

A first presentation about the ideas for a network project by Manuel Wissiak & Maximilian Stollmayer.

Modularity-Based Community Detection

Network: UN Global Migrations (1990-2015)

- source: [Netzschleuder](#)
- nodes: countries / regions (232)
- edges: directed migrationflow, weighted by amount of people migrating (11159)



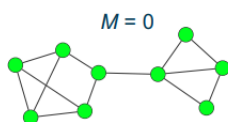
Presentation outline

Scene 1: Modularity

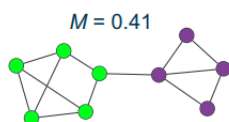
Explain modularity by using a simple toy graph in VR and showing modularity for different partitions, like in the lecture:

Modularity

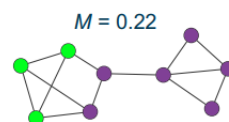
- Modularity of a particular partitioning: $M_c = \sum_{c=1}^{n_c} \left(\frac{L_c}{L} - \left(\frac{k_c}{2L} \right)^2 \right)$



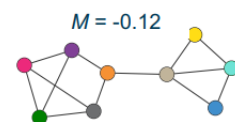
Single community:
 $M = 0$



Optimal community:
Largest modularity value



Suboptimal community:
Positive modularity



Negative modularity:
Partitioning does not
reflect communities.

Scene 2: Greedy Algorithm

Explain algorithm by using the toy graph in VR and transitioning through the steps described in the original paper, [Clauset, Newman & Moore: "Finding community structure in very large networks"](#).

Scene 3: Migration Network

Show network in VR and the detected communities using the algorithm.

Scene 4: Results

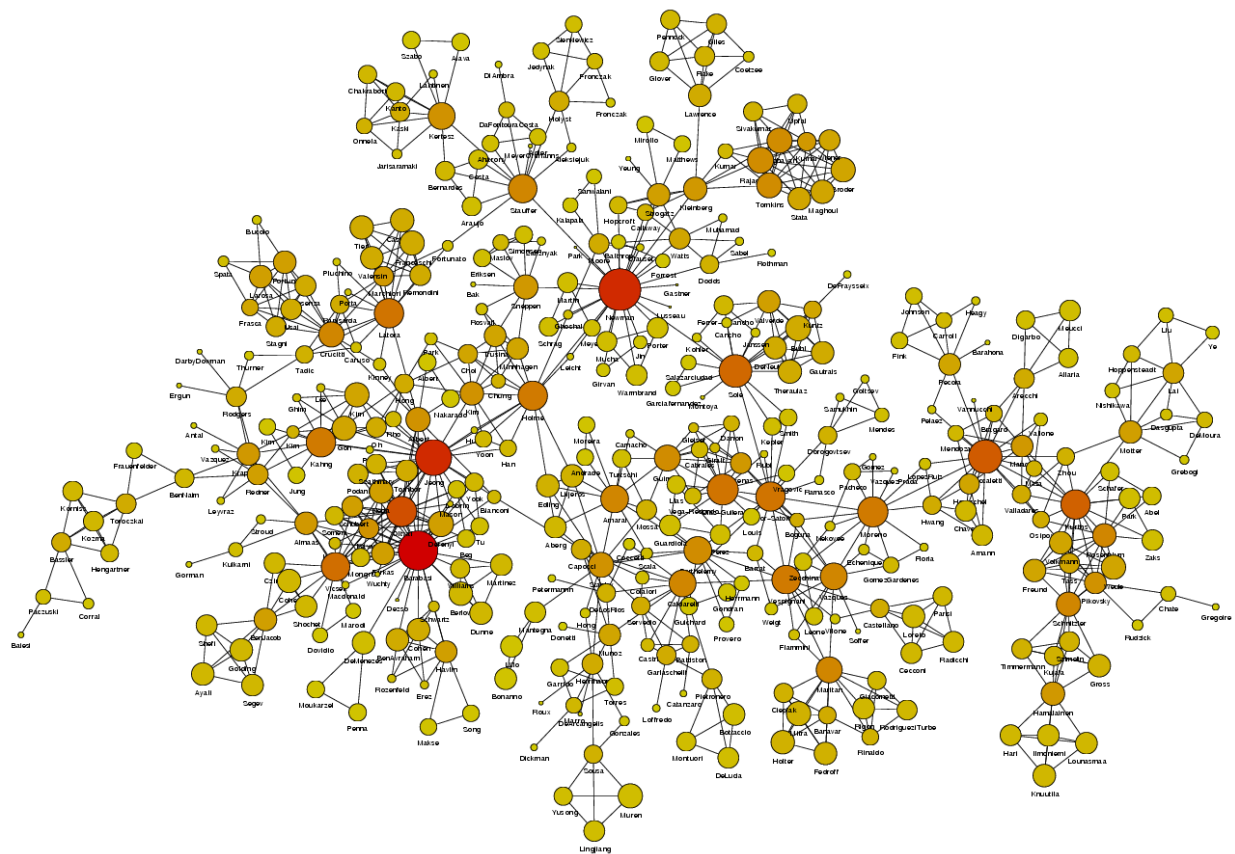
Interpret the findings and give outlook.

