The 15th GraphMasters International Conference

on Networks and Algorithms

July 15-18, 2018, Xi’an

July 14 2018 （Saturday）		
Register 会议报到	8:30-20:00	Jianguo Hotel Xian（西安建国饭店）

July 15 2018 （Sunday）		
Xi-Fang Lecture Hall， Xi'an Polytechnic University（西安工程大学，西纺报告厅）		
Open Ceremony 开幕式	08:00-08:40	Introduction and Welcome, Conference Photo
Key-note Talks Chair:	08:40-09:40	Ranking and scoring for Big Data analytics Frank Hsu, Fordham University, USA
	09:40-10:40	Graph Theory method and data analysis Guiying Yan, Chinese Academy of Science, China
Break 休息	10:40-11:00	Coffee Break
Invited Talks Chair:	11:00-11:30	The faulty diagnosability of some regular networks Rongxia Hao, Beijing Jiaotong University, China
	11:30-12:00	The number of weak balance structures in signed networks Yinghong Ma, Shandong Normal University, China
Lunch 午餐	12:00-14:00	Jianguo Hotel Xian（西安建国饭店）
Key-note Talks Chair:	14:00-15:00	Memetic Algorithms for Business Analytics and Data Science: A Survey Pablo Moscato, University of Newcastle, Australia
Invited Talks Chair:	15:00-15:30	Constant Approximations for k-connected m-dominating Set Problem in Unit Disk Graphs Wei Wang, Xian Jiaotong University, China
	15:30-16:00	Almost perfect matchings in k-partite k-graphs Hongliang Lu, Xian Jiaotong University, China
Break 休息	16:00-16:20	Coffee Break
Invited Talks Chair:	16:20-16:50	Hamiltonian Connectedness in Line Graphs Mingquan Zhan, Millersville University of Pennsylvania
	16:50-17:20	Neural Networks and ELMs Convergence Analysis with Sparse Neuron Response Qinwei Fan, School of Science, Xi’an Polytechnic University, China

Contributed Talks Chair:	17:20-17:40	On inclusive and non-inclusive vertex irregular d-distance vertex labelings Novi Herawati Bong, University of Delaware
	17:40-18:00	Connected Interior Domination in Graphs and Some Realization Problems Shiela Mae Pacardo, Notre Dame of Marbel University
Dinner 晚餐	18:00-19:30	Jianguo Hotel Xian（西安建国饭店）

July 16 2018 （Monday）		
Xi-Fang Lecture Hall， Xi'an Polytechnic University（西安工程大学，西纺报告厅）		
Key-note Talks Chair:	08:30-09:30	Nature-Inspired Optimization Algorithms: Nature's Ways to Tackle NP-Hard Problems Xinshe Yang, Middlesex University London
	09:30-10:30	The Hub Allocation Problem Sun-Yuan Hsieh, National Cheng Kung University, Taiwan
Break 休息	10:30-10:50	Coffee Break
Invited Talks Chair:	10:50-11:20	Some results on star edge-coloring of graphs Roman Soták, Pavol Jozef Safarik University in Kosice, Slovakia
	11:20-11:50	Equitable vertex arboricity of graphs Xin Zhang, School of Mathematics and Statistics, Xidian University, China
Lunch 午餐	12:00-14:00	Jianguo Hotel Xian（西安建国饭店）
Key-note Talks Chair:	14:00-15:00	Facial [r, s, t]-colorings of plane graphs Stanislav Jendrol, Pavol Jozef Safarik University in Kosice, Slovakia
Invited Talks Chair:	15:00-15:30	The Multiset Dimension of Graphs Rinovia Simanjuntak, Institut Teknologi Bandung, Indonesia
	15:30-16:00	TBA Jianfeng Hou, Fuzhou University, China
Break 休息	16:00-16:20	Coffee Break
Invited Talks Chair:	16:20-16:50	Study on Prediction Method of Quality Uncertainty in the Textile Processing Based on Big Data Jingfeng Shao, School of Management Science, Xi’an Polytechnic University, China
	16:50-17:20	A windowing waveform relaxation method for time-fractional differential equations Xiaoli Ding, School of Science, Xi’an Polytechnic University, China
Contributed Talks Chair:	17:20-17:40	Applying Trees with Strongly Parameter Type of Labellings for Big Data Security Hui Sun, Northwest Normal University, Lanzhou, China
	17:40-18:00	A New Topological Graphic Passwords Made By Graph Labelling Xiaohui Zhang, Northwest Normal University, Lanzhou, China
	18:00-18:20	On Topological Graphic Passwords Made By Hanzi-graphs Yarong Mu, Northwest Normal University, Lanzhou, China
会议宴会	18:20-20:00	Jianguo Hotel Xian（西安建国饭店）

