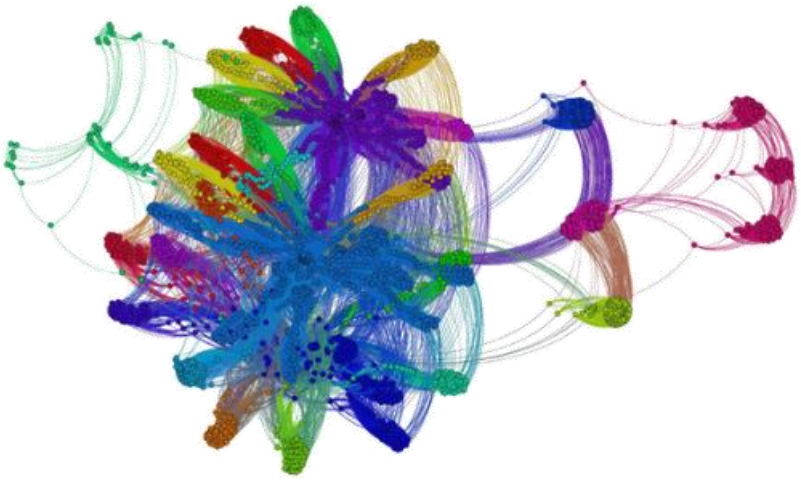
WANCSA'2018

Workshop on Advance in Nonlinear Complex Systems and Applications

2018 非线性复杂系统及应用前沿研讨会

程 序 册



Date: 28th June - 3rd July 2018

2018 年 6 月 28 日至 7 月 3 日 中国 武汉

Location: Wuhan Textile University, Wuhan, P. R. China.

会议地点：武汉纺织大学（南湖校区）

http://nonlinear.wtu.edu.cn/Conference.htm

WANCSA'2018 information:

WANCSA'2018 is organized by French and Chinese universities:

- **LMAH and LITIS, Le Havre Normandie University, France**
- **College of Mathematics and Computer Sciences, WTU, Wuhan, China**
- **School of Mathematics and Statistics, Hunan University of Commerce, China**

And supported by:

- **NSFC**
- **Wuhan Textile University**
- **Le Havre University**

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Sponsors

非线性科学研究中心

RESEARCH CENTRE OF NONLINEAR SCIENCE

会议介绍

为促进数学、计算机、生命科学、经济、社会管理及其他学科交叉研究、促进非线性科学研究领域学者之间的学术交流，增进同行之间的相互了解，“2018 非线性复杂系统及应用前沿研讨会（WANCSA2018）”拟于 2018 年 6 月 28 日至 7 月 3 日间在武汉举行。会议将以国内外在数学、计算机与生命科学等学科交叉研究领域相关科学家的学术报告为主、开展形式多样的学术交流、研讨。此次研讨会报告主题涵盖了非线性复杂系统及应用前沿多个热点领域的重要问题；会议还安排了相关议题的自由交流和特别论坛等环节。

WANCSA 研讨会由武汉纺织大学、诺曼底大学联盟、勒阿弗尔大学、湖南商学院共同发起主办，曾在武汉与法国勒阿弗尔两地举办，已历经三届，极大地促进了同行间的深入交流。WANCSA’2018 由武汉纺织大学非线性科学研究中心具体承办，获得了国家自然科学基金委、武汉纺织大学研究生处及科技处相关项目的共同资助，并且得到武汉纺织大学学科办、数学与计算机学院领导们的大力支持。

会议组织者热忱欢迎从事相关研究的广大科学工作者与相关专业的研究生参会！

此次研讨会具体信息如下：

一、会议时间与地点：

会议时间：2018 年 6 月 28 日-7 月 3 日

注：6 月 28 日晚上报到入住，29、30、1 日正式会议，7 月 2 日会后研讨，7 月 3 日离会。

各位专家具体拟定的报告时间将由此次会务人员与专家协商联系！

地点：武汉金谷国际酒店（武汉洪山光谷民族大道 307 号 电话: 027-52111111）

二、承办单位：

武汉纺织大学（数学与计算机学院、非线性科学研究中心）

三、会务联系人（会议期间，您有任何与会务有关的问题请联系我们）：

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四、会议日程安排

6 月 29 号上午

主持人：张本龚		
时　间	报告人	报告题目
8：10-8：40	开幕式	举办方代表、大会主席讲话、参会人员合影。
8：40-9：20	**M.A. Aziz Alaoui**	**Mathematical Analysis of Human Behaviors During Catastrophic Events**
9：20-10：00	**Chen Zeng**	**Statistical Inference in Biological Systems via Machine Learning**
10：00-10：10	茶歇	
主持人：　**Chen Zeng**		
10：10-10：50	陆君安	**Structure and Dynamics of Multilayer Network and Its Application**
10：50-11：30	刘继成	**Synchronization for stochastic differential equations with nonlinear multiplicative noise in the mean square sense**
11：30-12：00	徐　杰	**Strong solutions of two-time-scale jump-diffusion SDEs under the non-Lipschitz coefficients: existence, uniqueness, and averaging principle**
12：00-14：00	午餐	

