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Research Plan / Abstract

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The methodology for analyzing an epidemic on static networks is highly developed, but the complementary methods as applied to temporal or time-variant networks are still emerging. In a temporal network, such as a network of physical contacts between people in a city, it is challenging to know what information to keep from the network in order to accurately capture the dynamics relevant to a contact-based spreading process. Is there a finite period of time in which dynamics of the full spreading process of a disease can be captured?

We will explore this question by using two existing frameworks for epidemic modeling on contact networks to find when the static network approach to derive the epidemic threshold of the underlying network agrees with that of its temporal counterpart.

In the static approach of Newman [1], given a time period T (say T is six days), the epidemic threshold is derived by looking at all possible windows of six days within in the entire data collection window, where the contact network is treated as a fixed entity. In the temporal approach of Valdano et al. [2], the data collection window is partitioned into periods of length T, which are analyzed collectively to yield a single derivation of the epidemic threshold. When the thresholds agree will show the appropriate timescale on which to observe an epidemic on the underlying network; in other words, it tells us the optimal data collection window. We also expect that the structure of the network, such as its clustering, will play a role in the timescale as well.

Finding a characteristic timescale for a spreading process on a network allows for the possibility of accurately deriving the epidemic threshold from the static network, as opposed to the full underlying temporal version, minimizing the expense of computation and simplifying the amount of data and detail incorporated into the model.

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[1] M. E. J. Newman, Physical Review E **66**, 016128 (2002).
[2] E. Valdano, L. Ferreri, C. Poletto, and V. Colizza, Physical Review X **5**, 021005 (2015).