Journals on Complexity Science:
An Introduction

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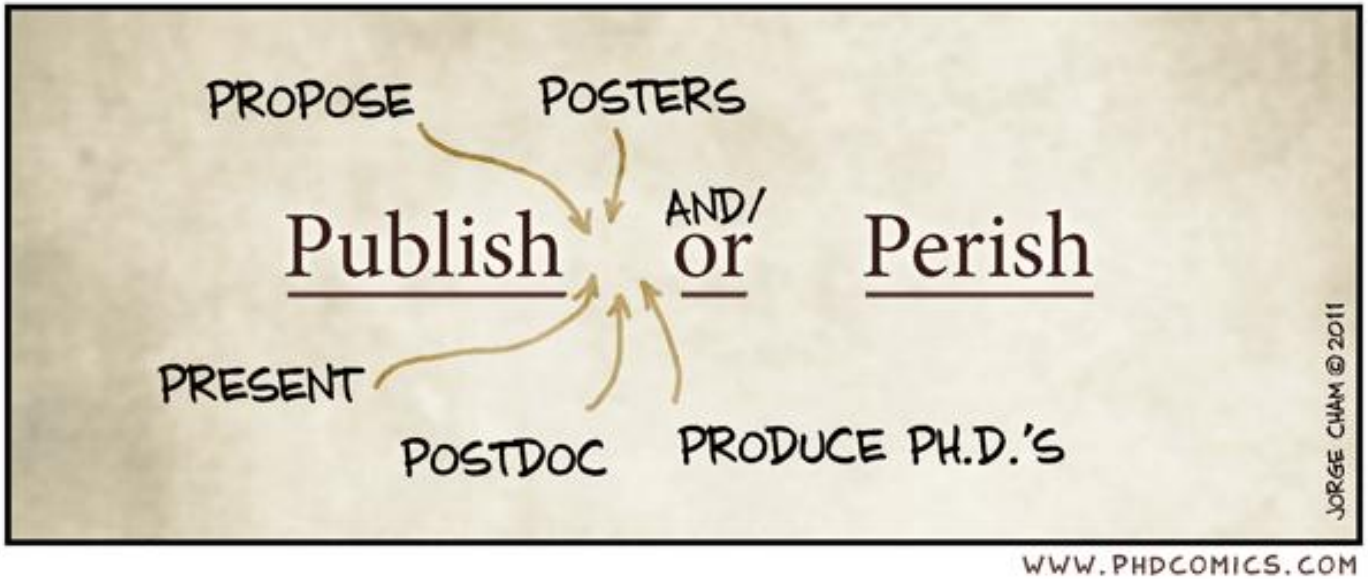
Nov 19, 2015


种下梦想！
然后，不离不弃。
Yes, I did it!
I WILL DO IT
I CAN DO IT
I'LL TRY TO DO IT
HOW DO I DO IT?
I WANT TO DO IT
I CAN'T DO IT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Science
AAAS
Magazine
Emergence of Scaling
Random Networks
Albert-László Barabási* and Réka Albert

Outline

- Journal
- Template
- Submission
- Tracking

Publishers (~ 17 P, 53 J)

IOP Publishing

APS physics

nature publishing group npg

World Scientific
Connecting Great Minds

NON SOLUS
ELSEVIER

Science AAAS

AIP Publishing

中国物理学会
Chinese Physical Society

PLoS

Taylor & Francis Online

Royal Society Publishing

Springer

edp sciences

电子科技大学学报
Journal of University of Electronic Science and Technology of China

palgrave macmillan

PNAS
Proceedings of the National Academy of Sciences of the United States of America www.pnas.org

Nature

npg

nature.com	41.456
nature physics	20.147
nature COMMUNICATIONS	11.470
SCIENTIFIC REPORTS	5.578
SCIENTIFIC DATA	
palgrave communications HUMANITIES | SOCIAL SCIENCES | BUSINESS	

Nature

LETTER

doi:10.1038/nature14604

Influence maximization in complex networks through optimal percolation

Flaviano Morone[1] & Hernán A. Makse[1]

The whole frame of interconnections in complex networks hinges on a specific set of structural nodes, much smaller than the total size, which, if activated, would cause the spread of information to the whole network[1], or, if immunized, would prevent the diffusion of a large scale epidemic[2,3]. Localizing this optimal, that is, minimal, set of structural nodes, called influencers, is one of the most important problems in network science[4,5]. Despite the vast use of heuristic strategies to identify influential spreaders[6–14], the problem remains unsolved. Here we map the problem onto optimal percolation in random networks to identify the minimal set of influencers, which arises by minimizing the energy of a many-body system, where the form of the interactions is fixed by the non-backtracking matrix[15] of the network. Big data analyses reveal that the set of optimal influencers is much smaller than the one predicted by previous heuristic centralities. Remarkably, a large number of previously neglected weakly connected nodes emerges among the optimal influencers. These are topologically tagged as low-degree nodes surrounded by hierarchical coronas of hubs, and are uncovered only through the optimal collective interplay of all

provides the mathematical support to the intuitive relation between influence and the concept of cohesion of a network: the most influential nodes are the ones forming the minimal set that guarantees a global connection of the network[5,9,10]. We call this minimal set the 'optimal influencers' of the network. At a general level, the optimal influence problem can be stated as follows: find the minimal set of nodes which, if removed, would break down the network into many disconnected pieces. The natural measure of influence is, therefore, the size of the largest (giant) connected component as the influencers are removed from the network.

We consider a network composed of N nodes tied with M links with an arbitrary-degree distribution. Let us suppose we remove a certain fraction q of the total number of nodes. It is well known from percolation theory[21] that, if we choose these nodes randomly, the network undergoes a structural collapse at a certain critical fraction where the probability of existence of the giant connected component vanishes, $G = 0$. The optimal influence problem corresponds to finding the minimum fraction q_c of influencers to fragment the network:

nature COMMUNICATIONS

ARTICLE

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DOI: 10.1038/ncomms9627

OPEN

Quantifying randomness in real networks

Chiara Orsini[1,2], Marija M. Dankulov[3,4], Pol Colomer-de-Simón[5], Almerima Jamakovic[6], Priya Mahadevan[7], Amin Vahdat[8], Kevin E. Bassler[9,10], Zoltán Toroczkai[11], Marián Boguñá[5], Guido Caldarelli[12], Santo Fortunato[13] & Dmitri Krioukov[1,14]

Represented as graphs, real networks are intricate combinations of order and disorder. Fixing some of the structural properties of network models to their values observed in real networks, many other properties appear as statistical consequences of these fixed observables, plus

nature physics

ARTICLES

PUBLISHED ONLINE: 10 AUGUST 2015 | DOI: 10.1038/NPHYS3422

Spectrum of controlling and observing complex networks

Gang Yan[1†], Georgios Tsekenis[1†], Baruch Barzel[2], Jean-Jacques Slotine[3,4], Yang-Yu Liu[5,6] and Albert-László Barabási[1,6,7,8★]

Recent studies have made important advances in identifying sensor or driver nodes, through which we can observe or control a complex system. But the observational uncertainty induced by measurement noise and the energy required for control continue to be significant challenges in practical applications. Here we show that the variability of control energy and observational uncertainty for different directions of the state space depend strongly on the number of driver nodes. In particular, we find that if all nodes are directly driven, control is energetically feasible, as the maximum energy increases sublinearly with the system size. If, however, we aim to control a system through a single node, control in some directions is energetically prohibitive, increasing exponentially with the system size. For the cases in between, the maximum energy decays exponentially when the number of driver nodes increases. We validate our findings in several model and real networks, arriving at a series of fundamental laws to describe the control energy that together deepen our understanding of complex systems.

