AKSOE 15: Social-, Information-, and Production Networks II

Time: Thursday 10:15–12:15 Location: EW 203

AKSOE 15.1 Thu 10:15 EW 203

Impact of human behavior on information spreading: Viral marketing and social networks — Jose Luis Iribarren[1] and •Esteban Moro[2] — [1]IBM corporation, ibm.com e-Relationship Marketing Europe, 28002 Madrid (Spain) — [2]Departamento de Matematicas, Universidad Carlos III de Madrid, 28911 Leganes (Spain)

The dynamics of information dissemination in social networks is of paramount importance in processes such as rumors or fads propagation , spread of product innovation, word-of-mouth communications or viral marketing. Due to the difficulty in tracking information when transmitted by people, most understanding of information spreading in social networks comes from models or indirect measurements. Using data collected in Viral Marketing campaigns that reached over 31,000 individuals in eleven European markets, we find that information travels mostly by super-spreading events and at an unexpected low pace (logarithmic in time) due to the large variability both in the frequency and intensity of participants' actions. Remarkable accurate description of the results is given by stochastic branching process which corroborates the importance of heterogeneity and shows how traditional population-average descriptions fail to describe information diffusion in social networks. The fact that humans show similar degrees of heterogeneity in many other activities suggests that our findings are pertinent to other human driven diffusion processes like rumors, innovations or news which has important consequences for business management, communications, marketing and online communities.

AKSOE 15.2 Thu 10:45 EW 203

Opinion Formation in Laggard Societies — •Peter Klimek[1], Renaud Lambiotte[2], and Stefan Thurner[1,3] — [1]Complex Systems Research Group; HNO; Medical University of Vienna; Währinger Gürtel 18-20; A-1090; Austria — [2]GRAPES; Universite de Liege; Sart-Tilman; B-4000 Liege; Belgium — [3]Santa Fe Institute; 1399 Hyde Park Road; Santa Fe; NM 87501; USA

We introduce a statistical physics model for opinion dynamics on random networks where agents adopt the opinion held by the majority of their direct neighbors only if the fraction of these neighbors exceeds a certain threshold, pu. We find a transition from total final consensus to a mixed phase where opinions coexist amongst the agents. The relevant parameters are the relative sizes in the initial opinion distribution within the population and the connectivity of the underlying network. As the order parameter we define the asymptotic state of opinions. In the phase diagram we find regions of total consensus and a mixed phase. As the 'laggard parameter' p_u increases the regions of consensus shrink. In addition we introduce rewiring of the underlying network during the opinion formation process and discuss the resulting consequences in the phase diagram.

AKSOE 15.3 Thu 11:15 EW 203

Effects of noise and confidence thresholds in metric Axelrod dynamics of social influence — •Tobias Galla[1,2] and Luca De Sanctis[2] — [1]The University of Manchester, School of Physics and Astronomy, Schuster Building, Manchester M13 9PL, UK — [2]The Abdus Salam International Centre for Theoretical Physics, Strada Costiera 11, 34014 Trieste, Italy

We study the effects of bounded confidence thresholds and of interaction and external noise on Axelrod's model of social influence. Our study is based on a combination of numerical simulations and an integration of the mean-field Master equation describing the system in the thermodynamic limit. We find that interaction thresholds affect the system only quantitatively, but that they do not alter the basic phase structure. The known crossover between an ordered and a disordered state in finite systems subject to external noise persists in models with general confidence threshold. Interaction noise here facilitates the dynamics and reduces relaxation times. We also study Axelrod systems with metric features, and point out similarities and differences compared to models with nominal features. Metric features are used to demonstrate that a small group of extremists can have a significant impact on the opinion dynamics of a population of Axelrod agents.

AKSOE 15.4 Thu 11:45 EW 203

Limits of Unsupervised Learning in Networks — •Jörg Reichardt[1] and Michele Leone[2] — [1]Institute f. Theoretical Physics, University of Würzburg — [2]ISI Foundation, Torino, Italy

Many systems in socio- and econophysics are abstracted as networks. Before we can build models for such systems, a careful data analysis is needed in order to select relevant features. The goal is to differentiate between those effects that arise from inherent randomness in the system and those that truly reflect structure in the data. Unsupervised learning algorithms can perform this task in an automated manner and the general experience from multi-variate data is that if the data set is only large enough, even the slightest deviation from randomness may be detected. The talk will show that this is not necessarily true for sparse networks. Even in the limit of infinite system size, sparse networks may not be differentiated from random networks despite them being generated by a non-random process. Equivalently, the fact that one cannot find deviations from randomness may not allow to rule out non-random data generating processes. The talk will discuss possible implications for the analysis of network data and limitations in our ability to forecast the evolution of the system.