July 17, 2018 （Tuesday）		
Xi-Fang Lecture Hall， Xi'an Polytechnic University（西安工程大学，西纺报告厅）		
Key-note Talks Chair:	08:30-09:30	Some current results on factors of graphs and related problems Mikio Kano, Ibaraki University, Japan
	09:30-10:30	Zero-Visibility Cops and Robbers on Graphs Boting Yang, University of Regina, Canada
Break 休息	10:30-10:50	Coffee Break
Key-note Talks Chair:	10:50-11:50	Probe Machine: Theory, Implementation and Application Jin Xu, Peking University, China
Lunch 午餐	12:00-14:00	Jianguo Hotel Xian（西安建国饭店）
	14:00-18:00	Open Problem And Discussion Session
Dinner 晚餐	18:00-19:30	Jianguo Hotel Xian（西安建国饭店）

July 18, 2018 （Wednesday）	
Jianguo Hotel Xian（西安建国饭店）	
09:00------	Problem Session， Open Discussion and Tour(at own expense)

Keynote Speakers Abstracts

Nature-Inspired Optimization Algorithms: Nature's Ways to Tackle NP-Hard Problems

Xin-She Yang
National Physical Laboratory, England

Algorithms inspired by nature has become effective tools to solve challenging problems in engineering designs, data mining and computational intelligence. Such nature-inspired algorithms can even potentially solve NP-hard problems. Algorithms based on characteristics of ants, bees, bats, cuckoos, fireflies and others have demonstrated their simplicity, flexibility and effectiveness. However, many challenging issues still exist. This talk highlights some of the recent developments and mathematical analysis of these algorithms concerning their convergence and stability. Application examples will be discussed with the emphasis on some key issues and future research directions.

Some current results on factors of graphs and related problems

Mikio Kano
Ibaraki University, Japan

Conjecture: every general 5-regluar graph has a {1,4}-factor. There are some results related to this conjecture and problems. The next problem is the following; For a mapping $H: V(G) \to \{red, blue\}$, a spanning subgraph F is called an H-factor if $deg_F(v) = 1$ if v is red , and $deg_F(v) \in \{0,2\}$, if v is blue.

The above condition is equivalent to that the red vertices are covered by the end-vertices of some vertex disjoint paths.

Theorem [Hongliang Lu and Kano] A connected graph G has an H-factor for every $H: V(G) \to \{red, blue\}$, with $H^{-1}(red)$ even if and only if $\omega(G - S \leq S+1$, for all $S \subseteq V(G)\}$.

Zero-Visibility Cops and Robbers on Graphs

Boting Yang,
University of Regina, Canada

In this talk, we consider the zero-visibility Cops and Robbers game, which differs from the classical Cops and Robbers game in one way: the robber is invisible. We show that the zero-visibility cop-number of a graph is bounded above by its pathwidth and cannot be bounded below by any nontrivial function of the pathwidth. We define a monotonic version of this game and show that the monotonic zero-visibility cop-number can be bounded both above and below by positive multiples of the pathwidth. As well, we investigate the zero-visibility cop-number of several classes of graphs, including cartesian product of graphs, split graphs, and complete multipartite graphs.

