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IPS Paper

Hypergraph Model with Preferential Attachment for Scientific Collaborations

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Brief Description

A hypergraph is useful to express the relationship between two or more nodes.

Real hypergraph data are typically weighted.

We propose a weighted evolving hypergraph model that considers preferential attachment.

The model allows variability on the two basic components of the evolving hypergraph: the number and the size of the hyperedges to be connected.

Under the mild distributional conditions on the two varying quantities, we derive the exact degree distribution that asymptotically follows a power-law distribution.

We find that the limiting power-law exponent is affected by the distribution of hyperedge sizes.

The distribution of the number of hyperedges to be connected has a considerable impact on a small-degree range in which non-power-law behavior is frequently observed in real data.

Moreover, we argue that the degree distribution of the model can be expressed as a mixture of the degree distributions with a fixed number of hyperedges to be connected.

The validity and usefulness of the model are explained with interpretations via a simulation study and real data analysis.

Abstract

A hypergraph is useful to express the relationship between two or more nodes. Real hypergraph data are typically weighted. We propose a weighted evolving hypergraph model that considers preferential attachment. The model allows variability on the two basic components of the evolving hypergraph: the number and the size of the hyperedges to be connected. Under the mild distributional conditions on the two varying quantities, we derive the exact degree distribution that asymptotically follows a power-law distribution. We find that the limiting power-law exponent is affected by the distribution of hyperedge sizes. The distribution of the number of hyperedges to be connected has a considerable impact on a small-degree range in which non-power-law behavior is frequently observed in real data. Moreover, we argue that the degree distribution of the model can be expressed as a mixture of the degree distributions with a fixed number of hyperedges to be connected. The validity and usefulness of the model are explained with interpretations via simulation study and real data analysis.