



COMPLEXITY
SCIENCE
HUB
VIENNA

CSH WORKSHOP AGENDA

SOCIAL INFORMATICS: EN ROUTE TOWARDS ASIMOV'S PSYCHOHISTORY?

February 1-2, 2018

COMPLEXITY SCIENCE HUB VIENNA
ROOM 201
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Abstract

Social Informatics or Data-driven Social Sciences represents a new transdisciplinary field of research that focuses on studying societal-scale social phenomena in interplay with today's increasingly socially-centric and multi-channeled information communication technology (ICT) based platforms. The goal of Social Informatics is on one hand to understand the anatomy, i.e. the structure, dynamics and functions, of human social connectomes or networks and on the other hand to create better understanding of socially-centric platforms not just as a technology, but also as a set of social phenomena as well as of the roles of information technology in social and organizational change, the uses of information technologies in social contexts, and the ways that the social organization of information technologies is influenced by social forces and social practices. Such understanding is crucial in applying information technology in the study of social phenomena, in applying social concepts in the design of information systems, in applying methods from the social sciences in the study of social computing and information systems, in applying computational analytics and modelling to facilitate the study of social systems and human social dynamics, and in designing information and communication technologies that consider social context. Social Informatics relies on the analysis of large scale datasets on human interaction and social dynamics and their computational modelling, thus being interdisciplinary and combining methodologies of Social Sciences, Management Sciences, Computer Science, Informatics, and Physics.

Workshop Organizers

Kimmo Kaski, Aalto University, External Faculty CSH

Invited Participants

Corominas-Murtra Bernat, Medical University Vienna, CSH

Garcia David, Medical University Vienna, CSH

Kertesz Janos, Central European University, External Faculty CSH

Klimek Peter, Medical University Vienna, CSH

Elisabeth Lex, TU Graz

Menczer Filippo, Indiana University

Yamir Moreno, University of Zaragoza, CSH

Sinatra Roberta, Central European University, External Faculty CSH

Yasserli Taha, Oxford Internet Institute, Oxford

Thurner Stefan, Medical University Vienna, CSH, IIASA, SFI

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ABOUT THE COMPLEXITY SCIENCE HUB VIENNA

The objective of CSH is to host, educate, and inspire complex systems scientists who are dedicated to collect, handle, aggregate, and make sense of big data in ways that are directly valuable for science and society. Focus areas include smart cities, innovation dynamics, medical, social, ecological, and economic systems. CSH is a joint initiative of AIT Austrian Institute of Technology, IIASA International Institute for Applied Systems Analysis, Medical University of Vienna, Vienna University of Technology, Graz University of Technology, and Vienna University of Economics and Business.

AGENDA

February 1, 2018

- 09:15 Welcome & Introduction
- Kimmo Kaski, Aalto University, CSH
- 09:30 Growth, Innovation, Sustainability and the Accelerating Pace of Life from Cells to Cities
- Geoffrey West, SFI, CSH
- 10:30 Coffee break
- 10:45 Political Turbulence, How Social Media Shape Collective Action
- Taha Yasseri, Oxford University
- 11:45 Interdisciplinarity, physics, and the Nobel prize
- Roberta Sinatra, CEU, CSH
- 12:45 Lunch break
- 14:00 How social media makes us vulnerable to misinformation
- Filippo Menczer, Indiana University
- 15:00 Coffee break
- 15:15 The impact of user and network properties on opinion dynamics in online collaboration networks
- Elisabeth Lex, TU Graz
- 16:15 The Physics of Humans
- Yamir Moreno, University of Zaragoza, CSH
- 17:15 Adjourn

February 2, 2018

- 09:30 Rise and Fall of an Online Social Network
- Janos Kertesz, CEU, CSH
- 10:30 Coffee break
- 10:45 Counter-dominance signaling drives evolution of cultural elites: quantitative evidence
from fashion cycles in music
- Peter Klimek, MUW, CSH
- 11:45 Circadian rhythms of urban people - an interplay between biological, environmental
and social factors
- Kimmo Kaski, Aalto University, CSH
- 12:45 Lunch break
- 14:00 The core structure of social networks: Finding the elite communities
- Bernat Corominas-Murtra, MUW, CSH
- 15:00 Collective emotions and social resilience in the digital traces after a terrorist attack
- David Garcia, MUW, CSH
- 16:00 Adjourn

CSH Workshop Series

on

Social Informatics: *en route* towards Asimov's Psychohistory?

