Graph Drawing Contest Report

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Abstract. This report describes the 14th Annual Graph Drawing Contest, held in conjunction with the 2007 Graph Drawing Symposium in Sydney, Australia. The purpose of the contest is to monitor and challenge the current state of graph-drawing technology.

1 Introduction

This year's Graph Drawing Contest had three distinct categories: the Graph Drawing Challenge, the Free-Style category, and a Social Network category. Repeating the focus of the previous year, the Graph Drawing Challenge, which took place during the conference, required the contestants to find minimum-area straight-line planar drawings of the challenge graphs. The Free-Style category provided participants with the opportunity to present their best graph visualizations, with a focus on both aesthetic beauty as well as relevance to the graph drawing community. The Social Network category was an open category asking contestants to develop and present novel ways of viewing and analyzing social networks. Various networks were suggested including using information from FaceBook, MySpace, and data collection sites such as Technorati, which indexes weblogs.

Although there were a total of 10 submissions, half the amount of previous years, most of these submissions came from participation in the Graph Drawing Challenge. Seven teams participated in the Challenge. There were three submissions in the Social Network category and no submissions in the general Free-Style category. The remaining sections go into more details about each category and the winning submissions. Since many of the winning submissions were animations, interested viewers should visit the contest's website[1] to download and view the winning animations along with their descriptions.

2 Graph Drawing Challenge

Continuing from the previous year, this year's challenge dealt with minimizing the area of straight-line drawings of planar graphs. At the start of the one-hour

[1] http://www.cs.usyd.edu.au/~visual/gd2007/gd_contest.html

S.-H. Hong, T. Nishizeki, and W. Quan (Eds.): GD 2007, LNCS 4875, pp. 395–400, 2007.

on-site competition, the contestants were given seven planar graphs ranging in size from 16 nodes to 324 nodes. As opposed to last year, the graphs were presented with an initial plane embedding, though that particular embedding did not have to be maintained. In response to feedback from the manual team participants of the previous year, the judges felt that too large an amount of time was spent finding valid plane embeddings of the graphs rather than compressing the drawings into a minimum area.

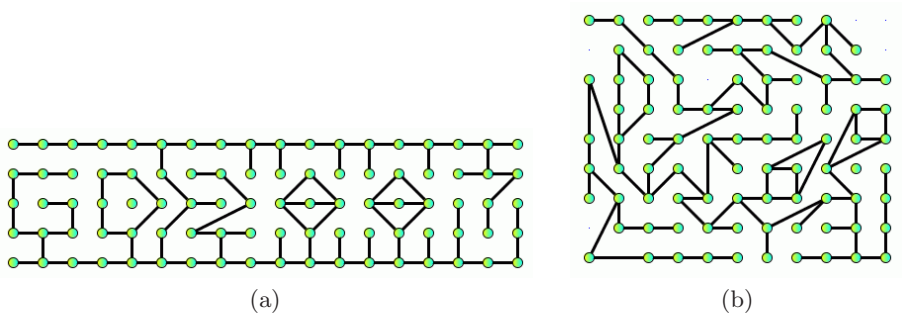
We allowed teams to participate in one of two categories, automated and manual. Manual teams came and solved the problems using ILOG's JViews Utility designed specifically for the Challenge, as a simple graph editing tool and not a specialized area minimization utility. The automated teams were allowed and highly encouraged to use additional software tools to help solve the problems. We also opened up the possibility for remote on-line participation but received no interested parties. This is a strategy we may pursue more aggressively in future challenges. Interestingly, the manual teams performed far better than the automated software. This is in stark contrast to the previous year, which we attribute partially to the fact that the graphs were given a starting, though not optimal, embedding. But, it also highlights the fact that much work still needs to be done to bridge the gap between human and computer performance on this fundamental criterion.

The seven graphs themselves consisted of a varying range of classes. The first graph was a simple graph of 17 nodes with an optimal area of 18, which was found in different representations by three teams. The second graph was a simple maximally planar graph of 16 nodes. The third graph was a bi-connected graph of 64 nodes. The fourth graph was a disconnected graph of 100 nodes and 7 connected components. The fifth graph was a general tree of 192 nodes. The sixth graph was a large graph of 324 nodes and several connected components. The final graph, dubbed GD2007, was a disconnected graph of 90 nodes for which one optimal solution spelled the words: GD2007, see Figure 1. The following table lists the various graphs with their optimal area[2] and the best solutions found by the contestants.

