1. Is network science more than graph theory?

Fatihcan M. Atay (Max Planck Institute for Mathematics in the Sciences, Germany)

2. Measuring and visualizing signals of collective intelligence at large organizations through network science

Peter A. Gloor (Massachusetts Institute of Technology, USA)

Abstract: Research into human dynamical systems has long sought to identify robust signals for human behavior. We have discovered a series of social network-based indicators that are reliable predictors of team creativity and collaborative innovation. We extract these signals from electronic records of interpersonal interactions, including e-mail, and face-to-face interaction measured via sociometric badges. The first of these signals is Rotating Leadership, measuring the degree to which, over time, actors in a team vary in how central they are to team's communication network's structure. The second is Rotating Contribution, which measures the degree to which, over time, actors in a team vary in the ratio of communications they distribute versus receive. The third is Prompt Response Time, which measures, over time, the responsiveness of actors to one another's communications. Finally, we demonstrate the predictive utility of these signals in a variety of contexts, showing them to be robust to various methods of evaluating *innovation.*

3. Collective dynamics of many-body systems on networks

Seung-Yeal Ha (Seoul National University, Korea)

Abstract: Flocking and synchronization of self-propelled particles and oscillatory systems are ubiquitous phenomena in biological complex systems. In this talk, we will review recent progress on these collective phenomena through prototype models arising from flocking and synchronization such as the Cucker-Smale and Kuramoto models. We also discuss some open mathematical problems in the collective dynamics of many-body systems.

4. Mathematical model for volatility flocking in a stock market

Hyeong-Ohk Bae (Ajou University, Korea)

Abstract： We present a mathematical model for volatility okcing in a stock market.Our proposed model consists of geometric Brownian motions with time-varying volatilities coupled through the Cucker-Smale ocking and regime switching mechanisms. For the all-to-all interactions where all assets' volatilities are coupled with each other with a constant interaction weight, we show that the common volatility emerges asymptotically, and discuss its _nancial applications. We also provide several numerical simulations and compare them with analytical results.

5. Optimal Plate Designs in High Throughput Screening Experiments

Harvey Qu (Oakland University, USA)

High-throughput screening (HTS) is a large-scale process that screens hundreds of thousands to millions of compounds in order to identify leading candidates rapidly and accurately. There are many statistically challenging issues in HTS. In this talk, I will focus the elimination of spatial effects in primary HTS through the design of experiment. I will discuss the consequences of spatial effects in selecting leading compounds and demonstrate why current experimental designs fail to eliminate spatial effects in HTS practice. A new class of designs will be proposed for the elimination of spatial effects. The new designs have the advantages such as all compounds are comparable within each microplate in spite of the existence of spatial effects; the maximum number of compounds in each microplate is attained, etc. Optimal designs are recommended for HTS experiments with one or multiple controls.

6. The long term sustainability issues on the internet and possible solutions.

Yicheng Zhang (University of Fribourg, Switzerland)

7. Statistical properties and problems analysis of online collective behavior

Jianguo Liu (University of Shanghai for Science and Technology, China)

Abstract：This talk will introduce the progresses of the Research Center of Complex Systems Science USST in the collective behavior analysis of online social interaction behavior, e-commercial system, as well as the reviews behaviors, which are used to identify the node importance and design personalized recommendation algorithms. More importantly, the problems, including multiple-dimension data analysis, mathematical description of the spreading process and the hypergraph model construction, are demonstrated.

8. On the Lojasiewicz exponent of Kuramoto model

Zhuchun Li (Harbin Institute of Technology, China)

Abstract：The Lojasiewicz inequality reveals a fundamental relation between a potential function and its gradient. It provides a powerful tool to analyze the convergence of gradient systems to a single equilibrium; moreover, the Lojasiewicz exponent is relevant to the convergence rate. In this talk, we will introduce some recent results on the Lojasiewicz exponent of the potential for Kuramoto model, and give some insights for the occurrence of exponentially fast and algebraically slow synchronization in Kurmaoto model. Some application to power networks is also involved

9. Spectral classes of regular, random, and empirical graphs

Jiao Gu (Shanghai Normal University, China)

Abstract: We define a (pseudo-)distance between graphs based on the spectrum of the normalized Laplacian, which is easy to compute or to estimate numerically. It can therefore serve as a rough classification of large empirical graphs into families that share the same asymptoticbehavior of the spectrum so that the distance of two graphs from the same family is bounded by O(1/n) in terms of size n of their vertex sets. Numerical experiments demonstrate that the spectral distance provides a practically useful measure of graph dissimilarity.

