Welcome Message from General Chairs

We are warmly welcoming you from all over the world to attend the Ninth International Conference on Swarm Intelligence (ICSI’2018) held in conjunction with the Third International Conference on Data Mining and Big Data (DMBD’2018) in the world-famous city of Shanghai, which is the largest and the most developed metropolis with both modern and traditional Chinese features in China.

The theme of the ICSI-DMBD’2018 is “Serving Life with Intelligence Science”.

In one hand, ICSI 2018 was the ninth international gathering in the world for researchers working on most of aspects of swarm intelligence, following successful events in Fukuoka (ICSI 2017), Bali (ICSI 2016), Beijing (ICSI-CCI 2015), Hefei (ICSI 2014), Harbin (ICSI 2013), Shenzhen (ICSI 2012), Chongqing (ICSI 2011), and Beijing (ICSI 2010), which provided a high-level academic forum for participants to disseminate their new research findings and discuss emerging areas of research. It also created a stimulating environment for participants to interact and exchange information on future challenges and opportunities in the field of swarm intelligence research. On the other hand, the DMBD 2018 is the third event after the successful first event (DMBD’2016) at Bali Island of Indonesia and second event (DMBD’2017) at Fukuoka City of Japan. With the advent of big data analysis and intelligent computing techniques we are facing new challenges to make the information transparent and understandable efficiently. The DMBD 2018 provided an excellent opportunity and an academic forum for academia and practitioners to present and discuss the latest scientific results, methods, and innovative ideas and advantages in theories, technologies, and applications in data mining, big data, and intelligent computing.

The ICSI-DMBD’2018 will provide a good opportunity for academia and practitioners to present and discuss the latest scientific results and methods, the innovative ideas and advantages in theories, technologies and applications in both swarm intelligence and data mining for big data.

The ICSI’2018 technical program will cover all aspects of swarm intelligence and related areas, while the DMBD’2018 technical program will cover many aspects of data mining and big data. The co-location events definitely benefit both fields of swarm intelligence and data mining for big data and will stimulate some innovative ideas in the cut-edges of those areas.

We believe that you will enjoy this important and hard-to-get gathering for the communities of the swarm intelligence and data mining for big data.

Thanks to the hard work of the Organization Committees and the Program Committees, the ICSI-DMBD’2018 will provide you with excellent program and schedule. The technical
program will cover many important aspects in swarm intelligence and data mining for big data.

The ICSI-DMBD’2018 was held in the Anting Crowne Plaza Holiday Hotel in Shanghai, which is the first 5-star international brand hotel in Jiading District of the Grand Shanghai of China. Located within the immediate vicinity of Shanghai Automobile Exhibition Center and strategically situated near Shanghai International Circuit, with easy access via Metro Line 11. The hotel blends nature and state-of-the-art design with extensive facilities and amenities, which ensure your stay whether on business or pleasure is a memorable experience. Shanghai, Hu for short, also known as Shen, is the largest and the most developed metropolis with both modern and traditional Chinese features in China. It is also a global financial centre and transport hub. Shanghai offers many spectacular views and different perspectives. It is a popular travel destination for visitors to sense the pulsating development of China. The participants of DMBD’2018 had the opportunity to enjoy traditional Hu operas, beautiful landscapes, and the hospitality of the Chinese people, Chinese cuisine, and a modern Shanghai.

In addition, the ICSI-DMBD’2018 will definitely contribute a lot to the enhancement of the research horizons of our delegates in both fields of swarm intelligence and data science. Certainly, we are sure that you will have a wonderful experience of visiting Shanghai of China during the ICSI-DMBD’2018.

On behalf of the organizing committees, I wish the ICSI-DMBD’2018 will be a memorable event for you to stay in Shanghai, China.

Sincerely yours!

General Chairs of ICSI-DMBD’2018

Ying Tan
Peking University, China

Russell C. Eberhart
Indiana University Purdue University Indianapolis, USA
Welcome Message from Program Committee Chair

The Ninth International Conference on Swarm Intelligence (ICSI’2018) is the ninth international gathering in the world for researchers working on all aspects of swarm intelligence, following the successful and fruitful previous eight events (ICSI’2017-2016, ICSI-CCI’2015, ICSI’2014-2010), which provided an excellent opportunity and/or an academic forum for academics and practitioners to present and discuss the latest scientific results and methods, innovative ideas, and advantages in theories, technologies, and applications in swarm intelligence. In this year event, the ICSI’2018 will be held in conjunction with the Third International Conference on Data Mining and Big Data (DMBD’2018) at Shanghai of China for sharing common mutual ideas, promoting transverse fusion, and stimulating innovation. The aim of this important co-location events are to exhibit the state of the art research and development in many aspects of both swarm intelligence and data mining from theoretical to practical researches.

For ICSI’2018 event, it received 197 submissions from about 488 authors in 38 countries and regions across six continents (Asia, Europe, North America, South America, Africa, and Oceania). Each submission was reviewed by at least two reviewers, and on average 2.7 reviewers. Based on rigorous reviews by the Program Committee members and reviewers, 113 high-quality papers were selected for publication in this proceedings volume with an acceptance rate of 57.36%. The papers are organized in 24 cohesive sections covering all major topics of swarm intelligence, computational intelligence and data science research and development.

For DMBD’2018 event, it received 126 submissions and invited manuscripts from about 358 authors in 35 countries and regions across six continents (Asia, Europe, North America, South America, Africa, and Oceania). Each submission was reviewed by at least two reviewers, and on average 2.3 reviewers. Based on rigorous reviews by the Program Committee members and reviewers, 74 high-quality papers were selected for publication in this proceedings volume with an acceptance rate of 58.73%. The papers are organized in 16 cohesive sections covering major topics of data mining and big data.

On behalf of the organization committees of ICSI-DMBD’2018, we would like to express sincere thanks to Tongji University, Peking University and Southern University of Science and Technology for their sponsorship, and to Robotics and Multi-body System Laboratory at School of Mechanical Engineering of Tongji University, Computational Intelligence Laboratory of Peking University, and IEEE Beijing Chapter for its technical cosponsorship, as well as to our supporters of International Neural Network Society, World Federation on Soft Computing, Beijing Xinglui Hi-Tech Co. and Springer-Nature.

We would also like to thank the members of the Advisory Committee for their guidance,
the members of the international Program Committee and additional reviewers for reviewing
the papers, and the members of the Publications Committee for checking the accepted papers
in a short period of time. We are particularly grateful to the proceedings publisher Springer
for publishing the proceedings in the prestigious series of Lecture Notes in Computer Science.
Moreover, we wish to express our heartfelt appreciation to the plenary speakers, session chairs,
and student helpers. In addition, there are still many more colleagues, associates, friends, and
supporters who helped us in immeasurable ways; we express our sincere gratitude to them
all. Last but not the least, we would like to thank all the speakers, authors, and participants
for their great contributions that made ICSI-DMBD’2018 successful and all the hard work
worthwhile.

We sincerely hope that all ICSI-DMBD’2018 participants will enjoy attending conference
sessions and social activities, meeting research partners, and setting up new research collaborati-
ons. Have a pleasant stay in Shanghai and enjoy!

Cheers!

ICSI-DMBD’2018 General Program Committee Chair

Yuhui Shi

Southern University of Science and Technology, China
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## Technical Program

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Organizing Committees

General Co-chairs
Ying Tan, Peking University, China  Russell C. Eberhart, IUPUI, USA

Programme Committee Chair
Yuhui Shi, Southern University of Science and Technology, China

Organizing Committee Chair
Qirong Tang, Tongji University, China

Advisory Committee Co-chairs
Gary G. Yen, Oklahoma State University, USA  Qidi Wu, Ministry of Education, China

Technical Committee Co-chairs
Haibo He, University of Rhode Island Kingston., USA
Kay Chen Tan, City University of Hong Kong, China
Nikola Kasabov, Auckland University of Technology, New Zealand
Ponnuthurai Nagaratnam Suganthan, Nanyang Technological University, Singapore
Xiaodong Li, RMIT University, Australia
Hideyuki Takagi, Kyushu University, Japan
M.Middendorf, University of Leipzig, Germany
Mengjie Zhang, Victoria University of Wellington, New Zealand
Lei Wang, Tongji University, China

Plenary Session Co-chairs
A.Engelbrecht, University of Pretoria, South Africa
Chaoming Luo, University of Detroit Mercy, USA

Invited Session Co-chairs
Maoguo Gong, N.W. Univ. Poly. China  Weian Guo, Tongji University, China

Special Session Co-chairs
Ben Niu, Shenzhen University, China
Yinan Guo, China University of Mining and Technology, China

Tutorial Co-chairs
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Publication Co-chairs
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Yaochu Jin, University of Surrey, UK

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Changhong Fu, Tongji University, China  Lulu Gong, Tongji University, China
International Program Committee

ICSI International Program Committee

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Peter András (Keele University)
Esther Andrés (INTA)

Sz Apotecas (CUA)
Carmelo J. A. Bastos Filho (University of Pernambuco)
Salim Bouzerdoum (University of Wollongong)
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Mu-Song Chen (Da-Yeh University)
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Yiqiang Chen (Institute of Computing Technology, Chinese Academy of Sciences)
Walter Chen (National Taipei University of Technology)
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Hui Cheng (Liverpool John Moores University)
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Zexuan Zhu (Shenzhen University)
Xingquan Zuo (Beijing University of Posts and Telecommunications)
DMBD International Program Committee

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David Camacho (Universidad Autonoma de Madrid)

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Qun Niu (Shanghai University)
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Somnuk Phon-Amnuaisuk (Universiti Teknologi Brunei)
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Prasad Kumar Singh (ABV-IIITM Gwalior)

Yifei Sun (Shaanxi Normal University)

Ying Tan (Peking University, Kyushu University)

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Andrysiak Tomasz (University of Technology and Life Sciences (UTP))

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Milan Tuba (John Naisbitt University)
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Gai-Ge Wang (Jiangsu Normal University)

Lei Wang (Tongji University)
Zhenzhen Wang (Jinling Institute of Technology)
Ka-Chun Wong (City University of Hong Kong)

Michal Wozniak (Wroclaw University of Technology)
Guohua Wu (National University of Defense Technology)

Zhou Wu (Chongqing University)
Wang Xiaochen (Wuhan University)

Zhao Xin (Tianjin University)
Rui Xu (Hohai University)

Xuesong Yan (China University of Geosciences)

Zhile Yang (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences)

Yingjie Yang (De Montfort University)

Guo Yi-Nan (China University of Mining and Technology)
Jie Zhang (Newcastle University)
Qieshi Zhang (Waseda University)

Xinchao Zhao (Beijing University of Post and Telecommunications)
Sponsors

Co-Sponsors

<table>
<thead>
<tr>
<th>Tongji University</th>
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<tbody>
<tr>
<td>Peking University</td>
</tr>
<tr>
<td>Southern University of Science and Technology</td>
</tr>
<tr>
<td>School of Mechanical Engineering, Tongji University</td>
</tr>
<tr>
<td>Laboratory of Robotics and Multibody System</td>
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<tr>
<td>Computational Intelligence Laboratory</td>
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Technical Co-Sponsors

<table>
<thead>
<tr>
<th>IEEE Computational Intelligence Society</th>
<th>International Neural Network Society</th>
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<tr>
<td>World Federation of Soft Computing</td>
<td>Springer</td>
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<tr>
<td>Lecture Notes in Computer Science</td>
<td>Beijing Xinghu High-Tech Co.</td>
</tr>
<tr>
<td>Bulinge Co.</td>
<td>Better-Rob Intelligent Technology Co., Ltd</td>
</tr>
</tbody>
</table>
Conference Venue

Location

ICSI 2018 & DMBD 2018 will be held at the five-star Anting Crowne Plaza Holiday Hotel (颖异皇冠假日酒店), located at the Jiading District of Shanghai.  
Address: No. 6555, Boyuan Road, Jiading District, Shanghai, China.  
(地址：上海市嘉定区安亭镇博园路6555号)  
Tel: 86-21-60568888

Anting Crowne Plaza Holiday Hotel

Floor Map

Map of conference and banquet halls

Grand Ballroom 1+2(B1)
June 18, 2018, 8:00 am: Opening Ceremony
June 18, 2018, 18:30 pm: Award Banquet

Grand Ballroom 3

Garden area

Garden floor

Lobby floor

Room A, B, C, D(1st floor)
June 18, 2018, 13:00 pm: Sessions
June 19, 2018: Sessions

A  B  C  D
Transportation

The Transportation from airport or railway station to Anting Crowne Plaza Holiday Hotel

