

Graph Visualisation

Daniel Archambault

Previously in CSCM27...

- What is graph mining?
- Name some types of graph mining.
- What is community finding?
- Name some ways we can evaluate it.

Previously in CSCM27...

- We have looked at methods for graph drawing
- Now we look at methods for visualising larger graphs

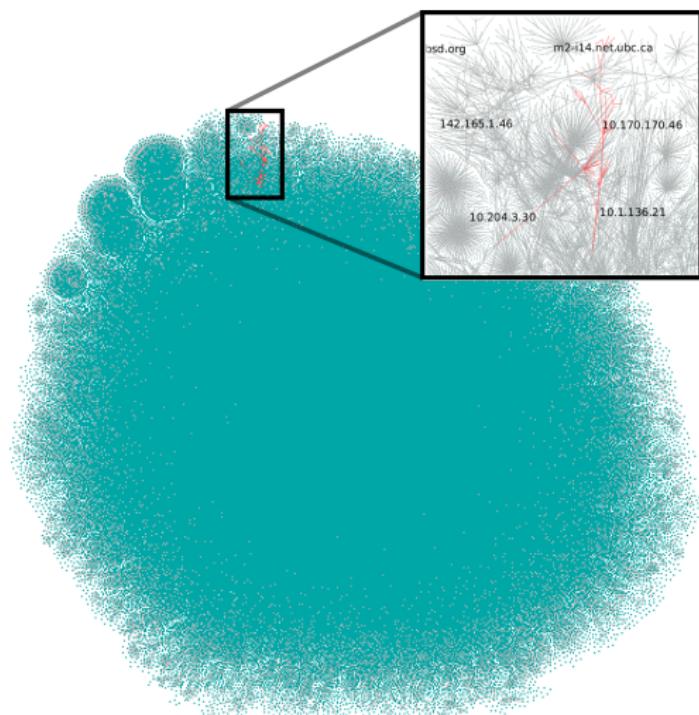
Graph Visualisation

Graph Drawing and Visualisation

- I'm making a bit of an artificial line
 - graph drawing involves computing node placements
 - graph visualisation involves more interactive elements
- More often than not the two are done simultaneously
- Usually, we need interaction to scale to big graphs

We want to scale to large graphs

- Looking at everything at once, can be cool but... effective?



Current Techniques for Visualising Large Graphs

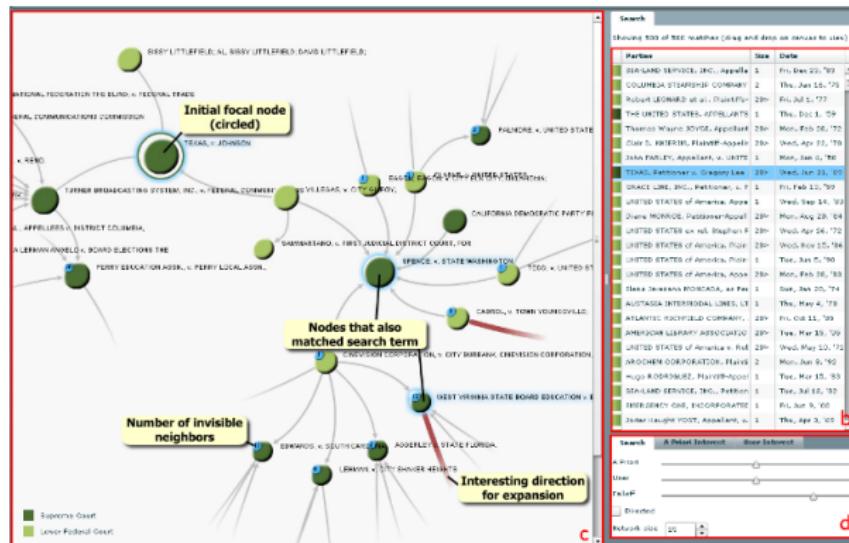
- To visualise a large graph, turn it into a small graph
 - a useful small graph
 - the small graph(s) say something about the large graph
- Two main ways of doing this:
 - filtering - remove nodes/edges from the large graph
 - aggregation - take nodes/edges and lump them together somehow
- Both methods lead to effective visualisation methods

