

Workshop on Clustering and Search techniques in large scale networks

On network clustering by modularity maximization with cohesion conditions

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Finding communities, or clusters, is a topic of much current research in network science. Defining a good clustering criterion is difficult. On the one hand, quality functions to be optimized have been proposed, the most studied of which is modularity. On the other hand, properties to be satisfied by each community of a partition have been suggested. It has recently been observed that one of the best known such properties, i.e., the weak condition proposed by Radicchi et al. (Proc. Natl. Acad. Sci. USA, 2004) was not satisfied by one or more communities in a partition which maximizes some of the best known criteria. We consider five community-defining conditions, that we call cohesion conditions (strong, semi-strong, almost-strong, weak and extra-weak conditions). We add these conditions, one at a time, as constraints to a modularity maximization problem, thus obtaining new mathematical optimization models, that we solve by exact methods. We thus study the impact of cohesion conditions on modularity maximization, attempting to move a step ahead towards the identification of a sound criterion to detect informative partitions.

(joint work with A. Costa, P.Hansen)