Many natural and man-made systems can be represented as networks[1–3], where nodes are the system's components and links describe the interactions between them. Thanks to concentration of a metabolite in a metabolic network[35], the geometric state of a chromosome in a chromosomal interaction network[14], or the belief of an individual in opinion dynamics[29,36].

SCIENTIFIC REPORTS

OPEN

Bootstrap percolation on spatial networks

Jian Gao[1], Tao Zhou[1,2] & Yanqing Hu[3,4]

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Published: 01 October 2015

Bootstrap percolation is a general representation of some networked activation process, which has found applications in explaining many important social phenomena, such as the propagation of information. Inspired by some recent findings on spatial structure of online social networks, here we study bootstrap percolation on undirected spatial networks, with the probability density function of long-range links' lengths being a power law with tunable exponent. Setting the size of the giant active component as the order parameter, we find a parameter-dependent critical value for the power-law exponent, above which there is a double phase transition, mixed of a second-order phase transition and a hybrid phase transition with two varying critical points, otherwise there is only a second-order phase transition. We further find a parameter-independent critical value around −1, about which the two critical points for the double phase transition are almost constant. To our surprise, this critical value −1 is just equal or very close to the values of many real online social networks, including LiveJournal, HP Labs email network, Belgian mobile phone network, etc.

Nature

SCIENTIFIC DATA

OPEN

SUBJECT CATEGORIES
» Complex networks
» Sociology
» Geography
» Computational science

A multi-source dataset of urban life in the city of Milan and the Province of Trentino

Gianni Barlacchi[1,2,*], Marco De Nadai[2,*], Roberto Larcher[1], Antonio Casella[1], Cristiana Chitic[1], Giovanni Torrisi[1], Fabrizio Antonelli[1], Alessandro Vespignani[3], Alex Pentland[4] & Bruno Lepri[2]

Received: 27 May 2015
Accepted: 18 September 2015
Published: 27 October 2015

The study of socio-technical systems has been revolutionized by the unprecedented amount of digital records that are constantly being produced by human activities such as accessing Internet services, using mobile devices, and consuming energy and knowledge. In this paper, we describe the richest open multi-source dataset ever released on two geographical areas. The dataset is composed of telecommunications, weather, news, social networks and electricity data from the city of Milan and the Province of Trentino. The unique multi-source composition of the dataset makes it an ideal testbed for methodologies and approaches aimed at tackling a wide range of problems including energy consumption, mobility planning, tourist and migrant flows, urban structures and interactions, event detection, urban well-being and many others.

Scientific Data (Mar 2014)

Scientific Data is an open-access, peer-reviewed publication for descriptions of scientifically valuable datasets. Our primary article-type, the Data Descriptor, is designed to make your data more discoverable, interpretable and reusable.

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HUMANITIES | SOCIAL SCIENCES | BUSINESS

ARTICLE

Received 1 Dec 2014 | Accepted 5 Jun 2015 | Published 14 Jul 2015 DOI: 10.1057/palcomms.2015.16 OPEN

Hierarchical networks of scientific journals

Gergely Palla[1,2], Gergely Tibély[3], Enys Mones[2], Péter Pollner[1,2] and Tamás Vicsek[1,3]

ABSTRACT Academic journals are the repositories of mankind's gradually accumulating knowledge of the surrounding world. Just as knowledge is organized into classes ranging from major disciplines, subjects and fields, to increasingly specific topics, journals can also be categorized into groups using various metric. In addition, they can be ranked according to their overall influence. However, according to recent studies, the impact, prestige and novelty of journals cannot be characterized by a single parameter such as, for example, the impact factor. To increase understanding of journal impact, the knowledge gap we set out to explore in our study is the evaluation of journal relevance using complex multi-dimensional measures. Thus, for the first time, our objective is to organize journals into multiple hierarchies based on citation data. The two approaches we use are designed to address this problem from different perspectives. We use a measure related to the notion of *m*-reaching centrality and find a network that shows a journal's level of influence in terms of the direction and efficiency with which information spreads through the network. We find we can also obtain an alterna-

Palgrave Communications (Jan 2015)

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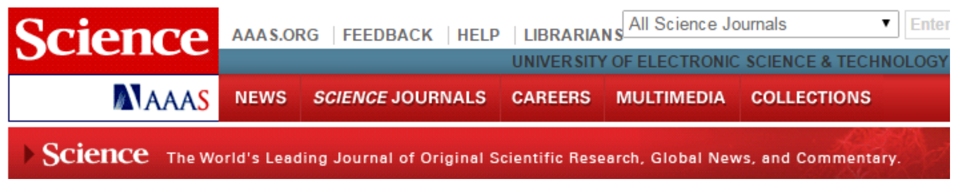
Science



33.611

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Science

RESEARCH ARTICLE

DISEASE NETWORKS

Uncovering disease-disease relationships through the incomplete interactome

Jörg Menche,[1,2,3] Amitabh Sharma,[1,2] Maksim Kitsak,[1,2] Susan Dina Ghiassian,[1,2] Marc Vidal,[2,4] Joseph Loscalzo,[5] Albert-László Barabási[1,2,3,5]*

According to the disease module hypothesis, the cellular components associated with a disease segregate in the same neighborhood of the human interactome, the map of biologically relevant molecular interactions. Yet, given the incompleteness of the interactome and the limited knowledge of disease-associated genes, it is not obvious if the available data have sufficient coverage to map out modules associated with each disease. Here we derive mathematical conditions for the identifiability of disease modules and show that the network-based location of each disease module determines its pathobiological relationship to other diseases. For example, diseases with overlapping network modules show significant coexpression patterns, symptom similarity, and comorbidity, whereas diseases residing in separated network neighborhoods are phenotypically distinct. These tools represent an interactome-based platform to predict molecular commonalities between phenotypically related diseases, even if they do not share primary disease genes.