Filtering

- Remove nodes and edges from the representation completely
- No, or little, representation of them initially
- Interaction allows nodes/edges to be inserted and removed
- Simple method, but can be quite effective
- A bit contrary to Shneiderman Mantra

Interactive Investigation of Local Neighbourhoods

- Focus on search result and expand out from there

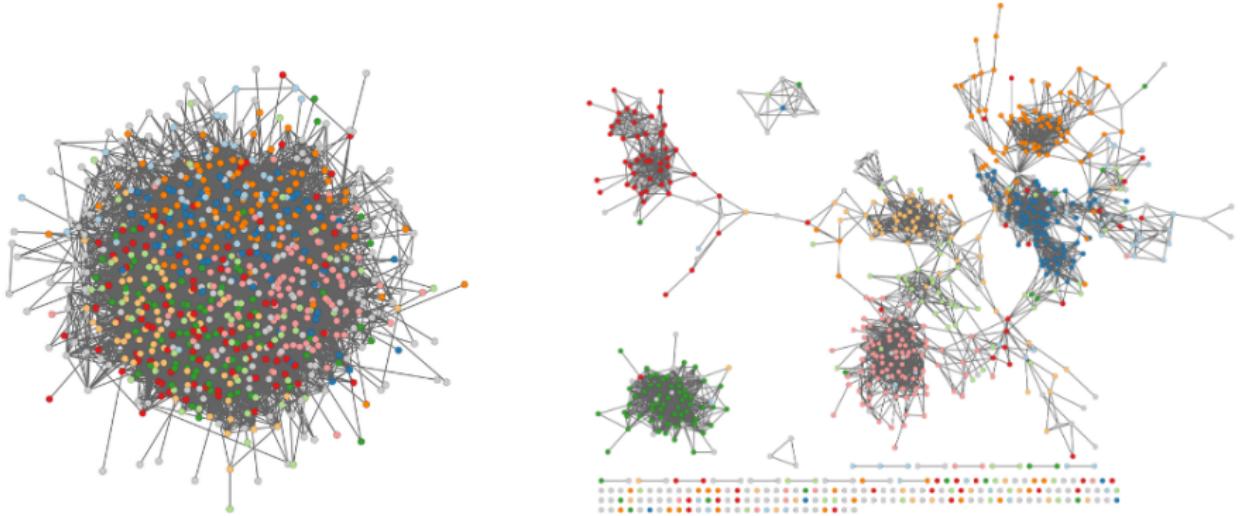


F. van Ham and A. Perer, "Search, Show Context, Expand on Demand": Supporting Large Graph Exploration with Degree-of-Interest," in IEEE Transactions on Visualization and Computer Graphics, 15(6):953–960, 2009.

Visualising Dense Social Networks

- Social networks can be very dense
- Sometimes density obscures community structure
- Only keep edges that are important
 - edges that support a number of short cycles (length 3)
 - some evidence that these define communities

Arlind Nocaj, Mark Ortmann and Ulrik Brandes: Untangling the Hairballs of Multi-Centered, Small-World Online Social Media Networks. *Journal of Graph Algorithms and Applications* 19(2):595-618, 2015.

