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RE	Restricted to a group specified by the consortium (including the Commission Services)	
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1.3 Document history

Version#	Date	Change
V0.1		Starting version, template
V0.2		
Etc.		
V1.0		Approved version to be submitted to EU

1.4 Document data

Keywords	social networks; socio-semantic networks; risk sharing protocol; consensus; risk diffusion; portfolio management; Prisoner's dilemma; social influence; mechanism design; nonlinear voter model; prediction; popularity; social networks; e-commerce; calibration; indirect inference; Wikipedia; norm emergence; innovation adoption; agent-based model; innovation speed; dispersals; ecology; high-performance computing; palaeoanthropology; spatiotemporal population; energy waste reduction; agent based dynamic behavior simulations; behaviour influenced appliance consumption modeling; taste similarity; adaptive complex networks; information diffusion and filtering; social recommendation;

	statistical physics; entropy; data mining; emotions; communication; sociophysics; massively distributed learning; adaptive classification; concept drift; gossip learning; P2P; rational choice; social influence; tax behaviour; tax evasion; tax morale.
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1.5 Distribution list

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QLectives Consortium

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QLectives introduction

QLectives is a project bringing together top social modelers, peer-to-peer engineers and physicists to design and deploy next generation self-organising socially intelligent information systems. The project aims to combine three recent trends within information systems:

- **Social networks** - in which people link to others over the Internet to gain value and facilitate collaboration
- **Peer production** - in which people collectively produce informational products and experiences without traditional hierarchies or market incentives
- **Peer-to-Peer systems** - in which software clients running on user machines distribute media and other information without a central server or administrative control

QLectives aims to bring these together to form Quality Collectives, i.e. functional decentralised communities that self-organise and self-maintain for the benefit of the people who comprise them. We aim to generate theory at the social level, design algorithms and deploy prototypes targeted towards two application domains:

- **QMedia** - an interactive peer-to-peer media distribution system (including live streaming), providing fully distributed social filtering and recommendation for quality
- **QScience** - a distributed platform for scientists allowing them to locate or form new communities and quality reviewing mechanisms, which are transparent and promote quality.

The approach of the QLectives project is unique in that it brings together a highly inter-disciplinary team applied to specific real world problems. The project applies a scientific approach to research by formulating theories, applying them to real systems and then performing detailed measurements of system and user behaviour to validate or modify our theories if necessary. The two applications will be based on two existing user communities comprising several thousand people - so-called "Living labs", media sharing community tribler.org; and the scientific collaboration forum EconoPhysics.

Contents

1 Introduction

The Advances of Complex Systems (ACS) Topical Issue on Agent-Based Modeling and Techno-Social Systems, edited by Dirk Helbing and Thomas Grund is published by World Scientific. The Topical Issue consists of 11 manuscripts, drawn from a selection of papers presented at the 'International Workshop on Agent-Based Models and Complex Techno-Social Systems', which was held on July 2-4, 2012 in Zurich, Switzerland. Details of the workshop can be found here: http://www.soms.ethz.ch/workshop2012

A summary of the manuscripts can be found in the following table. Note that online first dates will vary from paper to paper as we are dependent on the speed of referees. However, a Special Journal Issue will create larger dissemination than a book, which is easier to compile due to the simpler process. The whole issue will appear when all the papers have gone through the review and editorial process.

2 Details of manuscripts

1

Manuscript Number	ACS-D-12-00076
Title	Socio-semantic Frameworks for Socio-technical Systems
Authors	Camille Roth CNRS cams, cnrs/ehess, 190 avenue de France, Paris, f-75013, France cmb, cnrs/hu/maee, Friedrichstrasse 191, Berlin, D-10117, Germany roth@ehess.fr
Keywords	Social networks; socio-semantic networks
Abstract	Socio-technical systems involve agents who create and process knowledge, exchange in- formation and create ties between ideas in a distributed manner: webloggers, communi- ties of scientists, software developers and wiki contributors are, among others, examples of such networks. The state-of-the-art in this regard focuses on two main issues which are generally addressed in an independent manner: the description of content dynamics and the study of social network characteristics and evolution. This paper reviews recent endeavors to merge both types of dynamics into co-evolutionary, multi-level mod- eling frameworks, where social and semantic aspects are being jointly appraised. Case studies featuring socio-semantic networks, socio-semantic hypergraphs and automatic socio-semantic history reconstruction are notably discussed.
Online first date	28/02/13