1. From Pudong International Airport to Anting Crowne Plaza Holiday Hotel
   (a) By subway and bus
      i. Take Metro Line 2 (Pudong International Airport - Guanglan Road) from Pudong International Airport to Guanglan Road (via 8 stations)
      ii. Get off at Guanglan Road Station and transfer to the opposite side
      iii. Take Metro Line 2 (Guanglan Road - East Xujing) from Guanglan Road to Jiangsu Road (via 13 stations)
      iv. Take Metro Line 11 (Disney Resort - Huaqiao) from Jiangsu Road to Shanghai Automobile City (via 15 stations)
      v. Walk to Boyuan Road South Miquan Road (about 1084 meters) and take the Anhong Line (Hejing Road Anting Old Street - Fuquan Road West Tianshan Road) to Boyuan Road Anyan Road (via 2 stations)
      vi. Walk to the hotel (about 621 meters)
   (b) By taxi
      RMB 280, 150min

2. From Hongqiao International Airport/ Hongqiao Railway Station to Anting Crowne Plaza Holiday Hotel
(a) By subway and bus
   i. Take Metro Line 2 (East Xujing – Guanglan Road) from Hongqiao Railway Station/ Hongqiao Airport Terminal 1/ Hongqiao Airport Terminal 2 to Songhong Road (via 1 station)
   ii. Walk to Fuquan Road West Tianshan Road (about 245 meters) and take the Anhong Line (Fuquan Road West Tianshan Road – Hejing Road Anting Old Street) to Boyuan Road Anyan Road (via 22 stations)
   iii. Walk to the hotel (about 582 meters)

(b) By taxi
   RMB 74, 40min

3. From Shanghai Railway Station to Anting Crowne Plaza Holiday Hotel

(a) By subway and bus
   i. Take Metro Line 3/4 from Shanghai Railway Station to Caoyang Road (via 3 stations)
   ii. Take Metro Line 11 (Disney Resort - Huaqiao) from Caoyang Road to Shanghai Automobile City (via 13 stations)
   iii. Walk to Boyuan Road South Miquan Road (about 1084 meters) and take the Anhong Line (Hejing Road Anting Old Street – Fuquan Road West Tianshan Road) to Boyuan Road Anyan Road (via 2 stations)
   iv. Walk to the hotel (about 621 meters)

(b) By taxi
   RMB 98, 50min

4. From Shanghai South Railway Station to Anting Crowne Plaza Holiday Hotel

(a) By subway and bus
   i. Take Metro Line 1 (Xinzhuang – Fujin Road) from Shanghai South Railway Station to Xujiahui (via 3 stations)
   ii. Take Metro Line 11 (Disney Resort - Huaqiao) from Xujiahui to Shanghai Automobile City (via 17 stations)
   iii. Walk to Boyuan Road South Miquan Road (about 1084 meters) and take the Anhong Line (Hejing Road Anting Old Street – Fuquan Road West Tianshan Road) to Boyuan Road Anyan Road (via 2 stations)
   iv. Walk to the hotel (about 621 meters)

(b) By taxi
   RMB 127, 65min

Note: If you choose taxi, please stand by line on the official taxi station.
Bus Arrangement for Participants

Route:
Origination: Shanghai Anting Crowne Plaza
Transit place: Shanghai Automobile City Railway Station
Destination: Southern Gate of Tongji University (Jiading Campus)
Departure Time:

<table>
<thead>
<tr>
<th>June 17th</th>
<th>09:30 -18:30 (Every one hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 18th</td>
<td>7:00, 7:30, 8:00, 8:30, 12:00, 12:30, 13:00, 17:30, 18:00, 18:30, 19:00, 20:30, 21:00, 21:30</td>
</tr>
<tr>
<td>June 19th</td>
<td>7:00, 7:30, 8:00, 8:30, 12:00, 12:30, 13:00, 17:30, 18:00, 18:30, 19:00, 19:30, 20:00</td>
</tr>
</tbody>
</table>

Return Time: Return immediately after arrived at Tongji University
Social Program

Lunch, Dinner and Banquet

Buffet and Chinese Dinner are all included in the registration fees. For accompanying persons, banquet ticket can be purchased at the registration desk.

**Buffet (JUNE 18)**
Time: 12:00 - 14:00 pm
Place: Links Cafe at Anting Crowne Plaza Holiday Hotel

**Chinese Dinner (JUNE 18)**
Time: 18:00 - 21:00 pm
Place: House of Fame Chinese Restaurant at Anting Crowne Plaza Holiday Hotel

**Buffet (JUNE 19)**
Time: 12:00 - 14:00 pm
Place: Links Cafe at Anting Crowne Plaza Holiday Hotel

Post Conference Events: Optional City Walk Tours

**Only for those who order this optional excursion in advance.**

**Tourist line 1:** One day tour in Shanghai: *The Oriental Pearl TV Tower* (About ¥300 / person, all costs included.)

**Date:** June 20 (Wed)

**Meeting Point:** Lobby Floor of Crowne Plaza Shanghai Anting.

(a) The Oriental Pearl TV Tower  
(b) History Exhibition Center

(c) Huangpu River (The Bund)  
(d) Nanjing Road Walk Way
<table>
<thead>
<tr>
<th>Time</th>
<th>Itinerary</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>Set of designated locations and start the journey;</td>
</tr>
<tr>
<td>09:00</td>
<td>Go to the Landmark building in Shanghai <em>The Oriental Pearl TV Tower</em> (visit 263m Theme sightseeing hall and 259m All transparent hanging sightseeing corridor);</td>
</tr>
<tr>
<td>11:00</td>
<td>Visit hundred years of vicissitudes in Shanghai <em>History Exhibition Center</em>;</td>
</tr>
<tr>
<td>12:00</td>
<td>Have lunch, enjoy Chinese food or bring your own;</td>
</tr>
<tr>
<td>14:00</td>
<td>Take a cruise on the Huangpu river and go sightseeing the Scenery on both sides;</td>
</tr>
<tr>
<td>16:00</td>
<td>Walk on First street of China <em>Nanjing Road Walk Way</em> and visit the world Expo of architectures <em>The Bund</em>;</td>
</tr>
<tr>
<td>18:00</td>
<td>End of the trip and Return to the specified location.</td>
</tr>
</tbody>
</table>

**Tourist line 2**: One day tour in Shanghai: *Disneyland* (About ¥500 / person, all costs included.)

**Date**: June 20 (Wed)

**Meeting Point**: Lobby Floor of Crowne Plaza Shanghai Anting.

<table>
<thead>
<tr>
<th>Time</th>
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</tr>
</thead>
<tbody>
<tr>
<td>07:30</td>
<td>Set of designated locations and start the journey;</td>
</tr>
<tr>
<td>08:30</td>
<td>Arrive at <em>Disneyland</em> Resort;</td>
</tr>
<tr>
<td>20:00</td>
<td>End of the trip and Return to the specified location.</td>
</tr>
</tbody>
</table>
Tourist line 3: One day tour in Shanghai: *The Oriental Pearl TV Tower* and *Shanghai Madame Tussauds* (About ¥600 / person, all costs included.)

**Date:** June 20 (Wed)

**Meeting Point:** Lobby Floor of Crowne Plaza Shanghai Anting.

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**Shanghai Madame Tussauds**

<table>
<thead>
<tr>
<th>Time</th>
<th>Itinerary</th>
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</thead>
<tbody>
<tr>
<td>08:00</td>
<td>Set of designated locations and start the journey;</td>
</tr>
<tr>
<td>09:00</td>
<td>Visit <em>Shanghai Madame Tussauds</em>;</td>
</tr>
<tr>
<td>11:00</td>
<td>Walk on First street of China <em>Nanjing Road Walk Way</em> and visit the world</td>
</tr>
<tr>
<td></td>
<td>Expo of architectures <em>The Bund</em>;</td>
</tr>
<tr>
<td>12:00</td>
<td>Have lunch, enjoy Chinese food or bring your own;</td>
</tr>
<tr>
<td>14:00</td>
<td>Go to the Landmark building in Shanghai <em>The Oriental Pearl TV Tower</em> (visit 263m Theme sightseeing hall and 259m All transparent hanging sightseeing corridor);</td>
</tr>
<tr>
<td>16:00</td>
<td>Visit hundred years of vicissitudes in Shanghai <em>History Exhibition Center</em>;</td>
</tr>
<tr>
<td>18:00</td>
<td>Have dinner, enjoy Chinese food or bring your own;</td>
</tr>
<tr>
<td>20:00</td>
<td><em>Take a cruise</em> on the Huangpu river and go sightseeing the Scenery on both</td>
</tr>
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<td>sides;</td>
</tr>
<tr>
<td>21:00</td>
<td>End of the trip and Return to the specified location.</td>
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</tbody>
</table>

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**Campus Tour (Free)**

**Date & Time:** 09:30 - 11:30, June 20 (Wed)

**Meeting Point:** Southern Gate of Tongji University (Jiading Campus).
Plenary Talk 1

Evaluating the Swarm Metaphor based Heuristics for Continuous Optimization - Modern Performance Measures and the (Non-parametric) Statistical Perspectives

Dr. Swagatam Das
Electronics and Communication Sciences Unit of the Indian Statistical Institute, Kolkata, India

Abstract

Numerous metaheuristics have been proposed based on the life supporting activity of the swarming creatures in nature for solving optimization problems involving continuous search spaces. However, whether these algorithms will survive in the long run or whether their names will remain stipulated within the world of paper writing - this issue largely depends on the ease of implementation and efficiency in solving practical optimization problems. Most of the pioneering papers on swarm intelligence based metaheuristics generally exhibit the efficiency of the algorithm on a set of synthetic benchmark functions which are supposed to capture the different aspects of the real world optimization problems. This talk will focus on the benchmarking procedures adopted for comparing different metaheuristics meaningfully. The talk will elaborate on modern performance measures, design of experiments and provide some guidelines for selecting the suitable metaheuristic for solving a domain-specific problem. It will also discuss some recent non-parametric hypothesis test procedures to evaluate the comparative results. Finally some shortcomings of the modern statistical benchmarking procedures will be highlighted along with the discussion on some important future research directions.

Biography

Swagatam Das is currently serving as a faculty member at the Electronics and Communication Sciences Unit of the Indian Statistical Institute, Kolkata, India. His research interests include non-convex optimization and machine learning. Dr. Das has published one research monograph, one edited volume, and more than 300 research articles in peer-reviewed journals and international conferences. He is the founding co-editor-in-chief of Swarm and Evolutionary Computation, an international journal from Elsevier. He has also served as or is serving as the associate editors of several international journals of repute from IEEE, Elsevier and Springer. Dr. Das has 12000+ Google Scholar citations and an H-index of 54 till date. He has been associated with the international program committees and organizing committees of several regular international conferences including IEEE CEC, IEEE SSCI, and GECCO. He has acted as guest editors for special issues in journals like IEEE Transactions on Evolutionary Computation and IEEE Transactions on SMC, Part C. He is the recipient of the 2012 Young Engineer Award from the Indian National Academy of Engineering (INAE). He is also the recipient of the 2015 Thomson Reuters Research Excellence India Citation Award as the highest cited researcher from India in Engineering and Computer Science category between 2010 to 2014.
Plenary Talk 2

Fitness Landscape Information for Better Optimization Search
Prof. Hideyuki TAKAGI
Kyushu University, Fukuoka, Japan

Abstract

We explain several approaches to obtain fitness landscape information and use it to enhance the performance of population-based optimization algorithms. Individuals of population-based optimization algorithms converge to the global optimum gradually with exchanging searching information among them. If we can know the global optimum area or better searching areas before individuals converge to the global optimum, its/their location information is helpful to accelerate optimization.

The first approach of obtaining the information is approximation of a fitness landscape and estimate the global optimum area from the hyper-surface of the approximated landscape. Unlike a surrogate model which is an approximated landscape for expensive optimization tasks, we must choose approximation approaches that provide us the estimated global optimum point. We introduce such approaches.

The second approach is the estimation of the convergence point of individuals from their moving directions mathematically. Suppose we define a moving vector as a directional vector from a parent to its offspring. Since individuals aim toward the global optimum according to search generations, we obtain many moving vectors toward to the global optimum and can expect that one point that is the nearest to these moving vector locates near the global optimum. Estimating the global optimum area before individuals converge on there must be helpful to accelerate optimization search.

