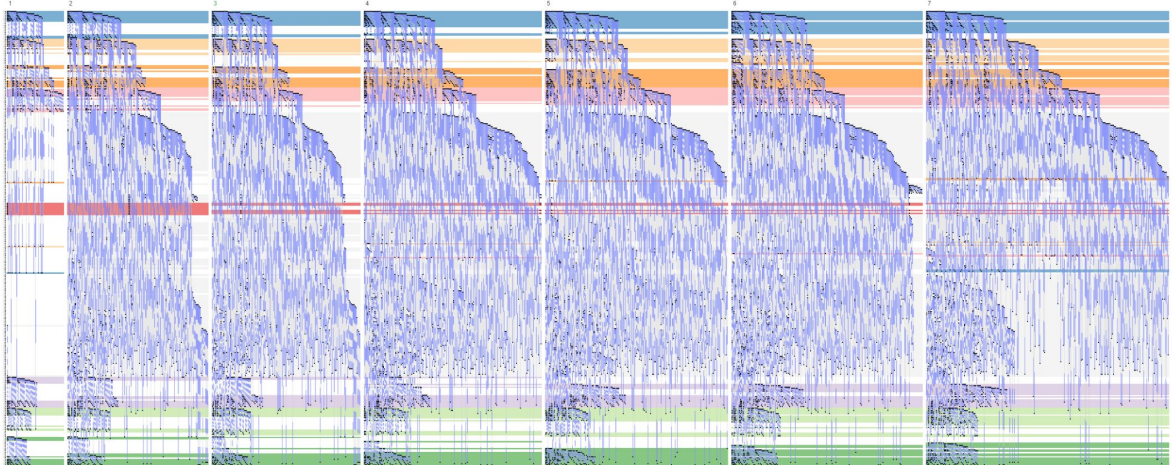


IVAN



Interactive and Visual Analysis of Networks

Torsten Möller, Univ. Vienna, Austria

<https://vda.cs.univie.ac.at>

Jean-Daniel Fekete, Inria, France

<http://www.aviz.fr>

Dimitri Van De Ville, EPFL, Switzerland

<http://miplab.epfl.ch>

Scientific Background

- Dynamic Networks are used in many scientific domains, such as
 - neurobiology to model the evolution of the brain according to signals (EEG, fMRI)
 - Social sciences to model the evolution of social ties according to documents or sites
- Clustering these networks is important to find regularities, invariants, better understand them, and achieve scalable analysis
- Novel clustering algorithms exist for dynamic networks, but they are black boxes, hard to understand, validate, control, adapt, steer
- The aim of the IVAN project is to make these novel algorithms accessible to a broad range of users and researchers to enable reliable and informed decisions based on the network analysis under uncertainty

Key Challenges and Potential Impact

- Development of harmonic analysis for graphs
 - Spectral methods and graph wavelet transforms, hard to understand and to harness
- Directed and zoom-able analysis to nodes of interest
 - Currently not able to analyse parts of the network while watching global network organization
- Comparative network clustering analysis
 - Tool make sense of clusterings, assessing the quality and uncertainty of the process
- Clustering sets of networks and clustered networks
 - Maintain hundreds of clusterings and explore them to understand their variety
- Understanding the needs and user tasks across different communities
- Need for computationally efficient methods

Partners

- Torsten Möller, Visualization and Data Analysis research group, Faculty of Computer Science, University of Vienna
 - Long history in exploring the issues of modeling under uncertainty and decision making. Successful in a collaboration with fisheries scientists and medical image segmentation.
- Jean-Daniel Fekete, Inria Saclay - Ile-de-France - EPI Aviz
 - Well-established reputation in HCI, network visualization, and evaluation methods for visualization. Collaborations with leading groups related to network visualization at scale.
- Dimitri Van De Ville, Ecole Polytechnique Fédérale de Lausanne / Institute of Bioengineering
 - Expertise in advanced signal processing, such as dynamic brain networks, wavelet design to obtain tight frames for multiplex graphs, statistical inference and surrogate data generation on graphs.

