

Random thoughts on random walks: Networks, centrality measures, and tracking the spread of disease

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Abstract:

Mathematical models of large-scale disease dynamics play an important role in public health decision-making. Network models are useful for understanding how the structure of social contacts influences the spread of disease, and which subpopulations are most relevant for tracking key surveillance objectives. For example, which segment of the population provides the earliest warning for the onset of a flu epidemic? In this tutorial-style talk, we review some basic notions of centrality in networks and discuss their applicability to disease surveillance. Since nodes of high centrality are typically unknown in real-world scenarios, we discuss methods for finding--or rather, sampling--them using random walks on the social graph. In doing so, we naturally touch upon fundamental ideas from probability (Markov chains), linear algebra (eigenvectors), and information theory (entropy).