10.Link predictability of complex networks

Linyuan Lü (Alibaba Research Center for Complexity Sciences, Hangzhou Normal University, China)

Abstract: 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 network links. In order 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 measure of network predictability, and (ii) a derivative algorithm outperforms state-of-the-art link prediction methods in both accuracy and universality. 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 IT practitioners.

11.Epidemic dynamics on complex networks

Xiaoguang Zhang(Shanxi University, China)

Abstract：Networks have been studied extensively in the social sciences. Many real systems can be properly described by complex networks whose nodes represent individuals or organizations and links denote the interactions among them. One of the original and primary reasons for studying networks is to understand the mechanisms by which diseases spread over them. The topology structures of complex networks can have dramatic effects on the behavior of epidemic dynamical processes running on top of it, and it has attracted a great deal of interest due to its practical real-world implications is the modeling of epidemic spreading on contact networks. This talk mainly focused on the research of modeling approaches of infectious disease on complex networks. We established several epidemic models based on networks to study that how the topology structures of complex networks affect the behaviors of disease spread, including degree

correlation, clustering coefficient. Furthermore, using the percolation theory and stability theory, we obtained the basic reproduction number, and the dynamical analysis of models are given in detail. These results can help understanding epidemics on contact networks, and provide the theoretical supports for the prevention measures of epidemic spreading in networks.

12.Learning Low-dimensional Structures in High-dimensional Data

Chenping Hou (National University of Defense Technology, China)

Abstract: High dimensionality is one of the most distinct character of big data. It is easier to confront the 'Curse of Dimensionality' problem when we manipulate the data directly. In this talk, we will discuss a new class of models and techniques that can effectively model and extract rich low-dimensional structures in high-dimensional data. It mainly including two types of methods: feature extraction and feature selection. Besides, we will also introduce our new methods to classify matrix data directly, without reshaping them into vectors. These works leverage recent adcancements in convex optimization for recovering low-rank and sparse signals that provide both strong theoretical guarantees and efficient and scalable algorithms for solving such high-dimensional combinatorial problems. We illustrate how these new mathematical models and tools could bring disruptive changes to solutions to many challenging tasks in pattern recognition, image processing and compuervision.

13.Flocking of the Cucker-Smale model with processing delay

Yicheng Liu (National University of Defense Technology, China)

Abstract: The processing delay is incorporated into the influence function of the well-known Cucker-Smale model for self-organized systems with multiple agents. Both symmetric and non-symmetric pairwise influence functions are considered, and an Lyapunov functional approach is developed to establish the existence of flocking solutions for the proposed delayed Cucker-Smale model. An analytic formula is given to calculate the asymptotic flocking velocity in terms of model parameters and the variation of the position in the initial time interval.

This is joint work with Jianhong Wu, York University, Canada.

14.Uncertainly propagation towards multi-constellation GNSS data processing

Xiaojun Duan (National University of Defense Technology, China)

Abstract: Maintaining accurate knowledge and the associated uncertainty of the orbit of space object is very important for the concrete positioning, prediction and control of space object. In this talk, towards the precise orbit determination for multi-satellites of multi-constellation Global Navigation Satellite System, the uncertainty representation and computation problems with some results are shown in the following three aspects, (1) Correct characterization of errors in

the modeling of dynamics, e.g. atmospheric drag and solar radiation, and their uncertainty including stochastic acceleration. (2) Proper characterization of the uncertainty of the input data for measurements and compensation for missing data, correct characterization of non-Gaussian probability density functions arising from nonlinear transformations. (3) Well-designed numerical procedures that achieve robustness and high efficiency.