Student Poster Session

During WG 2012 there was a Student Poster Session, where the following posters were presented (alphabetically ordered by student's last name).

The Canadian Tour Operator Problem (Online Graph Exploration with Disposal)

Sabine Büttner

In the prize-collecting travelling salesman problem, we are given a weighted graph $G = (V, E)$ with edge weights $l : E \to R_+$, a special vertex $r \in V$, penalties $p : V \to R_+$ and the goal is to find a closed tour T such that $r \in V(T)$ and such that the cost $l(T) + p(V \setminus V(T))$ is minimized. We consider an online variant of the prize-collecting travelling salesman problem related to graph exploration. In the *Canadian Tour Operator Problem* (ctop) the task is to find a closed route for a tourist bus in a given network $G = (V, E)$ in which some edges are blocked by avalanches. An online algorithm learns from a blocked edge only when reaching one of its endpoints. The bus operator has the option to avoid visiting each node $v \in V$by paying a refund of $p(v)$ to the tourists. The goal is to minimize the sum of the travel costs and the refunds. We show that no deterministic or randomized algorithm can achieve a bounded competitive ratio for the CTOP on general graphs. Further, we present a ϕ-competitive algorithm for the line and give a Ski-Rental like 3-competitive algorithm for tree networks.

Joint work with Sven O. Krumke.

Fully Dynamic Approximate Distance Oracles for Planar Graphs via Forbidden-Set Distance Labels [1]

Shiri Chechik

Distance oracle is a data structure that provides fast answers to distance queries. Recently, the problem of designing distance oracles capable of answering restricted distance queries, that is, estimating distances on a subgraph avoiding some forbidden vertices, has attracted a lot of attention. We consider forbidden set distance oracles for planar graphs. We present an efficient compact distance oracle that is capable of handing any number of failures. In addition, we consider a closely related notion of fully dynamic distance oracles. In the dynamic distance oracle problem instead of getting the failures in the query phase, we rather need to handle an adversarial online sequence of update and query operations. Each query operation involves two vertices s and t whose distance needs to be estimated. Each update operation involves inserting/deleting a vertex/edge from the graph. Our forbidden set distance oracle can be tweaked to give fully dynamic distance oracle with improved bounds compared to the previously known fully dynamic distance oracle for planar graphs.

Joint work with Ittai Abraham and Cyril Gavoille.

M.C. Golumbic et al. (Eds.): WG 2012, LNCS 7551, pp. 4–6, 2012.

Product Graphs Invariants with Applications to the Theory of Information [4]

Marcin Jurkiewicz

There are a large number of graph invariants. We consider some of them, e.g. the independence and chromatic numbers. It is well know that we cannot efficiently calculate these numbers for arbitrary graphs. We present relations between these invariants and some concepts from the theory of information. Concepts such as source coding and transmission over a noisy channel with zero probability of error are modeled using graph theoretical structures and are measured by the independence and chromatic numbers of some products of graphs, i.e. graphs arising from other graphs. It turns out that for some classes of product graphs, there exist algorithms and methods for determining these invariants. Using optimization algorithms together with some theoretical results, we can establish their values or bounds on previously mentioned invariants of product graphs.

Joint work with Marek Kubale.

Improved Approximation for Orienting Mixed Graphs [3]

Moti Medina

An instance of the maximum mixed graph orientation problem consists of a mixed graph and a collection of source-target vertex pairs. The objective is to orient the undirected edges of the graph so as to maximize the number of pairs that admit a directed source-target path. This problem has recently arisen in the study of biological networks, and it also has applications in communication networks.

In this paper, we identify an interesting local-to-global orientation property. This property enables us to modify the best known algorithms for maximum mixed graph orientation and some of its special structured instances, due to Elberfeld et al. (CPM '11), and obtain improved approximation ratios. We further proceed by developing an algorithm that achieves an even better approximation guarantee for the general setting of the problem. Finally, we study several well-motivated variants of this orientation problem.

Joint work with Iftah Gamzu.

SINR Diagram with Interference Cancellation [2]

Merav Parter

This paper studies the reception zones of a wireless network in the SINR model with receivers that employ interference cancellation (IC). IC is a recently developed technique that allows a receiver to decode interfering signals, and cancel them from the received signal in order to decode its intended message. We first derive the important topological properties of the reception zones and their relation to high-order Voronoi diagrams and other geometric objects. We then discuss the computational issues that arise when seeking an efficient description of the zones. Our main fundamental result states that although potentially there

are exponentially many possible cancellation orderings, and as a result, reception zones, in fact there are much fewer nonempty such zones. We prove a linear bound (hence tight) on the number of zones and provide a polynomial time algorithm to describe the diagram. Moreover, we introduce a novel parameter, the Compactness Parameter, which influences the tightness of our bounds. We then utilize these properties to devise a logarithmic time algorithm to answer point-location queries for networks with IC.

Joint work with Chen Avin, Asaf Cohen, Yoram Haddad, Erez Kantor, Zvi Lotker, and David Peleg

Approximating the Girth [5]

Roei Tov

This paper considers the problem of computing a minimum weight cycle in weighted undirected graphs. Given a weighted undirected graph $G(V, E, w)$, let C be a minimum weight cycle of G, let $w(C)$ be the weight of C and let $w_{max}(C)$ be the weight of the maximal edge of C. We obtain three new approximation algorithms for the minimum weight cycle problem:

1. For integral weights from the range $[1, M]$ an algorithm that reports a cycle of weight at most $\frac{4}{3}w(C)$ in $O(n^2 \log n(\log n + \log M))$ time.
2. For integral weights from the range $[1, M]$ an algorithm that reports a cycle of weight at most $w(C) + w_{max}(C)$ in $O(n^2 \log n(\log n + \log M))$ time.
3. For non-negative real edge weights an algorithm that for any $\varepsilon > 0$ reports a cycle of weight at most $(\frac{4}{3} + \varepsilon)w(C)$ in $O(\frac{1}{\varepsilon}n^2 \log n(\log \log n))$ time.

Joint work with Liam Roditty.

References

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4. Jurkiewicz, M., Kubale, M.: Product Graphs Invariants with Applications to the Theory of Information. In: The 5th International Interdisciplinary Technical Conference of Young Scientists InterTech (2012)
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