Identifying sequence variations associated with specific phenotypes represents only the first step of a systematic program toward understanding human disease. Indeed, most phenotypes reflect the interplay of multiple molecular forming one or several connected subgraphs that we call the disease module (Fig. 1A). This agglomeration of disease proteins is supported by a range of biological and empirical evidence (7, 17, 18) and has fueled the development of numerous tools

Inheritance in Man (OMIM) and genome-wide association study (GWAS) databases (30, 31), involving 2436 disease-associated proteins (Fig. 1, B and C, and SM section 1).

Despite the best curation efforts, both the interactome and the disease gene list remain incomplete (6, 11–16) and biased toward much-studied disease genes and disease mechanisms (32, 33). The consequences of this incompleteness are illustrated by multiple sclerosis: Of the 69 genes associated with the disease, only 11 disease proteins form a connected subgraph (observable module, Fig. 1D); the remaining 58 proteins appear to be distributed randomly in the interactome. This pattern holds for all 299 diseases, their observable modules comprising on average only 20% of the respective disease genes (Fig. 1C). Several factors contribute to this fragmentation (Fig. 1A), the main one being data incompleteness: Missing links leave many disease proteins isolated from their disease module (Fig. 1A).

In percolation theory, if only a p fraction of links is available, a connected subgraph (disease module) of m nodes undergoes a phase transition under certain conditions (34, 35): If p is above p_c^m, some fraction of nodes continue to form an observable module; if, however, p is below p_c^m, the module becomes too fragmented to be observable (Fig. 1E; see also fig. S14 and SM section 6). To quantify this phenomenon, we calculated the minimum network coverage p_c^m required to observe a disease module of original size m, finding that $p_c^m \sim 1/m$, valid for an arbitrary degree distribution of the underlying inter-

Science

RESEARCH ARTICLE

COMPLEX SYSTEMS

Systemic trade risk of critical resources

Peter Klimek,[1] Michael Obersteiner,[2] Stefan Thurner[1,2,3]*

10.1126/sciadv.1500522

In the wake of the 2008 financial crisis, the role of strongly interconnected markets in causing systemic instability has been increasingly acknowledged. Trade networks of commodities are susceptible to cascades of supply shocks that increase systemic trade risks and pose a threat to geopolitical stability. We show that supply risk, scarcity, and price volatility of nonfuel mineral resources are intricately connected with the structure of the worldwide trade networks spanned by these resources. At the global level, we demonstrate that the scarcity of a resource is closely related to the susceptibility of the trade network with respect to cascading shocks. At the regional level, we find that, to some extent, region-specific price volatility and supply risk can be understood by centrality measures that capture systemic trade risk. The resources associated with the highest systemic trade risk indicators are often those that are produced as by-products of major metals. We identify significant strategic shortcomings in the management of systemic trade risk, in particular in the European Union.

INTRODUCTION

Commodity price volatility has long been identified by political economists as a hindrance to sustainable economic development [for example, the Dutch Disease (1)] as well as a catalyst of geopolitical crises. Although traditionally associated with fossil fuel resources, the criticality of nonfuel mineral resources has become increasingly relevant because of their increasing importance in cutting-edge technological and medical applications (2). With the explosive growth of financial derivatives on commodities and a subsequent investment boom (and bust) in the mid-2000s, there is growing evidence that resource criticality, loosely defined as the importance of a resource to production processes, has become increasingly susceptible to financial perturbations from both within and outside the commodities sector (3, 4). A better understanding of the interconnected nature of commodity markets would allow policy-makers to hedge against threats to industrial sectors and reduce the risk of geopolitical instabilities induced by the price volatility of critical resources.

Systemic risk is often defined as the risk that a large fraction of a system will collapse as a consequence of seemingly minor and local is strongly related to the structure of the trade network of a particular resource. We introduce a novel method to assess the systemic risk level of trade networks and demonstrate its validity on 71 actual trade networks of resources. At the global level, we show that the scarcity of a resource is strongly related to the structural properties of its underlying trade network. The scarcer a resource is, the more susceptible it is to cascading shocks in the trade network. At the regional level, we show that the volatility of mineral prices within several world regions, in particular the United States and the European Union (EU), is closely related to specific network centrality measures that we propose to quantify systemic trade risk. We find that price disruptions in mineral resources also reflect cascades of supply shocks in the underlying trade network. The impact of these cascades, to some extent, can be mitigated by lowering trade barriers. We find the highest systemic trade risks in resources that are produced as by-products of other resources. It has been argued that these resources are especially prone to price disruptions because it is hard to predict whether their global supply will react to changes in global demand (16).

Publish in a broad array of fields including computer, engineering, environmental, life, mathematical, physical, and social sciences.

Science Advances

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PNAS Celebrating 100 Years 1915-2015 PNAS

9.674

Early Edition

New papers posted daily

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Solving the apparent diversity-accuracy dilemma of recommender systems

Tao Zhou[a,b,c,d], Zoltán Kuscsik[a,e], Jian-Guo Liu[a,b,c], Matúš Medo[a], Joseph Rushton Wakeling[a], and Yi-Cheng Zhang[a,c,1]

[a]Department of Physics, University of Fribourg, Chemin du Musée 3, CH-1700 Fribourg, Switzerland; [b]Department of Modern Physics and Nonlinear Science Center, University of Science and Technology of China, Hefei 230026, China; [c]Research Center for Complex Systems Science, University of Shanghai for Science and Technology, Shanghai 200093, China; [d]Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 610054, China; and [e]Department of Theoretical Physics and Astrophysics, P. J. Šafárik University, Park Angelinum 9, Košice 04001, Slovak Republic

Communicated by Giorgio Parisi, University of Rome, Rome, Italy, January 19, 2010 (received for review February 19, 2009)

Recommender systems use data on past user preferences to predict possible future likes and interests. A key challenge is that while the most useful individual recommendations are to be found among diverse niche objects, the most reliably accurate results are obtained by methods that recommend objects based on user or object similarity. In this paper we introduce a new algorithm specifically to address the challenge of diversity and show how it can be used to resolve this apparent dilemma when combined in an elegant hybrid with an accuracy-focused algorithm. By tuning the hybrid appropriately we are able to obtain, without relying on any semantic or context-specific information, simultaneous gains in both accuracy and diversity of recommendations.

hybrid algorithms | information filtering | heat diffusion | bipartite networks | personalization

Getting what you want, as the saying goes, is easy; the hard part is working out what it is that you want in the first place (1). Whereas information filtering tools like search engines typically require the user to specify in advance what they are looking for (2–5), this challenge of *identifying* user needs is the domain of *recommender systems* (5–8), which attempt to anticipate future

The clear concern is that an algorithm that focuses too strongly on diversity rather than similarity is putting accuracy at risk. Our main focus in this paper is to show that this apparent dilemma can in fact be resolved by an appropriate combination of accuracy- and diversity-focused methods. We begin by introducing a "heat-spreading" algorithm designed specifically to address the challenge of diversity, with high success both at seeking out novel items and at enhancing the personalization of individual user recommendations. We show how this algorithm can be coupled in a highly efficient hybrid with a diffusion-based recommendation method recently introduced by our group (25). Using three different datasets from three distinct communities, we employ a combination of accuracy- and diversity-related metrics to perform a detailed study of recommendation performance and a comparison to well-known methods. We show that not only does the hybrid algorithm outperform other methods but that, without relying on any semantic or context-specific information, it can be tuned to obtain significant and simultaneous gains in both accuracy and diversity of recommendations.