The third approach is finding local optima areas of multimodal tasks. Individuals aims not only the global optimum but also local optima especially in early generations. We may be able to separate local areas using the approximated fitness landscape, i.e. the first approach, or using the directions of moving vectors aiming the different local optima. They can be new niche methods. The numbers of these local optima areas is directly related with the complexity of its fitness landscape, and we also discuss how to know the complexity of tasks, which is also helpful for optimization search.

Biography

Prof. Hideyuki TAKAGI received the degrees of Bachelor and Master from Kyushu Institute of Design in 1979 and 1981, and the degree of Doctor of Engineering from Toyohashi University of Technology in 1991. He was a researcher at Panasonic Central Research labs in 1981 - 1995, was an Associate Professor of Kyushu Institute of Design in 1995 - 2003, and is a Professor of Kyushu University now. He was a visiting researcher at UC Berkeley in 1991-1993 hosted by Prof. L. A. Zadeh.

He had worked on neuro-fuzzy systems in 1987 - early 1990’s and extended his interests to fusing neuro-fuzzy-genetic algorithms and human factors. Now, he aims Humanized Computational Intelligence and is focusing on interactive evolutionary computation (IEC) as a tool for this
research direction and developing methods for enhancing evolutionary computation. The number of citations of the most cited his IEC paper is around 1,500 times, and his well cited papers can be found at Google Scholar Citations. He has been a volunteer for IEEE Systems, Man, and Cybernetics (SMC) Society. Some of his contributions are: Vice President in 2006 - 2009: a member of Administrative Committee/Board of Governors in 2001 - 2010, and 2016 - 2018: Chair of SMC Japan Chapter in 2014 - 2017: Technical Committee (TC) Coordinator in 2004 - 2005: Chair of TC on Soft Computing in 1998 - 2004 and since 2008: Distinguished Lecturer in 2006 - 2011: Associate Editor of IEEE Transactions on SMC, Part B / Cybernetics since 2001. See his further detail bio at his web page.
Plenary Talk 3

Swarm Intelligence in Dynamic Environments
Prof. Shengxiang Yang
De Montfort University, Leicester, UK

Abstract

Swarm Intelligence (SI) represents the property that the collective behaviors of agents that interact locally with their environment cause coherent functional global patterns to emerge. SI algorithms are inspired from simple behaviors and self-organizing interaction among agents, such as ant foraging, bird flocking and fish schooling, and have been applied in different fields. Most SI algorithms have been developed to address stationary optimization problems. However, many real-world problems have a dynamic environment that changes over time due to many factors. For such dynamic optimization problems (DOPs), it is difficult for a conventional SI algorithm to track the changing optimum once changes occur. DOPs have attracted a growing interest from the SI community in recent years due to the importance in the real-world applications of SI algorithms. This talk will first briefly introduce the concepts of SI and DOPs, then review the enhancement strategies integrated into SI algorithms to address dynamic changes, and describe several detailed case studies on SI methods for DOPs. Finally, some conclusions will be made and the future work on SI in dynamic environments will be briefly discussed.

Biography

Shengxiang Yang is now a Professor of Computational Intelligence (CI) and the Director of the Centre for Computational Intelligence, De Montfort University, UK. He has worked extensively for 20 years in the areas of CI methods, including evolutionary computation, swarm intelligence and artificial neural networks, and their applications for real-world problems. He has over 240 publications in these domains. He has 6500+ Google Scholar citations and an H-index of 42. His work has been supported by UK research councils (e.g., Engineering and Physical Sciences Research Council (EPSRC), Royal Society, and Royal Academy of Engineering), EU FP7 and Horizon 2020, Chinese Ministry of Education, and industry partners (e.g., BT, Honda, Rail Safety and Standards Board, and Network Rail, etc.), with a total funding of over GBP2M, of which two EPSRC standard research projects have been focused on CI for DOPs. He serves as an Associate Editor or Editorial Board Member of seven international journals, including IEEE Transactions on Cybernetics, Evolutionary Computation, Information Sciences, and Soft Computing. He is the founding chair of the IEEE CI Society (CIS) Task Force on Intelligent Network Systems and the chair of the IEEE CIS Task Force on Evolutionary Computation in Dynamic and Uncertain Environments. He has organized over 40 workshops and special sessions on CI in dynamic and uncertain environments for several major international conferences. He is the founding co-chair of the IEEE Symposium on CI in Dynamic and Uncertain Environments. He has co-edited over ten books, proceedings, and journal special issues. He has been invited to give over 10 keynote speeches/tutorials at international conferences, and over 40 seminars in different countries.
Program Schedule and Technical Program Overview

Registration
Registration will take place at Registration Desk in Crowne Plaza Shanghai Anting during the following hours:

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 17 (Sun)</td>
<td>10:30 - 18:00</td>
<td>Lobby Floor</td>
</tr>
<tr>
<td>June 18 (Mon)</td>
<td>08:00 - 12:00</td>
<td>Lobby Floor</td>
</tr>
<tr>
<td>June 19 (Tue)</td>
<td>08:00 - 12:00</td>
<td>Lobby Floor</td>
</tr>
</tbody>
</table>

Notable Events

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Events (At Crowne Plaza Shanghai Anting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 18 (Mon)</td>
<td>08:00 - 08:15</td>
<td>Opening Ceremony (B1 floor: Grand Ballroom 1+2) Chair: Qirong Tang</td>
</tr>
<tr>
<td></td>
<td>08:15 - 09:15</td>
<td>Plenary Talk I: Dr. Swagatam Das Chair: Qirong Tang</td>
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<tr>
<td></td>
<td>09:35 - 10:35</td>
<td>Plenary Talk II: Prof. Hideyuki TAKAGI Chair: Yuhui Shi</td>
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<td></td>
<td>10:35 - 11:35</td>
<td>Plenary Talk III: Prof. Shengxiang Yang Chair: Yuhui Shi</td>
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<td></td>
<td>12:00 - 14:00</td>
<td>Buffet (Links Cafe)</td>
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<td></td>
<td>13:00 - 18:00</td>
<td>Tutorial Sessions, Parallel Oral Sessions and Special Sessions (1st floor: Room A, Room B, Room C, Room D)</td>
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<td></td>
<td>18:00 - 21:00</td>
<td>Award Banquet (Chinese Dinner) (B1 Floor: Grand Ballroom 1+2)</td>
</tr>
<tr>
<td>June 19 (Tue)</td>
<td>08:00 - 18:00</td>
<td>Parallel Oral Sessions and Special Sessions (1st floor: Room A, Room B, Room C, Room D)</td>
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<td></td>
<td>12:00 - 14:00</td>
<td>Buffet (Links Cafe)</td>
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<tr>
<td>June 20 (Wed)</td>
<td>08:00 - 18:00</td>
<td>Tourist line 1: One day tour in Shanghai: The Oriental Pearl TV Tower (About ¥300 / person, all costs included.)</td>
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<td></td>
<td>07:30 - 20:00</td>
<td>Tourist line 2: One day tour in Shanghai: Disneyland (About ¥500 / person, all costs included.)</td>
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<td></td>
<td>08:00 - 21:00</td>
<td>Tourist line 3: One day tour in Shanghai: The Oriental Pearl TV Tower and Shanghai Madame Tussauds (About ¥600 / person, all costs included.)</td>
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<td></td>
<td>09:30 - 11:30</td>
<td>Campus Tour (Free) (Southern Gate of Tongji University, Jiading Campus)</td>
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<td>June 21 (Thu)</td>
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<td>Free activities.</td>
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<tr>
<td>June 22 (Fri)</td>
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<td>Free activities.</td>
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Technical Program Overview
<table>
<thead>
<tr>
<th>Time</th>
<th>Room A</th>
<th>Room B</th>
<th>Room C</th>
<th>Room D</th>
<th>Grand Ballroom 1+2</th>
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<tbody>
<tr>
<td>08:00 - 08:15</td>
<td>Opening Ceremony</td>
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<td>08:15 - 09:15</td>
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<td>12:00 - 14:00</td>
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<tr>
<td>13:00 - 14:00</td>
<td>Tutorial for “Brain Storm Optimization Algorithms” (13:00 - 13:45)</td>
<td>Theories and Models of Swarm Intelligence I/II</td>
<td>Finding Patterns and Recommendation I/II</td>
<td>Data Preprocessing &amp; Data Analysis</td>
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<td>14:40 - 15:40</td>
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<tr>
<td>14:50 - 16:30</td>
<td>Swarm-based Optimization Algorithms I/II</td>
<td>Theories and Models of Swarm Intelligence I/II</td>
<td>Multi-Agent Systems and Swarm Robotics I/III</td>
<td>Matrix Factorization &amp; Knowledge Management (14:50 - 16:50)</td>
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<td>16:30 - 16:40</td>
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<tr>
<td>16:40 - 18:00</td>
<td>Swarm-based Optimization Algorithms II/II</td>
<td>Hybrid Optimization Algorithms</td>
<td>Multi-Agent Systems and Swarm Robotics II/III</td>
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<td>18:30 - 20:30</td>
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<tr>
<td>08:00 - 09:40</td>
<td>Planning and Routing Problems</td>
<td>Multi-objective Optimization</td>
<td>Multi-Agent Systems and Swarm Robotics III/III</td>
<td>Pattern Discovery &amp; Data Mining</td>
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<td>09:40 - 09:50</td>
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<tr>
<td>09:50 - 11:50</td>
<td>Genetic Algorithms and Ant Colony Optimization</td>
<td>Fuzzy Logic Approaches and Hydrologic Cycle Optimization</td>
<td>Finding Patterns and Recommendation II/II</td>
<td>Classification</td>
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<td>12:00 - 14:00</td>
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<tr>
<td>13:00 - 14:20</td>
<td>Differential Evolution and Particle Swarm Optimization</td>
<td>Information and Image Processing</td>
<td>Artificial Bee Colony Algorithm and Fruit Fly Optimization Algorithm</td>
<td>Clustering &amp; Prediction</td>
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<td>14:20 - 14:50</td>
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<tr>
<td>14:50 - 16:30</td>
<td>Fireworks Algorithm and Bacterial Foraging Optimization</td>
<td>Classification and Clustering</td>
<td>Deep Learning</td>
<td>Visualization &amp; Recommendation System in Social Media</td>
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<td>16:30 - 16:40</td>
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<td>June 19 (Tue)</td>
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<td>June 18 (Mon)</td>
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June 18 (Mon):

- **08:00 - 09:15**: Opening Ceremony
- **09:15 - 09:35**: Plenary Talk 1
- **09:35 - 10:35**: Break
- **10:35 - 11:35**: Plenary Talk 2
- **12:00 - 14:00**: Lunch
- **13:00 - 14:00**: Tutorial for “Brain Storm Optimization Algorithms” (13:00 - 13:45)
- **14:40 - 15:40**: Break
- **14:50 - 16:30**: Plenary Talk 3
- **16:30 - 16:40**: Break
- **16:40 - 18:00**: Hybrid Optimization Algorithms
- **18:30 - 20:30**: Award Banquet
# Technical Program

## ICSI 2018 Oral Sessions

### June 18, 2018 (Monday)

<table>
<thead>
<tr>
<th>Session</th>
<th>Theories and Models of Swarm Intelligence I/II</th>
<th>Chair</th>
<th>Eugene Larkin</th>
<th>Co-Chair</th>
<th>Zvi Retchkiman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date/Time</td>
<td>June 18, 2018 (Monday) 13:00-14:40</td>
<td>Venue</td>
<td>Room B</td>
<td></td>
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</tbody>
</table>

13:00 - 13:20  Semi-markov Model of a Swarm Functioning  
*Eugene Larkin and Maxim Antonov*

13:20 - 13:40  Modeling and Verification Analysis of the Predator-Prey System via a Modal Logic Approach  
*Zvi Retchkiman*

13:40 - 14:00  The Access Model to Resources in Swarm System Based on Competitive Processes  
*Eugene Larkin, Alexey Ivutin, Alexander S. Novikov, Anna Troshina and Yulia Frantsuzova*

14:00 - 14:20  An Enhanced Monarch Butterfly Optimization with Self-Adaptive Butterfly Adjusting and Crossover Operators  
*Gai-Ge Wang, Guo-Sheng Hao and Zhihua Cui*

14:20 - 14:40  On the Cooperation between Evolutionary Algorithms and Constraint Handling Techniques  
*Chengyong Si, Jianqiang Shen, Weian Guo and Lei Wang*
### Session: Finding Patterns and Recommendation I/II