Persistent Homology

Network: Science Collaboration Network

- source: [Mark Newman's Network Repository](#)
- nodes: authors of network science publications (1589)
- edges: collaboration on at least a paper (2742), weighted by

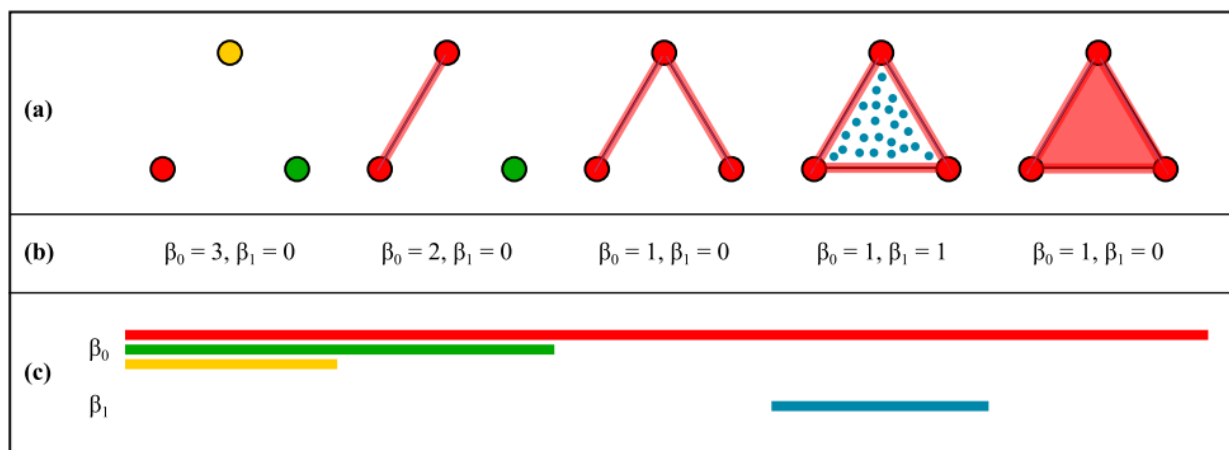
$$\sum_{\text{papers}} \frac{1}{\# \text{ authors of paper} - 1}$$



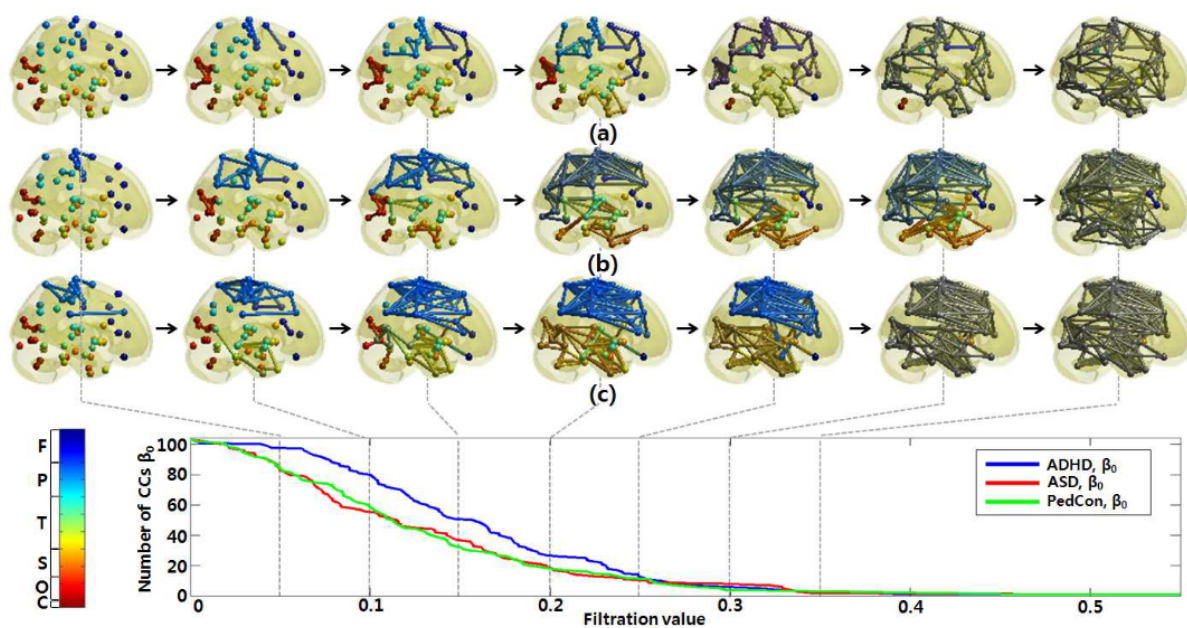
presentation outline

Scene 1: Persistent Homology

Motivate a different approach to analysing network properties and explain the topological concepts on a toy graph in VR. Like Betti numbers in the paper [Carstens, Horadam: "Persistent Homology of Collaboration Networks"](#):



Or like in the paper [Chung et al: "Persistent Brain Network Homology from the Perspective of Dendrogram"](#):



Scene 2: Collaboration Network

Show collaboration network in VR with the filtrations and maybe compare to the behaviour of a similar random model using some statistics.

Scene 3: Results

Interpret the findings and motivate some further research in the application of this concept.