Methods

Recommendation Procedure. Since explicit ratings are not always available

Toward link predictability of complex networks

Linyuan Lü[a,1,2], Liming Pan[a,b,1], Tao Zhou[b,c,1], Yi-Cheng Zhang[a,d,2], and H. Eugene Stanley[a,e,2]

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Contributed by H. Eugene Stanley, December 31, 2014 (sent for review March 10, 2014; reviewed by Giorgio Parisi and Dashun Wang)

The organization of real networks usually embodies both regularities and irregularities, and, in principle, the former can be modeled. The extent to which the formation of a network can be explained coincides with our ability to predict missing links. To understand network organization, we should be able to estimate link predictability. We assume that the regularity of a network is reflected in the consistency of structural features before and after a random removal of a small set of links. Based on the perturbation of the adjacency matrix, we propose a universal structural consistency index that is free of prior knowledge of network organization. Extensive experiments on disparate real-world networks demonstrate that (*i*) structural consistency is a good estimation of link predictability and (*ii*) a derivative algorithm outperforms state-of-the-art link prediction methods in both accuracy and robustness. This analysis has further applications in evaluating link prediction algorithms and monitoring sudden changes in evolving network mechanisms. It will provide unique fundamental insights into the above-mentioned academic research fields, and will foster the development of advanced information filtering technologies of interest to information technology practitioners.

Predictability is usually defined as the possible maximum precision of a prediction algorithm (19). However, this kind of definition is not suitable for link prediction since a real network's link predictability under such definition should be 1 because their nonobserved links are almost always distinguishable (see *Materials and Methods*). In this paper, link predictability indeed characterizes the inherent difficulty of prediction that does not depend on specific algorithms, and our fundamental hypothesis is that missing links are difficult to predict if their addition causes huge structural changes, and thus network is highly predictable if the removal or addition of a set of randomly selected links does not significantly change the network's structural features. Accordingly, we propose a so-called "structural consistency" index that is based on the first-order matrix perturbation, which can reflect the inherent link predictability of a network and does not require any prior knowledge of the network's organization. We also propose a structural perturbation method for link prediction that is more accurate and robust than the state-of-the-art methods.

Structural Consistency

APPLIED PHYSICAL SCIENCES

PSYCHOLOGICAL AND COGNITIVE SCIENCES

SOCIAL SCIENCES

American Physical Society

Reviews of Modern Physics	29.604
Physical Review X	9.043
Physical Review Letters	7.512
Physical Review B	3.736
Physical Review E	2.288

- *PRA*: Atomic, molecular, and optical physics
- *PRB*: Condensed matter physics and materials
- *PRC*: Nuclear physics
- *PRD*: Particle physics and cosmology
- *PRE*: Statistical and nonlinear physics
- *PRL*: All fields of physics

American Institute of Physics

AIP Publishing

AIP Applied Physics Letters	3.302
AIP Chaos: An Interdisciplinary Journal of Nonlinear Science (25TH ANNIVERSARY)	1.954
AIP Journal of Applied Physics	2.183
AIP Journal of Mathematical Physics	1.243

Royal Society

Royal Society

Publishing

PHILOSOPHICAL TRANSACTIONS B

350 YEARS OF SCIENTIFIC PUBLISHING

7.055

PROCEEDINGS B

350 YEARS OF SCIENTIFIC PUBLISHING

5.051

INTERFACE

350 YEARS OF SCIENTIFIC PUBLISHING

3.917

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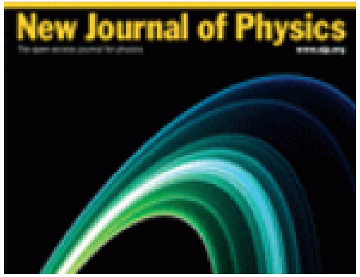
Institute of Physics

IOP Publishing



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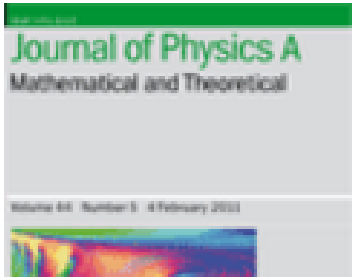

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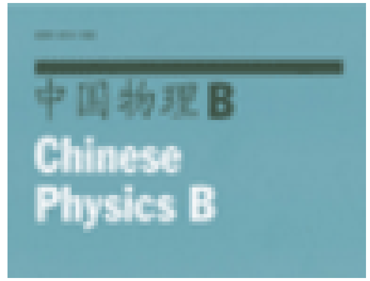
Institute of Physics

IOP Publishing

中国物理学会 Chinese Physical Society



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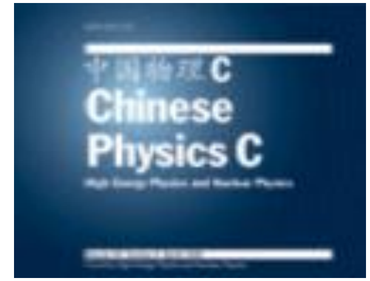

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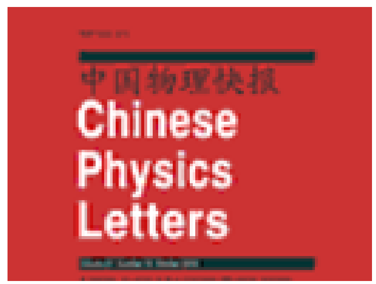

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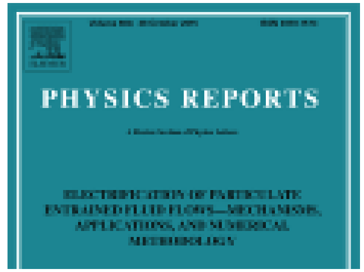
Elsevier (2,500 J & 33,000 B)



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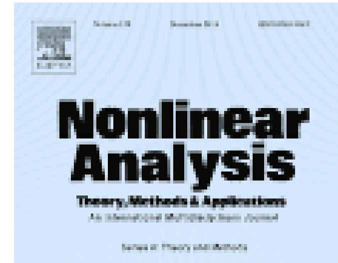

