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

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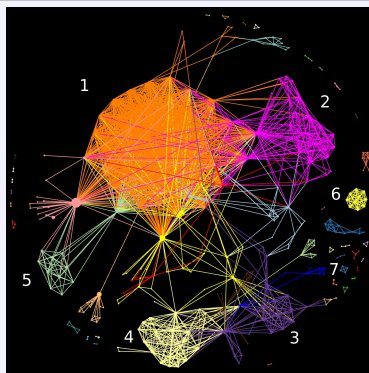
Context of research

◇ 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,
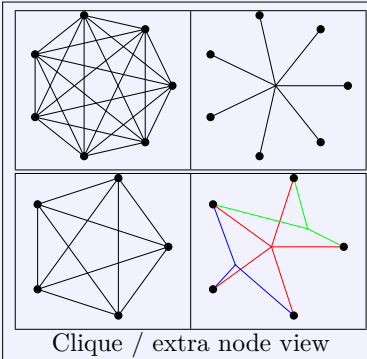- neuroscience, risk analysis,...

Graph of collaborations of organisations

Hypergraphs of collaborations

Hypergraphs:

◇ keep n-adic relationship

◇ have an intrinsic duality : sets / relationships

Clique / extra node view

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 multi-dimensional datasets such that it enhances collaboration, navigation and interaction in the different visual dimensions ?
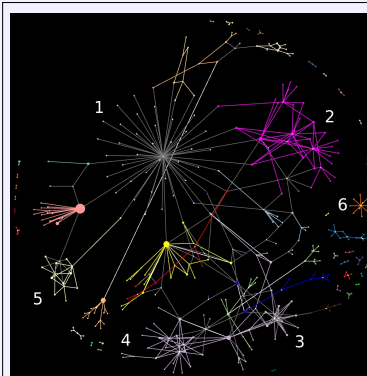
◇ Which visualization of collaborations for a single dimension ?

◇ 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

◇ **Litterature 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**.
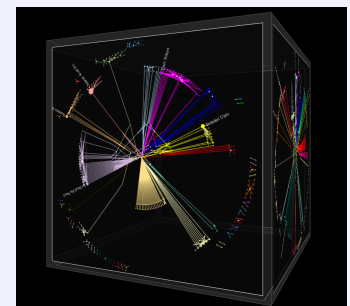
First results

◇ Different layouts for collaboration display

◇ First developments of multi-views

Extra node view

Multidimensional visualization

◇ Need for a model of data that enhances collaborations

◇ How to visualize different dimensions simultaneously ?

◇ What can we learn from such visualization ?

DataEdre, circular layout