SOE 19: Networks, From Topology to Dynamics II (joint with DY and BP)

Time: Thursday 12:15–13:00 Location: GÖR 226

SOE 19.1 Thu 12:15 GÖR 226

Synchronization in two-layer multiplex networks of conformist and contrarian interactions — •Maximilian Sadilek[1] and Stefan Thurner[1,2,3] — [1]Section for Science of Complex Systems, Medical University of Vienna, Spitalgasse 23, A-1090, Austria — [2]Santa Fe Institute, 1399 Hyde Park Road, Santa Fe, NM 87501, USA — [3]International Institute for Applied Systems Analysis, Schlossplatz 1, A-2361 Laxenburg, Austria

Several mathematical models have been proposed to describe synchronization in social, biological and physical systems, the most known being the Kuramoto model (KM).

We present a Kuramoto-type model on two layers which is designed to capture the interplay of synchronization-enhancing (conformist) and -reducing (contrarian) links in a multiplex network. The model is a combination of a KM on the first layer and a phase shifted KM on the second layer. The topology of the layers varies from random networks to small world networks.

We find indications of a phase transition from the synchronized to the unsynchronized phase in terms of the phase shift parameter of the model. Further, we observe an upward shift of the dominant frequencies in the power spectra with increasing values of the phase shift parameter.

These results may elucidate the understanding of synchronization modes in the human brain and their consequences.

SOE 19.2 Thu 12:30 GÖR 226

Controllability of Temporal Networks — •Márton Pósfai[1,2] and Philipp Hövel[2,3] — [1]Department of Physics of Complex Systems, Eötvös University, Budapest, Hungary — [2]Institut für Theoretische Physik, TU Berlin, Berlin, Germany — [3]Bernstein Center for Computational Neuroscience, HU Berlin, Berlin, Germany

The control of complex systems is an ongoing challenge of complexity research. Resent advances making use of structural control made it possible to deduce a wide range of control related properties from the network representation of complex systems. Here we examine the controllability of complex systems for which the timescale of the dynamics we control and the timescale of changes in the network topology are comparable. We provide analytical and computational tools to study the controllability of such systems based on temporal network characteristics of the system. We apply these results to investigate the controllable subnetwork using a single input. We present analytical results for a simple class of temporal network models, and we preform measurements using data collected from real systems. Depending on the density of the interactions compared to the timescale of the dynamics, we witness a phase transition describing the sudden emergence of a giant controllable subspace spanning a finite fraction of the network. We also study the role of temporal patterns in real data making use of various randomization processes, with special focus on the role of the hubs.

SOE 19.3 Thu 12:45 GÖR 226

Analysis of local network structure by node-specific triadic Z-score profiles — •Marco Winkler and Jörg Reichardt — Institute for Theoretical Physics, University of Würzburg, Germany

Over the last decade so called network motifs have attracted high attention. A motif is a subgraph pattern that appears significantly more often than in a random network with the same degree distribution as the original one. Triadic Z-score profiles, $\vec{Z}$, assign every possible triadic subgraph pattern i a score Z_i, corresponding to the magnitude of over-/underrepresentation of the pattern compared to the random null model. These Z-score profiles are a common tool to analyze complex networks.

However, triad patterns are not necessarily homogeneously distributed over the network. Therefore, we introduce the concept of *node-specific Z-scores*. For the node-specific Z-score profile, $\vec{Z}^{\alpha}$, of a node α, only the triads it participates in are taken into account. The node-specific Z-score profiles can then be used for classification of a network's vertices into different structural groups. We present results for various real-world data sets including neural networks and transcription networks.