6 月 29 号下午

主持人：陆君安		
时　间	报告人	报告题目
14：00-14：40	许小可	复杂网络的复杂性度量
14：40-15：20	李　炜	**Community detection in graphs: Algorithms based on label propagation**
15:　20-16: 00	周　进	**Identifying partial topology of complex dynamical networks via a pinning mechanism**
16：00-16：10	茶歇	
主持人：李　炜		
16：10-16：50	孙文	非恒同振子系统的合作行为研究
16：50-17：30	许新建	**Efficient construction of threshold networks of stock markets**
17: 30-18: 00	邓为炳	**Quantitative Linguistics: Stochastic Model for Phonemes**
18：00	晚餐	

6 月 30 号上午

主持人：万　立		
时　间	报告人	报告题目
8：30-9：10	丰建文	谐波振子网络的几个随机控制问题
9：10-9：50	刘建国	复杂社会系统的若干管理与决策问题研究
9: 50 – 10: 30	李澄清	数字混沌系统的网络分析
10：30-10：40	茶歇	
主持人：许小可		
10：40-11：20	陈建文	**Nonlinear commutator estimate and its application to quasi-geostrophic equation**
11：20-12：00	池丽平	**Robustness of temporal networks based on spreading dynamics**
12：00	午餐	

6 月 30 号下午：

主持人：　丰建文		
时　间	报告人	报告题目
14：00-14：40	赵蕴杰	**Computational study of non-catalytic pocket for drug design**
14：40-15：20	吴国成	分数阶差分方程中的混沌
15：20-16：00	张毅超	**Divide-And-Conquer Games on Social Networks**
16：00-16：10	茶歇	
主持人：　申传胜		
16：10-16：50	朱全新	**Existence-uniqueness and stability of stochastic nonlinear systems**
16：50-17：30	贾　贞	复杂网络的粗粒化及优化研究
17：30 -18：00	张　健	**Existence and concentration of ground state solutions to Hamiltonian elliptic systems**
18：00	晚餐	

7 月 1 号上午

主持人： 许新建		
时 间	报告人	报告题目
8：30-9：10	申传胜	**Large deviation induced phase switch in an inertial majority-vote model**
9：10-9：50	刘小平	**Hunt for disease tipping points by landscape dynamic network biomarkers**
9：50-10：30	苏厚胜	正性约束下的复杂网络连边一致性问题研究
10: 30 – 10： 40	茶歇	
主持人： 苏厚胜		
10：40-11：20	王 沛	**Exploring transcription factors reveals crucial members and regulatory networks involved in different abiotic stresses in Brassica napus L**
11：20-12：00	韦 相	双层关联网络疾病协同传播模型
12：00	午餐	

7 月 1 号下午：

主持人： 王 沛		
时 间	报告人	报告题目
14：00-14：40	郭 龙	**A dynamical approach to identify vertices' centrality in complex networks**
14：40-15：20	辜 娇	**Conformal prediction based on back-propagation neural network for the classification of Chinese liquors**
15：20-16：00	惠 子	**Epidemic dynamics on spatial network**
16：00-16：10	茶歇	
主持人：张群娇		
16：10-16：50	朱月英	**The formation of continuous opinion dynamics based on a gambling mechanism and its sensitivity analysis**
16：50-17：30	时亚洲	离子溶液中 RNA 假结的空间结构及稳定性预测
17:30 – 18:00	江 健	**Resource control of epidemic spreading through a multilayer network**
18：00	晚餐	

7 月 2 号 自由研讨 7 月 3 号离会

五、会议报告摘要（Abstract）：

6 月 29 日

Mathematical Analysis of Human Behaviors During Catastrophic Events

AZIZ-ALAOUI M. A

法国诺曼底大学、勒阿弗尔大学

In this talk, our aim is to present the Panic-Control-Reflex system, which is a mathematical model that was built in order to better understand and predict the behavioral reactions of individuals facing a catastrophic event. The geographical background of those specific phenomena naturally brings us to set the problem within the complex systems framework, thus we consider coupled networks of dynamical systems, in both finite and infinite dimensional spaces. Consequently, our work deals with complex networks of ordinary differential equations as well as partial differential equations. We analyze the effect of behavioral evolution, emotional contagion, linear and quadratic interactions among the population concerned with the catastrophe, and we take additionally into account the effect of the spatial diffusion. We pay a special attention to the panic behavior which is to be avoided and controlled, and analyze in which parameter regimes a persistence of panic can occur. Furthermore, we explore sufficient conditions on the topology of the graph which determines the structure of the geographical network, in order to reach a synchronization state of every node, in correspondence with the expected return of all individuals to a normal behavior.