	Graph 1	Graph 2	Graph 3	Graph 4	Graph 5	Graph 6	GD2007
Optimal	18	63	64	100	192	324	90
Best Found	18	63	72	108	204	348	99

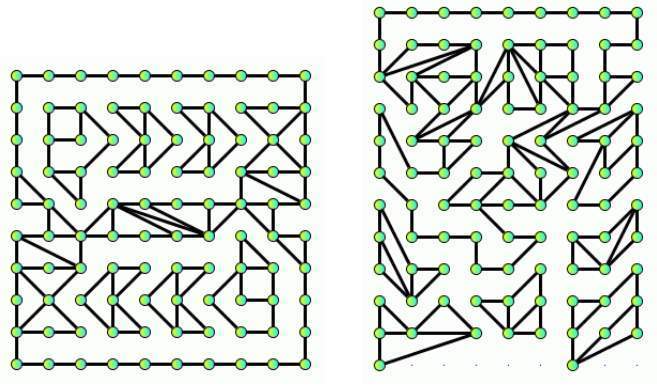
Seven teams participated with one team entering the automated category. The winner was the team of Wolfgang Brunner and Jens Schmidt. Figure 2 shows their winning submission for Graph 4 along with an optimal solution. The judges awarded honorable mentions to Marcus Krug (the sole automated participant), the team consisting of Giuseppe Di Battista, Fabrizio Frati, Michael Kaufmann,

[2] All graphs were constructed in a manner such that the optimal area was known, except for the second graph. As it was constructed in a different manner, the optimal area for the second graph is presumed correct but has not been verified.



(a) (b)

Fig. 1. (a) One optimal solution for the final challenge graph (GD2007). (b) The winning submission by Melanie Badent, Michael Baur, Robert Görke, and Marco Gaertler.



(a) (b)

Fig. 2. (a) One optimal solution for Graph 4. (b) The winning submission from the overall winners Wolfgang Brunner and Jens Schmidt.

Anika Kaufmann, Maurizio Patrignani, and Cagatay Gonsu, the team of Joe Fowler and Michael Schulz, and the team of Melanie Badent, Michael Baur, Robert Görke, and Marco Gaertler.

3 Social Network Category

The Social Network category received 3 submissions, each taking on a different network and having a different approach to its visualization. The judges were impressed with all three submissions.

First prize was awarded to Robert Theron, Rodrigo Santamaria, Juan Garcia, Diego Gomez, and Vadim Paz-Madrid of the VisUsal Group of the University of Salamanca. Their system, Overlapper, was designed to help analyze movies, but their techniques can be extended to other social networks with large collaborations. The tool uses a zone graph representation that is driven by a

force-directed layout algorithm. In their system, nodes represent people involved in a movie, and edges connect two people involved in the same project. However, rather than draw edges explicitly, zones are created. Each movie being a complete subgraph of the people involved is treated as a zone, which is drawn with a semi-transparent hull around it. People involved in more than one movie produce overlapping zones, but the transparency of the zones allows one to visualize the various movies involved. As this can potentially lead to some nodes being covered by zones for which they do not belong, node information is augmented by a pie chart to help discern in which areas the node truly belongs. On a user's demand, nodes are visualized at their position by glyphs identifying the role of the person involved, their corresponding pie chart, and various personal information. Figure 3 shows one snapshot of their animated submission.[3]

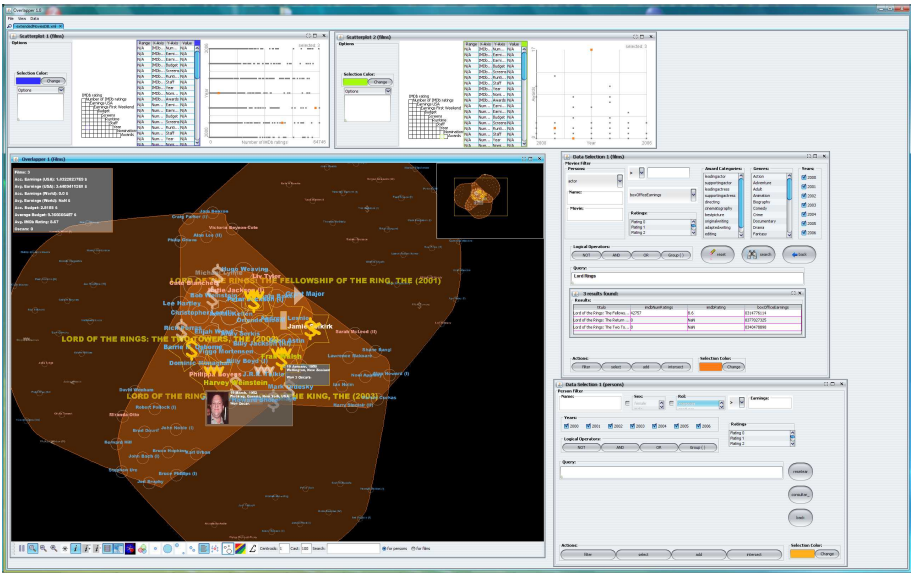


Fig. 3. A snapshot of the Salamanca group's Social Network visualization tool

The second prize submission, awarded to Robert Görke, Thomas Schank, and Dorothea Wagner from the University of Karlsruhe, investigates the co-author network of professors at their university. The nodes consist of all Professors within the Computer Science department along with their co-authors, and the edges are induced by their common publications. The contestants took two approaches to visualize this network. The first approach was a static visualization with measures based on electrical current flow. Between each pair of Professors, they use a uniform potential difference to compute conductivity (connectivity) and the current flowing through each edge. The edges of the graph are drawn

