Robust Genealogy Drawings

Fabian Klute

Problem "Definition"

Our family tree is really strange. It is still a DAG, but there are all these cross-layer edges and a lot of undirected cycles. Can we still draw it automatically?

Yes, we can augment the graph to use Sugiyama's Framework for an initial Layout and with some clever post-processing we get a nice drawing of our family tree.

1 Preprocess the Graph for Sugiyama¹

Find sets of nodes with same set of parents
- Add node for every such set
- Connect the new nodes to source and target nodes
- Adds a layer of virtual nodes between children and parents
- Introduces no cycles if virtual nodes are connected correctly

Split cross-layer edges for each layer they cross
- No cross-layer edges anymore
- Can be done since layers do not change afterwards

2 Sugiyama on the Augmented Graph

- In-layer node order is fixed afterwards
- Nodes don't overlap if drawn at the given coordinates
- Good crossing minimization

3 Straighten the Edges

Straighten long paths
- For every path try to straighten it on one vertical line
- When the path does not fit on one line pop node from the top
- Retry with the two parts
- Repeat until both parts are straight or we popped all nodes
No guarantee that paths are straight, but performs well enough on our examples.

4 Route Edges

Route edges orthogonally with two bends

Compute via Linear Program
- One Variable Y(e) for every edge e with a value between 0 and 1
- Variable will be interpreted as y-position of the bends

Edges split after family nodes
- Edges merge before family nodes

Edges interacting with splitting couple
- Only applied when nodes are left and right of split
- Differentiate if source node is inside the split nodes range or not
- If in the range we can draw the edge above the split couple
- Otherwise draw it below to potentially reduce drawn crossings

Splitting and merging edges
- If edges go into the same direction sort them appropriately
- Prevents the creation of new crossings

Remaining constraints in two steps
- So far created constraints include order for most edges
- All pairs of conflicting edges not yet sorted get a constraint based on the sources x-coordinate

Example - Excerpt from the GD 2016 Contest Graph

Cross layer relationship is easily trackable.

Confluence makes reading complicated crossings easier.


https://www.ac.tuwien.ac.at