Title：TBA

BERTELLE Cyrille

法国诺曼底大学、勒阿弗尔大学

详情请见报告。

Statistical Inference in Biological Systems via Machine Learning

Chen Zeng

George Washington University (chenz@gwu.edu)

Machine learning techniques, in particular, deep neural networks of suitable architecture have been applied to many areas with outstanding performance. I will use three biophysics examples of protein/RNA contact modeling, kinase inhibitor design, and single-cell metabolite detection to introduce our research on using machine-learning methods for biological systems. I hope to illustrate the efficiency and accuracy of machine learning and argue for its potential in providing key insights in big spatiotemporal datasets of biological sciences.

Structure and Dynamics of Multilayer Network and Its Application

Lu Jun-an (陆君安)

武汉大学 (jalu@whu.edu.cn)

Based on eigenvalue spectra of multilayer networks, we analyze the influence of network structures on synchronization and diffusion of multilayer networks. In particular, we focus on synchronization of duplex star networks, the influence of interlayer couplings on dynamical behaviors, the optimal interlayer couplings，pinning control and emergence of hyper-diffusion in multilayer networks. Finally, we briefly introduce other recent work of our group and some further research topics.

Synchronization for stochastic differential equations with nonlinear multiplicative noise in the mean square sense

Liu Jicheng (刘继成)

华中科技大学 (jcliu@hust.edu.cn)

We provide a clearer technique to deal with general synchronization problems for SDEs, when the multiplicative noise appears nonlinearly. Moreover, convergence rate of synchronization is obtained. A new method employed here is the techniques of moment estimates for general solutions based on the transformation of multi-scales equations. As a by-product, the relationship between general solutions and stationary solutions is constructed.

Strong solutions of two-time-scale jump-diffusion SDEs under the non-Lipschitz coefficients: existence, uniqueness, and averaging principle

Xu Jie (徐杰)

河南师范大学 (xujiescu@163.com)

This paper is devoted to studying the two-time-scale jump-diffusion SDEs under the non-Lipschitz coefficients. First, the existence and uniqueness of strong solutions for a jump-diffusion SDEs under the non-Lipschitz coefficients is established. Second, the averaging principle for a class of two-time-scale jump-diffusion SDEs under the non-Lipschitz coefficients is shown. Under suitable conditions, it is shown that the slow component mean-square strongly converges to the solution of the corresponding averaging equation. As a product, the scale of the convergence is also presented. This paper extends the result ``Strong convergence rate for two-time-scale jump-diffusion stochastic differential systems [SIAM J. Multi. Model. Simul. 6 (2) (2007) 577-594.]" to the non-Lipschitz case.

复杂网络的复杂性度量

Xu Xiaoke（许小可）

大连民族大学 (xuxiaoke@foxmail.com)

复杂网络一般是指拥有非平凡结构特性的既非随机又非规则的网络化复杂系统，长期以来很多网络虽然被称为复杂网络，但其复杂性程度一直没有被很好的刻画与度量。在本报告中，参考不同阶数的零模型网络，使用模体数量指标对多个实证网络的复杂性进行了度量，发现绝大多数复杂网络的复杂性均在 3 阶以上。研究中发现模体数量指标体现出比网络结构熵、结构不均匀性等指标更广泛的适用性，不仅可以度量复杂网络的复杂性，也能与网络的微观特性指标匹配系数、聚类系数、富人俱乐部系数等建立关联关系，同时能有效揭示网络的中观特性如社团结构对于网络结构的影响。本研究中基于复杂网络零模型能为实证网络提供一个准确的参照，结合统计量指标可以准确描述出实证网络的非平凡特性，有助于揭示复杂网络复杂性的来源。

Community detection in graphs: Algorithms based on label propagation

Li Wei (李炜)

华中师范大学 (liw@mail.ccnu.edu.cn)

Community structure is a prominent feature of complex networks. Designing scalable algorithms to find communities efficiently and accurately is of great significance in network science. In this talk, I will first introduce the community structure briefly, and then propose three dynamic label propagation based methods for community detection. We also compare our methods to the currently prevalent methods in the regards of performance and computation load. It turns out that ours are especially effective in dealing with large-scale networks.

