structural properties that cannot be observed either in Erdős-Rényi random graphs or in planar random graphs.

12.09.2017 17:30 Martin Zeiner HS 424

On Linear-Time Data Dissemination in Dynamic Rooted Trees

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We study the following data dissemination problem: In a set of n nodes, every node has a unique piece of information. The communication of the nodes is organized in discrete synchronous lock-step rounds. In each round every node sends all currently known pieces of information to all other nodes. Which nodes receive this message is determined by the actual communication graph, which may change from round to round.

These network models are interesting as they capture the communication behavior of wireless communication, process crash/recovery and process mobility far better then standard static communication models. In such distributed systems data dissemination is a pivotal task in many applications.

Recently, Charron-Bost, Függer, and Nowak proved an upper bound of $\mathcal{O}(n \log n)$ rounds for the case where every communication graph is an arbitratry rooted tree. We present a new formalism, which facilitates a concise proof of this result. Moreover, we establish linear-time data dissemination bounds for certain subclasses of rooted trees. In particular, we prove that only $(n-1)$ rounds are needed if the underlying graph is a directed path.

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Homological connectedness of random hypergraphs

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Linial and Meshulam introduced a model of random simplicial 2-complexes as follows. Start with n 0-simplices (or vertices) and let each pair of vertices form a 1-simplex (or edge). Finally, each triple of vertices forms a 2-simplex (or face) with probability p independently. Such a complex is called $\mathbb{F}_2$-*homological 1-connected* (or *hom-connected* for short) if its first homology group with coefficients in $\mathbb{F}_2$ is trivial. They showed that this model undergoes a phase transition with respect to hom-connectedness at around $p = \frac{2\log n}{n}$, and that the critical obstruction to hom-connectedness is the presence of an edge which is not contained in any face.

We take a different approach by defining our random simplicial 2-complex "top down" rather than "bottom up": in our model, each pair of vertices forms an edge only if it is part of a face. Thus the complex is generated by a random 3-uniform hypergraph by taking the down-closure. The critical obstruction to hom-connectedness in the previous model no longer exists in our model by definition. We show that in this model, the phase transition for hom-connectedness occurs at around $p = \frac{\log n + \frac{1}{2}\log\log n}{n}$ and give a characterisation of the new critical obstruction. The arguments are complicated by the fact that in this setting, hom-connectedness is not a monotone property.