Social Informatics or Data-driven Social Sciences represents a new transdisciplinary field of research that focuses on studying societal-scale social phenomena in interplay with today's increasingly socially-centric and multi-channelled information communication technology (ICT) based platforms. The goal of Social Informatics is on one hand to understand the anatomy, i.e. the structure, dynamics and functions, of human social connectomes or networks and on the other hand to create better understanding of socially-centric platforms not just as a technology, but also as a set of social phenomena as well as of the roles of information technology in social and organizational change, the uses of information technologies in social contexts, and the ways that the social organization of information technologies is influenced by social forces and social practices. Such understanding is crucial in applying information technology in the study of social phenomena, in applying social concepts in the design of information systems, in applying methods from the social sciences in the study of social computing and information systems, in applying computational analytics and modelling to facilitate the study of social systems and human social dynamics, and in designing information and communication technologies that consider social context. Social Informatics relies on the analysis of large scale datasets on human interaction and social dynamics and their computational modelling, thus being interdisciplinary and combining methodologies of Social Sciences, Management Sciences, Computer Science, Informatics, and Physics.

February 1, 2018

Geoffrey West

Growth, Innovation, Sustainability and the Accelerating Pace of Life from Cells to Cities

Why do all companies and people die whereas cities keep growing and the pace of life continues to accelerate? And how are these related to innovation, wealth creation, social networks, urbanisation and global sustainability? Global urbanisation has emerged as the source of the greatest challenge the planet has faced since humans became social. Cities are simultaneously the hubs of innovation, engines of wealth creation and centers of power, but are also the prime source of crime, pollution, disease, climate change and the consumption of energy and resources. Despite this dual role and the threat to global sustainability, there is no integrated, quantitative, predictive, framework for understanding their dynamics, growth and organization. Ideas for developing such a theory, inspired by a network-based framework for understanding diverse properties of organisms and ecosystems (such as growth, metabolism, aging and death) will be discussed and extended to companies. Although cities and companies are extraordinarily complex and diverse, many of their characteristics scale systematically with size, suggesting that universal principles that transcend history, geography and culture underlie their dynamics and structure. This has dramatic implications for growth,

development and long-term sustainability: left unchecked, innovation and wealth creation that fuel socio-economic systems potentially sow the seeds for collapse.

Taha Yasseri

Political Turbulence, How Social Media Shape Collective Action

As people go about their daily lives using social media, such as Twitter and Facebook, they are invited to support myriad political causes by sharing, liking, endorsing, viewing and following. Chain reactions caused by these tiny acts of participation form a growing part of collective action today, from neighbourhood campaigns to global political movements. Political Turbulence shows how most attempts at collective action online fail. Those that succeed can do so dramatically, but are unpredictable, unstable, and often unsustainable.

Roberta Sinatra

Interdisciplinarity, Physics, and the Nobel prize

We present the quantitative investigation of two success phenomena. First, we present an analysis of Web of Science data spanning more than 100 years, mapping out the complete physics literature and understanding the structure of the field of Physics. The analysis of this extended corpus treasure trove of quantitative information, unveiling the anatomy of the discipline. It demonstrates, for example, that our ability to define a field such as physics using sets of journals is long gone, and exposes the tribal nature of the different subdisciplines of physics: the smaller the subfield, the more self-referential it becomes. The analysis reveals the rapid growth and increasing multidisciplinary of physics — as well its internal map of subdisciplines. Second, we explore the interdisciplinarity of Nobel Prize papers, using massive Web of Science citation data, and find that in physics and life sciences, only pure physics and life science papers receive a Nobel Prize, while the chemistry prize is given to areas between these fields. We further unveil a neglected physics-life sciences axis, reflecting a complete lack of prizes at the intersection of physics and life sciences, including seminal works from signal processing, AI, or network science, demonstrating disciplinary biases in the Nobel Prize and the wide extent to which our public recognition for interdisciplinary research is out of date.

