Visual Analysis of Set Relations in a Graph

Panpan Xu¹, Fan Du², Nan Cao³, Conglei Shi¹, Hong Zhou⁴, Huamin Qu¹

¹ Hong Kong University of Science and Technology, 2 Zhejiang University,
   3 IBM T. J. Watson Research Center, 4 Shenzhen University

2013.06.19
Motivation: data model and research questions
Approaches
Previous works
Technical details
Case studies
Limitation and future works
Motivation: data model and research questions

Approaches
Previous works
Technical details
Case studies
Limitation and future works

Outline
Collaboration network

Research topics

- tree
- graph
- hierarchical data
- pipeline
- architecture
Data

Collaboration network

Research topics

- tree
- hierarchical data
- pipeline
- architecture
- graph

Data
Homophily effect

Research questions
Homophily effect

Do “birds of a feather flock together”?
Homophily effect

Do “birds of a feather flock together”? How proximity of nodes correlates to set relation?
Homophily effect
Do “birds of a feather flock together”? How proximity of nodes correlates to set relation?

Set relation over item clusters
Distribution and implicit overlap of the sets
Homophily effect
Do “birds of a feather flock together”? 
How proximity of nodes correlates to set relation?

Set relation over item clusters
Distribution and implicit overlap of the sets

Research questions
Outline

Motivation: data model and research questions

Approaches

Previous works

Technical details

Case studies

Limitation and future works

Outline
Homophily effect

Set relation over item clusters
Homophily effect

**Glyph design** at graph nodes correlates set relation and node distance

Set relation over item clusters
Homophily effect

Glyph design at graph nodes correlates set relation and node distance

Set relation over item clusters

Approaches
Homophily effect

**Glyph design** at graph nodes correlates set relation and node distance

**Set relation over item clusters**

**Contour map + visual link** design

**Layout algorithm** trades precise location of the items for visual simplicity (inspired by metro map drawing, storyline visualization)

Approaches
Homophily effect

**Glyph design** at graph nodes correlates set relation and node distance

**Set relation over item clusters**

**Contour map + visual link design**

**Layout algorithm** trades precise location simplicity (inspired by metro map design)
Outline

Motivation: data model and research questions
Approaches

Previous works
Technical details
Case studies
Limitation and future works

Outline
Previous works - graph visualization

Facetatlas [Cao et al. 10]

PivotPath [Dörk et al. 12]
Previous works – graph visualization

Facetatlas [Cao et al. 10]

PivotPath [Dörk et al. 12]

GraphDice [Bezerianos et al. 10]
Untangling Euler diagrams
[Riche and Dwyer, 10]
Previous works – set visualization

- Untangling Euler diagrams [Riche and Dwyer, 10]
- Bubble Set [Collins et al., 09]
- Line Set [Alper et al., 11]
- Kelp Diagram [Dinkla et al., 12]
Motivation: data model and research questions
Approaches
Previous works
**Technical details**
Case studies
Limitation and future works

Outline
Correlate set overlap and node distance

Scatterplot

Glyph design
Correlate set overlap and node distance

more compact

Shade $\propto$ amount of set overlap

Height $\propto$ the number of nodes at same distances and with similar amount of overlap

Scatterplot  Stacked Barchart

Glyph design
Correlate set overlap and node distance

Scatterplot  Stacked Barchart  Stacked Graph

Glyph design
Draw glyphs for each node on a graph

**Hue:** size of the set compared to its neighbors

Glyph design
Draw glyphs for each node on a graph

Hue: size of the set compared to its neighbors

Glyph design

lots of overlap with distant nodes

community with locally distributed interests
Set visualization over item clusters

- Layout Items
- Generate contour map
- Form backbone spanning tree
- Route visual links

Visually summarize item clusters

Layout visual links for sets

Result
MDS: similar items form visual clusters

- Tree
- Graph
- Hierarchical data
- Pipeline
- Architecture

流程图:

1. 布局项目
2. 生成轮廓图
3. 形成主干树
4. 路由视觉链接
MDS: similar items form visual clusters
Contour map with KDE:
abstracted display of item clusters

MDS: similar items form visual clusters

- tree
- graph
- hierarchical data
- pipeline
- architecture

**Diagram:**

1. **Layout Items**
2. **Generate contour map**
3. **Form backbone spanning tree**
4. **Route visual links**
Contour map with KDE: abstracted display of item clusters

form context for drawing the sets

MDS: similar items form visual clusters

Layout Items → Generate contour map → Form backbone spanning tree → Route visual links
pipeline architecture
hierarchical data
tree
graph
spanning tree
Form backbone spanning tree
Layout Items
Generate contour map
Route visual links
Form MST for items in selected sets

- tree
- graph
- hierarchical data
- pipeline
- architecture

Flow:
1. Layout Items
2. Generate contour map
3. Form backbone spanning tree
4. Route visual links
Form MST for items in selected sets

- Layout Items
- Generate contour map
- Form backbone spanning tree
- Route visual links

Fold small branches on MST
pipeline
architecture
hierarchical data
tree
graph
Fold small branches on MST
Form MST for items in selected sets
Route visual links
Form backbone spanning tree
Straighten branches
Generate contour map
Layout Items
Form MST for items in selected sets

Fold small branches on MST

Segment

Straighten branches

Layout Items → Generate contour map → Form backbone spanning tree → Route visual links
Draw visual link for individual sets

Layout Items ➔ Generate contour map ➔ Form backbone spanning tree ➔ Route visual links
the original MST and the simplified backbone

the visual links for three sets

Layout Items → Generate contour map → Form backbone spanning tree → Route visual links
Motivation: data model and research questions
Approaches
Previous works
Technical details
Case studies
Limitation and future works

Outline
Infovis proceedings (95-02)
Titles, Authors
Abstracts, References
Infovis proceedings (95-02)
Titles, Authors
Abstracts, References

overlap of distant nodes
unique interests

Bibliographic data
Social site data

Last.fm
Artist similarity
User friendship
Listening history
Social site data

Last.fm
Artist similarity
User friendship
Listening history
Glyph design for homophily analysis
Set visualization over item clusters and layout algorithm
Case studies
Motivation: data model and research questions
Approaches
Previous works
Technical details
Case studies
Limitation and future works

Outline
Scalability of glyph design

Use different graph layout, aggregate the nodes
Scalability of glyph design
Use different graph layout, aggregate the nodes

Scalability of set visualization
Improve layout algorithm
Scalability of glyph design
Use different graph layout, aggregate the nodes

Scalability of set visualization
Improve layout algorithm

Evaluation
Compare with existing techniques (Line set, Kelp diagram)
Scalability of glyph design
Use different graph layout, aggregate the nodes

Scalability of set visualization
Improve layout algorithm

Evaluation
Compare with existing techniques (Line set, Kelp diagram)

Application of set visualization technique
Draw sets on word cloud, tree map, etc.
Thanks!
panpan
pxu@ust.hk
Last.fm Data
Artist similarity collected through Last.fm web API
User information could also be accessed

Infovis 04 publication data
Keyword similarity: through topic modeling (LDA) and co-citation