

Graphs and Trees

Lecture 14 CPSC 533C, Fall 2004

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Topic Presentations

material

- 2 papers from my suggestions
- 1 paper found on your own

talk

- slides required
- critical points of papers
- comparison and critique
not just outline

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Graphs and Trees

Hermann survey

Graph Visualisation in Information Visualisation: a Survey. Iwan Herman, Guy Melancon, M. Scott Marshall. IEEE Transactions on Visualization and Computer Graphics, 6(1), pp. 24-44, 2000. <http://citeseer.nj.nec.com/herman00graph.html>

Animated Radial Layouts

Animated Exploration of Graphs with Radial Layout. Ka-Ping Yee, Danyel Fisher, Rachna Dhamija, and Marti Hearst, Proc InfoVis 2001. <http://bailando.sims.berkeley.edu/papers/infosvis01.htm>

SpaceTree

SpaceTree: Supporting Exploration in Large Node Link Tree, Design Evolution and Empirical Evaluation. Catherine Plaisant, Jesse Grosjean, and Ben B. Bederson. Proc. InfoVis 2002. <http://ftp.cs.umd.edu/pub/hcil/Reports-Abstracts-Bibliography/2002-05html/2002-05.pdf>

Cushion Treemaps

Cushion Treemaps. Jack J. van Wijk and Huub van de Wetering, Proc InfoVis 1999, pp 73-78. <http://www.win.tue.nl/~vanwijk/ctm.pdf>

Multiscale Small-World Graphs

Multiscale Visualization of Small World Networks. David Auber, Yves Chircota, Fabien Jourdan, Guy Melancon, Proc. InfoVis 2003. <http://dept-info.labri.fr/~auber/documents/publi/auberIV03Seattle.pdf>

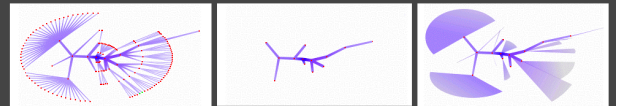
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Hermann survey

true survey, won't try to summarize here

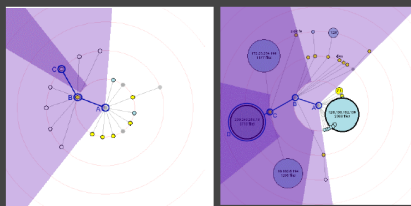
nice abstraction work by authors

- Strahler skeletonization
- ghosting, hiding, grouping



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Animated Radial Layouts



[Animated Exploration of Graphs with Radial Layout.
Ka-Ping Yee, Danyel Fisher, Rachna Dhamija, and Marti Hearst, Proc InfoVis 2001.
<http://bailando.sims.berkeley.edu/papers/infosvis01.htm>]

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Dynamic Graph Layout

static radial layouts: known algorithm

dynamic: little previous work

- DynaDAG [North, Graph Drawing 95]
- DA-TU [Huang, Graph Drawing 98]

minimize visual changes

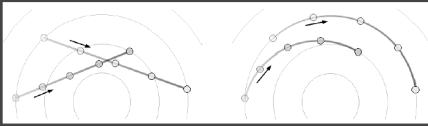
stay true to current dataset structure

[video]

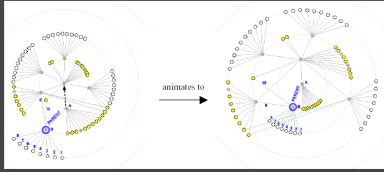
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Animation

polar interpolation



maintain neighbor order



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More Dynamic Graphs

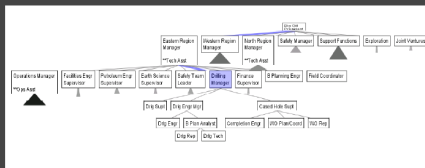
[video]

Dynamic Drawing of Clustered Graphs
Yaniv Frishman, Ayellet Tal
InfoVis 2004 Video Proceedings

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SpaceTree

focus+context tree
· animated transitions



semantic zooming

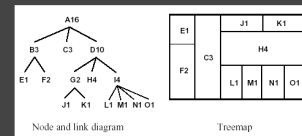


[demo]

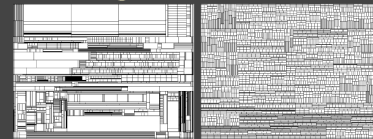
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Treemaps

containment not connection



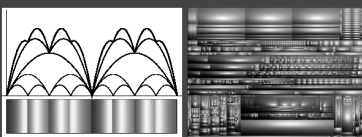
difficulties reading



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Cushion Treemaps

show structure with shading
· scale parameter controls global vs. local



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Cushion Treemaps

application

- SequoiaView, Windows app
- hard drive usage
- <http://www.win.tue.nl/sequoiaview/>

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Small-World Networks

high clustering, small path length
 · vs. random uniform distribution

examples

- social networks
- movie actors
- Web
- software reverse engineering

multiscale small-world networks

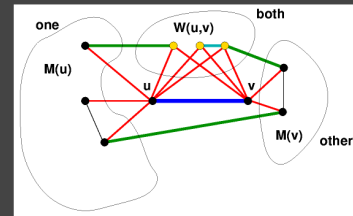
- exploit these properties for better layout

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Strength Metric

strength: contribution to neighborhood cohesion
 calculate for each edge based on