2

Manuscript Number	ACS-D-12-00066R1
Title	Enhancing the Resilience of Networked Agents through Risk Sharing
Authors	AKIRA NAMATAME Dept. of Computer Science National Defense Academy of Japan 1-10-20 Hashirimizu, Yokosuka, Kanagawa 239-8686 Japan nama@nda.ac.jp HOANG ANH Q.TRAN Dept. of Computer Science National Defense Academy of Japan 1-10-20 Hashirimizu, Yokosuka, Kanagawa 239-8686 Japan em50061@nda.ac.jp
Keywords	risk sharing protocol; Consensus; risk diffusion; portfolio management
Abstract	Since social-economic systems increase interdependency, a crucial question arises: Is an interconnected world a safer or a more dangerous place in which to live? Over the last few years, we have witnessed the dark side of increasing interdependencies. As such, there is a growing need to focus on how to mitigate networked risk and to enhance the system resilience to the impact of a large-scale shock. The traditional engineering approach has been to design systems that are less vulnerable to damage from hazard events. On the other hand, system resilience is the ability to recover from failure and provide the continuity of system function. The goal of the present paper is to investigate the gain from risk sharing. We propose a mechanism of risk sharing that may enhance the resilience of the networked systems. The proposed risk sharing protocols are based on coordinated incentives of agents to survive collectively by absorbing external shocks. The key issue we would like to analyze is how the gain from risk sharing depends on the capacity of each agent to absorb shock and on the interconnections patterns among agents with risk sharing rules. We demonstrate that risk sharing is beneficial from a systems point of view when the agents' capacities to shocks is high and detrimental when it is low. In particular, we evaluate the effectiveness of risk sharing in two domains. In the first domain, in which networked agents have the possibility of cascading failure, risk sharing is useful in mitigating systemic failure, especially if the agents are running at

	high load. In the second domain, we evaluate the ratio of safe agents who invest in risky portfolios or projects collectively. In this case, risk sharing is only beneficial if the agents' risk absorbing capacity is high.
Online first date	23/12/12

3

Manuscript Number	ACS-D-12-00074
Title	How can social herding enhance cooperation?
Authors	Frank Schweitzer Pavlin Mavrodiev Claudio Juan Tessone ETH Zurich, SWITZERLAND
Keywords	Prisoner's dilemma; social influence; mechanism design; nonlinear voter model
Abstract	We study a system in which N agents have to decide between two strategies θ_{i} ($i \in 1\ldots N$), for defection or cooperation, when interacting with other n agents (either spatial neighbors or randomly chosen ones). After each round, they update their strategy responding nonlinearly to two different information sources: (i) the payoff $a_{i}(\theta_{i}, f_{i})$ received from the strategic interaction with their n counterparts, (ii) the fraction f_{i} of cooperators in this interaction. For the latter response, we assume social herding, i.e.~agents adopt their strategy based on the frequencies of the different strategies in their neighborhood, \emph{without} taking into account the consequences of this decision. We note that f_{i} already determines the payoff, so there is \emph{no additional} information assumed. A parameter ζ defines to what level agents take the two different information sources into account. For the strategic interaction, we assume a Prisoner's Dilemma game, i.e.~one in which defection is the evolutionary stable strategy. However, if the additional dimension of social herding is taken into account, we find instead a stable outcome where cooperators are the majority. By means of agent-based computer simulations and analytical investigations, we evaluate the critical conditions for this transition

	towards cooperation. We find that, in addition to a high degree of social herding, there has to be a \emph{nonlinear} response to the fraction of cooperators. We argue that the transition to cooperation in our model is based on \emph{less} information, i.e.~on agents which are not informed about the payoff matrix, and therefore rely on just observing the strategy of others, to adopt it. By designing the right mechanisms to respond to this information, the transition to cooperation can be remarkably enhanced.
Online first date	31/03/13 (at latest)

4

Manuscript Number	ACS-D-12-00070
Title	Trend prediction in temporal bipartite networks: the case of Movielens, Netflix, and Digg
Authors	An Zeng Stanislao Gualdi Matúš Medo Yi-Cheng Zhang Physics Department, University of Fribourg, CH-1700 Fribourg, Switzerland
Keywords	prediction; popularity; social networks; e-commerce
Abstract	Online systems where users purchase or collect items of some kind can be effectively represented by temporal bipartite networks where both nodes and links are added with time. We use this representation to predict which items might become popular in the near future. Various prediction methods are evaluated on three distinct datasets originating from popular online services (Movielens, Netflix, and Digg). We show that the prediction performance can be further enhanced if the social user network is known and contribution of individual users are weighted by their centrality.
Online first date	31/03/13 (at latest)

5

Manuscript Number	ACS-D-12-00067R1
Title	A framework for the calibration of social simulation models
Authors	Giovanni Luca Ciampaglia School of Informatics and Computing

