Carnegie Mellon University
School of Computer Science

THEORY SEMINAR

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Friday, February 9, 2018
2:00-3:00pm
Newell-Simon Hall 3305

An almost-linear time algorithm for uniform random spanning tree generation

Abstract: We give an $m^{1+o(1)}\beta^{o(1)}$-time algorithm for generating uniformly random spanning trees in weighted graphs with max-to-min weight ratio β. In the process, we illustrate how fundamental tradeoffs in graph partitioning can be overcome by eliminating vertices from a graph using Schur complements of the associated Laplacian matrix.

Our starting point is the Aldous-Broder algorithm, which samples a random spanning tree using a random walk. As in prior work, we use fast Laplacian linear system solvers to shortcut the random walk from a vertex v to the boundary of a set of vertices assigned to v called a "shortcutter." We depart from prior work by introducing a new way of employing Laplacian solvers to shortcut the walk. To bound the amount of shortcutting work, we show that most random walk steps occur far away from an unvisited vertex. We apply this observation by charging uses of a shortcutter S to random walk steps in the Schur complement obtained by eliminating all vertices in S that are not assigned to it.

Bio: Aaron Schild is a EECS PhD student at UC Berkeley who is co-advised by Satish Rao and Nikhil Srivastava. His research interests revolve around graph algorithms and their applications. In the past, he has worked on spectral graph theory and planar graph algorithms.