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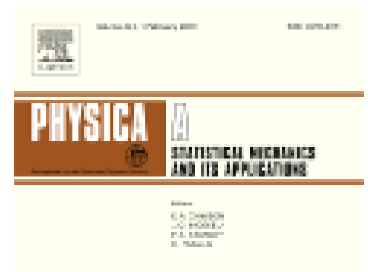

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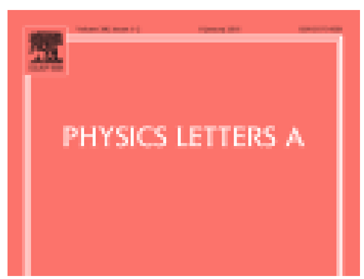

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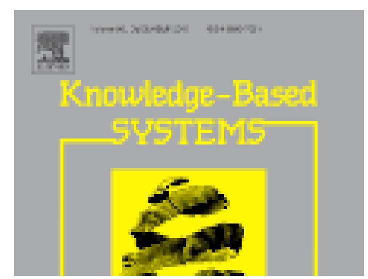

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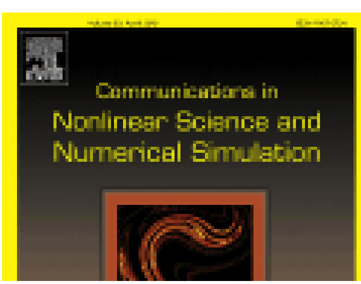

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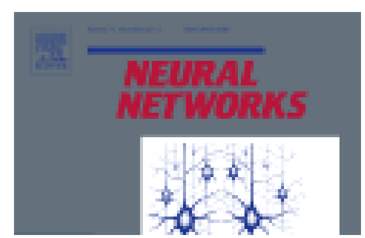

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Springer (1,900 J & 5,500 B)

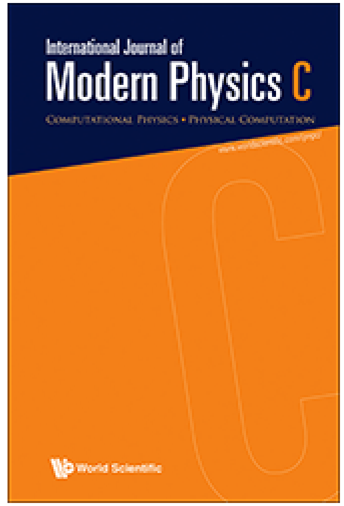
Springer

1.184

1.345

World Scientific

World Scientific
Connecting Great Minds



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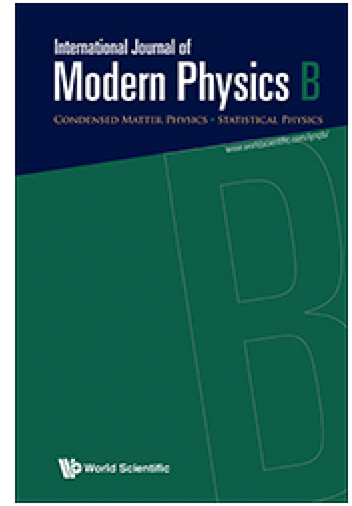

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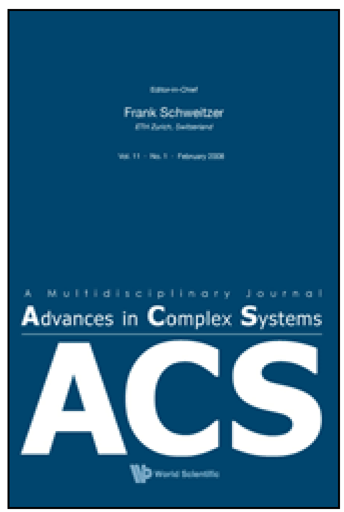

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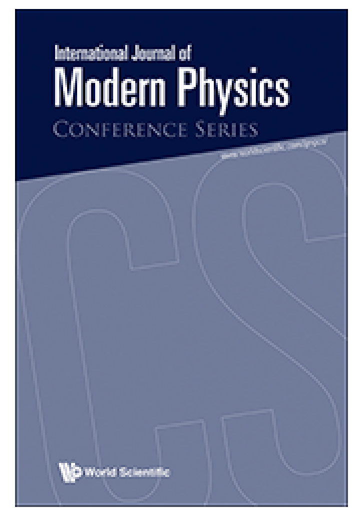

PLoS

PLOS ONE 3.234

PLOS COMPUTATIONAL BIOLOGY 4.620

1. scientific research. 2. not been published.
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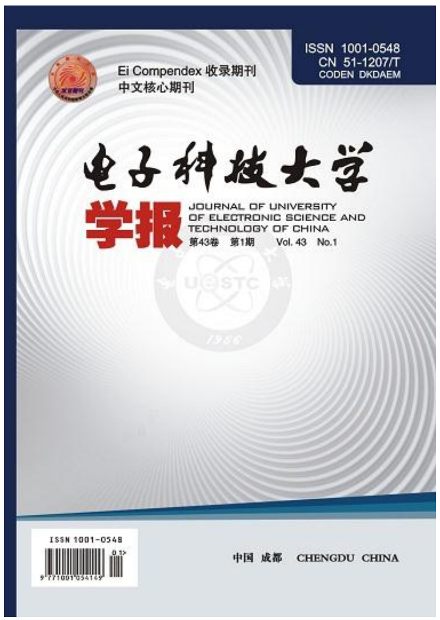

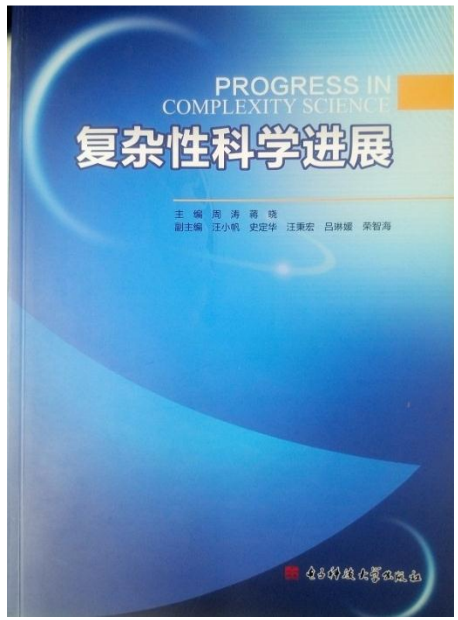

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\author[1]{Jian Gao}
\author[1,2]{Tao Zhou}
\author[3,4,*]{Yanqing Hu}
\affil[1]{CompleX Lab, Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 611731, China.}
\affil[2]{Big Data Research Center, University of Electronic Science and Technology of China, Chengdu 611731, China.}
\affil[3]{School of Mathematics, Southwest Jiaotong University, Chengdu 610031, China.}
\affil[4]{School of Information Science and Technology, Sun Yat-sen University, Guangzhou 510006, China.}
\affil[*]{E-mail: yanqing.hu.sc@gmail.com}

\begin{abstract}
Bootstrap percolation is a general representation of some networked activation process, which has found applications in explaining many important social phenomena, such as the propagation of information. Inspired by some recent
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\bibitem{chalupa1979bootstrap}
Chalupa, J., Leath, P. L. \& Reich, G. R. Bootstrap percolation on a Bethe lattice. {\em J. Phys. C: Solid State Phys.\/} {\bf 12}, L31 (1979).

