SOE 7: Social Systems, Opinion and Group Formation I

Time: Monday 16:00–17:15 Location: H17

SOE 7.1 Mon 16:00 H17

Investigating viral dynamics using cellular automata on mobility networks — •Rory Humphries, Philipp Hövel, and Kieran Mulchrone — School of Mathematical Sciences, University College Cork

The prevalence of anti-biotic resistant bacteria is increasing at a rate outpacing the development of new effective drugs. Developing new ways of tackling epidemics is an important consideration in the future as prevention may become more important than cure. The goal of this contribution is to model the spatial path that a disease is most likely to follow, and to identify areas to be hardest hit. A SEIR model realized as a cellular automaton is investigated. One major challenge for modelling viral dynamics on large spatial scales is the implementation of the movement of individuals, a major facilitator of the spread of disease. Thus, a focal point of this contribution addresses the resulting complex spatial dynamics. For the description of mobility, we consider Lévy processes as they may provide a quite natural model for the random movement of people across all spatial scales, by allowing for more localised diffusive dynamics as well as long range jumps.

SOE 7.2 Mon 16:15 H17

Social influence with recurrent mobility and multiple options — •Attila Szilva[1] and Jérôme Michaud[2] — [1]Department of Physics and Astronomy, University of Uppsala, 752 37 Uppsala, Sweden — [2]Department of Physics and Astronomy, University of Uppsala, 752 37 Uppsala, Sweden and Department of Sociology, University of Uppsala, 751 20 Uppsala, Sweden

In this paper, we discuss the possible generalizations of the social influence with recurrent mobility (SIRM) model [Phys. Rev. Lett. 112, 158701 (2014)]. Although the SIRM model worked approximately satisfying when U.S. election was modeled, it has its limits: it has been developed only for two-party systems and can lead to unphysical behavior when one of the parties has extreme vote share close to 0 or 1. We propose here generalizations to the SIRM model by its extension for multiparty systems that are mathematically well-posed in case of extreme vote shares, too, by handling the noise term in a different way. In addition, we show that our method opens alternative applications for the study of elections by using an alternative calibration procedure and makes it possible to analyze the influence of the *free will* (creating a new party) and other local effects for different commuting network topologies.

SOE 7.3 Mon 16:30 H17

Argument Exchange Dynamics in a Population with Divergent Mindsets — •Sven Banisch, Tat Dat Tran, and Eckehard Olbrich — Max-Planck Institut für Mathematik in den Naturwissenschaften, Leipzig

We present a simple model of argument communication, which allows to analyze the effects of different world views. In the model, agents exchange beliefs about facts. Agents evaluate these facts and form an attitudinal judgement on an issue through their cultural glasses. Facts may, if believed, contribute positively or negatively to this judgement in a way borrowed from expectancy value theory. The interaction probability of two agents depends on two types of homophily: one based on the difference of their attitudes and the other one based on whether they belong to the same culture. This allows for an analysis of the effects that the interplay of opinion homophily and cultural segregation may have on the dynamics of opinion formation by argument persuasion. We analytically show that cultural diversity may play a depolarizing role in argument exchange processes.

SOE 7.4 Mon 16:45 H17

Accelerating dynamics of the public discussion — •Philipp Lorenz-Spreen[1], Sune Lehmann[2], and Philipp Hövel[3] — [1]Max Planck Insitute for Human Development, Berlin, Germany — [2]Technical University of Denmark, Lyngby, Denmark — [3]University College Cork, Cork, Ireland

With news pushed to smart phones in real time and social media reactions spreading across the globe in seconds, the public discussion can feel accelerated and temporally fragmented. In longitudinal datasets across various domains, covering a range of time spans, we find significantly increasing gradients and shortened periods in the trajectories of public attention.

Is this a consequence of recent developments or the inevitable conclusion of the way information is disseminated and absorbed by the public? Our findings support the latter hypothesis.

Using a simple mathematical model of competing topics, we are able to explain the empirical data remarkably well. Our modeling suggests that the accelerating ups and downs of content popularity are driven by increasing rates of creation and consumption of cultural items. The interplay of the ephemerality of attention and the competition for novelty causes growing turnover rates and shorter attention spans.

SOE 7.5 Mon 17:00 H17

Change points, memory and epidemic spreading in temporal networks — •Tiago Peixoto[1] and Laetitia Gauvin[2] — [1]University of Bath, UK — [2]ISI Foundation, Turin, Italy

Dynamic networks exhibit temporal patterns that vary across different time scales, all of which can potentially affect processes that take place on the network. However, most data-driven approaches used to model time-varying networks attempt to capture only a single characteristic time scale in isolation — typically associated with the short-time memory of a Markov chain or with long-time abrupt changes caused by external or systemic events. Here we propose a unified approach to model both aspects simultaneously, detecting short and long-time behaviors of temporal networks. We do so by developing an arbitrary-order mixed Markov model with change points, and using a nonparametric Bayesian formulation that allows the Markov order and the position of change points to be determined from data without overfitting. In addition, we evaluate the quality of the multiscale model in its capacity to reproduce the spreading of epidemics on the temporal network, and we show that describing multiple time scales simultaneously has a synergistic effect, where statistically significant features are uncovered that otherwise would remain hidden by treating each time scale independently.