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Event</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 18, 2018(Monday) 13:00-14:40</td>
<td>13:00 - 13:20 Investigating the Effectiveness of Helpful Reviews and Reviewers in Hotel Industry</td>
<td>Yen Tzu Chao, Ping-Yu Hsu, Ming-Shien Cheng, Hong Tsuen Lei, Shih Hsiang Huang, Yen-Huei Ko, Grandys Frieska Prassida and Chen Wan Huang</td>
</tr>
<tr>
<td></td>
<td>13:20 - 13:40 Mapping the Landscapes, Hotspots and Trends of the Social Network Analysis Research from 1975 to 2017</td>
<td>Zeng Li, Zili Li, Zhao Zhao and Meixin Mao</td>
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<tr>
<td></td>
<td>13:40 - 14:00 Investigating the Relationship between the Emotion of Blogs and the Price of Index Futures</td>
<td>Yen Hao Kao, Ping-Yu Hsu, Ming-Shien Cheng and Hong Tsuen Lei,</td>
</tr>
<tr>
<td></td>
<td>14:00 - 14:20 A Novel Model for Finding Critical Products with Transaction Logs</td>
<td>Ping Yu Hsu, Chen Wan Huang, Shih Hsiang Huang, Pei Chi Chen and Ming Shien Cheng</td>
</tr>
<tr>
<td></td>
<td>14:20 - 14:40 Investigating Deciding Factors of Product Recommendation in Social Media</td>
<td>Jou Yu Chen, Ping-Yu Hsu, Ming-Shien Cheng, Hong Tsuen Lei, Shih Hsiang Huang, Yen-Huei Ko and Chen Wan Huang</td>
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</table>

### Session: Swarm-based Optimization I/II

<table>
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<tr>
<th>Date/Time</th>
<th>Event</th>
<th>Authors</th>
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</thead>
<tbody>
<tr>
<td>June 18, 2018(Monday) 14:50-16:10</td>
<td>14:50 - 15:10 Brain Storm Optimization with Multi-Population Based Ensemble of Creating Operations</td>
<td>Yuehong Sun, Ye Jin and Dan Wang</td>
</tr>
<tr>
<td></td>
<td>15:10 - 15:30 A Novel Memetic Whale Optimization Algorithm for Optimization</td>
<td>Zhe Xu, Yang Yu, Hanaki Yachi, Junkai Ji, Yuki Todo and Shangce Gao</td>
</tr>
</tbody>
</table>
15:30 - 15:50 Logistic Distribution Center Location Based on Improved Harmony Search Algorithm
Xiaobing Gan, Entao Jiang, Yingying Peng, Shuang Geng and Mijat Kustudic

15:50 - 16:10 Impact of Purchasing Power on User Rating Behavior and Purchasing Decision
Yong Wang, Xiaofei Xu, Jun He, Chao Chen and Ke Ren

**Session** Theories and Models of Swarm Intelligence II/II  
**Chair** Eugene Larkin

**Date/Time** June 18, 2018 (Monday) 14:50-16:30  
**Venue** Room B

14:50 - 15:10 Soft Island Model for Population-Based Optimization Algorithms
Shakhnaz Akhmedova, Vladimir Stanovov and Eugene Semenkin

15:10 - 15:30 A Smart Initialization on the Swarm Intelligence Based Method for Efficient Search of Optimal Minimum Energy Design
Tun-Chieh Hsu and Frederick Kin Hing Phoa

15:30 - 15:50 Multiple Swarm Relay-Races with Alternative Routes
Eugene Larkin, Vladislav Kotov, Aleksandr Privalov and Alexey Bogomolov

15:50 - 16:10 Adaptive Variable-size Random Grouping for Evolutionary Large-Scale Global Optimization
Evgenii Sopov

16:10 - 16:30 On Island Model Performance for Cooperative Real-Valued Multi-Objective Genetic Algorithms
Christina Brester, Ivan Ryzhikov, Eugene Semenkin and Mikko Kolehmainen

**Session** Multi-Agent Systems and Swarm Robotics I/III  
**Chair** Hai Huang

**Date/Time** June 18, 2018 (Monday) 14:50-16:10  
**Venue** Room C

14:50 - 15:10 Path Following of Autonomous Agents under the Effect of Noise
Krishna Sami Raghuwaiya, Bibhya Nand Sharma, Jito Vanualailai and Parma Nand
15:10 - 15:30 Development of Adaptive Force-Following Impedance Control for Interactive Robot
Huang Jianbin, Li Zhi and Liu Hong

15:30 - 15:50 A Real-Time Multiagent Strategy Learning Environment and Experimental Framework
Hongda Zhang, Decai Li, Liying Yang, Peng Gu and Yuqing He

15:50 - 16:10 Learning based Target Following Control of Underwater Vehicles
Hai Huang, Zhou Hao, Mingwei Sheng, Zhaoliang Wan and Ze-Xing Zhou

Session Swarm-based Optimization Chair Peng Wang
Swarm-based Optimization Algorithms II/II

Date/Time June 18, 2018(Monday) 16:40-18:00 Venue Room A

16:40 - 17:00 Optimization of steering linkage including the effect of McPherson strut front suspension
Suwin Sleesongsom and Sujin Bureerat

17:00 - 17:20 Multi-scale quantum harmonic oscillator algorithm with individual stabilization strategy
Peng Wang, Bo Li, Jin Jin, Lei Mu, Gang Xin, Yan Huang and Xinggui Ye

17:20 - 17:40 Improved Differential Evolution Based on Mutation Strategies
John Saveca, Zenghui Wang and Yanzia Sun

17:40 - 18:00 A Deep Prediction Architecture for Traffic Flow with Precipitation Information
Jingyuan Wang, Xiaofei Xu, Feishuang Wang, Chao Chen and Ke Ren

Session Hybrid Optimization Algorithms Chair Peng-Yeng Yin
Hybrid Optimization Algorithms

Date/Time June 18, 2018(Monday) 16:40-18:00 Venue Room B

16:40 - 17:00 A Hybrid Evolutionary Algorithm for Combined Road-Rail Emergency Transportation Planning
Zhongyu Rong, Min-Xia Zhang, Yi-Chen Du and Yu-Jun Zheng
17:00 - 17:20  A Fast Hybrid Meta-heuristic Algorithm for Economic/Environment Unit Commitment with Renewables and Plug-in Electric Vehicles
Zhile Yang, Qun Niu, Yuanjun Guo, Haiping Ma and Boyang Qu

17:20 - 17:40  A Hybrid Differential Evolution Algorithm and Particle Swarm Optimization with Alternative Replication Strategy
Lulu Zuo, Lei Liu, Hong Wang and Lijing Tan

17:40 - 18:00  A Hyper-Heuristic of Artificial Bee Colony and Simulated Annealing for Optimal Wind Turbine Placement
Peng-Yeng Yin and Geng-Shi Li

Session  Multi-Agent Systems and Swarm Robotics II/III  
Chair  Rongjie Kang  

Date/Time  June 18, 2018(Monday) 16:40-18:00  Venue  Room C

16:40 - 17:00  GLANS: GIS based Large-scale Autonomous Navigation System
Manhui Sun, Shaowu Yang and Hengzhu Liu

17:00 - 17:20  Optimal Shape Design of an Autonomous Underwater Vehicle Based on Gene Expression Programming
Qirong Tang, Yinghao Li, Zhenqiang Deng, Di Chen, Ruiqin Guo and Hai Huang

17:20 - 17:40  A Space Tendon-driven Continuum Robot
Shineng Geng, Youyu Wang, Cong Wang and Rongjie Kang

17:40 - 18:00  Transaction Flows in Multi-Agent Swarm Systems
Eugene Larkin, Alexey Ivutin, Alexander S. Novikov and Anna Troshina
### Planning and Routing Problems

**Chair**: Hugo Hernandez

**Date/Time**: June 19, 2018 (Tuesday) 08:00-09:40

**Venue**: Room A

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<td>Using FAHP-VIKOR for Operation Selection in the Flexible Job-Shop Scheduling Problem: A Case Study in Textile Industry</td>
<td>Miguel Angel Ortiz Barrios, Dionicio Neira Rodado, Genett Jimenez and Hugo Hernandez Palma</td>
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<td>A Solution Framework based on Packet Scheduling and Dispatching Rule for Job-Based Scheduling Problems</td>
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### Multi-objective Optimization

**Chair**: Jing Liang

**Date/Time**: June 19, 2018 (Tuesday) 08:00-09:40

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<td>A Decomposition-based Multiobjective Evolutionary Algorithm for Sparse Reconstruction</td>
<td>Jiang Zhu, Muyao Cai, Shujuan Tian, Yanbing Xu and Tingrui Pei</td>
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<td>A Novel Many-objective Bacterial Foraging Optimizer Based on Multi-engine Cooperation Framework</td>
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08:40 - 09:00 An Improved Bacteria Foraging Optimization Algorithm for High Dimensional Multi-objective Optimization Problems
Yueliang Lu and Qingjian Ni

09:00 - 09:20 A Self-Organizing Multi-Objective Particle Swarm Optimization Algorithm for Multimodal Multi-Objective Problems
Jing Liang, Qianqian Guo, Caitong Yue, Boyang Qu and Kunjie Yu

09:20 - 09:40 A Decomposition based Evolutionary Algorithm with Angle Penalty Selection Strategy for MaOPs
Zhiyong Li, Ke Lin, Mourad Nouioua and Jiang Shilong

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| 08:20 - 08:40               | Deep Regression Models for Local Interaction in Multi-Agent Robot Tasks
Fredy Martinez, Cristian Penagos and Luis Pacheco |
| 08:40 - 09:00               | Multi-Drone Framework for Cooperative Deployment of Dynamic Wireless Sensor Networks
Jon-Vegard Sorli and Olaf Hallan Graven |
| 09:00 - 09:20               | Distributed Decision Making and Control for Cooperative Transportation Using Mobile Robots
Henrik Ebel and Peter Eberhard |
| 09:20 - 09:40               | Deep-Sarsa based Multi-UAV Path Planning and Obstacle Avoidance in a Dynamic Environment
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10:10 - 10:30 Fault Diagnosis on Electrical Distribution Systems based on Fuzzy Logic
Ramon Perez, Amelec Viloria, Esteban Inga, Alexander Aguila, Carmen Vasquez, Liliana Lima and Maury-Ardila Henry

10:30 - 10:50 A Hybrid GA-PSO Adaptive Neuro-Fuzzy Inference System for Short-Term Wind Power Prediction
Rendani Mbuvha, Ilyes Boulkaibet, Tshilidzi Marwala and Fernando Buarque De Lima-Neto

10:50 - 11:10 Hydrologic Cycle Optimization Part I: Background and Theory
Xiaohui Yan and Ben Niu

11:10 - 11:30 Hydrologic Cycle Optimization Part II: Experiments and Real-World Application
Ben Niu, Huan Liu and Xiaohui Yan

### Session

**Finding Patterns and Recommendation II/II**

**Chair** Zengda Guan

**Date/Time** June 19, 2018 (Tuesday) 09:50-11:30

**Venue** Room C

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Xiaoyan Shi, Wei Fang and Guizhu Zhang

10:10 - 10:30 A Personalized Friend Recommendation Method Combining Network Structure Features and Interaction Information
Chen Yang, Tingting Liu, Lei Liu, Xiaohong Chen and Zhiyong Hao

10:30 - 10:50 A Hybrid Movie Recommendation Method Based on Social Similarity and Item Attributes
Chen Yang, Xiaohong Chen, Lei Liu, Tingting Liu and Shuang Geng

10:50 - 11:10 Multi-feature Collaborative Filtering Recommendation For Sparse Dataset
Zengda Guan

11:10 - 11:30 Tag Prediction in Social Annotation Systems Based on CNN and BiLSTM
Baiwei Li, Qingchuan Wang, Xiaoru Wang and Wei Li
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**Chair:** Victor Parque  
**Co-Chair:** Junqi Zhang  
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**Chair:** Rui Zhang  
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*Lei Liu, Chen Yang, Tingting Liu, Xiaohong Chen and Sung-Shun Weng*

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*Yinan Guo, Pei Zhang, Jian Cheng, Cui Ning and Chen Jingjing*

15:30 - 15:50  A Large-Scale Data Clustering Algorithm based on BIRCH and Artificial Immune Network  
*Yangyang Li, Guangyuan Liu, Peidao Li and Licheng Jiao*

15:50 - 16:10  A Distance-based Term Weighting Method for Text Clustering  
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14:50 - 15:10  A Deep Learning Model for Predicting Movie Box Office Based on Deep Belief Network  
*Wei Wang and Jiapeng Xiu*

