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

Xavier Ouvrard supervised by Pr. Stéphane Marchand-Maillet – UniGe

PhD context

⬦ PhD done within **Collaboration Spotting** project, team of J.M. Le Goff: graph-based data visual navigation.
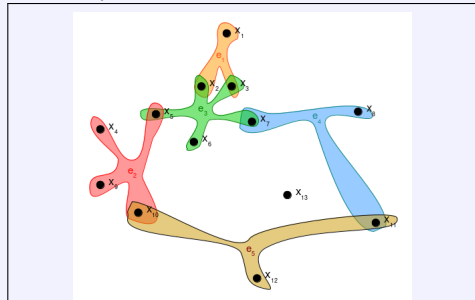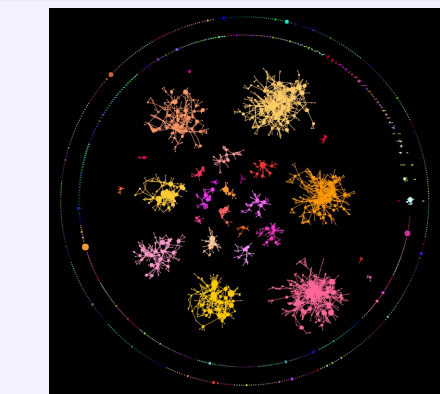
Hypergraphs

⬦ **Collaborations**:
 – sets of elements
 – n-adic relationships
⬦ **Hypergraphs** fits for n-adic relationships

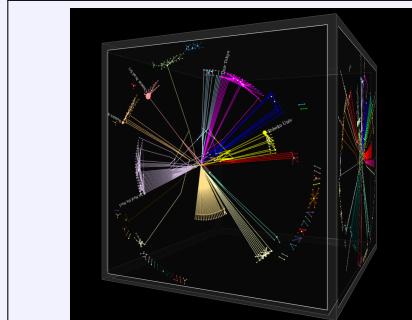"PaintSplash" representation of hypergraph

Visualisation of large hypergraphs

Hypergraph Framework

⬦ Interaction between facets through a reference
⬦ Collaborations built via a reference

DataEdre, circular layout

Research questions

⬦ One global RQ:
How to visually render collaborations so it allows smooth interaction with the data for knowledge discovery?
⬦ Different facets of the global RQ:
 ⊛ **Modelisation of dataset with collaborations**:
– Are hypergraphs pertinent to achieve interactive navigation and visualisation of facets in an information space?
 ⊛ **Visualisation of hypergraphs and KD**:
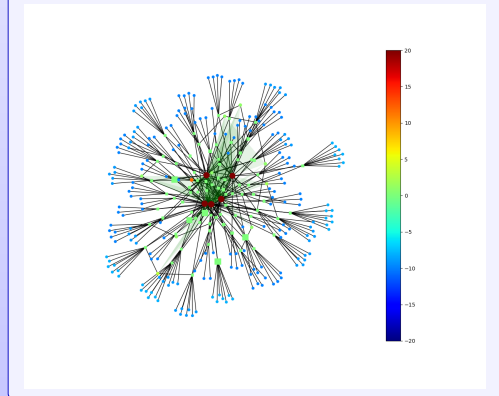=> implies answering theoretical RQ on hypergraphs:
– **How to extend the concept of adjacency in a hypergraph?**
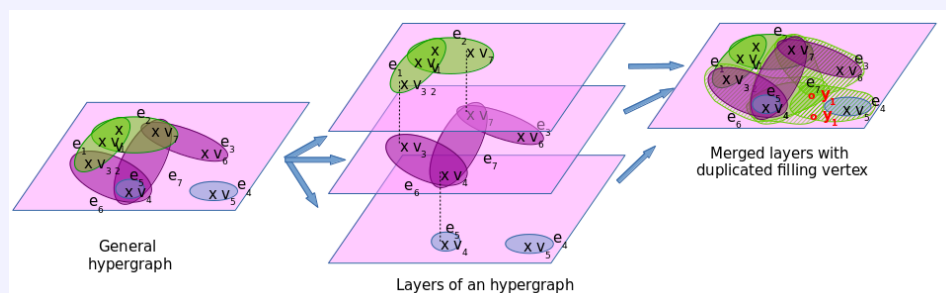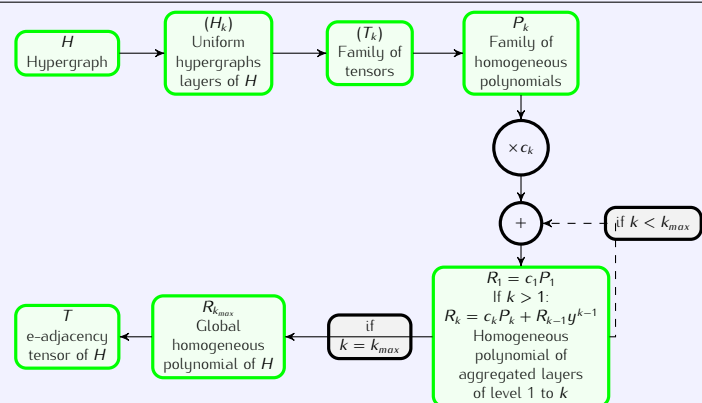– **How to coarsen a hypergraph?**

e-adjacency tensor

⬦ k-**adjacency**: k nodes in one given hyperedge
⬦ **e-adjacency**: nodes that belongs to same hyperedge
⬦ in general hypergraph: e-adjacency $\implies |e|$-adjacency
⬦ **e-adjacency tensor**:
 – making family of tensor of different orders one tensor
 – order: $\max |e|$, dimension: $|V| + \max |e| - 1$

Additional element in the lower level and merging (step 1)

Coarsening of hypergraphs

⬦ Different techniques: k-core, diffusion, exchange, spectral techniques, summarization
⬦ Coarsening by keeping meaningful informations and structures
⬦ **Exchange approach** allows to retrieve main nodes / hyperedges