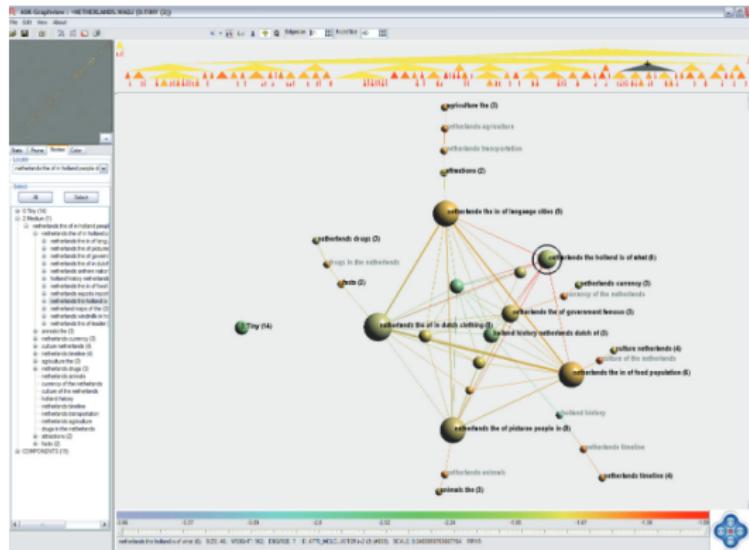


- Filtering out edges makes community structure clearer

Aggregation

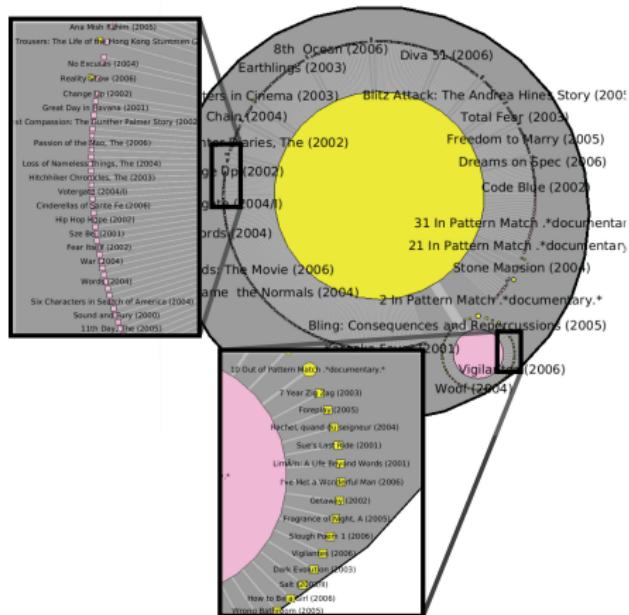
- Take nodes or edges and group them together somehow
- Simplifies visual complexity of information
- Often group is substituted with a simpler representation

ASK-GraphView



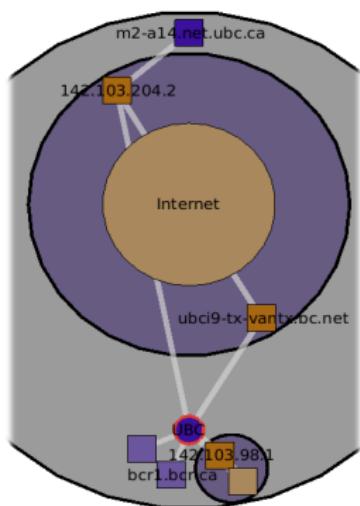
J. Abello, F. V. Ham and N. Krishnan, "ASK-GraphView: A Large Scale Graph Visualization System," in IEEE Transactions on Visualization and Computer Graphics, 12(5):669-676, 2006.

Large Graph Exploration: GrouseFlocks

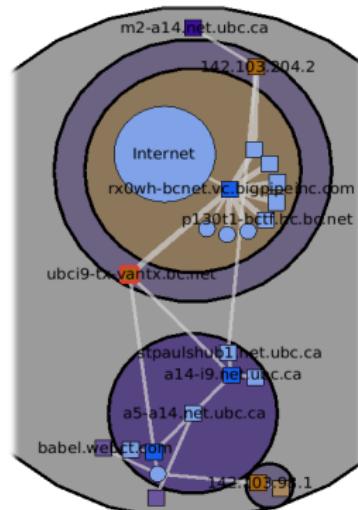


- GrouseFlocks can be used to explore results
- Drawing and hierarchy refined on demand

Large Graph Exploration: TugGraph



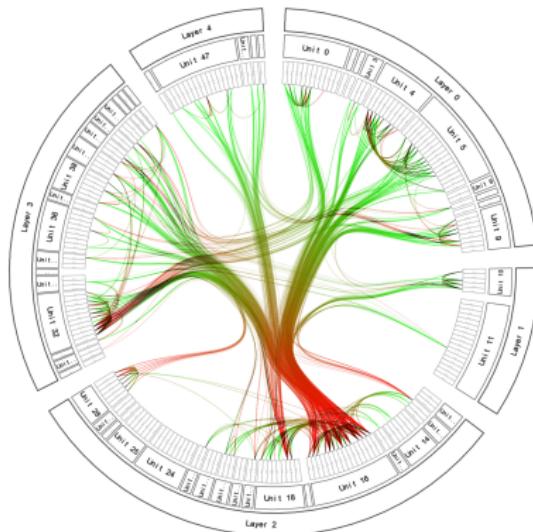
(a) UBC



(b) UBC Tug

- Given a decomposition, adjacent components can be revealed
- Almost like pulling on a rope in the graph
- Sections are drawn on demand during pull