Identifying partial topology of complex dynamical networks via a pinning mechanism

Zhou Jin (周进)

武汉大学 (jzhou@whu.edu.cn)

In this talk, we study the problem of identifying the partial topology of complex dynamical networks via a pinning mechanism. By using the network synchronization theory and the adaptive feedback controlling method, we propose a method which can greatly reduce the number of nodes and observers in the response network. Particularly, this method can also identify the whole topology of complex networks. A theorem is established rigorously, from which some corollaries are also derived in order to make our method more cost-effective. Several numerical examples are provided to verify the effectiveness of the proposed method. In the simulation, an approach is also given to avoid possible identification failure caused by inner synchronization of the drive network.

非恒同振子系统的合作行为研究

Sun Wen (孙文)

长江大学 (sunw@amss.ac.cn)

由于其丰富的物理意义以及重要的应用前景，有关振子复杂网络的集群与控制研究长期以来倍受到人们的关注。然而目前绝大多数研究都集中在经典的恒同振子复杂网络上，对非恒同的振子复杂网络主要针对 Kuromoto 模型，而对其他模型的研究所知甚少。本报告首先对当前的非恒同振子网络合作行为作简单介绍；其次介绍我们在这方面做的一点工作，特别是我们发现参数不匹配的振子，其动力学差别较大，通过局部的相互作用，也能出现较强的合作行为。

Efficient construction of threshold networks of stock markets

Xu Xinjian（许新建）

上海大学 (xinjxu@shu.edu.cn)

Although the threshold network is one of the most used tools to characterize the underlying structure of a stock market, the identification of the optimal threshold to construct a reliable stock network remains challenging. In this paper, the concept of dynamic consistence between the threshold network and the stock market is proposed. The optimal threshold is estimated by maximizing the consistence function. The application of this procedure to stocks belonging to Standard & Pool's 500 Index from January 2006 to December 2011 yields the threshold value 0.28. In analyzing topological characteristics of the generated network, three globally financial crises can be distinguished well from the evolutionary perspective.

Quantitative Linguistics: Stochastic Model for Phonemes

Deng Weibing (邓为炳)

华中师范大学 (wdeng@mail.ccnu.edu.cn)

We study rank-frequency relations for phonemes, the minimal units that still relate to linguistic meaning. We show that these relations can be described by the Dirichlet distribution, a direct analogue of the ideal-gas model in statistical mechanics. This description allows us to demonstrate that the rank-frequency relations for phonemes of a text do depend on its author. The author-dependency effect is not caused by the author's vocabulary (common words used in different texts), and is confirmed by several alternative means. This suggests that it can be directly related to phonemes. These features contrast to rank-frequency relations for words, which are both author and text independent and are governed by the Zipf's law.

6 月 30 日

谐波振子网络的几个随机控制问题

Feng Jianwen (丰建文)

深圳大学 (fengjw@szu.edu.cn)

谐波振子作为经典的哈密尔顿系统具有丰富动力学性质，近年来作为耦合网络、多主体系统等的协调性成为研究热点。本报告将介绍我们小组在谐波振子网络方面的几个随机控制方面工作：包括周期采样下的随机反馈耦合、服从 Markovian 跳的耦合强度在脉冲耦合和分段线性耦合协议下的几乎必然同步等。最后对所得结果进行简短的讨论，并指出可能的进一步工作。

复杂社会系统的若干管理与决策问题研究

Liu Jianguo（刘建国）

上海财经大学 (liujg004@ustc.edu.cn)

如何利用海量社交数据及其网络结构建立辅助决策模型是当前复杂社会系统管理面临的重要挑战之一。本报告将从数据建模与分析的角度介绍基于引文分析的研究机构排名研究，基于深度学习的量化交易策略研究，基于股吧关注度的量化投资策略研究，以及基于文本情感分析的 P2P 平台用户的自披露行为对投资决策行为的影响研究。从网络分析，集群行为，情感分析等角度对研究小组的工作进行初步介绍。

数字混沌系统的网络分析

Li Chengqing (李澄清)

湖南大学 (chengqingg@qq.com)

数字混沌系统和元胞自动机(CA)是被视为重要的伪随机数生成源。以状态为点、映射关系为边，建立离散系统对应的状态映射网络(SMN)。以 Logistic 映射、Tent 映射、Cat 映射、一维 CA 为分析对象，通过研究它们的 SMN 参数随实现精度递增时的变化规律来揭示它们的内在结构。所得结果为分析基于这些离散系统的伪随机生成器的随机性能提供了全新的工具。.