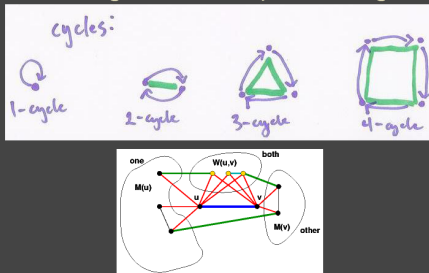
- edge's POV partition of graph: one, other, both



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Strength via Cycles

3-cycles through (u,v) + 4-cycles through (u,v)

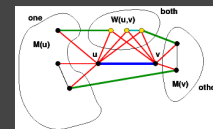


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Cycles: Cohesion Measure

3-cycles through u/v

- blue + 2 red edges == yellow nodes in both



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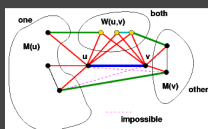
Cycles: Cohesion Measure

3-cycles through u/v

- blue + 2 red edges == yellow nodes in both

all other 3-cycles don't contain blue u/v edge

- magenta edges impossible
- black, red/green, red/black, etc



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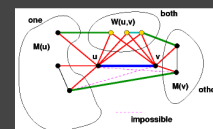
Cycles: Cohesion Measure

3-cycles through u/v

- blue + 2 red edges == yellow nodes in both

existing
 all possible

yellow nodes
 all nodes

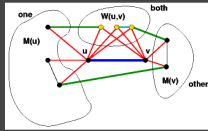


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Cycles: Cohesion Measure

- 4-cycles through u/v
- blue + 2 red + 1 green
 - blue + 2 red + 1 cyan

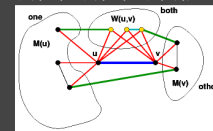
$$s(A,B) = \frac{\text{existing edges between sets}}{\text{all possible edges between sets}}$$



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Strength

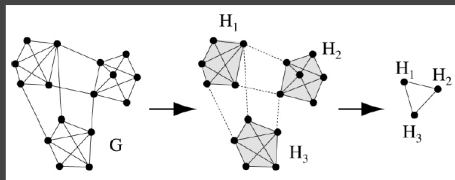
- 4-cycles [green edges]
- one-both, other-both, one-other
 - $s(M(u), W(u,v)) + s(M(v), W(u,v)) + s(M(u), M(v))$
- 4-cycles [cyan edges]
- both-both
 - $s(W(u,v))$
- 3-cycles [yellow nodes in both]
- $|W(u,v)| / (|M(u)| + |M(v)| + |W(u,v)|)$



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Hierarchical Decomposition

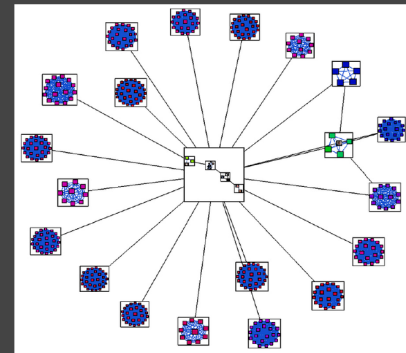
- remove low-strength edges
maximal disconnected subgraphs
quotient graph: subgraph = higher-level node



[Multiscale Visualization of Small World Networks. Auber, Chircota, Jourdan, and Melancon. Proc. InfoVis 2003]

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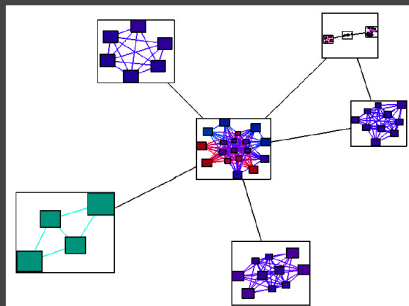
Nested Quotient Graphs



[Multiscale Visualization of Small World Networks. Auber, Chircota, Jourdan, and Melancon. Proc. InfoVis 2003]

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Nested Quotient Graphs

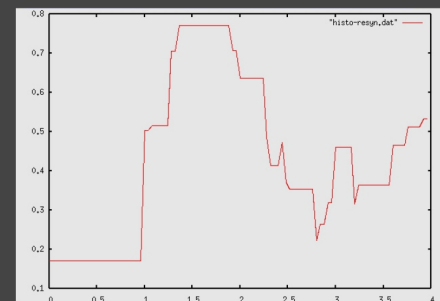


[Multiscale Visualization of Small World Networks. Auber, Chircota, Jourdan, and Melancon. Proc. InfoVis 2003]

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Clustering Quality Metric

- automatically determine how many clusters



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Critique

pros

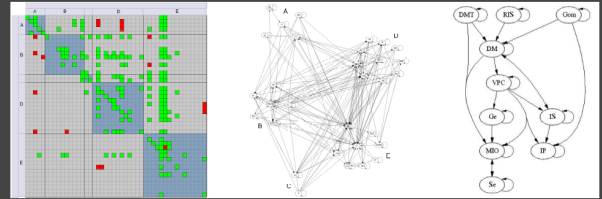
- exploit structure of data
- hierarchical structure shown visually
- automatically determine number of clusters
- nifty math

cons

- information density could be better
- what if mental model doesn't match clustering metric?

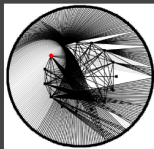
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Previous: Multilevel Call Matrices



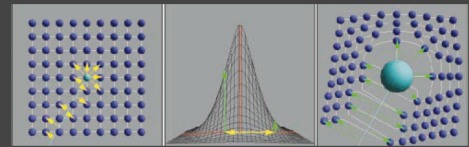
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Previous: EdgeLens



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Previous: Visual Access Distortion



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Previous: H3



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Previous: TJ