[3] See also `http://carpex.usal.es/~visusal/site/`

with an intensity based on their accumulated current. The connectivity (conductivity) of each Karlsruhe Professor to their colleagues is visualized by color with more red indicating a stronger connection. For other nodes, only those names with the highest current turnover are shown. Figure 4 shows their resulting static visualization. The authors also consider a dynamic case, visualizing the network for each year from 1999 to 2006 separately. In this case, the emphasis is on preserving the mental map. The details of this approach can be found on the contest's website.[4]

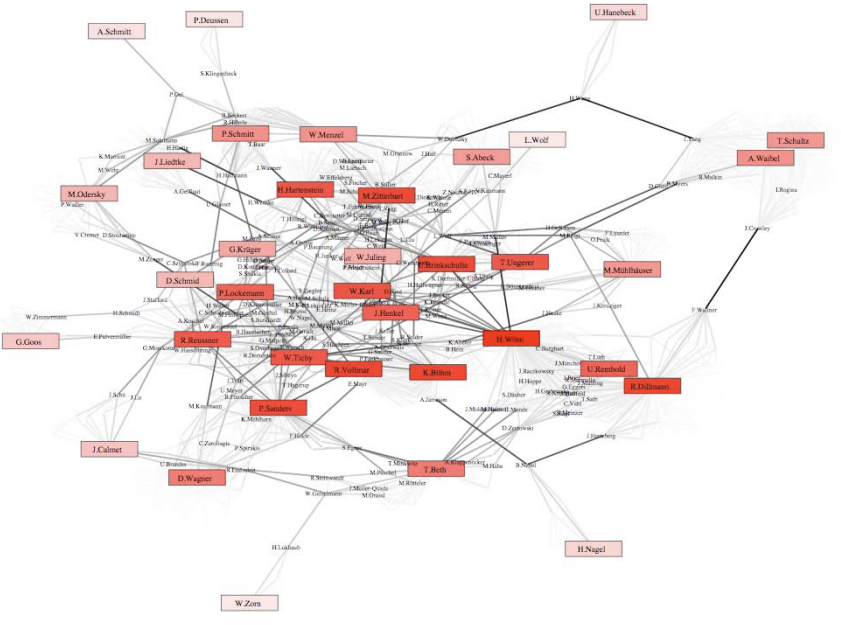


Fig. 4. The static visualization of the Karlsruhe group's co-author network analysis

4 Free-Style Category

Surprisingly, this year we received no submissions for the Free-Style category. However, the judges felt that one of the social network submissions was a worthy Free-Style candidate based on its artistic merit and strong relevance to graph visualization. Therefore, first prize in the Free-Style category was awarded to Felix Heinen for his depiction of the variety and attitudes of members of the Internet community MySpace. The submission consisted of two large poster images. The first poster, Figure 5, shows information gathered from the demographic data of each member's profile, highlighting connections between gender, age, and educational background among the members. The second poster gives the viewer a feel for the geographic distribution of the members. The work was primarily done

[4] See also `http://i11www.iti.uni-karlsruhe.de/people/schank/gd07cont/`

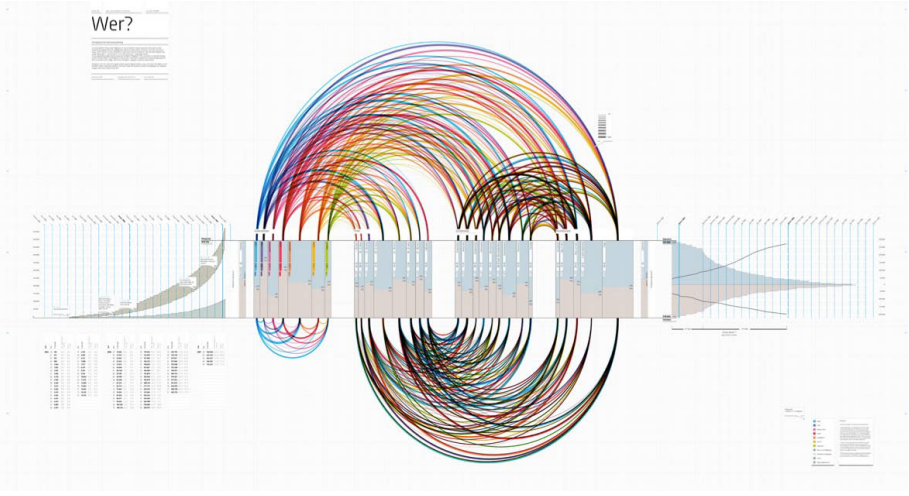


Fig. 5. A visual analysis, created by Felix Heinen, of member profiles of an Internet community

by hand using various Adobe products. For further details visit the contest's website.[5]

Acknowledgments

We wish to thank the contestants and all the sponsors of the symposium, including ILOG, Tom Sawyer, and the HxI Initiative, for their generous support of the Graph Drawing Contest.

[5] See also `http://www.felixheinen.de/020.html`