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Feng Bill Shi* (bill110@email.unc.edu). *Community Structures in Hypergraph Networks*. Preliminary report.

Networks have become a standard tool in representing and analyzing systems consisting of complex interactions. An important advancement in network methods is the ability to detect large-scale structures-communities-that often correspond to functional or organizational modules of the systems. Consequently, applications in diverse domains have facilitated the growth of network science; substantial progress has been made for temporal or multiplex networks.

However, most of the work is on pairwise interactions, and relatively little progress is made on structures due to higher-order interactions. While pairwise interactions are the fundamental structural units and their patterns reveal important information about the networks, considering higher-order interactions adds not only marginal knowledge but also potentially new insights [Benson et al.,*Science* 353,163]. E.g., higher-order interactions between species are found to be a possible mechanism to maintain a stable coexistence of diverse competitors in nature [Grilli et al.,*Nature* 548,210].

We develop a formal treatment for higher-order interactions using hypergraphs, and extend the stochastic block model via tensor decompositions. We apply the method to a set of real networks and compare the results with pairwise networks. (Received September 25, 2017)