and the TKO measure provide the requisite targets for the hunt for effective predictive measures.

keywords: networks, temporal webs, centrality, influence, immunization

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