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Extracting connectivity of networks from dynamics of nodes EMILY S.C. CHING, Department of Physics, The Chinese University of Hong Kong, P.-Y. LAI, Department of Physics, Graduate Institute of Biophysics, and Center for Complex Systems, National Central University, C.Y. LEUNG, Department of Physics, The Chinese University of Hong Kong — The knowledge of how the different nodes of a network interact or connect with one another is crucial for the understanding of the collective behavior and the functionality of a network. We have recently developed a method that extracts network connectivity using only measurements of the dynamics of the nodes for bidirectional networks with uniform coupling strength. Our method is built upon a noise-induced relation between the Laplacian matrix L_{ij} of the network and the pseudoinverse of the dynamical covariance matrix C_{ij}^+ : $L_{ij} = \sigma^2/(2g)C_{ij}^+$, where σ is the noise amplitude and g the coupling strength. This relation is exact for consensus dynamics. The extraction of connectivity is based on the separation of $r_{ij} \equiv C_{ij}^+/C_{ii}^+$, for each node *i*, into two groups depending on whether node j is connected to node i or not. Such a separation is guaranteed by the above relation, and has been found to exist even in networks with nonlinear dynamics. Using examples of different networks and dynamics, we have demonstrated that our method can give accurate local connectivity information as well as global network properties of the degree distribution and eigenvalue spectrum of the adjacency matrix for a wide range of σ and g.

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