15:10 - 15:30  A Deep-layer Feature Selection Method Based on Deep Neural Networks  
*Chen Qiao, Kefeng Sun and Bin Li*

15:30 - 15:50  Video Vehicle Detection and Recognition Based on MapReduce and Convolutional Neural Network  
*Chen Mingsong, Wang Weiguang, Dong Shi and Zhou Xinling*

15:50 - 16:10  A Uniform Approach for the Comparison of Opposition-Based Learning  
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   Yuxin Chen, Shun Li and Jiahui Yao

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11:10 - 11:30  A Self-Training Method for Detection of Phishing Websites  
Xuepeng Jia and Xiaofeng Rong

11:30 - 11:50  A Rule-Based System to Classify Scheduling Problems and Solution Techniques for Service Systems  
Eduyn Lopez-Santana, German Mendez Giraldo and Jose Ignacio Rodriguez Molano

Session | Clustering & Prediction | Chair | Amelec Viloria
Date/Time | June 19, 2018 (Tuesday) 13:00-14:20 | Venue | Room D

13:00 - 13:20  Multiple Kernel Shadowed Clustering in Approximated Feature Space  
Yin-Ping Zhao, Long Chen and C. L. Philip Chen

13:20 - 13:40  Data Mining Using Clustering Techniques as Leprosy Epidemiology Analyzing Model  
Ygor Eugenio Dutra Da Silva, Claudio Guedes Salgado, Valney Mara Gomes Conde and Guilherme Augusto Barros Conde

13:40 - 14:00  Determination of Dimensionality of the Psychosocial Risk Assessment of Internal, Individual, Double Presence and External Factors in Work Environments  
Nunziatina Bucci, Marisabel Luna, Amelec Viloria, Jenny Lis, Alexander Parody, Darwin Solano and Luz Borrero

14:00 - 14:20  A Novel SPITters Detection Approach with Unsupervised Density-based Clustering  
Jianzhong Zhang, Jingjing Wang, Yu Zhang, Jingdong Xu and Huan Wu

Session | Visualization & Recommendation | Chair | Jaerock Kwon
Date/Time | June 19, 2018 (Tuesday) 14:50-16:30 | Venue | Room D

14:50 - 15:10  Image Processing Pipeline for Web-Based Real-Time 3D Visualization of Teravoxel Volumes  
Akanksha Ashwini and Jaerock Kwon
15:10 - 15:30 Big Data Visualization of the Alcohol Expenses in Taiwan

Chien-Wen Shen, Thai-Ha Luong, Li-An Chien and Jung-Tsung Ho

15:30 - 15:50 Efficiency Analysis of the Visibility of Latin American Universities and Their Impact on the Ranking Web

Maritza Torres, Carmen Vasquez, Amelec Viloria, Tito Crissien Borrero, Noel Varela, Danelys Cabrera, Mercedes Gaitan-Angulo and Jenny Paola

15:50 - 16:10 Public Opinion toward Social Business from a Social Media Perspective

Chien-Wen Shen and Jung-Tsung Ho


Yu Yadong and Liu Jun

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**Session**

Deep Learning and its Applications

**Date/Time**

June 19, 2018 (Tuesday) 16:40-18:00

**Venue** Room D

**Chair** Fusaomi Nagata

16:40 - 17:00 Bibliometric Analysis of the Deep Learning Research Status with the Data from Web of Science

Meixin Mao, Zili Li, Zhao Zhao and Zeng Li

17:00 - 17:20 A Data-driven Path Planner for Small Autonomous Robots using Deep Regression Models

Fredy Martinez, Angelica Rendon and Mario Arbulu

17:20 - 17:40 Design Tool of Deep Convolutional Neural Network for Visual Inspection

Fusaomi Nagata, Kenta Tokuno, Akimasa Otsuka, Takeshi Ikeda, Hiroaki Ochi, Hisami Tamano, Hitoshi Nakamura, Keigo Watanabe and Maki K. Habib

17:40 - 18:00 A Deep Point-of-Interest Recommendation System in Location-Based Social Networks

Yuehua Wang, Zhinong Zhong, Anran Yang and Ning Jing
Abstracts

Tutorial for “Brain Storm Optimization Algorithms”
June 18, 2018(Monday) 13:00-13:45 Room A

Brain Storm Optimization Algorithms
Shi Cheng and Yuhui Shi

Abstract. For swarm intelligence algorithms, each individual in the swarm represents a solution in the search space, and it also can be seen as a data sample from the search space. Based on the analyses of these data, more effective algorithms and search strategies could be proposed. Brain storm optimization (BSO) algorithm is a new and promising swarm intelligence algorithm, which simulates the human brainstorming process. Through the convergent operation and divergent operation, individuals in BSO are grouped and diverged in the search space/objective space. In this talk, the development history, and the state-of-the-art of the BSO algorithm are reviewed. Every individual in the BSO algorithm is not only a solution to the problem to be optimized, but also a data point to reveal the landscape of the problem. Based on the survey of brain storm optimization algorithms, more analyses could be conducted to understand the function of BSO algorithm and more variants of BSO algorithms could be proposed to solve different problems.

The Brain Storm Optimization (BSO) algorithm is a new kind of swarm intelligence algorithm, which is based on the collective behaviour of human being, that is, the brainstorming process. There are two major operations involved in BSO, i.e., convergent operation and divergent operation. A “good enough” optimum could be obtained through recursive solution divergence and convergence in the search space. The designed optimization algorithm will naturally have the capability of both convergence and divergence.

BSO possess two kinds of functionalities: capability learning and capacity developing. The divergent operation corresponds to the capability learning while the convergent operation corresponds to capacity developing. The capacity developing focuses on moving the algorithm’s search to the area(s) where higher potential solutions may exist while the capability learning focuses on its actual search towards new solution(s) from the current solution for single point based optimization algorithms and from the current population of solutions for population-based swarm intelligence algorithms. The capability learning and capacity developing recyle to move individuals towards better and better solutions. The BSO algorithm, therefore, can also be called as a developmental brain storm optimization algorithm.

The capacity developing is a top-level learning or macro-level learning methodology. The capacity developing describes the learning ability of an algorithm to adaptively change its parameters, structures, and/or its learning potential according to the search states of the problem to be solved. In other words, the capacity developing is the search potential possessed by an algorithm. The capability learning is a bottom-level learning or micro-level learning. The capability learning describes the ability for an algorithm to find better solution(s) from current solution(s) with the learning capacity it possesses.

The BSO algorithm can also be seen as a combination of swarm intelligence and data mining techniques. Every individual in the brain storm optimization algorithm is not only a solution to the problem to be optimized, but also a data point to reveal the landscapes of the problem. The swarm intelligence and data mining techniques can be combined to produce benefits above and beyond what either method could achieve alone.

Theories and Models of Swarm Intelligence I/II
June 18, 2018(Monday) 13:00-14:40 Room B

Semi-markov Model of a Swarm Functioning
Eugene Larkin and Maxim Antonov

Abstract. The method of a physical swarm modeling, based on application of semi-Markov process theory to description of swarm unit cyclograms is worked out. It is shown, that ordinary semi-Markov processes with structural states are abstract analogue of units cyclograms. The method of gathering of ordinary semi-Markov processes into M-parallel process and further transformation of it into complex semi-Markov process with functional states is proposed. It is shown that functional states may

**Modeling and Verification Analysis of the Predator-Prey System via a Modal Logic Approach**

*Zvi Retchkiman*

**Abstract.** Consider the interaction of populations, in which there are exactly two species, one of which the predators eat the preys thereby affecting each other. In the study of this interaction Lotka-Volterra models have been used. Other non-classical methodologies as Petri nets and first order logic have been employed too. This paper proposes a formal modeling and verification analysis methodology, which consists in representing the interaction behavior by means of a modal logic formula. Then, using the concept of logic implication, and transforming this logical implication relation into a set of clauses, a modal resolution qualitative method for verification (satisfiability) as well as performance issues, for some queries is applied.

**The Access Model to Resources in Swarm System Based on Competitive Processes**

*Eugene Larkin, Alexey Ivutin, Alexander S. Novikov, Anna Troshina and Yulia Frantsuzova*

**Abstract.** The article describes the approach to evaluation of the results of “competitions” arising from the access of intellectual agents to resources in distributed swarm systems. A mathematical model of “competitions” based on Petri-Markov nets was developed. Expressions for calculation of time and probabilistic characteristics of “competitions” are defined. Methods of simulation modelling of the process of “competition” and experimental determination of time parameters are proposed. The obtained results can be used for planning information processes of swarm distributed system.

**An Enhanced Monarch Butterfly Optimization with Self-Adaptive Butterfly Adjusting and Crossover Operators**

*Gai-Ge Wang, Guo-Sheng Hao and Zhihua Cui*

**Abstract.** After studying the behavior of monarch butterflies in nature, Wang et al. proposed a new promising swarm intelligence algorithm, called monarch butterfly optimization (MBO), for addressing unconstrained optimization tasks. In the basic MBO algorithm, the fixed butterfly adjusting rate is used to carry out the butterfly adjusting operator. In this paper, the self-adaptive strategy is introduced to adjust the butterfly adjusting rate. In addition, the crossover operator that is generally used in evolutionary algorithms (EAs) is used to further improve the quality of butterfly individuals. The two optimization strategies, self-adaptive and crossover operator, are combined, and then self-adaptive crossover operator is proposed. After incorporating the above strategies into the basic MBO algorithm, a new version of MBO algorithm, called Self-adaptive Monarch Butterfly Optimization (SaMBO), is put forward. Also, few studies of constrained optimization has been done for MBO research. In this paper, in order to verify the performance of our proposed SaMBO algorithm, the proposed SaMBO algorithm is further benchmarked by 21 CEC 2017 constrained optimization problems. The experimental results indicate that the proposed SaMBO algorithm outperforms the basic MBO and other five state-of-the-art metaheuristic algorithms.

**On the Cooperation between Evolutionary Algorithms and Constraint Handling Techniques**

*Chengyong Si, Jianqiang Shen, Weian Guo and Lei Wang*

**Abstract.** During the past few decades, many Evolutionary Algorithms (EAs) together with the Constraint Handling Techniques (CHTs) have been developed to solve the constrained optimization problems (COPs). To obtain competitive performance, an effective CHT needs to be in conjunction with an efficient EA. In the previous paper, how the Differential Evolution influence the relationship between problems and penalty parameters was studied. In this paper, further study on how much can be improved through good evolutionary algorithms, or whether a good enough EA can make up the shortcoming of a simple CHT, and which factors are related will be the focus. Four different EAs are taken as an example, and Deb’s feasibility-based rule is taken as the CHT for its simplicity.
Experimental results show that better performance in EAs is not necessarily the reason for the improved performance of constrained optimization evolutionary algorithms (COEAs), and the key point is to find the shortcoming of the CHT and improve the shortcoming in the corresponding revision of EA.

Investigating the Effectiveness of Helpful Reviews and Reviewers in Hotel Industry

Yen Tzu Chao, Ping-Yu Hsu, Ming-Shien Cheng, Hong Tsuen Lei, Shih Hsiang Huang, Yen-Huei Ko, Grandys Frieska Prassida and Chen Wan Huang

Abstract. With the growth of e-commerce, online consumer reviews have become important attributes that influence purchasing decisions. Especially, hotel industry has strongly influenced by online reviews due that most tourists cannot experience all hotels personally and the service levels among hotels are very different. However, the flood of online consumer reviews has caused information overload, making it difficult for consumers to choose reliable reviews. Therefore, helpful remarks of hotel review should potentially have strong influence on users. Previous research focused on how to predict the helpful scores of reviews, but it has not explored the influence of reviews marked with helpfulness. The aim of this study is to investigate whether the helpful reviews and reviewers who contribute many reviews really have effects on the marks hotel received. With analysis of reviews contributed in TripAdvisor.com for three hundred hotels scattered in ten cities of U.S., this study found both reviewer contribution, and helpful review has a positive effect on marks of hotels. Moreover, the research also discovered that the helpfulness of reviews is negatively relates to the ratings. Also, the research found that the standard deviation of review mark is positively relates to hotel ranks.

