AGSOE 19: Networks: From Topology to Dynamics IV

Time: Thursday 16:00–18:00 Location: BAR 205

AGSOE 19.1 Thu 16:00 BAR 205

Statistical Mechanics and Homology of Neighborhod Complexes — •Danijela Horak[1], Slobodan Maletic[2], and Milan Rajkovic[2] — [1]Max Planck Institute for Mathematics in the Natural Sciences, Leipzig — [2]Institute of Nuclear Sciences Vinca, Belgrade

Complex networks are encoded into simplicial complexes (neighborhood complexes) and analyzed from alegbraic, combinatorial and topological aspect. Certian topological invariants are shown to have distinct statistical properties and in analogy to statistical mechanics of networks we develop a statistical mechanics of simplicial complexes. Long lived topological features, considered as topological signal, are distinguished from short lived ones, considered as topological noise. A new topological invariant, persistent homology, is determined and presented as a parametrized version of a Betti number. Complex networks with distinct degree distributions exhibit distinct persistent topological features. Persistent toplogical attributes, shown to be related to robust quality of networks, also reflect defficiency in certain connectivity properites of networks. Random networks, networks with exponential conectivity distribution and scale-free networks are considered for homological persistency analysis. Furthermore, the advantages of such an approach and new results are illustrated in applications to economic and social models on networks (e.g. Axelrod model and its variants).

AGSOE 19.2 Thu 16:30 BAR 205

Networks of monetary transactions as signals of growth or decay in production chains — Marco Lamieri[1], •Volker Nannen[1], and Guy Kelman[2] — [1]Fondazione ISI, Torino, Italy — [2]Hebrew University, Jerusalem, Israel

While numerous publications have acknowledged the fact that businesses form a network and that the nature of this network has significant consequences for the economic dynamics, to the best of our knowledge no attempt has so far been made to extract this network from transaction records.

Here we use the database of economic transactions (bank transfers and financial factoring among Italian firms) provided by Intesa Sanpaolo s.p.a., the biggest Italian commercial bank group. The available sample covers 80% of Italian firms and represents about 25% of the total value of Italian financial transactions. The sample is representative both at the sector level and at the geographical level.

We aggregate the raw data into a comprehensive dynamic transaction network where the nodes are firms, characterized by turnover and risk level, and the links are transactions. We present the statistical properties of this network like the dynamics of the connectivity and monetary flow. Special attention is given to the effects of the current financial crisis.

AGSOE 19.3 Thu 17:00 BAR 205

Delays in Train Networks — •Christoph Fretter[1], Marc-Thorsten Hütt[2], Lachezar Krumov[3], Matthias Müller-Hannemann[1], and Karsten Weihe[3] — [1]Martin Luther Universität Halle — [2]Jacobs Universy Bremen — [3]Technische Universität Darmstadt

In cooperation with Deutsche Bahn AG, we study the propagation of delays in railway networks. In case of a train delay, a waiting policy determines whether a connecting train has to wait. Depending on these decisions passengers miss or reach their connection. Letting trains wait for others introduces a delay cascade.

We investigate delay response functions derived from real passenger data of the current train schedule, and discuss several models which give insight into the connection between topology and dynamics.

AGSOE 19.4 Thu 17:30 BAR 205

Public Transport Routes and Self-avoiding Walks — •Christian von Ferber[1,2], Taras Holovatch[1,3], Yurij Holovatch[4,5], and Vasyl Palchykov[4] — [1]Applied Mathematics Research Centre, Coventry University, UK — [2]Physikalisches Institut, Universität Freiburg — [3]Laboratoire de Physique des Materiaux, Université Nancy, France — [4]ICPM National Academy of Sciences of Ukraine, Lviv — [5]Institut für Theoretische Physik, Universität Linz, Österreich

We explore the fractal dimensions of public transport routes of different cities with the finding that their fractal behaviour is close to that of self-avoiding walks. Self-avoiding walks, apart from observing the constraint of non-self-intersection evolve randomly. The fact that PT routes appear to display a similar scaling symmetry is quite unexpected. In particular, this behavior seems to be at odds with the requirement of minimizing passengers traveling time between origin to destination. The latter argument, however, ignores the time passengers spend walking to the initial and from the final stations. Including these, one understands the need for the routes to cover larger areas by meandering through neighborhoods. Given the requirements for a PTN to cover a metropolitan area with a limited number of routes while simultaneously offering fast transport across the city routes scaling like SAWs may present an optimal solution.

On Thursday evening, there will be social get-together with all invited speakers from the AGSOE program and the SYCS Symposium. Details are announced during the member's meeting on Monday, 18:00-19:00.