Nonlinear commutator estimate and its application to quasi-geostrophic equation

Chen Jianwen (陈建文)

湖南商学院 (jwchen@hnuc.edu.cn)

In this talk, we will present a new commutator estimate with respect to a nonlinear convection upper bounded by a single partial derivative component in Hilbert and Besov spaces. As an application, regularity criteria on the supercritical quasi-geostrophic equation are obtained provided that solution growth conditions are assumed to involve a single partial derivative component.

Robustness of temporal networks based on spreading dynamics

Chi Liping (池丽平)

华中师范大学 (chilp@mail.ccnu.edu.cn)

Temporal networks have attracted extensive investigation recently due to the availability of high time-resolved data. In this work we study the robustness and repair mechanism of temporal networks based on Susceptible-Infected-Recovered (SIR) spreading model. The selection and removal of a node is according to three strategies: the static degree, the temporal degree and the spreading ability. We measure the disruption of the temporal network by the metrics of temporal robustness, temporal efficiency and the average spreading ability. The result indicates that the temporal robustness weighs out in distinguishing the random failures and intelligent attacks. We also study the response of temporal networks under the random repair mechanism in which a contact between two nodes at time t is created with a random probability. We find that there exists an optimal time to improve the network performance for each given temporal network.

Computational study of non-catalytic pocket for drug design

Zhao Yunjie (赵蕴杰)

华中师范大学（yjzhaowh@mail.ccnu.edu.cn)

Cyclin-dependent kinases (CDKs) are critical to the cell cycle and many other biological processes, and as such, are considered as one of the promising targets for therapy against cancer and other diseases. Most pan-CDK inhibitors bind to the highly conserved catalytic ATP-binding pocket and therefore lack the specificity to prevent side effects. It is desirable to develop drugs targeting non-catalytic pockets for specificity towards individual CDKs. Here we developed a computational method to identify useful non-catalytic pockets and performed a systematic analysis of a region underneath the T-loop, which we term TL pocket, for potential inhibitor development. Specifically, we compared the TL pockets of human CDK2 and CDK7-homolog Pfmrk of Plasmodium falciparum, a malaria-causing parasite. Molecular dynamics simulations of several short peptides revealed that this less conserved TL pocket could be used to design potentially specific inhibitors against malaria disease

分数阶差分方程中的混沌

Wu Guocheng (吴国成)

南京财经大学、内江师范学院

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报告回顾了离散时间上的分数阶差分算子的背景，定义以及性质，介绍了一类分数阶的混沌映射及其在实际应用中的优势，将分数阶差分推广至离散空间领域，提出了二种新的 Riesz 空间分数阶差分，并得出了格子分数阶扩散方程数值格式。

Divide-And-Conquer Games on Social Networks

Zhang Yichao (张毅超)

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In this talk, we mainly discuss two topics: unfavorable individuals in social gaming networks and divide-and-conquer tournament on social networks. In the first topic, we investigate the topological properties of unfavorable individuals in evolutionary games. The unfavorable individuals are defined as the individuals gaining the lowest average payoff in a round of game. Since the average payoff is normally considered as a measure of fitness, the unfavorable individuals are very likely to be eliminated or change their strategy updating rules from a Darwinian perspective. Considering that humans can hardly adopt a unified strategy to play with their neighbors, we propose a divide-and-conquer game model, where individuals can interact with their neighbors in the network with appropriate strategies. We test and compare a series of highly rational strategy updating rules. In the tested scenarios, our analytical and simulation results surprisingly reveal that the less-connected individuals in degree-heterogeneous networks are more likely to become the unfavorable individuals. Our finding suggests that the connectivity of individuals as a social capital fundamentally changes the gaming environment. In the second topic, we investigate a divide-and-conquer tournament among 14 well-known strategies on social gaming networks. In the tournament, an individual's fitness is measured by accumulated and average payoff aggregated for a certain number of rounds. On the base of their fitness, the evolution of the population follows a local learning mechanism. Our observation indicates that the distribution of individuals adopting a strategy in degree ranking fundamentally changes the frequency of the strategy. In the divide-and-conquer gaming networks, our result suggests that the connectivity in social networks and strategy are two key factors that govern the evolution of the population.