\bibitem{Soriano2008}
Soriano, J., Mart{\'i}nez, M. R., Tlusty, T. \& Moses, E. Development of input connections in neural cultures. {\em Proc. Natl. Acad. Sci. USA\/} {\bf 105}, 13758-13763 (2008).
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Bootstrap percolation on spatial networks

Jian Gao[1], **Tao Zhou**[1,2], **and Yanqing Hu**[3,4,*]

[1]CompleX Lab, Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 611731, China.
[2]Big Data Research Center, University of Electronic Science and Technology of China, Chengdu 611731, China.
[3]School of Mathematics, Southwest Jiaotong University, Chengdu 610031, China.
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ABSTRACT

Bootstrap percolation is a general representation of some networked activation process, which has found applications in explaining many important social phenomena, such as the propagation of information. Inspired by some recent findings

References

1. Chalupa, J., Leath, P. L. & Reich, G. R. Bootstrap percolation on a Bethe lattice. *J. Phys. C: Solid State Phys.* **12**, L31 (1979).
2. Soriano, J., Martínez, M. R., Tlusty, T. & Moses, E. Development of input connections in neural cultures. *Proc. Natl. Acad. Sci. USA* **105**, 13758-13763 (2008).
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Figure legends

Figure 1. Illustration of the undirected Kleinberg's spatial network constrained on a 2-dimensional periodic square lattice. Each node has four short-range links (colored blue for node i) and one long-range link (colored black). The probability density function (PDF) of a node to have a long-range link at Manhattan distance r scales as $P(r) \sim r^{\alpha}$. For the target node i (colored red), when $r = 2$, there are eight candidate nodes (colored green), from which we can choose an uncoupled node j to make a connection. For another target node u, we can choose to connect it with node v when $r = 3$. (drawn by J.G.)

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        \affiliation{Web Sciences Center, University of Electronic Science and
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        \affiliation{Big Data Research Center, University of Electronic Science
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Bootstrap Percolation on Spatial Networks

Jian Gao,[1] Tao Zhou,[1,2] and Yanqing Hu[3,*]

[1] Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 610054, People's Republic of China
[2] Big Data Research Center, University of Electronic Science and Technology of China, Chengdu 610054, People's Republic of China
[3] School of Mathematics, Southwest Jiaotong University, Chengdu 610031, People's Republic of China

(Dated: August 1, 2014)

We numerically study bootstrap percolation on Kleinberg's spatial networks, in which the probability density function of a node to have a long-range link at distance r scales as $P(r) \sim r^{\alpha}$. Setting the ratio of the size of the giant active component to the network size as the order parameter, we find a critical exponent $\alpha_c = -1$, above which a hybrid phase transition is observed, with both the first-order and the second-order critical points are constant. When $\alpha < \alpha_c$, the second-order critical point increases as the decreasing of α, and there is either absent of the first-order phase transition or with a decreasing first-order critical point as the decreasing of α, depending on other parameters. Our results expand the current understanding on the spreading of information and the adoption of behaviors on spatial social networks.

PACS numbers: 89.75.Hc 64.60.ah 05.70.Fh

II. MODEL

Kleinberg model [34, 35] is a typical social network model, which has been well justified by empirical data [33]. In this paper, Kleinberg network is constrained on a 2-dimensional periodic lattice consisting of $N = L \times L$ nodes. In addition to its initially connected four nearest neighbors, each node i has a random long-range link to a node j with probability $Q(r_{ij}) \sim r_{ij}^{\alpha-1}$, where α is a tunable exponent and r_{ij} denotes the Manhattan dis-

III. RESULTS

We focus on the following three indicators: (i) The relative size of the giant active component (S_{gc}) at the equilibrium, i.e. the probability that an randomly selected node belongs to the giant active component; (ii) The number of iterations (NOI) to reach the equilibrium, which is usually used to determine the critical points for the first-order phase transition [44–47]; (iii) The relative size of the second giant active component (S_{gc2}), which is usually used to detect the critical points for the second-order phase transition [40, 47].

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\title[]{Bootstrap percolation on spatial networks}

\author{Jian Gao$^1$, Tao Zhou$^{1,2}$ and Yanqing Hu$^3$}
\address{$^1$ Web Sciences Center, University of Electronic Science and Technology
of China, Chengdu 610054, People's Republic of China}
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\ead{yanqing.hu.sc@gmail.com (corresponding author)}

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\bibitem{chalupa1979bootstrap}
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\href{http://stacks.iop.org/0022-3719/12/i=1/a=008}{{\bf 12} L31}

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E\/} \href{http://link.aps.org/doi/10.1103/PhysRevE.81.061921}{{\bf 81}(6) 061921}
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Bootstrap percolation on spatial networks

Jian Gao[1], **Tao Zhou**[1,2] **and Yanqing Hu**[3]

[1] Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 610054, People's Republic of China

[2] Big Data Research Center, University of Electronic Science and Technology of China, Chengdu 610054, People's Republic of China

[3] School of Mathematics, Southwest Jiaotong University, Chengdu 610031, People's Republic of China

E-mail: `yanqing.hu.sc@gmail.com (corresponding author)`

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2. Model

Kleinberg model [34, 35] is a typical spatial network model, which has been well justified by empirical data [29, 30, 31, 32, 33]. In this paper, Kleinberg's network is constrained on a 2-dimensional periodic lattice consisting of $N = L \times L$ nodes. In addition to its initially connected four nearest neighbors, each node i has a random long-range link to a node j with probability $Q_i(r_{ij}) \sim r_{ij}^{\alpha-1}$, where α is a tunable exponent and r_{ij} denotes the Manhattan

References

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PHYSICA A
STATISTICAL MECHANICS AND ITS APPLICATIONS

Evaluating user reputation in online rating systems via an iterative group-based ranking method

Jian Gao[a,*], Tao Zhou[a,b]

[a]CompleX Lab, Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 611731, People's Republic of China
[b]Big Data Research Center, University of Electronic Science and Technology of China, Chengdu 611731, People's Republic of China

Abstract

Reputation is a valuable asset in online social lives and it has drawn increased attention. Due to the existence of noisy ratings and spamming attacks, how to evaluate the reputation of users in online rating systems is especially significant.

