Special Issue of Selected Papers from the 22nd International Symposium on Graph Drawing (GD 2014) Guest Editors' Foreword

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This special issue of the Journal of Graph Algorithms and Applications is dedicated to the 22nd International Symposium on Graph Drawing, which was held at the University of Würzburg in Würzburg, Germany, September 24-26, 2014. As the editors of this JGAA special issue, we invited the authors of some of the best papers from GD 2014 to submit a revised and extended version of their work. After a thorough reviewing process and further revisions, the following eight papers were accepted to this special issue. These papers reflect the broad variety of topics covered in the Graph Drawing community including both applied and theoretical fields.

- Efrat, Hu, Kobourov, and Pupyrev introduce MapSets as a way to visualize clustered graphs as maps where the vertices are in fixed locations and the clusters are drawn as non-fragmented and non-overlapping regions. The drawing technique also optimizes the convexity of the resulting regions.

- Nocaj, Ortmann, and Brandes define hairball graphs as graphs having a low variation in their pairwise shortest path distances, such as the small-world friendship graphs arising from social networks. When drawn using standard force-directed methods, the low path distance causes the drawings to appear as hairballs. To improve the resulting drawings of a class of small-world social networks, the authors introduce and evaluate a pre-processing technique that uses a sparse but connected spanning subgraph consisting of strong ties holding together communities.

- Bannister, Devanney, Eppstein, and Goodrich use Galois theory to explain why implementations of force-directed and other common graph drawing techniques use iterative numerical approximations instead of constructing and solving exact algebraic expressions even though they have algebraic formulations. In particular, the authors show that exact symbolic solutions for the algebraic formulations of several common graph drawing techniques do not exist.

- Bekos, Gronemann, Kaufmann, and Krug investigate planar octilinear drawings of planar graphs with maximum degree k using at most one bend per edge. They show that when k is 4 such one-bend octilinear drawings exist on a grid of cubic area while super-polynomial area suffices for the case when k is 5. They also construct an infinite class of planar graphs with maximum degree 6 that require edges with at least two bends in an octlinear drawing.

- Chan, Frati, Gutwenger, Lubiw, Mutzel, and Schaefer show how to extend a straight-line planar drawing of a subgraph of a planar graph to the planar drawing of the entire graph using at most a linear number of bends per edge. They also show a related result for creating simultaneously planar drawings of two graphs, in which shared edges and vertices coincide in both drawings.

- Di Giacomo, Liotta, and Montecchiani explore outer 1-planar graphs, graphs that can be drawn in the plane with each vertex on the outer face and each edge crossed by at most one other edge. They show how to construct outer 1-planar straight-line drawings of outer 1-planar graphs with bounded degree Δ using $O(\Delta)$ different slopes for the edges. They also show that outer 1-planar graphs of bounded degree Δ have (crossing-free) planar drawings using $O(\Delta^2)$ different slopes.

- A directed path is four-directional if the edges are assigned the labels "up", "down", "left", and "right" and is three-directional if the edges have three of the four labels. Aichholzer, Hackl, Lutteropp, Mchedlidze and Vogtenhuber study the problem of constructing a planar straight-line drawing of a given n-vertex three- or four-directional path P on a given convex set S of n points such that each point in P is mapped to a unique point in S and every edge in P has a direction consistent with its label.

- A geometric path P is increasing-chord if, for every four points a, b, c, and d in this order on P, it holds that $|bc| < |ad|$, and a geometric graph is increasing-chord if there exists an increasing-chord path between every pair of vertices. Dehkordi, Frati, and Gudmundsson prove that for any point set S with n points there exists an increasing-chord planar graph spanning S with $O(n)$ Steiner points and, if the point set is convex, there exists an increasing-chord graph with no Steiner points and $O(n \log n)$ edges.

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