Improve Visual Perception and Human Understanding of Big Data using Graph/Hypergraph-based Visualisation

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Context of research

- PhD done within Collaboration Spotting project, team of J.M. Le Goff: graph-based data visual navigation.
- Different use cases:
  - publications and patents of particle physics,
  - TIM powered by JRC UE,
  - Ariadne LHCb,
  - neuroscience, risk analysis, ...

Hypergraphs of collaborations

Hypergraphs:
- keep n-adic relationship
- have an intrinsic duality: sets / relationships

Opened questions:
- Which layout of hypergraphs optimizes the visual information displayed?
- How to assess the loss of information in this context?
- How to quantify the gain in visualization efficiency?
- Need for user evaluation

Research questions

- How to visualize multidimensional datasets such that it enhances collaboration, navigation and interaction in the different visual dimensions?
- Which visualization of collaborations for a single dimension?
- How to optimize the quantity of visual information given?
- How to compare the different visualizations for a better visual perception and human understanding?
- Which model and visualization of data suits to collaborations enhancement with growing number of dimensions?
- What is a multi-view of dataset?
- Which layout for the different dimensions?
- How to optimize the rendering?
- How to evaluate these different approaches?

Approach and challenges

- Literature survey: data models, visual analytics, graph and hypergraph theory, measurement of visual information, layout algorithms
- Find typical use cases: publication and patents, particle physics, neuroscience, risk analysis
- Building a generic model of data that enhances collaborations
- Computational issues: most of the algorithms are in $O(n^2)$. Finding strategies for visualization and processing of large data sets.

First results

- Different layouts for collaboration display
- First developments of multi-views

Multidimensional visualization

- Need for a model of data that enhances collaborations
- How to visualize different dimensions simultaneously?
- What can we learn from such visualization?

Graph of collaborations of organisations

DataEdre, circular layout

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