We also consider the computational complexity aspects of the zero-visibility Cops and Robbers game. We provide an algorithm that computes the zero-visibility cop-number of a tree in linear time. On the other hand, we show that the corresponding decision problem is NP-complete even for starlike graphs.

Facial [r,s,t]-colorings of plane graphs

Stanislav Jendrol
Pavol Jozef Safarik University in Kosice, Slovakia

Let G be a plane graph. Two edges are facially adjacent in G if they are consecutive edges on a boundary walk of a face of G. Given nonnegative integers r,s, and t, a facial [r,s,t]-coloring of a plane graph G = (V, E) is a mapping $f: V \cup E \to \{1, 2, \dots, k\}$ such that $|f(v_2)| \geq r$ for every two adjacent vertices v_1 and v_2, $|f(e_1) - f(e_2)| \geq s$ for every two facially adjacent edges e_1 and e_2, and $|f(v) - f(e)| \geq t$ for all pairs of incident vertices v and edges e. The facial [r,s,t]-chromatic number $\bar{\chi}_{r,s,t}(G)$ of G is defined to be the minimum k such that G admits a facial [r,s,t] -coloring. In the paper we show that $\bar{\chi}_{r,s,t}(G) \leq 3r3s + t + 1$ for any plane graph. For some triplets [r,s,t] and for

some families of plane graphs this bound is improved. Specific attention is devoted to the cases when parameters *r*,*s*, and *t* are small.

Memetic Algorithms for Business Analytics and Data Science: A Survey

Pablo Moscato
University of Newcastle, Australia

TBA

Ranking and scoring for Big Data analytics

Frank Hsu
Laboratory of Informatics and Data Mining, Fordham University, USA

Ranking and scoring have been used in STEM disciplines and many areas of domain applications in society, industry and government. This talk concerns the problem of ranking and scoring and discusses methods and practices of combining multiple scoring systems (MSS) for analyzing big data in a variety of practical domains, e.g.: Biomedical informatics and technology, virtual screening, target tracking, cognitive neuroscience, joint decision making, wireless network selection, search engine optimization, and portfolio management.

A scoring system A consists of a score function sA and a rank function rA from $D=\{d_1,d_2,\ldots,d_n\}$ to R= set of real numbers and $N=\{1,2,\ldots,n\}$ respectively. In an application, a score function sA: $D\rightarrow R$ is given or obtained using information regarding the items d_i,=1,…,n. Rank function rA is computed by sorting the score values in ascending order and a rank number is assigned to the data item in that order. It is known in the community of data science, data mining, machine learning, AI, computational X and X-informatics that combining two or more systems can perform better than each of the individual systems. However, it remains to be a challenging problem as to understand “when” and “how” this can happen. We will discuss combination of MSS’ using rank-score characteristic (RSC) function and cognitive diversity (cd).

A RSC function fA of a scoring system A is defined mathematically as f_A:$N\rightarrow R$ and $(i)=s_A(r_A{}^{-1}(i))=(s_A\circ r_A-1)(i)$ for each i in N. There are at least three ways to measure the difference (or dissimilarity) between two scoring system A and B: (a) d(A, B) = d(S_A, S_B); e.g.: Pearson’s Correlation, (b) d(A, B) = d(r_A, r_B); e.g.: Kendall’s tau or Spearman’s rho, and (c) d(A, B) = d(f_A, f_B); e.g. cognitive diversity. Cognitive diversity $(A,)$ between scoring systems A and B is defined as the distance (f_A,f_B) between RSC functions f_A and f_B. One of the popular measurements to measure the cognitive diversity between two scoring systems A and B is the area between these two RSC function graphs,

$d(A,B) = \Sigma|f_A(i) - ni = 1 f_B(i)|$, where f_A and f_B are normalized to the interval [0,1] of real numbers. We have demonstrated, using many examples, that combination of two or more systems can perform better than each of the individual systems *only if* they are relatively good and they are cognitively diverse. As to the issue of "how", we consider four cases: (1) Rank vs score combination, (2) Average vs weighted combination of various statistical methods and machine learning algorithms, (3) Other non-linear combination such as Mixed Group Rank (MGR) and Partial Ordered Set, and (4) Recently developed "deep scoring" method.