1. Introduction

At the age of Internet, individual reputation plays the role of fundamental blocks in building up online ecosystems, especially in the filed of e-commerce [1, 2]. Meanwhile, new challenges arise that how to create and maintain reputation in online communities? To better uncover objects' true quality, many platforms implement online rating systems, e.g. Amazon, eBay, systems. As the core of reputation systems, a variety of user reputation evaluation methods have been proposed [24, 25], where each user is assigned with a reputation value based on their rating behaviors [26, 27]. Typically, these previous methods can be divided into three categories:

- Network-based methods. As online rating systems can be described by bipartite networks [28], the reputation for

References

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Evaluating user reputation in online rating systems via an iterative group-based ranking method

Jian Gao[a,*], Tao Zhou[a,b]

[a]CompleX Lab, Web Sciences Center, University of Electronic Science and Technology of China, Chengdu 611731, People's Republic of China
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Reputation is a valuable asset in online social lives and it has drawn increased attention. Due to the existence of noisy ratings and spamming attacks, how to evaluate the reputation of users in online rating systems is especially significant.

1. Introduction

At the age of Internet, individual reputation plays the role of fundamental blocks in building up online ecosystems [49, 60, 61]. For example, the reputation mechanisms help to realize the governance structures of social commerce in the field of e-commerce [65], the online reputations of job applicants are helpful to employers in making better hiring choices, and the online reputations of users have been used to enhance the performance of recommender systems [2, 9, 44, 48, 69]. Moreover, online reputations can potentially affect the accuracy of the information that we obtained

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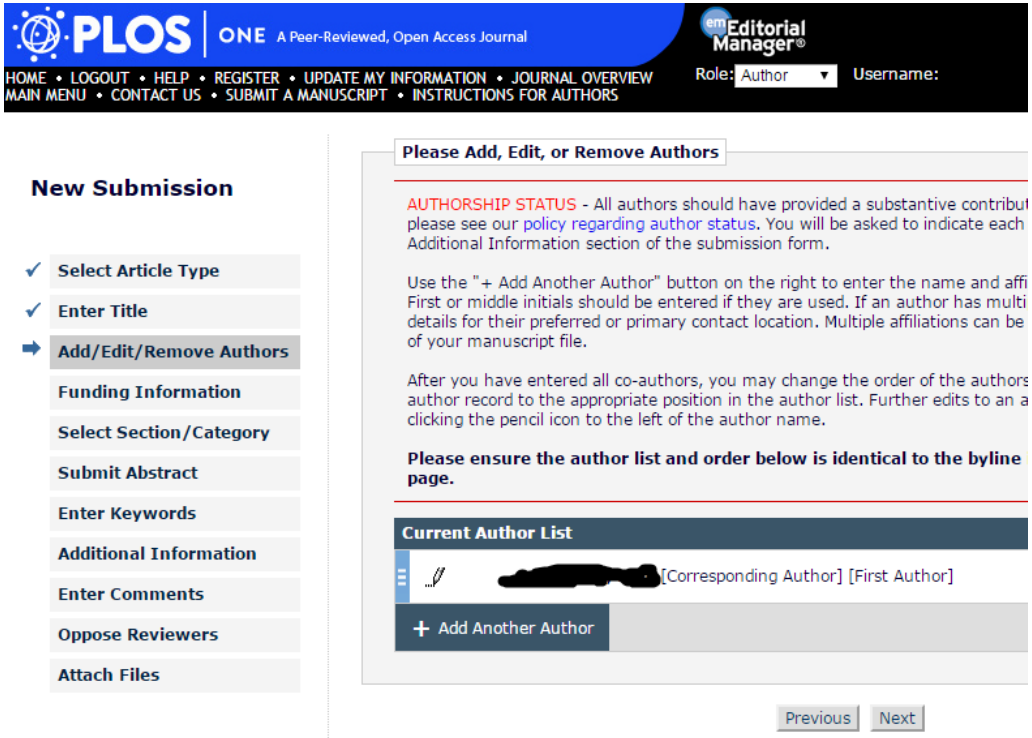
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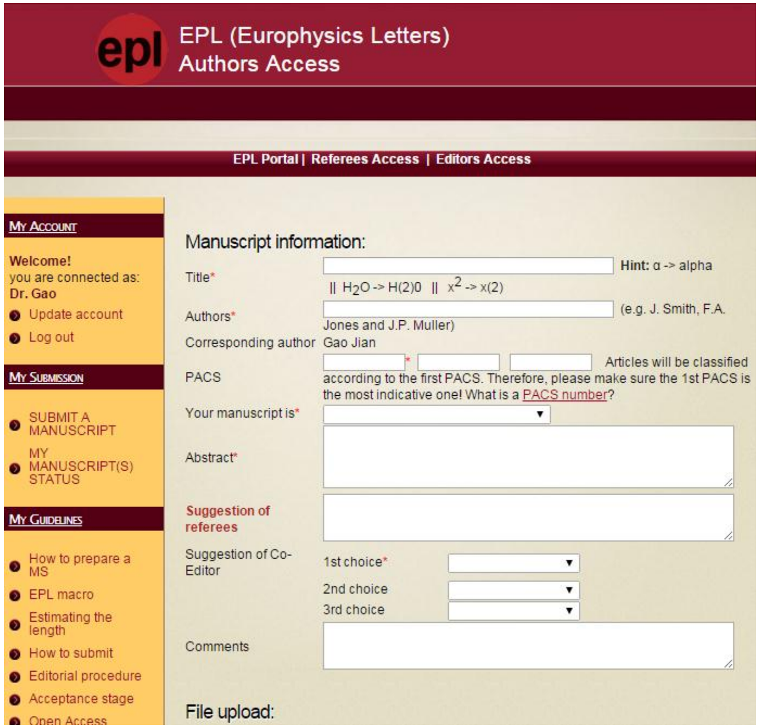
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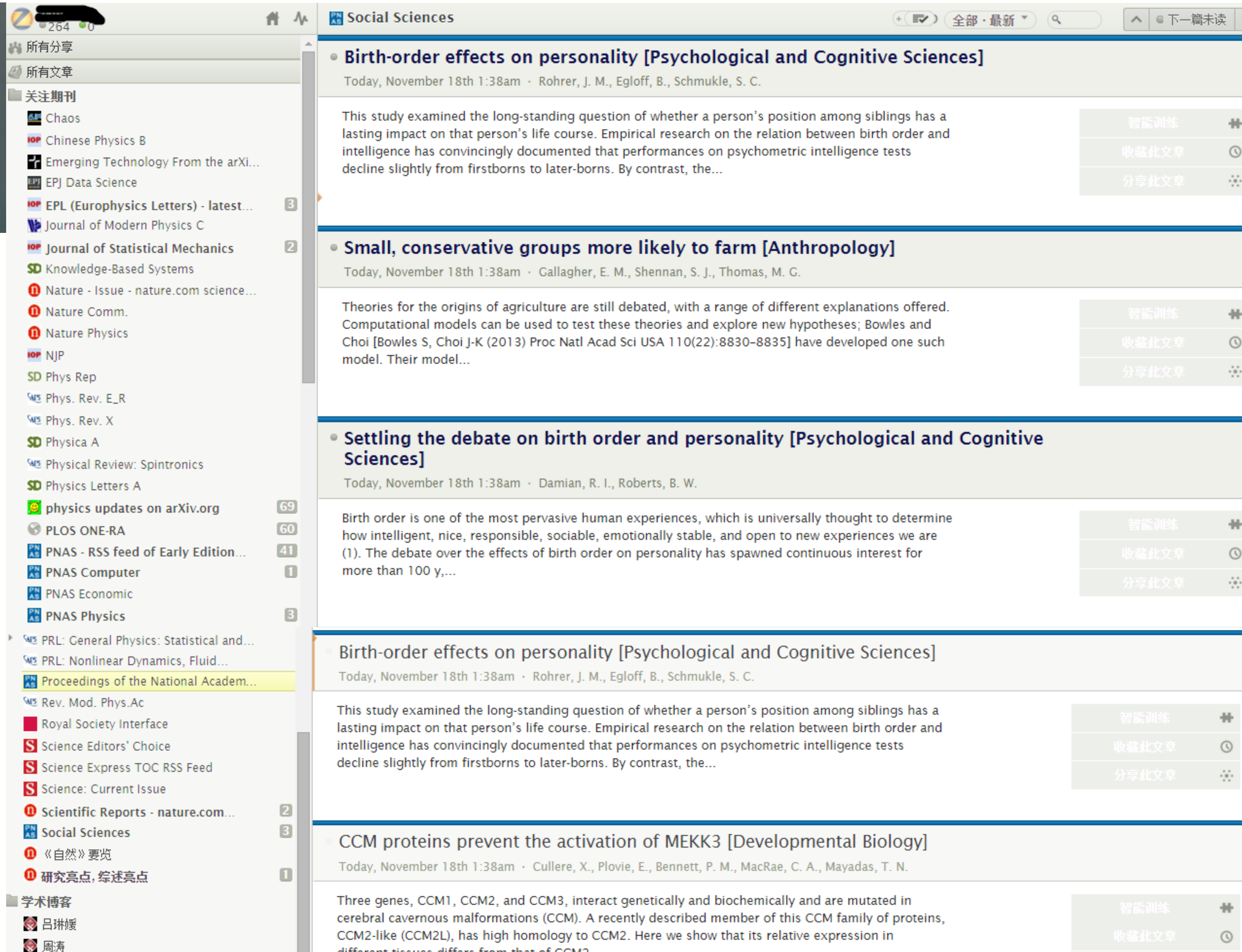

