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Affiliation Networks

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Abstract

In the last decade, structural properties of several naturally arising networks (the Internet, social networks, the web graph, etc.) have been studied intensively with a view to understanding their evolution. In recent empirical work, Leskovec, Kleinberg, and Faloutsos identify two new and surprising properties of the evolution of many real-world networks: densification (the ratio of edges to vertices grows over time), and shrinking diameter (the diameter reduces over time to a constant). These properties run counter to conventional wisdom, and are certainly inconsistent with graph models prior to their work.

In this paper, we present the first model that provides a simple, realistic, and mathematically tractable generative model that intrinsically explains all the well-known properties of the social networks, as well as densification and shrinking diameter. Our model is based on ideas studied empirically in the social sciences, primarily on the groundbreaking work of Breiger (1973) on bipartite models of social networks that capture the affiliation of agents to societies.

We also present algorithms that harness the structural consequences of our model.

Research

Specifically, we show how to overcome the bottleneck of densification in computing shortest paths between vertices by producing sparse subgraphs that preserve or approximate shortest distances to all or a distinguished subset of vertices. This is a rare example of an algorithmic benefit derived from a realistic graph model.

Finally, our work also presents a modular approach to connecting random graph paradigms (preferential attachment, edge-copying, etc.) to structural consequences (heavy-tailed degree distributions, shrinking diameter, etc.)

Research Areas

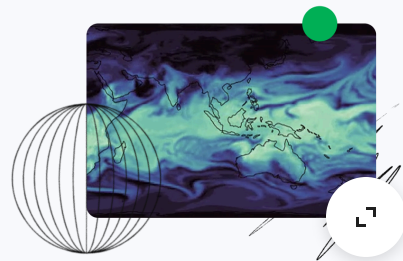
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