Mapping the Landscapes, Hotspots and Trends of the Social Network Analysis Research from 1975 to 2017

Zeng Li, Zili Li, Zhao Zhao and Meixin Mao

Abstract. A Bibliometric analysis was applied in this paper to quantitatively evaluate the social network analysis research from 1975 to 2017 based on 7311 bibliographic records collected from the Science Citation Index (SCI) database. Firstly, a comprehensive analysis was conducted to reveal the current landscapes such as scientific outputs, international collaboration, subject categories, and research performances by individuals, we then use innovative methods such as Burst Detection, Referenced Publication Years Spectroscopy and Keyword Semantic Clustering to provide a dynamic view of the evolution of social network analysis research hotpots and trends from various perspectives. Results shows that social network analysis research has developed rapidly in the past four decades and is in the growth period with a maturity of 50.00%, the total of 7311 articles cover 120 countries (regions) and the top five most productive countries are USA, England, China, Canada and Germany. Among the 1181 major journal related to social network analysis, University of Illinois, University of Sydney and Carnegie Mellon University ranked as the top three. In addition burst keywords such as Knowledge Management, Centrality, Modularity, Community, Link Prediction, Learning Analytics and Big Data demonstrate the trends of this field. The result provides a dynamic view of the evolution of Social Network Analysis research landscapes, hotspots and trends from various perspectives which may serve as a potential guide for future research.

Investigating the Relationship between the Emotion of Blogs and the Price of Index Futures

Yen Hao Kao, Ping-Yu Hsu, Ming-Shien Cheng and Hong Tsuen Lei

Abstract. As the financial derivatives tradable market developed quickly in Taiwan, the trading volumes in futures grew quickly in recent years. At the same time, many people posted and shared opinion on social media. Many research in economics and behavioral finance have posited and confirmed that investor’s “mood” correlated with the performance of financial market. Several researches had devoted to study the relationship between the volatility of financial market and sentiments expressed in social media. On the other hand, even though emotion can describe the feeling of people more precisely than sentiment, to the best of our knowledge, only one research has tried to discover
the relationship between futures performance and emotion fluctuation. The research tracked the evolvement of specific events. Instead of tracking long-term emotional fluctuation, this study strived to predict price change of derivatives with emotion expressed in social media in previous day. The result confirmed that there was a significant correlation between the intensity of emotion “fear” and the market decline. When the major emotions were “good” and “sad”, the strength of emotion was significantly correlated with the change of the market price.

**A Novel Model for Finding Critical Products with Transaction Logs**

Ping Yu Hsu, Chen Wan Huang, Shih Hsiang Huang, Pei Chi Chen and Ming Shien Cheng

**Abstract.** For the consumer market, finding valuable customers is the first priority and is assumed to assist companies in obtaining more profit. If we could discover critical products that are related with valuable customers, then it will lead to better marketing strategy to fulfill those essential customers. It will also assist companies in business development. This study selects real retail transaction data via the recency, frequency, and monetary (RFM) analysis and adopts the K-means algorithm to obtain results. Moreover, the Apriori algorithm with minimum support and skewness criteria is used to filter and find critical products. In this research, we found a novel methodology through setting the minimum support and skewness criteria and utilized the Apriori algorithm to identify 31 single critical products and 60 critical combinations (two products). This study assist companies in finding critical products and important customers, which is expected to provide an appropriate customer marketing strategy.

**Investigating Deciding Factors of Product Recommendation in Social Media**

Jou Yu Chen, Ping-Yu Hsu, Ming-Shien Cheng, Hong Tsuen Lei, Shih Hsiang Huang, Yen-Huei Ko and Chen Wan Huang

**Abstract.** With the growing popularity of social media, the number of people using social media to communicate and interact with others has increased steadily. As a result, social commerce has become a new phenomenon. In the past, most of the product recommendations in microblogging only dealt with personal preferences and interests, and ignored other possible factors such as Crowd Interest, Popularity of Products, Reputation of Creators, Types of Preference and Recent. Nowadays, these variables used by Facebook to recommend posts to their users. Therefore, this research adapted those five aspects and analyzed their effectiveness to recommend products on social media. This study used the Plurk API to develop and implement recommended robots that recommend products at specific times of the day so that they can get product information and meet recommended tasks in the social circle. The empirical results showed that the Interest, Popularity and Type have significant impacts on recommendation effectiveness.

**Swarm-based Optimization Algorithms I/II**

June 18, 2018 (Monday) 14:50-16:10 Room A

**Brain Storm Optimization with Multi-Population Based Ensemble of Creating Operations**

Yuehong Sun, Ye Jin and Dan Wang

**Abstract.** Brain storm optimization (BSO) algorithm is a novel swarm intelligence algorithm. Inspired by differential evolution (DE) with multi-population based ensemble of mutation strategies (MPEDE), a new variant of BSO algorithm, called brain storm optimization with multi-population based ensemble of creating operations (MPEBSO), is proposed in this paper. There are three equally sized smaller indicator subpopulations and one much larger reward subpopulation. BSO algorithm is used to update individuals in every subpopulation. At first, each creating operation has one smaller indicator subpopulation, in which different mutation strategy is used to add noise instead of the Gaussian random strategy. After every certain number of generations, the larger reward subpopulation will be adaptively assigned to the best performing creating operation with more computational resources. The competitive performance of the proposed MPEBSO on CEC2005 benchmark functions is highlighted compared with DE, MPEDE, and other four variants of BSO.
A Novel Memetic Whale Optimization Algorithm for Optimization
Zhe Xu, Yang Yu, Hanaki Yachi, Junkai Ji, Yuki Todo and Shangce Gao

Abstract. Whale optimization algorithm (WOA) is a newly proposed search optimization technique which mimics the encircling prey and bubble-net attacking mechanisms of the whale. It has proven to be very competitive in comparison with other state-of-the-art metaheuristics. Nevertheless, the performance of WOA is limited by its monotonous search dynamics, i.e., only the encircling mechanism drives the search which mainly focus the exploration in the landscape. Thus, WOA lacks of the capacity of jumping out the of local optima. To address this problem, this paper propose a memetic whale optimization algorithm (MWOA) by incorporating a chaotic local search into WOA to enhance its exploitation ability. It is expected that MWOA can well balance the global exploration and local exploitation during the search process, thus achieving a better search performance. Forty eight benchmark functions are used to verify the efficiency of MWOA. Experimental results suggest that MWOA can perform better than its competitors in terms of the convergence speed and the solution accuracy.

Logistic Distribution Center Location Based on Improved Harmony Search Algorithm
Xiaobing Gan, Entao Jiang, Yingying Peng, Shuang Geng and Mijat Kustudic

Abstract. Logistics distribution center are important logistics nodes and the choice of locations are critical management decisions. This study addresses a logistics distribution center location problem that aims at determining the location and allocation of the distribution centers. Considering the characteristic and complexity of problem, we propose an improved harmony search algorithm, in which we employ a novel way of improvising new harmony. The improved algorithm is compared with genetic algorithm, particle swarm optimization, generalized particle swarm optimization, and classical harmony search algorithm in solving a simulated distribution center location problem. Experiment results show that the improved algorithm can solve the logistics distribution center problem with more stable convergence speed and higher accuracy.

Impact of Purchasing Power on User Rating Behavior and Purchasing Decision
Yong Wang, Xiaofei Xu, Jun He, Chao Chen and Ke Ren

Abstract. Recommender system have broad and powerful applications in e-commerce, news promotion and online education. As we all know, the user’s rating behavior is generally determined by subjective preferences and objective conditions. However, all the current studies are focused on subjective preferences, ignoring the role of the objective conditions of the user. The user purchasing power based on price is the key objective factor that affects the rating behavior and even purchasing decision. Users’ purchasing decisions are often affected by the purchasing power, and the current researches did not take into account the problem. Thus, in this paper, we consider the influence of user preferences and user purchasing power on rating behavior simultaneously. Then, we designed a reasonable top-N recommendation strategy based on the user’s rating and purchasing power. Experiments on Amazon product dataset show that our method has achieved better results in terms of accuracy, recall and coverage. With ever larger datasets, it is important to understand and harness the predictive purchasing power on the user’s rating behavior and purchasing decisions.

Theories and Models of Swarm Intelligence II/II
June 18, 2018(Monday) 14:50-16:30 Room B

Soft Island Model for Population-Based Optimization Algorithms
Shakhnaz Akhmedova, Vladimir Stanovov and Eugene Semenkin

Abstract. Population-based optimization algorithms adopt a regular network as topologies with one set of potential solutions, which may encounter the problem of premature convergence. In order to improve the performance of optimization techniques, this paper proposes a soft island model topology. The initial population is virtually separated into several subpopulations, and the connection
between individuals from subpopulations is probabilistic. The workability of the proposed model was demonstrated through its implementation to the Particle Swarm Optimization and Differential Evolution algorithms and their modifications. Experiments were conducted on benchmark functions taken from the CEC’2017 competition. The best parameters for the new topology adaptation mechanism were found. Results verify the effectiveness of the population-based algorithms with the proposed model when compared with the same algorithms without the model. It was established that by applying this topology adaptation mechanism, the population-based algorithms are able to balance their exploitation and exploration abilities during the search process.

A Smart Initialization on the Swarm Intelligence Based Method for Efficient Search of Optimal Minimum Energy Design

Tun-Chieh Hsu and Frederick Kin Hing Phoa

Abstract. Swarm intelligence is well-known to enjoy fast convergence towards optimum. Recently, the Swarm Intelligence Based (SIB) method was proposed to deal with discrete optimization problems in mathematics and statistics. Whether it was the traditional framework or the augmented version, the initialization of the particles were always done randomly. In this work, we introduced a smart initialization procedure to improve the computational efficiency of the SIB method. We demonstrated the use of the SIB method, initialized by both the uniform pool (standard procedure) and the MCMC pool (smart initialization), on the search of optimal minimum energy designs, which were a new class of designs for computer experiments that considered uneven or functional gradients on the search domain. We compared two initialization approaches and showed that the SIB method with smart initialization could save much experimental resources and obtain better optimal solutions within equivalent number of iterations or time.

Multiple Swarm Relay-Races with Alternative Routes

Eugene Larkin, Vladislav Kotov, Aleksandr Privalov and Alexey Bogomolov

Abstract. Competition of swarms, every of which performs a conveyor cooperation of units, operated in physical time, is considered. Such sort of races objectively exists in economics, industry, defense, etc. It is shown, that natural approach to modeling of multiple relay-race with alternative routes is M-parallel semi-Markov process. Due to alternation there are multiple arks in the graph, represented the structure of semi-Markov process. Notion “the space of switches” is introduced. Formulae for calculation the number of routes in the space of switches, stochastic and time characteristics of wandering through M-parallel semi-Markov process are obtained. Conception of distributed forfeit, which depends on stages difference of swarm units, competed in pairs, is proposed. Dependence for evaluation of total forfeit of every participant is obtained. It is shown, that sum of forfeit may be used as optimization criterion in the game strategy optimization task.

Adaptive Variable-size Random Grouping for Evolutionary Large-Scale Global Optimization

Evgenii Sopov

Abstract. In recent years many real-world optimization problems have had to deal with growing dimensionality. Optimization problems with many hundreds or thousands of variables are called large-scale global optimization (LSGO) problems. Many well-known real-world LSGO problems are not separable and are complex for detailed analysis, thus they are viewed as the black-box optimization problems. The most advanced algorithms for LSGO are based on cooperative coevolution with problem decomposition using grouping methods, which form low-dimensional non-overlapping subcomponents of a high-dimensional objective vector. The standard random grouping can be applied to the wide range of separable and non-separable LSGO problems, but it does not use any feedback from the search process for creating more efficient variables combinations. Many learning-based dynamic grouping methods are able to identify interacting variables and to group them into the same subcomponent. At the same time, the majority of the proposed learning-based methods demonstrate greedy search and perform well only with separable problems. In this study, we proposed a new adaptive random grouping approach that create and adaptively change a probability distribution for assigning variables to subcomponents. The approach is able to form subcomponents of different size or can be used with predefined fix-sized subcomponents. The results of numerical experiments for benchmark problems are presented and discussed. The experiments show that the proposed approach outperforms the standard
random grouping method.

On Island Model Performance for Cooperative Real-Valued Multi-Objective Genetic Algorithms
Christina Brester, Ivan Ryzhikov, Eugene Semenkin and Mikko Kolehmainen

Abstract. Solving a multi-objective optimization problem results in a Pareto front approximation, and it differs from single-objective optimization, requiring specific search strategies. These strategies, mostly fitness assignment, are designed to find a set of non-dominated solutions, but different approaches use various schemes to achieve this goal. In many cases, cooperative algorithms such as island model-based algorithms outperform each particular algorithm included in this cooperation. However, we should note that there are some control parameters of the islands' interaction and, in this paper, we investigate how they affect the performance of the cooperative algorithm. We consider the influence of a migration set size and its interval, the number of islands and two types of cooperation: homogeneous or heterogeneous. In this study, we use the real-valued evolutionary algorithms SPEA2, NSGA-II, and PICEA-g as islands in the cooperation. The performance of the presented algorithms is compared with the performance of other approaches on a set of benchmark multi-objective optimization problems.

