Publications of Nadym Mallek

Hasso Plattner Institut
Digital Engineering · Universität Potsdam

This document lists all peer-reviewed publications of Nadym Mallek, Chair for Algorithm Engineering, Hasso Plattner Institute, Potsdam, Germany. This listing was automatically generated on July 28, 2024. An up-to-date version is available online at hpi.de/friedrich/docs/publist/mallek.pdf.

Conference papers

[1] Friedrich, T., Issac, D., Kumar, N., Mallek, N., Zeif, Z., Approximate Max-Flow Min-Multicut Theorem for Graphs of Bounded Treewidth. In: *Symposium Theory of Computing (STOC)*, pp. 1325–1334, 2023.

We prove an approximate max-multiflow min-multicut theorem for bounded treewidth graphs. In particular, we show the following: Given a treewidth-r graph, there exists a (fractional) multicommodity flow of value f, and a multicut of capacity c such that $f \leq c \leq \mathcal{O}(\ln(r+1)) \cdot f$. It is well known that the multiflow-multicut gap on an r-vertex (constant degree) expander graph can be $\Omega(lnr)$, and hence our result is tight up to constant factors. Our proof is constructive, and we also obtain a polynomial time $\mathcal{O}(ln(r+1))$-approximation algorithm for the minimum multicut problem on treewidth-r graphs. Our algorithm proceeds by rounding the optimal fractional solution to the natural linear programming relaxation of the multicut problem. We introduce novel modifications to the well-known region growing algorithm to facilitate the rounding while guaranteeing at most a logarithmic factor loss in the treewidth.

[2] Friedrich, T., Issac, D., Kumar, N., Mallek, N., Zeif, Z., A Primal-Dual Algorithm for Multicommodity Flows and Multicuts in Treewidth-2 Graphs. In: *Approximation Algorithms for Combinatorial Optimization Problems (APPROX)*, pp. 55:1–55:18, 2022.

We study the problem of multicommodity flow and multicut in treewidth-2 graphs and prove bounds on the multiflow-multicut gap. In particular, we give a primal-dual algorithm for computing multicommodity flow and multicut in treewidth-2 graphs and prove the following approximate max-flow min-cut theorem: given a treewidth-2 graph, there exists a multicommodity flow of value f with congestion 4, and a multicut of capacity c such that $c \leq 20f$. This implies a multiflow-multicut gap of 80 and improves upon the previous best known bounds for such graphs. Our algorithm runs in polynomial time when all the edges have capacity one. Our algorithm is completely combinatorial and builds upon the primal-dual algorithm of Garg, Vazirani and Yannakakis for multicut in trees and the augmenting paths framework of Ford and Fulkerson.