Fil Menczer

How social media make us vulnerable to misinformation

As social media become major channels for the diffusion of news and information, it becomes critical to understand how the interplay between cognitive, social, and algorithmic biases triggered by our reliance on online social networks makes us vulnerable to misinformation and other manipulations. This talk overviews ongoing network analytics, data mining, and modeling efforts to understand the spread of misinformation online and offline. I present theoretical models to study how fake news and fact-checking compete for our collective attention. These efforts will be framed by a case study in which, ironically, our own research became the target of a coordinated disinformation campaign. Joint work with collaborators at the Center for Complex Networks and Systems Research (cnets.indiana.edu) and the Indiana University Network Science Institute (iuni.iu.edu). This research is supported by the National Science Foundation and McDonnell Foundation. Any opinions, findings, and conclusions or recommendations expressed in this material

are those of the authors and do not necessarily reflect the views of these funding agencies.

Elisabeth Lex

The impact of user and network properties on opinion dynamics in online collaboration networks

Online collaboration systems such as Stackexchange or Wikipedia have become increasingly pervasive in our daily lives. In such systems, users collaborate and exchange opinions with others to achieve a common goal such as writing an article or answering a question. Ideally, at some point, consensus emerges among the interacting parties. In this talk, we show how user and network properties such as social status and network structure govern the process of opinion dynamics and consensus building. For our experiments, we turn to the Naming Game model, which we extend with a mechanism that accounts for a set of user and network properties. This mechanism lets us tune the opinion flow between user groups and thus, influence consensus building. Our findings indicate that both user and network properties strongly impact opinion dynamics and consensus building in online collaboration networks. Finally, this presentation will make an attempt to relate the ideas and research outcomes of this work to Asimov's Psychohistory.

Yamir Moreno

The Physics of Humans

The modeling of social systems has recently attracted a renewed attention as a result of the Data Science revolution. Ideally, we would like to develop tools and methods that allow in-silico simulations of real-world societal scenarios and systems. To this end, it is imperative to inform models with as many details as possible about human behavior at various scales. This constitutes nowadays a challenge due to our current limited knowledge of the laws describing most human behavioral responses. In this talk, we describe recent advances in this direction by analyzing social movements as given by online social networks and discussing several experiments involving humans -in some cases a few, in others hundreds- playing a diversity of social dilemmas. We also identify the experimental (data) and theoretical challenges in the study of socio-technical systems and propose a way to tackle such problems.

February 2, 2018

Janos Kertesz

Rise and Fall of an Online Social Network

The Hungarian Online Social Network (OSN) iWiW used to be the most popular web page in the country. Established in 2002, first as an elite club, later, after getting purchased by a large telecommunication company in 2006, it got the engine of the spread of the Internet in the country. At its peak it had 4.5 million, overwhelmingly Hungarian speaking registered users (out of 15 million around the Globe). After 2010, due to the competition by Facebook, the number of churners started to increase rapidly, leading to a dramatic collapse of the OSN, which was officially closed down on June 30, 2014. We first show that the peculiar system of recruiting new users by vouchers allows for a simple model of the growth phase. A closer look into the structure of the iWiW network reveals interesting regional features. We analyze the collapse and conclude that there were two main factors in play: At early stage mostly the loosely bound users disappeared, later collective effects became dominant leading to cascading failures. We present a theory based on a generalized threshold model to explain the findings and show how the collapse time can be estimated in advance using the dynamics of the churning users.

