SOE 14: Computational Social Science

Time: Wednesday 15:00–16:45 Location: H11

SOE 14.1 Wed 15:00 H11

Issue bundles: Understanding ideological patterns of polarization in political spaces. — •Eckehard Olbrich[1] and Sven Banisch[2] — [1]Max Planck Institut for Matematics in the Sciences, Leipzig, Germany — [2]Institute of Technology Futures, Karlsruhe Institute of Technology, Germany

Many scholars of politics discuss the rise of the new populism in Western Europe and the US with respect to a new political cleavage related to globalization. In this contribution we empirically address this reconfiguration of the political space by comparing political spaces for Germany built using topic modeling with the spaces based on the content analysis of the Manifesto project and the corresponding categories of political goals. We find that both spaces have a similar structure and that the right-wing populist AfD appears on a new dimension. In order to characterize this new dimension we employ a novel technique to identify clusters of political goals, issue bundles, by maximizing the coherence of inter-issue consistency networks (IICN). These issue bundles allow to analyze the evolution of the correlations between the political positions on different issues over several elections. We find that the new dimension introduced by the AfD can be related to the split off of a new "culturally right" issue bundle from the previously existing center-right bundle.

E. Olbrich, and S. Banisch, The rise of populism and the reconfiguration of the German political space, Frontiers in Big Data 4, 731349 (2021).

SOE 14.2 Wed 15:30 H11

Quantifying the social dimension of citation behavior — •Frank Schweitzer — Chair of Systems Design, ETH Zürich, Switzerland

Collaboration networks of scientists are a prime example of complex social systems. We study co-authorship networks to quantify the impact of social constituents, e.g. of previous co-authors, joint publications, on the success of publications as measured by their number of citations. This requires to solve different problems which are addressed in the talk: (i) to model growing networks with two coupled layers, the network of authors and the network of publications, (ii) to generate and test different hypotheses about the coupling between these two layers, (iii) to estimate parameters and compare models with different complexity. But it is worth the effort: After all, producing academic publications is a social endeavour, and our results shed more light on social feedback mechanisms and successful career paths of authors.

[1] V. Nanumyan, C. Gote, F. Schweitzer: Multilayer network approach to modeling authorship influence on citation dynamics in physics journals, Physical Review E 102, 032303 (2020)

[2] C. Zingg, V. Nanumyan, F. Schweitzer: Citations Driven by Social Connections? A Multi-Layer Representation of Coauthorship Networks, Quantitative Science Studies 1, 1493-1509 (2020)

SOE 14.3 Wed 16:00 H11

Idea engines: Innovation & obsolescence in markets, genetic evolution, science — •Edward Lee[1], Christopher Kempes[2], and Geoffrey West[2] — [1]Complexity Science Hub Vienna, Vienna, Austria — [2]Santa Fe Institute, Santa Fe, USA

Innovation and obsolescence describe dynamics of ever-churning and adapting systems from the development of economic markets and scientific progress to biological evolution. The shared aspect is that agents destroy and extend the "idea lattice" in which they live, finding new possibilities and rendering old solutions irrelevant. We focus on this aspect with a simple model to study the central relationship between the rates at which replicating agents discover new ideas and at which old ideas are rendered obsolete. When the rates match, the space of the possible (e.g. ideas, markets, technologies, mutations) is static. A positive or negative difference distinguishes flourishing, ever-expanding idea lattices from Schumpeterian dystopias in which the system collapses. We map the phase space in terms of rates at which agents enter, replicate, and die. With higher dimensions, cooperative agents, or obsolescence-driven innovation, we find that the essential features of the model are preserved. In all cases, we predict a density profile of agents that drops close to new and old frontiers. With data, we reveal that the density signals a follow-the-leader dynamic in firm cost efficiency and biological evolution, whereas scientific progress reflects consensus that waits on old ideas to go obsolete. We show how the fundamental forces of innovation and obsolescence provide a unifying perspective on complex systems.

SOE 14.4 Wed 16:15 H11

Loss of sustainability in scientific work — •Niklas Reisz[1], Vito Domenico Pietro Servedio[1], Vittorio Loreto[1,2,3], William Schueller[2], Márcia Ferreira[1], and Stefan Thurner[1,4,5] — [1]Complexity Science Hub Vienna, Vienna, Austria — [2]Sony Computer Science Lab, Paris, France — [3]Sapienza University, Rome, Italy — [4]Medical University of Vienna, Vienna, Austria — [5]Santa Fe Institute, Santa Fe, USA

For decades the number of scientific publications has been rapidly increasing, effectively out-dating knowledge at a tremendous rate. Only few scientific milestones remain relevant and continuously attract citations. Here we quantify how long scientific work remains being utilized, how long it takes before today's work is forgotten, and how milestone papers differ from those forgotten. To answer these questions, we study the complete temporal citation network of all APS journals. We quantify the probability of attracting citations for individual publications. We capture both aspects, the forgetting and the tendency to cite already popular works, in a microscopic generative model. We find that the probability of citing a specific paper declines with age as a power law with an exponent of a=-1.4. Whenever a paper in its early years can be characterized by a scaling exponent above a critical value, ac, the paper is likely to become "ever-lasting". We validate the model with out-of-sample predictions. The model also allows us to predict that 95% of papers cited in 2050 have yet to be published. Our findings suggest a worrying tendency toward information overload and raises concerns about scientific publishing's long-term sustainability.

SOE 14.5 Wed 16:30 H11

On the empirical distribution functions of examination performance in beginning semesters in mathematics and physics — •Magda Schiegl — University of Applied Sciences Landshut, Am Lurzenhof 1, D-84036 Landshut

With increasing heterogeneity of student groups, the measurement and interpretation of individual study performance becomes more and more important, both in terms of classification in group performance and under developmental aspects. We investigate the empirical distribution of study performance in the 1st and 2nd semesters of industrial engineering over several years. The basis of the study is the exam performance of large groups (approx. 100 students and more per year). We compare the subjects mathematics and physics. Characteristics of the empirical CDFs of the respective cohorts (year groups) are examined. The results are compared,summarised and interpreted.