Existence-uniqueness and stability of stochastic nonlinear systems

Zhu Quanxin (朱全新)

南京师范大学、湖南师范大学

In this talk, we are concerned with the existence-uniqueness and stability for a class of stochastic nonlinear systems with/without delays. The systems under our investigation are highly nonlinear not satisfying the linear growth condition, which makes the analysis difficult to ensure the existence and uniqueness of solutions. We first introduce a set of new highly nonlinear growth conditions with/without delays, and then we study the existence and uniqueness of solutions although the corresponding deterministic system may explode in a finite time as well as some properties of the solutions. Furthermore, we also discuss the stability of stochastic nonlinear systems. Finally, several examples are given to show the effectiveness and potential of theoretic results.

复杂网络的粗粒化及优化研究

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复杂网络的规模往往十分庞大，使得计算和仿真的复杂度非常高，给研究工作带来困难。网络的粗粒化在缩减网络规模的同时，保持原始网络的某种拓扑或动态性质，为大规模网络的研究提供了可行途径。我们在谱粗粒化的理论基础上，提出了一种更加有效改进谱粗粒化算法，同时，深入研究了谱粗粒化的优化算法，在满足一定精度下要求下，最大限度的缩减网络规模，获得最优粗粒化网络。

Existence and concentration of ground state solutions to Hamiltonian elliptic systems

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In this talk, standing wave solutions of Hamiltonian elliptic systems are considered. Such systems arise from mathematical models in nonlinear optics. We will introduce our some recent works on the existence, concentration phenomena and exponential decay of ground state solutions to Hamiltonian elliptic system.

7 月 1 日

Large deviation induced phase switch in an inertial majority-vote model

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We theoretically study noise-induced phase switch phenomena in an inertial majority-vote (IMV) model. The IMV model generates a strong hysteresis behavior as the noise intensity f goes forward and backward, a main characteristic of a first-order phase transition, in contrast to a second-order phase transition in the original MV model. Using the Wentzel-Kramers-Brillouin approximation for the master equation, we reduce the problem to finding the zero-energy trajectories in an effective Hamiltonian system, and the mean switching time depends exponentially on the associated action and the number of particles N. Within the hysteresis region, we find that the actions, along the optimal forward switching path from the ordered phase (OP) to disordered phase (DP) and its backward path show distinct variation trends with f, and intersect at f=fc that determines the coexisting line of the OP and DP. This results in a nonmonotonic dependence of the mean switching time between two symmetric OPs on f, with a minimum at fc for sufficiently large N. Finally, the theoretical results are validated by Monte Carlo simulations

Hunt for disease tipping points by landscape dynamic network biomarkers

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Identifying the critical state or the tipping point of a complex disease with its leading genes before disease onset is of great importance for clinical prevention and treatment of the disease. However, in contrast to the disease state, identifying the critical state is a difficult task due to its similarities to the normal state in terms of phenotypes and molecular expressions. In this work, we have developed a new model-free method called landscape dynamic network biomarkers (l-DNBs), which can identify the tipping point just before serious disease deterioration only by single-sample omics data. In addition to the solid theoretical background, we show that l-DNBs not only provide early-warning signals of disease deterioration on a single-sample basis but also detect the critical genes or network biomarkers, i.e., DNB members, which lead the normal state to the disease state. To demonstrate the predictive power, l-DNBs have been applied to real datasets of influenza symptom and three tumors. Specifically, l-DNBs were used to predict the severe influenza symptom just before the actual symptom appearance in 17 subjects of influenza virus infection. Then, they were also applied to three tumors, i.e., lung adenocarcinoma, kidney renal clear cell carcinoma, and thyroid carcinoma in TCGA datasets, for which we identified critical stages before tumor deteriorations with individual DNBs of each patient. In addition to the tipping points, when we further used those individual DNBs as individual biomarkers for the analyses of physiological data, two types of biomarkers were discovered to be surprisingly effective for the prognosis of tumors as common biomarkers, i.e., one type of DNBs for predicting the poor prognosis, and another for predicting the good prognosis of tumor patients.

正性约束下的复杂网络连边一致性问题研究

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随着复杂网络越来越广泛的实际应用，以及对一致性问题研究体系更加完善的需求，研究基于连边动力学模型的复杂网络的分析与控制具有重要的实际意义与理论价值。为此，本报告针对带正性约束的复杂网络连边一致性控制问题展开了一系列研究，首先建立了连边网络模型和基于正系统的连边动力学模型，借助节点网络与连边网络的联系，结合正系统相关理论与技术，基于状态反馈和输出反馈，研究了无向节点网络和有向节点网络在连续时间、离散时间连边动力学模型中存在参数不确定、输入非线性时的连边正一致性问题。

双层关联网络疾病协同传播模型

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本报告介绍本小组最近的一项工作，研究双层关联网络疾病协同传播规律，从三个不同的度分布粗粒尺度提出传播模型，来分析双层网络的结构和层间连接方式如何影响关联网络的传播阈值和最终感染规模. 总之,我们证明了关联网络的全局传播阈值由相关和不相关网络的超相关矩阵和超邻接关系的最大特征值决定. 三个模型从不同的角度揭示关联网络协同传播会降低传播阈值并提高最终感染率，意味着协同传播过程促进疾病传播. 所得结论解释了为什么禽流感疫情很快就会蔓延到人类，为公共卫生部门进行疾病控制和预防提供参考.