Edge Bundling



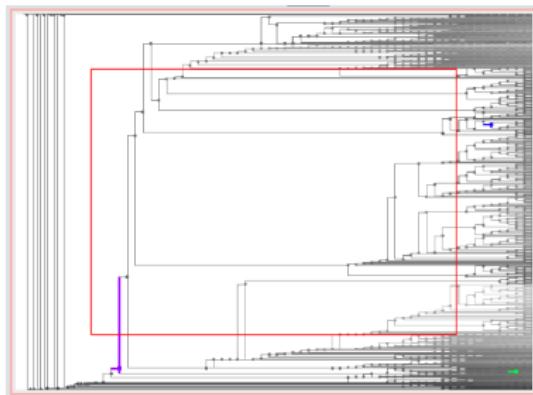
Danny Holten. 2006. Hierarchical Edge Bundles: Visualization of Adjacency Relations in Hierarchical Data. IEEE Transactions on Visualization and Computer Graphics 12(5):741-748.

- Edges can be grouped together in order to reduce visual clutter
- Initial approaches based on superimposed hierarchy

Focus+Context and Overview+Detail

- These types of overview apply to information visualisation in general
- Orthogonal dimension: Focus+Context and Overview+Detail
 - focus+context - a focus surrounded by a summary of the rest
 - overview+detail - detail plus a disjoint overview
- Two ways of satisfying an overview first method

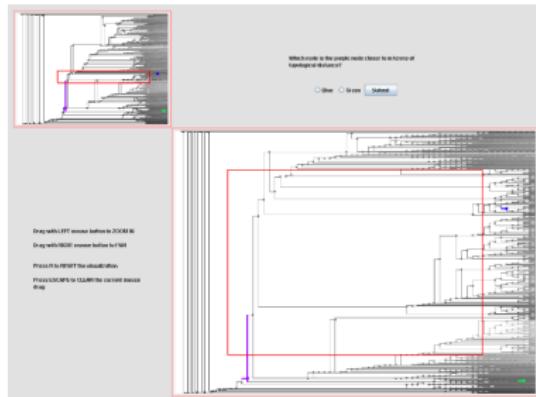
Focus+Context



An Evaluation of Pan&Zoom and Rubber Sheet Navigation with and without an Overview. Dmitry Nekrasovski, Adam Bodnar, François Guimbretière, Joanna McGrenere, and Tamara Munzner Proc. ACM Conf. on Human Factors in Computing Systems (CHI) 2006, p 11-20

- Show detail in central window and “warp” what is around it

Overview+Detail



An Evaluation of Pan&Zoom and Rubber Sheet Navigation with and without an Overview. Dmitry Nekrasovski, Adam Bodnar, François Guimbretière, Joanna McGrenere, and Tamara Munzner Proc. ACM Conf. on Human Factors in Computing Systems (CHI) 2006, p 11-20

- Show detail window and provide a separate overview of everything

Famous Surveys on the Topic

- *I. Herman, G. Melançon and M. S. Marshall, “Graph visualization and navigation in information visualization: A survey,” in IEEE Transactions on Visualization and Computer Graphics, 6(1):24-43, 2000.*
 - most cited TVCG article
- *von Landesberger, T., Kuijper, A., Schreck, T., Kohlhammer, J., van Wijk, J.J., Fekete, J.-D. and Fellner, D.W. (2011), Visual Analysis of Large Graphs: State-of-the-Art and Future Research Challenges. Computer Graphics Forum, 30(6): 1719-1749.*
- *N. Elmquist and J. D. Fekete, “Hierarchical Aggregation for Information Visualization: Overview, Techniques, and Design Guidelines,” in IEEE Transactions on Visualization and Computer Graphics, 16(3):439-454*

Quiz

- What are the two methods of graph simplification discussed
- Give some advantages and disadvantages of each
- Is Google Maps focus+context or overview+detail?
- Name some software of each type