Advances in Graph Drawing

Special Issue on Selected Papers from the Sixth International Symposium on Graph Drawing, GD'98

Guest Editors' Foreword

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Introduction

This Special Issue on the Sixth International Symposium on Graph Drawing (GD'98)[1] brings together eight papers based on work presented at the conference. As editors, we chose to invite papers from GD'98 that would reflect the broad nature of the annual symposia on graph drawing, which showcase theoretical contributions as well as experimental work and visualization systems.

We have also included a contribution based on the GD'98 Graph Drawing Contest. This contest is an annual conference tradition. Long before the conference takes place, the contest committee posts at the conference web site textual descriptions of one or more non-trivial graphs, typically with a set of desired features or requirements for "good" visualizations. Contestants from all over the world compete for cash prizes, awarded at the conference banquet. The contest is known for pushing graph drawing technologies to their limits and for stimulating new research directions.

One of our goals as editors has been to explore the potential of an electronic journal to convey information that cannot be captured easily by a static medium such as paper. Hence we are pleased to include two contributions accompanied by web sites. Since the web sites are maintained by the authors rather than by the journal, their evolution over time is at the authors' discretion. An impression of the original web site, which went through the refereeing process together with its associated paper, can be gotten either by looking at a "snapshot" version maintained by the journal or by looking at the paper itself.

All contributions in this Special Issue have been through a rigorous review process, whether they follow the style of traditional journal papers or whether they describe working systems or a contest entry. We thank the authors, the referees, and the editorial board of the journal for their careful work and for their patience, generosity, and support of our endeavor to explore the potential of electronic journal publication. We hope that we have captured a bit of the dynamic quality that the range of research interests presented at the graph drawing symposia imparts.

Scanning the Issue

Among theoretical contributions, the paper by M. Dillencourt, D. Eppstein, and D.S. Hirschberg introduces and studies the *geometric thickness* of a graph, a notion that lies between the graph-theoretical thickness and the book thickness.

A variant of the well-known binary space partition decomposition defined in the context of computational geometry is described in the paper by C. A. Duncan, M. T. Goodrich, and S. G. Kobourov, for the purpose of drawing huge graphs. They present the *balanced aspect ratio (BAR) tree*, which supports

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[1]GD'98 was held August 13-15, 1998, at McGill University, Montreal, Canada. Proceedings published in the Springer-Verlag Lecture Notes in Computer Science (LNCS) series, vol. 1547, available on-line at http://link.springer.de/link/service/series/0558/tocs/t1547.htm .

recursive division of a graph into subgraphs of roughly equal size, such that the drawing of each subgraph has a balanced aspect ratio.

The problem of measuring similarities between different drawings of the same graph is studied in the paper by S. Bridgeman and R. Tamassia, who define a general framework for quantifying how much a change in a drawing affects the user's mental map. This type of study provides basic principles for designing interactive algorithms for drawing graphs when preserving the mental map is a priority.

Two of the papers with a strong experimental component deal with *orthogonal* drawings, i.e. drawings where the vertices are placed at grid points and the edges are chains of horizontal and vertical segments.

The paper by J. M. Six, K. G. Kakoulis, and I. G. Tollis gives a postprocessing technique called *refinement*, whose purpose is to improve the readability of orthogonal drawings in the plane. Their experimental analysis shows significant improvements in such measurable graph drawing aesthetics as area, bends, crossings, and total edge length.

The paper by G. Di Battista, M. Patrignani, and F. Vargiu studies orthogonal drawings in $3D$ space and presents a new approach, called *split&push*, to compute orthogonal drawings of graphs of maximum degree six. A final drawing is produced through a sequence of steps: starting from a degenerate drawing, each step splits the current drawing into two pieces and finds a structure closer to the final version. The experimental analysis compares the resulting algorithm with other existing algorithms, taking into account computational time, volume, average edge length, and average number of bends.

The paper by U. Brandes and D. Wagner is motivated by a very practical application: visualizing timetables of train schedules. They do this with drawings of graphs whose vertices have fixed positions determined by the geographic locations of the railway stations and whose edges join pairs of stations connected by non-stop train service. To avoid visual clutter, some edges are drawn as straight lines, while others are drawn as Bezier curves. Force-directed methods compute the final visualization.

The paper by P. Eades and Mao Lin Huang presents a strategy intended for visualizing and navigating in huge graphs. Using this strategy, a user views an *abridgment* of a graph, that is, a small part of the graph that is currently of interest. By changing the abridgment, the user may travel through the graph. The changes use animation to transform smoothly from one view to the next. The strategy has been implemented in a prototype system called `DA-TU`, which is accessible through the web.

Finally, the paper by U. Brandes, V. Kääb, A. Löh, D. Wagner, and T. Willhalm, chosen to represent the Graph Drawing Contest, shows an example of dynamic $3D$ straight-line drawing of directed graphs. The contestants were given a dynamic graph of links between World Wide Web pages. The goal was to depict the content as it evolved. The authors use a force directed approach to create an animation of the given graph. The animation is accessible through the web.