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Keywords	Agent-based model; calibration; indirect inference; Wikipedia; norm emergence
Abstract	Simulation with agent-based models is increasingly used in the study of complex socio- technical systems and in social simulation in general. This paradigm offers a number of attractive features, namely the possibility of modeling emergent phenomena within large populations. As a consequence, often the quantity in need of calibration may be a distribution over the population whose relation with the parameters of the model is analytically intractable. Nevertheless, we can simulate. In this paper we present a simulation-based framework for the calibration of agent-based models with distributional output based on indirect inference. We illustrate our method step by step on a model of norm emergence in an online community of peer production, using data from three large Wikipedia communities. Model fit and diagnostics are discussed.
Online first date	15/03/13

6

Manuscript Number	ACS-D-12-00068
Title	No need for speed: Modelling innovation adoption in a heterogeneous population
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Keywords	innovation adoption; agent-based model; innovation speed
Abstract	The pace of social and technological changes is constantly increasing. Innovations are a prerequisite for economic development but the speed of their introduction carries additional costs that may largely affect the ability of the social systems to adopt them. While the financial costs constitute a limit to adoption, the psychological and social costs may also profoundly change the adoption potential. In an agent-based model of a heterogeneous population of adopters we explore the consequences of increasing the pace of novelty introduction on their satisfaction and the degree to which innovations may permeate the system. We show that introduction speed has a diametrically different impact on different adopter groups: opinion leaders are most satisfied when the mainstream individuals are least content and vice versa. Moreover, introduction speed profoundly affects the ability of fads to penetrate the system - the lower the introduction speed, the higher the level of penetration of the social system. With high speeds of introduction, only a small fraction of the most attractive novelties is able to permeate the system. In sum, these results show that both the wellbeing of the social system as well as its capacity to adopt innovations are dependent on the pace of change.
Online first date	31/03/13 (at latest)

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Manuscript	ACS-D-12-00065

Number	
Title	An Agent-based Model of Human Dispersals at a Global Scale
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Keywords	agent-based models; dispersals; ecology; high-performance computing; palaeoanthropology; spatiotemporal population dynamics
Abstract	In this paper we report on the theoretical foundations, empirical context, and technical implementation of an agent-based modeling (ABM) framework, that uses a high- performance computing (HPC) approach to investigate human population dynamics on a global

	scale, and on evolutionary time scales. The ABM-HPC framework provides an "in-silico" testbed to explore how short-term/small-scale patterns of individual human behavior and long-term/large-scale patterns of environmental change act together to influence human dispersal, survival and extinction scenarios. These topics are currently at the center of the "Neanderthal debate", i.e., the question why Neanderthals died out during the Late Pleistocene, while modern humans dispersed over the entire globe. To tackle this and similar questions, simulations typically adopt one of two opposing approaches, top-down (equation-based) and bottom-up (agent-based) models of population dynamics. We propose HPC technology as an essential computational tool to bridge the gap between these approaches. Using the numerical simulation of worldwide human dispersals as an example, we show that integrating different levels of model hierarchy into an ABM-HPC simulation framework provides new insights into emergent properties of the model, and into the potential and limitations of agent-based versus continuum models.
Online first date	31/03/13 (at latest)

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Manuscript Number	ACS-D-12-00071R1
Title	Simulating the Occupants' Behaviour for Energy Waste Reduction in Dwellings: A Multi Agent Methodology
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Keywords	energy waste reduction; agent based dynamic behavior simulations; behaviour influenced appliance consumption

	modeling
Abstract	The energy waste due to inhabitants' behaviour within residential buildings has emerged as potential research area because of the growing energy needs and worldwide population. The existing approaches for the energy simulations are limited to office buildings based on static profiles. It restricts us from assessing actual energy consumption and waste associated with the inhabitants' behaviour in residential buildings. In this paper we have proposed a 4-step co-simulation methodology to simulate behaviour influenced appliance consumptions to accurately assess the energy consumption patterns and wastes associated to them due to human behaviour. The proposed approach is validated using a case study with refrigerator-freezer along with cooking and non cooking activities having influence on the fridge consumption cycles. The fridge is selected because it is highly complex to model and is strongly impacted by the inhabitants' behaviour resulting in high energy consumptions. The fridge is physically modeled in Matlab where simulation results are used to find high energy consuming activities. Human behaviour is modeled and simulated in Brahms language and simulation environment. A scenario is implemented using Brahms modelling language where results coming from the fridge simulations and consumption database (IRISE) analysis are transformed into tuning parameters. These tuning parameters dynamically vary the cooking and non cooking activities throughout the simulations. The consumption distribution from the simulated scenario is compared with actual distribution and this step is repeated to find optimum values of tuning parameters for less than 10% variation. This methodology enables to physically model and simulate behaviour influenced appliance consumptions to assess actual energy consumptions and associated waste components.
Online first date	31/3/13 (at latest)