Peter Klimek

Counter-dominance signaling drives evolution of cultural elites: quantitative evidence from fashion cycles in music

Human symbol systems such as art and fashion styles emerge from complex social processes that govern the continuous re-organization of modern societies. They provide a signaling scheme that allows members of an elite to distinguish themselves from the rest of society. Efforts to understand the dynamics of art and fashion cycles have so far been based on costly signaling theory, where elite members signal their superior status by introducing new symbols (e.g. fashion-styles), which are subsequently adopted by low-status groups. In response to this adoption, the elite members need to introduce yet new symbols to signal their status. We propose an alternative explanation based on counter-dominance-signaling. There, members of the elite want others to imitate their symbols; changes only occur when outsider groups successfully challenge the elite by introducing signals that contrast those endorsed by members of the elite. To clarify the mechanism that actually drives fashion cycles in musical styles, we use a dynamic network approach on data containing almost 8 million musical albums released between 1956 and 2015. There a network systematically quantifies artistic similarities of competing musical styles. By studying the dynamics of the network, we can formulate statistical hypothesis tests for whether new symbols are introduced (i) by current elite members as predicted by costly signaling theory or (ii) as a consequence of challenges by peripheral groups through countersignals. We find clear evidence that counter-dominance-signaling drives changes in musical styles. This provides a quantitative, completely data-driven answer to a century old debate about the nature of the underlying social dynamics of art and fashion cycles.

Kimmo Kaski

Circadian rhythms of urban people - an interplay between biological, environmental and social factors

All living organisms, including humans, have internal biological or circadian clock that helps them anticipate and adapt to the regular rhythm of the day. The timings of human activities are marked by circadian clocks which in turn are entrained to different environmental signals. In an urban environment, the presence of artificial lighting and various social cues tend to disrupt the natural entrainment with the sunlight. However, it is not completely understood to what extent this is the case. Here we exploit the large-scale data analysis techniques to study the mobile phone calling activity of people in large cities to infer the dynamics of urban daily rhythms. From the calling patterns of about 1,000,000 users spread over different cities but lying inside the same time-zone, we show that the onset and termination of the calling activity synchronizes with the east-west progression of the sun. We also find that the onset and termination of the calling activity of users follows yearly dynamics, varying across seasons, and that its timings are entrained to solar midnight. Furthermore, we show that the average mid-sleep time of people living in urban areas depends on the age and gender of each cohort, most likely as a result of biological and social factors.

Bernat Corominas-Murtra

The core structure of social networks: Finding the elite communities

Elites are subgroups of individuals within a society that have the ability and means to influence, lead, govern, and shape societies. Members of elites are often well connected individuals, which enables them to impose their influence to many and to quickly gather, process, and spread information. The identification of elites through the classic Rich-club or K-core structures is grounded on the hypothesis that the larger the connectivity of an individual, the larger her/his influence can be. In this talk we will argue that elites are not only composed of highly connected individuals, but also of intermediaries connecting hubs to form a cohesive and structured elite-subgroup at the core of a social network. We explore this hypothesis through a collection of new techniques which explicitly include the role of weakly connected core regions and the connector nodes. We thus totally redefine the notion of the core of the network and provide a much richer structure than the one obtained using traditional methods. We show the validity of the idea in the framework of a virtual world defined by a massive multiplayer online game, 'Pardus' on which we have complete information of various social networks. The analysis of the Elite or influence-related scores reveals that our approach outperforms qualitatively the success of the classic methods of core extraction to isolate the most influential individuals of a social system.

David Garcia

Collective emotions and social resilience in the digital traces after a terrorist attack

After collective traumas like natural disasters and terrorist attacks, members of concerned communities experience intense emotions and talk profusely about them. These verbal exchanges resemble emotional venting and seem devoid of social functions. However, Durkheim's theory of emotional effervescence postulates that these collective emotions fulfill major social functions, generating social identity, reinforcing shared beliefs, and leading to higher solidarity. We present the

first large-scale test of this theory through the longitudinal analysis of digital traces captured in Twitter after the Paris terrorist attacks of November, 2015. Examining the temporal evolution of these collective emotional responses, we observe them to last considerably longer than emotions in isolation. Collective emotional expression is followed by a marked increase in the use of lexical indicators related to social resilience, in particular social processes, prosocial behavior, and shared values. In addition, we show that individuals who participated to a higher degree in the collective emotion also evidenced a superior use of terms associated to social resilience in the months after, though they did not evidence this trend in the months before the attacks. Together, our findings support the conclusion that collective traumas can activate emotion sharing feedback loops in the concerned community, as described by Durkheim. Our results support the existence of social resilience effects following the collective emotions elicited by a terrorist attack.