

Title: Testing Graph Clusterability: Algorithms and Lower Bounds

Speaker: Ashish Chiplunkar, EPFL Laussane

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Venue: RM 101

Abstract: In this talk, I will introduce the problem of testing graph cluster structure where, given access to a graph $G=(V,E)$, the goal is to quickly determine whether the graph can be partitioned into a few clusters with good inner conductance, or is far from any such graph. This is a generalization of the well-studied problem of testing graph expansion, where one wants to distinguish between the graph having good expansion (i.e. being a good single cluster) and the graph having a sparse cut (i.e. being a union of at least two clusters). A recent work of Czumaj, Peng, and Sohler (STOC'15) gave an ingenious sublinear time algorithm for testing k -clusterability in time $\tilde{O}(n^{1/2} \text{poly}(k))$. Their algorithm implicitly embeds a random sample of vertices of the graph into Euclidean space, and then clusters the samples based on estimates of Euclidean distances between the points. This algorithm works only if the cluster structure is very strong: it is necessary to assume that the gap between conductances of accepted and rejected graphs is at least logarithmic in the size of the graph G . I will discuss how one can leverage more refined geometric information, namely angles as opposed to distances, to obtain a sublinear time tester that works even when the gap is constant. Our tester is based on the singular value decomposition of a natural matrix derived from random walk transition probabilities from a small sample of seed nodes. I will also give an overview of a matching lower bound on the query complexity of testing clusterability based on a novel property testing problem, which we analyze using Fourier analytic tools.

This is joint work with Michael Kapralov, Sanjeev Khanna, Aida Mousavifar, and Yuval Peres.

Bio: Ashish Chiplunkar completed his Ph.D. in CSE from IIT Bombay. Subsequently, he was a Post-doctoral scholar at Tel-Aviv University, and is currently a Post-Doctoral scholar at EPFL, Laussane.