Message-Passing on Hypergraphs: Detectability, Phase Transitions and Higher-Order Information

Community detection is a long-standing problem in the study of complex systems. While the detectability limits of communities in networks are well understood, much less is known for hypergraphs. In this talk, I will present: (i) a message-passing algorithm that performs Bayesian inference to recover communities in hypergraphs, (ii) closed-form detectability limits for a class of hypergraphs based on the stochastic block model, and (iii) information-theoretic quantities that unify these results and formalize the common intuition that hypergraphs are "more informative" than networks. The methods discussed work successfully on real-world data and scale efficiently to very large hypergraphs, even when hyperedge sizes extend well beyond the typical truncation limits of three or four nodes per hyperedge.

Paper: https://iopscience.iop.org/article/10.1088/1742-5468/ad343b
Open-source code: https://github.com/nickruggeri/hypergraph-message-passing