Algorithms for Graph Visualization
Introduction to Practical Task

Marcel Radermacher and Tamara Mchedlidze
Metro Map Metaphor
Metro Map Metaphor

**Definition:** $H = (V, \mathcal{E})$ a hypergraph.

**Line-representation** of $H$:
- $V$ is depicted by a set of points on the plane,
- $E$ as a set of curves such that the curve corresponding to $E \in \mathcal{E}$ passes through all vertices in $E$.

Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$
Your Task: Heuristic approaches for line-representations

Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$
Some Theory

- The graph $G = (V, E)$, $E = \{\text{set of segments connecting two consequent stations}\}$ is called a **path-based support graph** of hypergraph $H$.

Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$
Some Theory

• The graph $G = (V, E)$, $E = \{\text{set of segments connecting two consequent stations}\}$ is called a **path-based support** graph of hypergraph $H$

• It is **path-based** support, because each hyperedge is represented by a path (not necessarily induced)

• More generally in a **support** graph of $H$, each hyperedge induces a connected graph

Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$
Some Theory

• Given a hypergraph $H$ it is NP-complete to compute a path-based support with the minimum number of edges
• or to decide whether there is a planar path-based support


Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$
Task

Your Task: Heuristic approaches for line-representations

Part A:

• Compute a path-based support, that has a reasonable visualization: not necessarily planar, with minimum edges, etc.
• You can also formalise the problem and study it theoretically.
• Provide a heuristic and implement it.
• Or formally prove some bounds on the performance of the heuristic.
Task

Your Task: Heuristic approaches for line-representations

Part B:
• Draw the path-based support using existing or modified algorithms (e.g. force-directed).
• The target is to draw the graph so that each path is readable.
• How can we formalise the readability?
• What are aesthetic measures?
Task

Your Task: Heuristic approaches for line-representations

Part B:

• Draw the path-based support using existing or modified algorithms (e.g. force-directed).
• The target is to draw the graph so that each path is readable.
• How can we formalise the readability?
• What are aesthetic measures?

Part C: Implement the display the paths.
Task

Your Task: Heuristic approaches for line-representations

Part B:

• Draw the path-based support using existing or modified algorithms (e.g. force-directed).
• The target is to draw the graph so that each path is readable.
• How can we formalise the readability?
• What are aesthetic measures?

Part C: Implement the display the paths.

Options:
• Give priority to either part A or part B
• Think of an integrated approach
Relevant Material

Building a memory transit map

- http://memoryunderground.com
- Brian Foo
- The input assumes a sequence of events, i.e. vertices within a hyperedge are ordered
“Getting to more abstract places using the metro map metaphor”
Keith Nesbitt
InfoVis 2004
Metromaps of historical events

“Information Cartography: Creating Zoomable, Large-Scale Maps of Information”

Jure Leskovec et al.
KDD 2013
Relevant Material
