AKSOE 10: Social-, Information-, and Production Networks

Time: Wednesday 13:30–18:15 Location: H8

AKSOE 10.1 Wed 13:30 H8

Collective behaviour in clustered social networks. — •Maciej Wołoszyn[1], Dietrich Stauffer[2], and Krzysztof Kułakowski[1] — [1]Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, al. Mickiewicza 30, PL-30059 Kraków, Poland — [2]Institute of Theoretical Physics, University of Köln, Zülpicher Str. 77, D-50937 Köln, Germany

A hierarchy of groups forming the network model of community (D.J. Watts et al., Science 296 (2002) 1302) is investigated in search for the order-disorder phase transition. Each group consists of 5 individuals endowed with a spin-like variables $s_i = \pm 1$ with Ising interaction $J > 0$. Links between individuals are created with probability proportional to $exp(-\alpha x)$, where x is the distance in the hierarchy and α is a clustering parameter. The Metropolis algorithm is used to calculate the ordering temperature T_c from the relaxation time of the average value of spins. As a result, T_c was found to be close to 3.3 for $\alpha < 1.0$ and falling down to zero above this value, which provides a mathematical illustration of the social ability to a collective action via weak ties, as discussed by M. Granovetter (Am. J. of Sociology 78 (1973) 1360).

AKSOE 10.2 Wed 14:00 H8

Stochastic models for social tagging behavior — •Ciro Cattuto[1,2], Vittorio Loreto[2], and Luciano Pietronero[2] — [1]Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi, Roma, Italy — [2]La Sapienza University Physics Department, Roma, Italy

A new paradigm has been quickly gaining ground on the World Wide Web: Collaborative Tagging. In web applications like del.icio.us, Flickr, Connotea, users manage their personal collection of online resources by enriching them with semantically meaningful information in the form of freely chosen tags. Despite the anarchic nature of users' behavior, the global dynamics of these systems leads to a self-organised categorization (folksonomy) of a large and evolving body of information. Here we collect data from a popular online system and select a semantic context by extracting all the resources associated with a given tag. On studying the distribution of tags co-occurring with the selected one, we find a heavy-tailed behavior and observe properties that point to an emergent hierarchy of tags. We introduce a stochastic model embodying two main aspects of collaborative tagging: (i) a multiplicative character related to the exposure of users to each other's activity; (ii) a notion of long-term memory. Remarkably, our model is able to account quantitatively for the measured properties of tag association, providing a clear indication that collaborative tagging is able to recruit the uncoordinated actions of web users to create a coherent and predictable semiotic dynamics at the emergent level.

— SYNF Symposium "Nonlinear and Fractional Transport in Complex Systems"14:30 - 17:15 in H1 —

AKSOE 10.3 Wed 17:15 H8

Efficient Recovery from Cascading Failures in Complex Networks — •Lubos Buzna[1], Karsten Peters[2], and Dirk Helbing[1] — [1]Chair for Traffic Modelling and Econometrics, TU Dresden, Dresden, Germany — [2]Chair for Logistics and Transport, TU Dresden, Dresden, Germany

Most infrastructures, organisations and communication systems in modern societies are based on large complex networks. The possibility of cascading failures is an "Achille's heel"of these complex systems and reflects their vulnerability. If an initial failure affects other elements of the network, it may multiply its impact and can result in disastrous problems. Using a recently developed generic model for failure spreading mechanisms, we have studied the dynamic evolution of failures for sample networks. Based on computer simulations of failure spreading scenarios, we have investigated the efficiency of different strategies to fight the spreading of disasters. Our investigations are focused on the comparison of strategies under different conditions. The results indicate that, for certain parameter regions, the success of recovery measures and disaster containment depends crucially on the chosen management strategy. We have demonstrated that, under certain circumstances, optimization techniques can be employed to improve the performance of recovery strategies.

AKSOE 10.4 Wed 17:45 H8

Robustness and Dynamical Behaviour of Small-Scale Manufacturing Networks — •Reik Donner[1], Uwe Hinrichs[2], and Bernd Scholz-Reiter[2] — [1]Institute of Transport and Economics, Technical University Dresden, Andreas-Schubert-Str. 23, 01062 Dresden — [2]BIBA, University of Bremen, Hochschulring 20, 28359 Bremen, Germany

Intrinsic instabilities of production networks are a serious economic danger especially for small companies. On the one hand, random fluctuations of processing times cause an immediate instability which can lead to production breakdowns due to a lack of material and result in an intermittent accumulation of orders. On the other hand, event-discrete simulations indicate that such fluctuations may also have a constructive effect on the dynamics: If a push strategy is applied for the production process, long down times of the machines after each processed workpiece may lead to a successive increase of the stocks of semi-finished material. This increase is found to be decelerated by fluctuating processing times. In the more realistic case of a pull control, improper lot sizes result in an aperiodic behaviour even for constant processing times. The critical parameters associated with the different effects are identified for two different network topologies: linear supply chains and symmetrically interacting manufacturers. For a quantitative characterization of the dynamics, we apply sophisticated nonlinear methods of time series analysis, such as concepts basing on a symbolic dynamics description as well as recurrence quantification analysis.