

AKSOE 10 Social, Information and Production Networks I

Zeit: Dienstag 10:00–12:30

Raum: TU P-N203

Hauptvortrag

AKSOE 10.1 Di 10:00 TU P-N203

Information Horizons and Self Organization in Social Networks — ●KIM SNEPPEN — NORDITA, Blegdamsvej 17, Dk 2100, Copenhagen, Denmark

Life without information is not life. From the genetic blueprint in our DNA to the world-wide Internet, information and its dynamic counterpart communication define our civilization. However, we live under the limited information horizon, in the sense that information is often imperfect and communication is always finite. In a society the information horizon is set by each individual's social contacts, which in turn is a part of the global network of human communication. One simple goal for individuals is to be central. Thus we model a society where players try to be as close as possible to everybody else by moving their social connections. Thus we suggest a model that quantify the interplay between local communication and the emergent global organization of social networks.

The concept of a limited information horizon in a complex network can be quantified by counting the number of bits needed to navigate between nodes in the network. We discuss the thereby introduced search information, and show how different real world networks organize with respect to this measure. We discuss how to navigate in these networks, and quantify how limited information access influence our ability to search a network.

— 15 min. Break —

AKSOE 10.2 Di 11:00 TU P-N203

Network analysis of markets — ●JÖRG REICHARDT and STEFAN BORNHOLDT — Institute for Theoretical Physics, University of Bremen

Many systems in economy and society may be viewed as networks which often show a surprising modularity. An analysis of this modular structure is often of considerable interest for empirical market research.

Considering a market data set, we apply a recently developed algorithm [1] to the *de novo* detection of product or consumer communities. To do so, we map the problem of network community detection onto finding the minima in the Hamiltonian of a Potts spin glass. Communities are found to coincide with the domains of equal spin value in these minima. Comparing global and local minima of the Hamiltonian allows for the detection of hierarchies and overlapping ("fuzzy") communities and quantifying the association of nodes with multiple communities as well as the robustness of a community. The resulting product communities are compared with standard classifications and the consumer communities clustering allows for targeted marketing.

[1] J. Reichardt, S. Bornholdt, Phys. Rev. Lett. **93**, 218701, (2004)

AKSOE 10.3 Di 11:30 TU P-N203

Interaction Network Approach to Catastrophe Dynamics — ●CHRISTIAN KÜHNERT, DIRK HELBING, and HENDRIK AMMOSER — Institute for Transport & Economics, Dresden University of Technology

Catastrophes like the Weißeritz and Elbe flooding in 2002 or recent blackouts in the US and Italy exhibit a lot of domino-effects: one critical situation triggers another and therefore worsens the situation even more. These connected effects complicate accessing decisions in disaster management. They bear the risk that decisions are made which consider short-term effects only and neglect possible negative long-term consequences.

We describe the interdependencies between the sectors by an interaction network model. Analyses of former events allow to identify the network structures of different types of catastrophes. We simulate the temporal development of the catastrophe and evaluate the total effect on the system. This allows the disaster management to compare several options in fighting the catastrophe in advance and to choose the most suitable one.

AKSOE 10.4 Di 12:00 TU P-N203

Social Networks of Money analyzed with Feynman-Graphs — ●DIETER BRAUN — Noether Group on Dissipative Biosystems, Applied Physics, LMU München, Amalienstr. 54, D-80799 München

Social networks are created by transfer of goods which are memorized in the asset-liability nomenclature of double entry bookkeeping. These social webbing can be analyzed with a revealing analogy based on that positive momentum mimics asset, negative momentum liability [1-4]. From

this axiom, it follows that particle pair creation stands for money creation, force for profit and energy for the quantity of money. Bookkeeping - like quantum mechanics - implements conservation of momentum, but no strict conservation of energy. Feynman-graphs decompose monetary networks into their axiomatic asset-liability pair creations/annihilations. We find:

(i) Economies under random transfer suffer information overload under a diverging quantity of money [3].

(ii) They converge under transfers from a concave potential. The wealth distribution is given by a Boltzmann law [3].

(iii) Bank bookkeeping should implement a system of two independent currencies for debit and credit.

(iv) Tunneling metastable transfer potentials can lead to catastrophic wealth concentration.

[1] Physica A 324:266-271 (2003)

[2] Physica A 290:491-500 (2001)

[3] Physica A 321:605-618 (2003)

[4] www.bookkeepingmechanics.com