Exploring transcription factors reveals crucial members and regulatory networks involved in different abiotic stresses in Brassica napus L

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Brassica napus (B. napus) encompasses diverse transcription factors (TFs), but thorough characterization of TF families and their transcriptional responsiveness to multifarious stresses are still not clear. Totally 2167 TFs belonging to five families were genome-widely identified in B. napus, including 518 BnAP2/EREBPs, 252 BnbZIPs, 721 BnMYBs, 398 BnNACs and 278 BnWRKYs, which contained some novel members in comparison with existing results. Sub-genome distributions of BnAP2/EREBPs and BnMYBs indicated that the two families might have suffered from duplication and divergence during evolution. Synteny analysis revealed strong co-linearity between B. napus and its two ancestors, although chromosomal rearrangements have occurred and 85 TFs were lost. About 7.6% and 9.4% TFs of the five families in B. napus were novel genes and conserved genes, which both showed preference on the C sub-genome. RNA-Seq revealed that more than 80% TFs were abiotic stress inducible and 315 crucial differentially expressed genes (DEGs) were screened out. Network analysis revealed that the 315 DEGs are highly co-expressed. The homologous gene network in A. thaliana revealed that a considerable amount of TFs could trigger the differential expression of many targeted genes, resulting in a complex clustered regulatory network with clusters of genes responsible for targeted stress responsiveness.The investigations deepen our understanding of stress tolerance in B. napus.

A dynamical approach to identify vertices' centrality in complex networks

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In this work, we proposed a dynamical approach to assess vertices' centrality according to the synchronization process of the Kuramoto model. In our approach, the vertices' dynamical centrality is calculated based on the Difference of vertices' Synchronization Abilities (DSA), which is different from traditional centrality measurements that are related to the topological properties. Through applying our approach to complex networks with a clear community structure, we have calculated all vertices' dynamical centrality and found that vertices at the end of weak links have higher dynamical centrality. Meanwhile, we analyzed the robustness and efficiency of our dynamical approach through testing the probabilities that some known vital vertices were recognized. Finally, we applied our dynamical approach to identify community due to its satisfactory performance in assessing overlapping vertices. Our present work provides a new perspective and tools to understand the crucial role of heterogeneity in revealing the interplay between the dynamics and structure of complex networks.

Conformal prediction based on back-propagation neural network for the classification of Chinese liquors

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This work extends the conventional back-propagation neural network to the classification of Chinese liquors of different flavors according to their Raman spectra. Conformal prediction is applied to assign reliable confidence measures for each prediction and support an effective framework to make the machine learning on classification trustable. Back-propagation neural network can be used to predict the flavors of Chinese liquors according to their Raman spectra, and a classification rate of 89.74% can be achieved. However, this algorithm could not evaluate each prediction. From the analysis of associations among neurons in different layers, flavors of Chinese liquors probably depend on molecules containing the stretching vibrations of C-C and C-H. Different from the classification algorithm based on distance judgment, a nonconformity score is defined to generate p-value for each prediction. Moreover, the validity of conformal prediction in online mode is discussed. The number of cumulative errors in the conformal prediction is much less than that without conformal prediction. The relationship between the cumulative error and confidence levels shows that a high confidence level leads to low cumulative errors, but many cumulative errors will occur under a very high confidence level. One possible reason is that some of useful predictions with low confidence cannot be used to predict future samples in the case of high confidence level. The result implies that conformal prediction is a useful framework to make our predictions reliable and valid.

Epidemic dynamics on spatial network

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The epidemic spreading on spatial-driven network is studied with the spatial susceptible-infected-susceptible (SIS) model. The network is constructed by random addition of nodes on the plan. The probability for a previous node to be connected to the new one is inversely proportional to their spatial distance to the power α. The spreading rate between two nodes is inversely proportional to their spatial distance. The effective spreading time increases with the increasing of α. The proportional coefficient is found to have a α-dependent threshold with a maximum situated in the interval $1.5< \alpha < 2$.