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Toward link predictability of complex networks

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Contributed by H. Eugene Stanley, December 31, 2014 (sent for review March 10, 2014; reviewed by Giorgio Parisi and Dashun Wang)

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Significance

Quantifying a network's link predictability allows us to (*i*) evaluate predictive algorithms associated

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Tao Zhou[a,b,c,d], Zoltán Kuscsik[a,e], Jian-Guo Liu[a,b,c], Matúš Medo[a], Joseph Rushton Wakeling[a], and Yi-Cheng Zhang[a,c,1]

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Communicated by Giorgio Parisi, University of Rome, Rome, Italy, January 19, 2010 (received for review February 19, 2009)

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Elizabeth M. Gallagher, Stephen J. Shennan, and Mark G. Thomas

Transition to farming more likely for small, conservative groups with property rights, but increased productivity is not essential

PNAS 2015 112 (46) 14218-14223; published ahead of print November 2, 2015,

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Transition to farming more likely for small, conservative groups with property rights, but increased productivity is not essential

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Edited by Bruce P. Winterhalder, University of California, Davis, CA, and accepted by the Editorial Board September 19, 2015 (received for review June 21, 2015)

Theories for the origins of agriculture are still debated, with a range of different explanations offered. Computational models can be used to test these theories and explore new hypotheses; Bowles and Choi [Bowles S, Choi J-K (2013) *Proc Natl Acad Sci USA* 110(22):8830–8835] have developed one such model. Their model shows the coevolution of farming and farming-friendly property rights, and by including climate variability, replicates the timings for the emergence of these events seen in the archaeological record. Because the processes modeled occurred a long time ago, it can be difficult to justify exact parameter values; hence, we pro- ng to idealized outcomes (FIO) method to explore the ameter space in more detail. We have replicated the owles and Choi, and used the FIO method to identify s and interactions of the model previously unidentified. Our results indicate that the key parameters for the emergence of farming are group structuring, group size, conservatism, and farming-friendly property rights (lending further support to Bowles and Choi's original proposal). We also find that although advantageous, it is not essential that farming productivity be greater than foraging productivity for farming to emerge. In addition, we highlight how model behaviors can be missed when gauging parameter sensitivity via a fix-all-but-one variation approach.

Computational Approaches

Investigating the reasons behind the transition to agriculture is problematic because modern ethnographic data may not be informative on ancient population dynamics, and the material culture record is sparse and only weakly informative on social aspects of the transition. Furthermore, the appearance of domestication traits in various species is likely to postdate their initial cultivation or management, sometimes by some considerable margin (14). In this context, computational models can be helpful in exploring the ecological and social conditions necessary for the transition to agriculture. There are many examples of such models [e.g., 13, 15–22; also the modeling review by Baker et al. (23) and discussion of modeling approaches by Gerbault et al. (24)], which, together, have explored most of the major hypotheses for the origins of agriculture (most notably, climate and population pressure).

Bowles and Choi Model

It has been argued that during the transition to agriculture, the institution of private property emerged (25–27). This idea led Bowles and Choi (13) to hypothesize that the advent of farming was impossible without farming-friendly property rights, and vice versa. Furthermore, they posit that farming was not suddenly invented and then adopted because it was a "better way to

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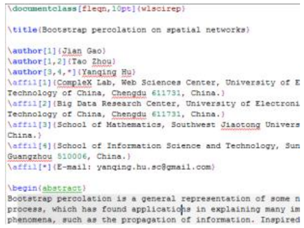
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\title{Bootstrap percolation on spatial networks}

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\begin{abstract}
Bootstrap percolation is a general representation of some n
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phenomena, such as the propagation of information. Inspired
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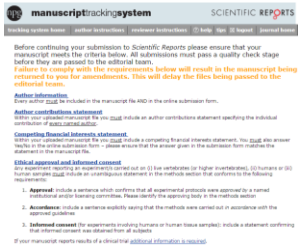

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CompleX Lab, Web Sciences Center, UESTC

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