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Manuscript Number	ACS-D-12-00064R1
Title	The Role of Taste Affinity in Agent-Based Models for Social Recommendation
Authors	Giulio Cimini An Zeng

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Keywords	Taste similarity; agent-based modeling; adaptive complex networks; information diffusion and filtering; social recommendation.
Abstract	In the Internet era, online social media emerged as the main tool for sharing opinions and information among individuals. In this work we study an adaptive model of a social network where directed links connect users with similar tastes, and over which information propagates through social recommendation. Agent-based simulations of two different artificial settings for modeling user tastes are compared with patterns seen in real data, suggesting that users differing in their scope of interests is a more realistic assumption than users differing only in their particular interests. We further introduce an extensive set of similarity metrics based on users' past assessments, and evaluate their use in the given social recommendation model with both artificial simulations and real data. Superior recommendation performance is observed for similarity metrics that give preference to users with small scope---who thus act as selective filters in social recommendation.
Online first date	29/01/13

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Manuscript Number	ACS-D-12-00062R1
Title	Entropy-growth-based model of emotionally charged online dialogues
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Keywords	statistical physics; entropy; data mining; emotions; communication; sociophysics
Abstract	We analyze emotionally annotated massive data from IRC (Internet Relay Chat) as well as from BBC Forum website and model the dialogues between chat participants by assuming that the driving force for the discussion is the entropy growth of emotional probability distribution. This process is claimed to be responsible for a power-law distribution of the discussion lengths observed in the dialogues. We perform numerical simulations based on the noticed phenomenon obtaining a good agreement with the real data. Finally, we propose a method to artificially prolong the duration of the discussion that relies on the entropy of emotional probability distribution.
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Manuscript Number	ACS-D-12-00060R1
Title	Massively Distributed Concept Drift Handling in Large Networks
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Keywords	massively distributed learning, adaptive classification; concept drift; gossip learning; P2P
Abstract	In fully distributed networks data mining is an important tool for monitoring, control, and for offering personalized services to users. The underlying data distribution can change as a function of time according to periodic (daily, weakly) patterns, sudden events, or long term transformations of the environment or the system itself. For a large space of the possible models of this dynamism---when the network is very large and only a few training samples can be obtained at all nodes locally---no efficient fully distributed solution is known. Here we present two approaches, that are able to follow concept drift in very large scale and fully distributed networks. The algorithms do not collect data to a central location, instead they are based on online learners taking random walks in the network. To achieve adaptivity we propose two orthogonal mechanisms. In the first case the diversity of the learners is controlled by managing the lifespans of the models. In our second proposal, the performance of the models is measured and a the model is discarded if it is judged outdated. We demonstrate through a thorough experimental analysis that in a well specified range of feasible models of concept drift, where there is little data available locally in a large network, our algorithms outperform the known methods from related work. The two mechanisms fulfill complementary roles: while the age distribution approach is very generic and efficient, the drift detection approach provides extra information about the underlying drift pattern that can be useful in monitoring applications.
Online first date	31/03/13 (at latest)

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Manuscript Number	ACS-D-12-00072R1
Title	An Agent-Based Model of Tax Compliance: An Application to the Spanish Case
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Keywords	Rational choice; social influence; tax behaviour; tax evasion; tax morale.
Abstract	We present a new agent-based model for the simulation of tax compliance and tax evasion behaviour (SIMULFIS). The main novelties of the model are the introduction of a`behavioural filter approach' to model tax decisions, the combination of a set of different mechanisms to produce tax compliance (namely rational choice, normative commitments, and social influence), and the use of the concept of `fraud opportunity use rate' (FOUR) as the main behavioural outcome. After describing the model in detail, we display the main behavioural and economic results of 1,920 simulations calibrated for the Spanish case and designed to test for the internal validity of SIMULFIS. The behavioural outcomes show that scenarios with strict rational agents strongly overestimate tax evasion, while the introduction of social influence and normative commitments allows to generate more plausible compliance levels under certain deterrence conditions. Interestingly, the relative effect of social influence is shown to be ambivalent: it optimizes compliance under low and middle deterrence conditions, but not when deterrence is made harder. Finally, SIMULFIS economic outcomes are broadly in line with theoretical expectations, thus supporting the reliability of the model.
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