Multi-Agent Systems and Swarm Robotics I/III
June 18, 2018(Monday) 14:50-16:10 Room C

Path Following of Autonomous Agents under the Effect of Noise
Krishna Sami Raghwaiya, Bibhya Nand Sharma, Jito Vanualailai and Parma Nand

Abstract. In this paper, we adopt the architecture of the Lyapunov-based Control Scheme (LbCS) and integrate a leader-follower approach to propose a collision-free path following strategy of a group of mobile car-like robots. A robot is assigned the responsibility of a leader, while the follower robots position themselves relative to the leader so that the path of the leader robot is followed with arbitrary desired clearance by the follower robot, avoiding any inter-robot collision while navigating in a terrain with obstacles under the influence of noise. A set of artificial potential field functions is proposed using the control scheme for the avoidance of obstacles and attraction to their designated targets. The effectiveness of the proposed nonlinear acceleration control laws is demonstrated through computer simulations which prove the efficiency of the control technique and also demonstrates its scalability for larger groups.

Development of Adaptive Force-Following Impedance Control for Interactive Robot
Huang Jianbin, Li Zhi and Liu Hong

Abstract. This paper presented a safety approach for the interactive manipulator. At first, the basic compliance control of the manipulator is realized by using the Cartesian impedance control, which inter-related the external force and the end position. In this way, the manipulator could work as an external force sensor. A novel force-limited trajectory was then generated in a high dynamics interactive manner, keeping the interaction force within acceptable tolerance. The proposed approach also proved that the manipulator was able to contact the environment compliantly, and reduce the instantaneous impact when collision occurs. Furthermore, adaptive dynamics joint controller was extended to all the joints for complementing the biggish friction. Experiments were performed on a 5-DOF flexible joint manipulator. The experiment results of taping the obstacle, illustrate that the interactive robot could keep the desired path precisely in free space, and follow the demand force in good condition.

A Real-Time Multiagent Strategy Learning Environment and Experimental Framework
Hongda Zhang, Decai Li, Liying Yang, Feng Gu and Yuying He

Abstract. Many problems in the real world can be attributed to the problem of multiagent. The study on the issue of multiagent is of great significance to solve these social problems. This paper reviews the research on multiagent based real-time strategy game environments, and introduces the
multiagent learning environment and related resources. We choose a deep learning environment based on the StarCraft game as a research environment for multiagent collaboration and decision-making, and form a research mentality focusing mainly on reinforcement learning. On this basis, we design a verification platform for the related theoretical research results and finally form a set of multiagent research system from the theoretical method to the actual platform verification. Our research system has reference value for multiagent related research.

Learning based Target Following Control of Underwater Vehicles
Hai Huang, Zhou Hao, Mingwei Sheng, Zhaoliang Wan and Ze-Xing Zhou

Abstract. Target following of underwater vehicles has attracted increasingly attentions on their potential applications in oceanic resources exploration and engineering development. However, underwater vehicles confront with more complicated and extensive difficulties in target following than those on the land. This study proposes a novel learning based target following control approach through the integration of type-II fuzzy system and support vector machine (SVM). The type-II fuzzy system allows researchers to model and minimize the effects of uncertainties of changing environment in the rule-based systems. In order to improve the vehicle capacity of self-learning, an SVM based learning approach has been developed. Through genetic algorithm generating and mutating fuzzy rules candidate, SVM learning and optimization, one can obtain optimized fuzzy rules. Tank experiments have been performed to verify the proposed controller.

Optimization of steering linkage including the effect of McPherson strut front suspension
Suwin Sleesongsom and Sujin Bureerat

Abstract. This paper proposes to optimise the steering linkage including an effect of McPherson strut front suspension. Usually, the suspension is exerted with an impact force due to uneven road, which dynamically changes to performance of a steering linkage. The present work proposes to study an effect of suspension to performance of steering mechanism with comparative study of steering mechanism with and without suspension system, which is included in optimization problem. The performance is minimised in both turning radius and steering error, that is called multi-objective optimisation problems. The model of McPherson strut front suspension is simplified model but it is sufficient accuracy. The results show that the suspension is an important effect on the optimisation design and the optimisation results show that the design concept leads to effective design of rack and pinion steering linkages satisfying both steering error and turning radius criteria.

Multi-scale quantum harmonic oscillator algorithm with individual stabilization strategy
Peng Wang, Bo Li, Jin Jin, Lei Mu, Gang Xin, Yan Huang and Xinggui Ye

Abstract. Multi-scale quantum harmonic oscillator algorithm (MQHOA) is a novel global optimization algorithm inspired by wave function of quantum mechanics. In this paper, a MQHOA with individual stabilization strategy (IS-MQHOA) is proposed utilizing the individual steady criterion instead of the group statistics. The proposed strategy is more rigorous for the particles in the energy level stabilization process. A more efficient search takes place in the search space made by the particles and improves the exploration ability and the robustness of the algorithm. To verify its performance, numerical experiments are conducted to compare the proposed algorithm with the state-of-the-art SPSO2011 and QPSO. The experimental results show the superiority of the proposed approach on benchmark functions.

Improved Differential Evolution Based on Mutation Strategies
John Saveca, Zenghui Wang and Yanxia Sun

Abstract. Differential Evolution (DE) has been regarded as one of the excellent optimization algorithm in the science, computing and engineering field since its introduction by Storm and Price
in 1995. Robustness, simplicity and easiness to implement are the key factors for DE's success in optimization of engineering problems. However, DE experiences convergence and stagnation problems. This paper focuses on DE convergence speed improvement based on introduction of newly developed mutation schemes strategies with reference to DE/rand/1 on account and tuning of control parameters. Simulations are conducted using benchmark functions such as Rastrigin, Ackley and Sphere, Griewank and Schwefel function. The results are tabled in order to compare the improved DE with the traditional DE.

A Deep Prediction Architecture for Traffic Flow with Precipitation Information

Jingyuan Wang, Xiaofei Xu, Feishuang Wang, Chao Chen and Ke Ren

Abstract. Traffic flow prediction is an important building block to enabling intelligent transportation systems in a smart city. An accurate prediction model can help the governors make reliable traffic control strategies. In this paper, we propose a deep traffic flow prediction architecture P-DBL, which takes advantage of a deep bi-directional long short-term memory (DBL) model and precipitation information. The proposed model is able to capture the deep features of traffic flow and take full advantage of time-aware traffic flow data and additional precipitation data. We evaluate the prediction architecture on the dataset from Caltrans Performance Measurement System (PeMS) and the precipitation dataset from California Data Exchange Center (CDEC). The experiment results demonstrate that the proposed model for traffic flow prediction obtains high accuracy compared with other models.

Hybrid Optimization Algorithms
June 18, 2018(Monday) 16:40-18:00 Room B

A Hybrid Evolutionary Algorithm for Combined Road-Rail Emergency Transportation Planning
Zhongyu Rong, Min-Xia Zhang, Yi-Chen Du and Yu-Jun Zheng

Abstract. As one of the most critical components in disaster relief operations, emergency transportation planning often involves huge amount of relief goods, complex hybrid transportation networks, and complex constraints. In this paper, we present a new emergency transportation planning model which combines rail and road transportation and supports transfer between the two modes. For solving the problem, we propose a novel hybrid algorithm that integrates two meta-heuristics, water wave optimization (WWO) and particle swarm optimization (PSO), whose operators are elaborately adapted to effectively balance the exploration and exploitation of the search space. Experimental results show that the performance of our method is better than a number of well-known heuristic algorithms on test instances.

A Fast Hybrid Meta-heuristic Algorithm for Economic/Environment Unit Commitment with Renewables and Plug-in Electric Vehicles
Zhile Yang, Qun Niu, Yuanjun Guo, Haiping Ma and Boyang Qu

Abstract. To tackle with the urgent scenario of significant green house gas and air pollution emissions, it is pressing for modern power system operators to consider environmental issues in conventional economic based power system scheduling. Likewise, renewable generations and plug-in electric vehicles are both leading contributors in reducing the emission cost, however their integrations into the power grid remain to be a remarkable challenging issue. In this paper, a dual-objective economic/emission unit commitment problem is modelled considering the renewable generations and plug-in electric vehicles. A novel fast hybrid meta-heuristic algorithm is proposed combing a binary teaching-learning based optimization and the self-adaptive differential evolution for solving the proposed mix-integer problem. Numerical studies illustrate the competitive performance of the proposed method, and the economic and environmental cost have both been remarkably reduced.
A Hybrid Differential Evolution Algorithm and Particle Swarm Optimization with Alternative Replication Strategy

Lulu Zuo, Lei Liu, Hong Wang and Lijing Tan

Abstract. A new hybrid algorithm, combining Particle Swarm Optimization (PSO) and Differential Evolution (DE), is presented in this paper. In the proposed algorithm, an alternative replication strategy is introduced to avoid the individuals falling into the suboptimal. There are two groups at the initial process. One is generated by the position updating method of PSO, and the other is produced by the mutation strategy of DE. Based on the alternative replication strategy, those two groups are updated. The poorer half of the population is selected and replaced by the better half. A new group is composed and conducted throughout the optimization process of DE to improve the population diversity. Additionally, the scaling factor is used to enhance the search ability. Numerous simulations on eight benchmark functions show the superior performance of the proposed algorithm.

A Hyper-Heuristic of Artificial Bee Colony and Simulated Annealing for Optimal Wind Turbine Placement

Peng-Yeng Yin and Geng-Shi Li

Abstract. The ascending of quantity of CO2 emissions is the main factor contributing the global warming which results in extremely abnormal weather and causes disaster damages. Due to intensive CO2 pollutants produced by classic energy sources such as fossil fuels, practitioners and researchers pay increasing attentions on the renewable energy production such as wind power. Optimal wind turbine placement problem is to find the optimal number and placement location of wind turbines in a wind farm against the wake effect. The efficiency of wind power production does not necessarily grows with an increasing number of installed wind turbines. This paper presents a hyper-heuristic framework combining several lower-level heuristics with an artificial bee colony algorithm and a simulated annealing technique to construct an optimal wind turbine placement considering wake effect influence. Finally, we compare our approach with existing works in the literature. The experimental results show that our approach produces the wind power with a lower cost of energy.

GLANS: GIS based Large-scale Autonomous Navigation System

Manhui Sun, Shaowu Yang and Hengzhu Liu

Abstract. The simultaneous localization and mapping (SLAM) systems are widely used for self-localization of a robot, which is the basis of autonomous navigation. However, the state-of-art SLAM systems cannot suffice when navigating in large-scale environments due to memory limit and localization errors. In this paper, we propose a Geographic Information System (GIS) based autonomous navigation system (GLANS). In GLANS, a topological path is suggested by GIS database and a robot can move accordingly while being able to detect the obstacles and adjust the path. Moreover, the mapping results can be shared among multi-robots to re-localize a robot in the same area without GPS assistance. It has been proved functioning well in the simulation environment of a campus scenario.

Optimal Shape Design of an Autonomous Underwater Vehicle Based on Gene Expression Programming

Qirong Tang, Yinghao Li, Zhenqiang Deng, Di Chen, Ruqin Guo and Hai Huang

Abstract. A novel strategy combining gene expression programming and crowding distance based multi-objective particle swarm algorithm is presented in this paper to optimize an underwater robot’s shape. The gene expression programming method is used to establish the surrogate model of resistance and surrounded volume of the robot. After that, the resistance and surrounded volume are set as two optimized factors and Pareto optimal solutions are then obtained by using multi-objective particle swarm optimization. Finally, results are compared with the hydrodynamic calculations. Result shows the efficiency of the method proposed in the paper in the optimal shape design of an underwater robot.
A Space Tendon-driven Continuum Robot
Shineng Geng, Youyu Wang, Cong Wang and Rongjie Kang

Abstract. In order to avoid the collision of space manipulation, a space continuum robot with passive structural flexibility is proposed. This robot is composed of two continuum joints with elastic backbone and driving tendons made of NiTi alloy. The kinematic mapping and the Jacobian matrix are obtained through the kinematic analysis. Moreover, an inverse kinematics based closed-loop controller is designed to achieve position tracking. Finally, a simulation and an experiment is carried out to validate the workspace and control algorithm respectively. The results show that this robot can follow a given trajectory with satisfactory accuracy.