In the context of graph algorithm and network, we consider a Cayley graph where each node is a permutation representing the rank function r_A of the scoring system A on D, the set of n data items $d_1, d_2, \ldots, dn$. Hence the node set of the Cayley graph (S_n) is the symmetric group of order n, S_n. The adjacency or the distance between two nodes r_A and r_B can be defined using rank correlation or some other metrics. Therefore, Big Data Analytics in the context of combining multiple scoring systems can be interpreted as: Given a set of p rank functions r_{Ai}, $i=1,2,\ldots,p$, how can we combine these rank functions in a stochastic or combinatorial process to have the resulting rank function as close to the true rank function (or ideal rank function) as possible? We also note that the Cayley graph (S_n) defined in the geometric space is a polyhedral (in the sense of score function) or a polytope (in the sense of rank function) on the symmetric group S_n of order n.

Graph Theory method and Data analysis

Guiying YAN

Institute of Mathematics and System Science, Chinese Academy of Science

Why Google can get massive webpage data and how it can judge how important or valuable a webpage might be? Applying the ideas of connections and relationships to various data, graph theory method can help reveal the nature of the data itself, telling us what relates and what doesn't, and what's important and what isn't. In this talk, we will explain how to understand big data using graph theory.

Probe Machine: Theory, Implementation and Application

Jin Xu

School of Information Science and Technology, Peking University, China

As the electronic computer cannot effectively efficiently solve large-scale NP-problems, exploring non-conventional computing model has become one of the most important research directions in the field of information processing. From the perspective of decomposability, the computer is a general purpose device built upon a computing model, and manufactured by certain materials that can be used to implement the specific computing model. For instance, today's electronic computer is conceptualized by Turing machine (TM), and composed of electronic components. The difficulty in solving large-scale NP-problems for an electronic computer is its computing model—TM. In a TM, the data is stored one next to another, in other words, data units are placed linearly. In this linear data placement mode, only adjacently placed data units can be processed simultaneously, which greatly limits its computation capability. Hence, it is necessary to break through these constraints and search for a new computing model that is fundamentally more powerful and efficient than TM. Accordingly, there is a central requirement for devising such a conceptually brand-new model—the model needs to be capable of simultaneously processing as many data units as possible. That is, the way of placing data should be non-linear, which is the main motivation that we propose the Probe Machine (PM). In this report, we will introduce the research progress of the PM respectively from the aspects of its theory, implementation, and applications.

The hub allocation problem

Sun-Yuan Hsieh
National Cheng Kung University, Taiwan

Given a metric graph $G = (V, E, w)$, a center $c \in V$, and an integer k, the **Star *k*-Hub Center Problem** is to find adepth-2 spanning tree T of G rooted by c such that c has exactly k children and the diameter of T is minimized. Those children of c in T are called hubs. A similar problem called the **Single Allocation *k*-Hub Center Problem** is to find a spanning subgraph H^* of G such that (i) C^* is a clique of size k in H^*; (ii) $V \setminus C^*$ forms an independent set in H^*; (iii) each $v \in V \setminus C^*$ is adjacent to exactly one vertex in C^*; and (iv) the diameter $D(H^*)$ is minimized. The vertices selected in C^* are called hubs and the rest of vertices are called non-hubs. Both **Star *k*-Hub Center Problem** and **Single Allocation *k*-Hub Center Problem** are NP-hard and have applications in transportation system, telecommunication system, and post mail system. In this talk, we give 5/3-approximation algorithms for both problems. Moreover, we prove that for any $\varepsilon > 0$, the **Star *k*-Hub Center Problem** has no $(1.5-\varepsilon)$-approximation algorithm unless P = NP. Under the assumption P ≠ NP, for any $\varepsilon > 0$ the **Single Allocation *k*-Hub Center Problem** has no $(4/3-\varepsilon)$-approximation algorithm.