

IMPORTANCE OF SINGLE NODES IN DYNAMICS ON NETWORKS

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Introduction. Identifying key players in collective dynamics remains a challenge in several research fields, from the efficient dissemination of ideas to drug target discovery in biomedical problems. The difficulty lies at several levels: how to single out the role of individual elements in such intermingled systems, or which is the best way to quantify their importance. Centrality measures describe a node's importance by its position in a network. The key issue obviated is that the contribution of a node to the collective behavior is not uniquely determined by the structure of the system but it is a result of the interplay between dynamics and network structure.

Materials and methods. We linearize dynamics, considering spreading by SIS, SIR and the Ising model as well as the voter model. The linearization reveals the matrix M underlying the dynamical process, e.g. the graph Laplacian for the voter model being of diffusive type. Dynamical influence is taken as the principal eigenvector of M .

Results and discussion. We show that dynamical influence measures explicitly how strongly a node's dynamical state affects collective behavior. For critical spreading, dynamical influence targets nodes according to their spreading capabilities. For diffusive processes it quantifies how efficiently real systems may be controlled by manipulating a single node.

References.

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2. K. Klemm, *Searchability of central nodes in networks*, J. Stat. Phys. 151, 707 (2013).