The formation of continuous opinion dynamics based on a gambling mechanism and its sensitivity analysis

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The formation of continuous opinion dynamics is investigated based on a virtual gambling mechanism where agents fight for a limited resource. Local communication happens only when the opinion distance between corresponding agents is no larger than a pre-defined confidence threshold. Theoretical analysis regarding special cases provides a deep understanding of the roles of both resource allocation parameter and confidence threshold in the formation of opinion dynamics. Numerical results also imply that consensus state is generated only when the following three conditions are satisfied simultaneously: mindless agents are absent, the resource is concentrated in one clique, and confidence threshold tends to a critical value. For fixed confidence threshold and resource allocation parameter, the most chaotic steady state of the dynamics happens when the fraction of mindless agents is about 0.7. It is also demonstrated that economic agents are more likely to win at gambling, compared to mindless ones. Finally, the importance of three involved parameters in establishing the uncertainty of model response is quantified in terms of Latin hypercube sampling-based sensitivity analysis.

离子溶液中 RNA 假结的空间结构及稳定性预测

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RNA 赝结（pseudoknot）结构是一类非常典型的 RNA 三级结构单元，其在生物体内发挥着极其重要功能。对其空间结构和结构稳定性的研究不仅是理解其功能机理的关键，而且还能有助于相关疾病的预防和治疗。在本次汇报中，我们首先对 RNA 及 RNA 赝结结构做简单介绍，然后重点回顾我们构建的粗粒化模型，并展示利用该模型在假结分子上的一些研究结果。研究结果主要包括：（1）从 RNA 序列出发，可以预测给出 RNA 赝结分子的空间结构；（2）能够准确地得到不同序列的 RNA 赝结在不同离子溶液中的稳定性；（3）通过预测分析给出影响和调节 RNA 赝结折叠路径的主要因素（序列和离子条件）。

Resource control of epidemic spreading through a multilayer network

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While the amount of resource is an important factor in control of contagions, outbreaks may occur when they reach a finite fraction of the population. An unexplored issue is how much the resource amount is invested to control this outbreak. Here we analyze a mechanic model of epidemic spreading, which considers both resource factor and network layer. We find that there is a resource threshold, such that a significant fraction of the total population may be infected (i.e., an outbreak will occur) if the amount of resource is below this threshold, but the outbreak may be effectively eradicated if it is beyond the threshold. The threshold is dependent upon both the connection strength between the layers and their internal structure. We also find that the layer-layer connection strength can lead to transition from the first-order phase to the continuous phase or vice versa, whereas the internal connection can result in a different kind of phase (called as hybrid phase) apart from first-order and continuous phases. Our results could have important implications for government decisions on public health resources devoted to epidemic disease control.

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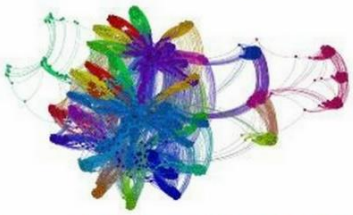

Dates : **28th June - 3rd July, 2018**

Location : **Wuhan Textile University, Wuhan, P. R. China.** **https://www.wtu.edu.cn/**

Home Organization Program Deadlines Registration Participants Accomodation Venue

The previous WANCSA2016 and **WANCSA2017** were held in Wuhan-China (WTU), May 28-29, 2016, in China, and in University of Le Havre-Normandie, July 4-5, 2017, in France, respectively.

WANCSA'2018 (which will be heldon the date from the 28th June to the 3rd July, 2018) will focus on recent advances in complex systems, complex networks, and applications in all fields of science and engineering. There will be several invited expository addresses covering recent trends and invited lectures on problems of current interest and important applications in various disciplines. Among surrounding areas of modelling capable of synthesizing the complexity of the systems, networks have well formalized mathematical bases which help in the operational effectiveness of these models; they are also an important vector of interdisciplinary reflection so much their presence seems obvious to represent the complex interlacing of various phenomena, natural, social and artificial systems. They represent naturally systems of interaction between several parts. It is then frequent to see the emergence of collective behavior stemming from these parts in interaction. Examples are many, whether it is in the natural world (nervous system, immune system, chains trophiques food, ...) or artificial (supply chain, cloud computing, internet, network social, ...) In which particular properties can emerge resulting from the interaction of the parts or from elements establishing the whole. Complex networks are one of more powerful tools to describe, analyze and control all these natural or artificial complex systems, which are omnipresent. To understand and analyze them, new approaches based on integrative modellings are necessary.

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- Complex networks based-models
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