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Hypergraph assortativity: A dynamical systems perspective

The largest eigenvalue of the matrix describing a network's contact structure is often important in predicting the behavior of dynamical processes. We extend this notion to hypergraphs and motivate the importance of an analogous eigenvalue, the *expansion eigenvalue*, for hypergraph dynamical processes. Using a mean-field approach, we derive an approximation to the expansion eigenvalue and its associated eigenvector in terms of the degree sequence for uncorrelated hypergraphs. We introduce a generative model for hypergraphs that includes degree assortativity, and use a perturbation approach to derive an approximation to the expansion eigenvalue and its corresponding eigenvector for assortative hypergraphs. We validate our results with both synthetic and empirical datasets. We define the *dynamical assortativity*, a dynamically sensible definition of assortativity for uniform hypergraphs, and describe how reducing the dynamical assortativity of hypergraphs through preferential rewiring can extinguish epidemics.