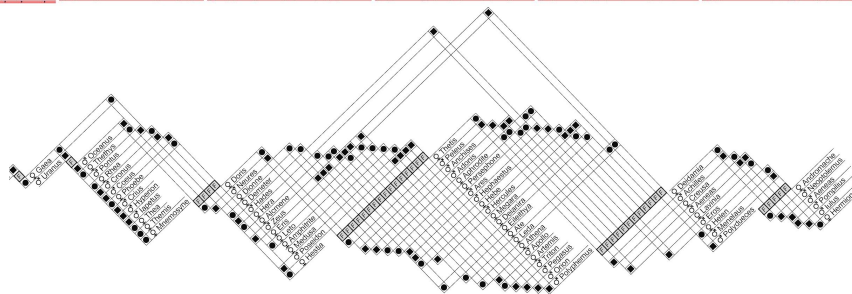
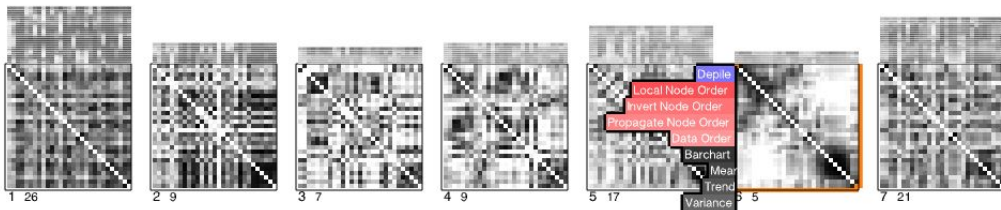
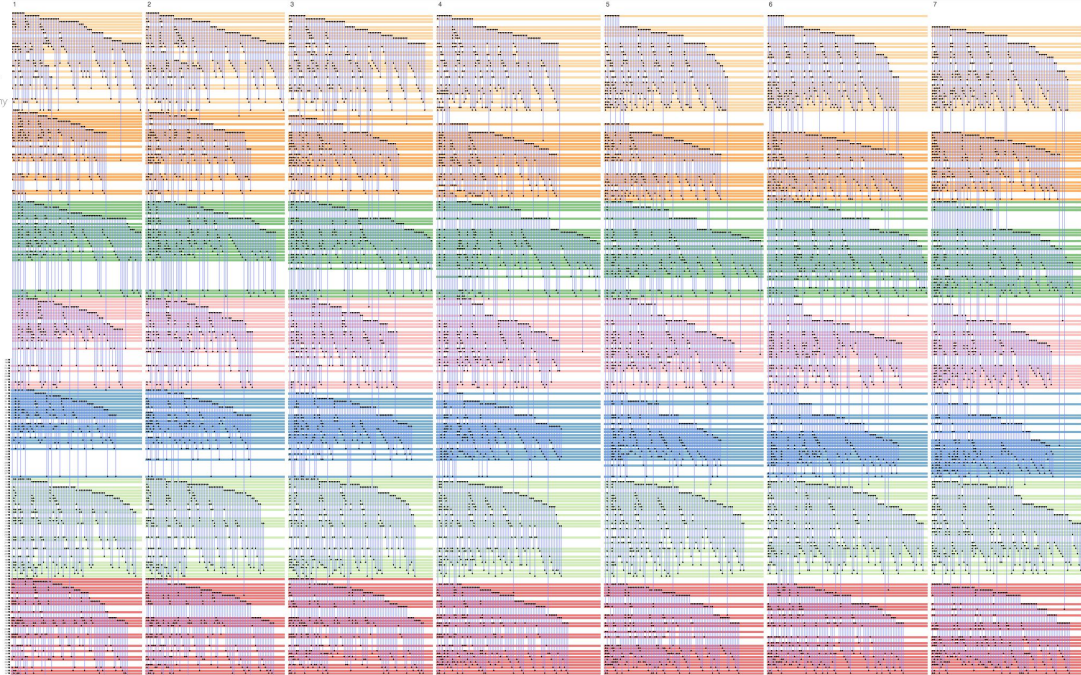
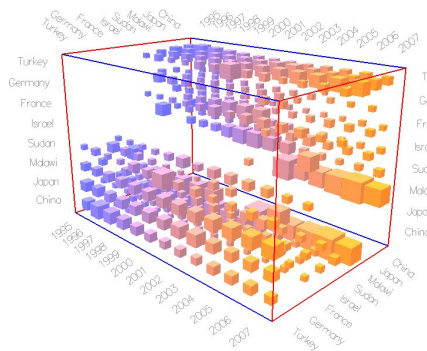
Complementary Skills

- Dr. Van De Ville's group at EPFL expert in mathematical analysis of graphs
 - Will benefit from the advanced interactive visualization methods, as well as expertise of new application areas (e.g., social networks, like Twitter data) from Aviz/Inria
 - Will benefit from the experience of UofV to more swiftly test hypothesis and come up with intuitions on how to build better and faster algorithms
- Dr. Fekete's group at Inria expert in network visualization and interaction
 - Will benefit from EPFL expertise in clustering and analysis of dynamic networks
 - Will benefit from UofV expertise in building interfaces for the exploration of parameter spaces
- Dr. Möller's group at UofV expert in exploration of parameter spaces, and data-driven modeling
 - Will analyse the needs and requirements of modern mathematical modeling approaches applied to network and graph analysis from EPFL
 - Will learn the state-of-the-art in network visualization from Aviz/Inria

Results

To come

It's going to be Amazing!



Sustainability & Valorisation

- Open source developments on github or similar repositories
- Tools will be applied to public datasets (and replicable)
 - from the SNAP such as the 476 million Twitter tweets,
 - the coauthorship network of the French HAL publication repository containing metadata for 1.2 million articles and 422,000 full texts (hal.archives-ouvertes.fr/),
 - EEG data recorded and simulated, in the range of seconds and 300 sensors (MEG SIM Data at cobre.mrn.org/megsim/empdata/),
 - fMRI data from the Human Connectome Project
- Scientific Publications
- Direct collaborations with specific users
 - biologists, engineers, or social scientists, with classes and schools