SOE 16: Networks and Systemic Risks (joint SOE/DY)

Time: Thursday 9:30–11:30 Location: H17

SOE 16.1 Thu 9:30 H17

Large-deviation properties of random graphs — •Alexander K. Hartmann — University of Oldenburg

Distributions of the size of the largest component of the 2-core and of the graph diamater for Erdős-Rényi (ER) random graphs with finite connectivity c and a finite number N of nodes are numerically studied [1]. The distributions are obtained basically over the full range of the support, with probabilities down to values as small as 10^{-320}. This is achieved by using an artificial finite-temperature (Boltzmann) ensemble. The distributions for the 2-core [2] resemble roughly the results obtained previously [3] for the largest components of the full ER random graphs, but they are shifted to much smaller probabilities ($c \leq 1$) or to smaller sizes ($c > 1$). For the diameter [4], for values $c < 1$, our results are in good agreement with analytical results. For $c > 1$ the distribution is more complex and no complete analytical results are available.

For both cases, the numerical data is compatible with a convergence of the rate function to a limiting shape, i.e., the large-deviations principle apparently holds.

[1] A. K. Hartmann, Big Practical Guide to Computer Simulations, World-Scientific, Singapore (2015)
[1] A.K. Hartmann, Eur. Phys. J. Special Topics **226**, 567 (2017)
[2] A.K. Hartmann, Eur. Phys. J. B **84**, 627-634 (2011)
[3] A.K. Hartmann and M. Mézard, Phys. Rev. E **97**, 032128 (2018)

SOE 16.2 Thu 10:00 H17

Sparse Network Reconstruction and Systemic Risk — •Alexander Becker[1], Irena Vodenska[1], and Diego Garlaschelli[2] — [1]Boston University, Boston, USA — [2]IMT Lucca, Lucca, Italy

The study of systemic risk in complex networks requires both a good model and detailed knowledge of the network. Often, we cannot observe individual edges, and information is only available about the nodes on an aggregate level. If systemic risk is to be modeled as a shock propagation, an accurate estimate of the edges is imperative. Recently, a variety of network reconstruction methods has been put forth, of which the configuration model based on the principle of maximum entropy has emerged as a front runner.

Remarkably, such reconstruction attempts on the Japanese firm-bank data set have yielded networks which underestimate the systemic risk in the system. We establish limits on the applicability of reconstruction methods for sparse networks and demonstrate the implications for systemic risk analysis.

SOE 16.3 Thu 10:15 H17

Agent Bases Models and Complex Networks for Insurance Riskmanagement — •Magda Schiegl — University of Applied Sciences, Landshut, Germany

Riskmanagement is a main topic in insurance business with a variety of methods that are used traditionally in this field. The natural sciences develop models and methods to describe and understand complex systems. Some of the most successful developments of the last few decades are agent based models and complex networks. They have also been applied to socio-economic contexts and have been documented in a huge amount of scientific literature. We deal with the application of agent based models and complex networks in insurance business. We give a review of scientific research in these fields with special relevance for riskmanagement. Some examples that can be examined and/or modelled with this kind of methods are: risk aggregation schemes as the Solvency II tree structure in the context of networks, credit risk, pandemia, supply chain and operational risk. Further we focus on one of the few published agent based models for a typical insurance application. It is embedded in an economic context and published in an actuarial journal. We formulate it as a discrete time dynamic model and discuss it from the physic*s point of view. We compare our results with Monte Carlo simulations of the model.

SOE 16.4 Thu 10:30 H17

Reproducibility in Statistical Analysis of Natural Language: the case of Project Gutenberg — •Francesc Font-Clos[1] and Martin Gerlach[2] — [1]Center for Complexity and Biosystems, University of Milan, Italy — [2]Department of Chemical and Biological Engineering, Northwestern University, USA

Data from the Project Gutenberg (PG) has been extremely popular in statistical analysis of language for more than 25 years. However, in contrast to other fields, no standardized consensual version of the dataset exists to date. In fact, most PG studies so far either consider only a small number of manually selected books, leading to potentially biased subsets, or employ vastly different pre-processing strategies (often specified in insufficient details).

In order to address these shortcomings, we present the Standardized Project Gutenberg Corpus (SPGC), an open science approach to a curated version of the complete PG data containing more than 50,000 books and more than 3×10^9 word-tokens. We publish our methodology in detail, the code to download and process the data, as well as the corpus itself on 3 different levels of granularity. In this way, we provide a reproducible, pre-processed, full-size version of Project Gutenberg as a new scientific resource for corpus linguistics, natural language processing, and information retrieval.

Manuscript: arxiv.org/abs/1812.08092
Code: github.com/pgcorpus/gutenberg
Data: zenodo.org/record/2422561

SOE 16.5 Thu 10:45 H17

Failure and reliability in gene regulatory networks — •Stefan Bornholdt — Universität Bremen, Germany

Life is based on reliable regulation and control of cells and multicellular organisms. Complex networks of interacting genes and proteins perform this task with great precision, despite being implemented in "wetware" with huge biochemical stochasticity. This implies risk of network failure in every single moment. I here review biological strategies to tackle these uncertainties and secure reliable performance in regulatory networks. The astonishingly reliable cell cycle control network in Yeast, central to beer production, will be used to exemplify control mechanisms in detail.

15 min. break