Subcounts on random multiplex networks

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Abstract

One of the earliest topics studied in the evolution of random graphs was subgraph counts, namely identifying the threshold for the existence of a copy of a fixed graph (H). Multiplex networks extend the notion of Erdös–Rényi random graphs to multigraphs in which the same set of nodes interacts through different types of connections or edges. Each type of connection is referred to as a layer, and edges may be correlated across layers.

In this talk, we study the existence of copies of submultiplexes in a two-layer Erdös–Rényi model. For any fixed submultiplex (H), we identify the exact threshold for its appearance and show that the corresponding parameter regime forms a polyhedral region in (R^3). Within this region, the number of copies of (H) satisfies a central limit theorem with quantitative error bounds, while on the boundary the distribution transitions to Poisson-type limits.

These results extend the classical idea of comparing edge densities across all submultiplexes of (H) by incorporating the effect of correlations between the two layers of the model.

This is joint work with Bhaswar B. Bhattacharya, Sanchayan Bhowal, Karambir Das and Shaibal Karmakar.

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