Transaction Flows in Multi-Agent Swarm Systems
Eugene Larkin, Alexey Ivutin, Alexander S. Novikov and Anna Troshina

Abstract. The article presents a mathematical model of transaction flows between individual intelligent agents in swarm systems. Assuming that transaction flows are Poisson ones, the approach is proposed to the analytical modeling of such systems. Methods for estimating the degree of approximation of real transaction flows to Poisson flows based on Pearson’s criterion, regression, correlation and parametric criteria are proposed. Estimates of the computational complexity of determining the parameters of transaction flows by using the specified criteria are shown. The new criterion based on waiting functions is proposed, which allows obtaining a good degree of approximation of an investigated flow to Poisson flow with minimal costs of computing resources. That allows optimizing the information exchange processes between individual units of swarm intelligent systems.

Planning and Routing Problems
June 19, 2018(Tuesday) 08:00-09:40 Room A

Using FAHP-VIKOR for Operation Selection in the Flexible Job-Shop Scheduling Problem: A Case Study in Textile Industry
Miguel Angel Ortiz Barrios, Dionicio Neira Rodado, Genett Jimenez and Hugo Hernandez Palma

Abstract. Scheduling of Flexible Job Shop Systems is a combinatorial problem which has been addressed by several heuristics and meta-heuristics. Nevertheless, the operation selection rules of both methods are limited to an ordered variant wherein priority-dispatching rules are not simultaneously deemed in the reported literature. Therefore, this paper presents the application of dispatching algorithm with operation selection based on Fuzzy Analytic Hierarchy Process (FAHP) and VIKOR methods while considering setup times and transfer batches. Dispatching, FAHP, and VIKOR algorithms are first defined. Second, a multi-criteria decision-making model is designed for operation prioritization. Then, FAHP is applied to calculate the criteria weights and overcome the uncertainty of human judgments. Afterwards, VIKOR is used to select the operation with the highest priority. A case study in the textile industry is shown to validate this approach. The results evidenced, compared to the company solution, a reduction of 61.05% in average delay.

A Solution Framework based on Packet Scheduling and Dispatching Rule for Job-based Scheduling Problems
Rongrong Zhou, Hui Lu and Jinhua Shi

Abstract. Job-based scheduling problems have inherent similarities and relations. However, the current researches on these scheduling problems are isolated and lack references. We propose a unified solution framework containing two innovative strategies: the packet scheduling strategy and the greedy dispatching rule. It can increase the diversity of solutions and help in solving the problems with large solution space effectively. In addition, we propose an improved particle swarm optimization (PSO) algorithm with a variable neighborhood local search mechanism and a perturbation strategy. We apply the solution framework combined with the improved PSO to the benchmark instances of different job-based scheduling problems. Our method provides a self-adaptive technique for various job-based scheduling problems, which can promote mutual learning between different areas and provide guidance for practical applications.
A Two-stage Heuristic Approach for a Type of Rotation Assignment Problem
Ziran Zheng and Xiaoju Gong

Abstract. A two-stage heuristic algorithm is proposed for solving a trainee rotation assignment problem in a local school of nursing and its training hospital. At the first stage, the model is reduced to a simplified assignment problem and solved using a random search procedure. At the second stage, a problem-specific operator is designed and employed with a hill climber to further improve solutions. We benchmark our algorithm with instances generated based on the real-life rules. Results show that the proposed algorithm yields high-quality solutions in less computation time for large scale instances when compared with integer linear programming formulation using the commercial solver Cplex.

An Improved Blind Optimization Algorithm for Hardware/Software Partitioning and Scheduling
Xin Zhao, Tao Zhang, Xinqi An and Long Fan

Abstract. Hardware/software partitioning is an important part in the development of complex embedded system. Blind optimization algorithms are suitable to solve the problem when it is combined with task scheduling. To get hardware/software partitioning algorithms with higher performance, this paper improves Shuffled Frog Leaping Algorithm-Earliest Time First (SFLA-ETF) which is a blind optimization algorithm. Under the supervision of the aggregation factor, the improved algorithm named Supervised SFLA-ETF (SSFLA-ETF) used two steps to better balance exploration and exploitation. Experimental results show that compared with SFLA-ETF and other swarm intelligence algorithms, SSFLA-ETF has stronger optimization ability.

Interactive Multi-model Target Maneuver Tracking Method Based on the Adaptive Probability Correction
Jiadong Ren, Xiaotong Zhang, Jiandang Sun and Qingshuang Zeng

Abstract. Non-cooperative target tracking is a key technology for complex space missions such as on-orbit service. To improve the tracking performance during the unknown maneuvering phase of the target, two methods including the IMM(interactive multi-model) algorithm based on extended CW equation and the variable IMM algorithm based on CW and extended CW equation are presented. The analysis and simulation results show that the higher the maneuvering index of the target is, the more obvious the advantages of the classical augmented IMM method are. However, the variable dimension IMM method has consistent performance for all the maneuver index interval of the target, and it is relatively suitable for engineering applications due to the lower complexity of algorithm.

Multi-objective Optimization
June 19, 2018(Tuesday) 08:00-09:40 Room B

A Decomposition-based Multiobjective Evolutionary Algorithm for Sparse Reconstruction
Jiang Zhu, Muyao Cai, Shujuan Tian, Yanbing Xu and Tingrui Pei

Abstract. Sparse reconstruction is an important method aiming at obtaining an approximation to an original signal from observed data. It can be deemed as a multiobjective optimization problem for the sparsity and the observational error terms, which are considered as two conflicting objectives in evolutionary algorithm. In this paper, a novel decomposition based multiobjective evolutionary algorithm is proposed to optimize the two objectives and reconstruct the original signal more exactly. In our algorithm, a sparse constraint specific differential evolution is designed to guarantee that the solution remains sparse in the next generation. In addition, a neighborhood-based local search approach is proposed to obtain better solutions and improve the speed of convergence. Therefore, a set of solutions is obtained efficiently and is able to closely approximate the original signal.
A Novel Many-objective Bacterial Foraging Optimizer Based on Multi-engine Cooperation Framework

Shengminjie Chen, Rui Wang, Lianbo Ma, Zhao Gu, Xiaofan Du and Yichuan Shao

Abstract. In order to efficiently manage the diversity and convergence in many-objective optimization, this paper proposes a novel multi-engine cooperation bacterial foraging algorithm (MCBFA) to enhance the selection pressure towards Pareto front. The main framework of MCBFA is to handle the convergence and diversity separately by evolving several search engines with different rules. In this algorithm, three engines are respectively endowed with three different evolution principles (i.e., Pareto-based, decomposition-based and indicator-based), and their archives are evolved according to comprehensive learning. In the foraging operations, each bacterium is evolved by reinforcement learning (RL). Specifically, each bacterium adaptively varies its own run-length unit and exchange information to dynamically balance exploration and exploitation during the search process. Empirical studies on DTLZ benchmarks show MCBFA exhibits promising performance on complex many-objective problems.

An Improved Bacteria Foraging Optimization Algorithm for High Dimensional Multi-objective Optimization Problems

Yueliang Lu and Qingjian Ni

Abstract. In this paper, an improved bacterial foraging optimization algorithm (BFO), which is inspired by the foraging and chemotactic phenomenon of bacteria, named high dimensional multi-objective bacterial foraging optimization (HMBFO) is introduced for solving high dimensional multi-objective optimization (MO) problems. The high-dimension update strategy is presented in this paper to solve the problem that the global Pareto solutions can be hardly obtained by traditional MBFO in high-dimension MO problems. According to this strategy, the position of bacteria not only can be rapidly updated to the optimal solution, but also can enhance the searching precision and reduce chemotaxis dependency remarkably. Moreover, the penalty mechanism is considered for solving the inequality constraints MO problems, and three different performance metrics (Hypervolume, Convergence metric, Spacing metric) are introduced to evaluate the performances of algorithms. Compared with the other four evolutionary MO algorithms (MBFO, MOCLPSO, MOPSO, PESA2), the simulation result shows that in most cases, the proposed algorithm carries out better than the other existing algorithms, it has high efficiency, rapid speed of convergence and strong search capability of global Pareto solutions.

A Self-Organizing Multi-Objective Particle Swarm Optimization Algorithm for Multimodal Multi-Objective Problems

Jing Liang, Qianqian Guo, Caitong Yue, Boyang Qu and Kunjie Yu

Abstract. To solve the multimodal multi-objective optimization problems which may have two or more Pareto-optimal solutions with the same fitness value, a new multi-objective particle swarm optimizer with a self-organizing mechanism (SMPSO-MM) is proposed in this paper. First, the self-organizing map network is used to find the distribution structure of the population and build the neighborhood in the decision space. Second, the leaders are selected from the corresponding neighborhood. Meanwhile, the elite learning strategy is adopted to avoid premature convergence. Third, a non-dominated-sort method with special crowding distance is adopted to update the external archive. With the help of self-organizing mechanism, the solutions which are similar to each other can be mapped into the same neighborhood. In addition, the special crowding distance enables the algorithm to maintain multiple solutions in the decision space which may be very close in the objective space. SMPSO-MM is compared with other four multi-objective optimization algorithms. The experimental results show that the proposed algorithm is superior to the other four algorithms.

A Decomposition based Evolutionary Algorithm with Angle Penalty Selection Strategy for MaOPs

Zhiyong Li, Ke Lin, Mourad Nouioua and Jiang Shilong

Abstract. Evolutionary algorithms (EAs) based on decomposition have shown to be promising in solving many-objective optimization problems (MaOPs). The population (or objective space) is divided into K subpopulations (or subregions) by a group of uniform distribution reference vectors and each subpopulation evolves independently in parallel. But the solutions located around the
boundary of the subregion are often very dense solutions. The maintenance of population diversity is of great importance and challenging. In this paper, we propose a decomposition based evolutionary algorithm with angle penalty selection strategy for MaOPs (MOEA-APS). In our proposed angle penalty selection strategy (APS), the angle similarity \( AS \) for any two solutions is defined. Once a good solution \( x \) is selected for a sub population, the solutions whose angle similarity with \( x \) exceeding \( \eta \) or pareto dominated by \( x \) will be punished. Therefore, the dense solutions are effectively prevented from entering the next generation of population simultaneously that will greatly improve the diversity of the population. Our experimental results on DTLZ benchmark test problems show that the proposed algorithm is competitive in comparison with four state-of-the-art EAs for MaOPs.

### Multi-Agent Systems and Swarm Robotics III/III

**Event-Triggered Communication Mechanism for Distributed Flocking Control of Nonholonomic Multi-agent System**

*Weiwei Xun, Wei Yi, Xi Liu, Xiaodong Yi and Yanzhen Wang*

**Abstract.** As the scale of multi-agent systems (MAS) increases, communication becomes a bottleneck. In this paper, we propose an event-triggered mechanism to reduce the inter-agent communication cost for the distributed control of MAS. Communication of an agent with others only occurs when event triggering condition (ETC) is met. In the absence of communication, other agents adopt an estimation process to acquire the required information about the agent. Each agent has an above estimation process for itself and another estimation based on Kalman Filter, the latter can represent its actual state considering the measurement value and error from sensors. The error between the two estimators indicates whether the estimator in other agents can maintain a relatively accurate state estimation for this agent, and decides whether the communication is triggered. Simulations demonstrate the effectiveness and advantages of the proposed method for the distributed control of flocking in both Matlab and Gazebo.

**Deep Regression Models for Local Interaction in Multi-Agent Robot Tasks**

*Fredy Martinez, Cristian Penagos and Luis Pacheco*

**Abstract.** A direct data-driven path planner for small autonomous robots is a desirable feature of robot swarms that would allow each agent of the system to directly produce control actions from sensor readings. This feature allows to bring the artificial system closer to its biological model, and facilitates the programming of tasks at the swarm system level. To develop this feature it is necessary to generate behavior models for different possible events during navigation. In this paper we propose to develop these models using deep regression. In accordance with the dependence of distance on obstacles in the environment along the sensor array, we propose the use of a recurrent neural network. The models are developed for different types of obstacles, free spaces and other robots. The scheme was successfully tested by simulation and on real robots for simple grouping tasks in unknown environments.

**Multi-Drone Framework for Cooperative Deployment of Dynamic Wireless Sensor Networks**

*Jon-Vegard Sorli and Olaf Hallan Graven*

**Abstract.** A system implementing a proposed framework for using multiple-cooperating-drones in the deployment of a dynamic sensor network is completed and preliminary tests performed. The main components of the system are implemented using a genetic strategy to create the main elements of the framework. These elements are sensor network topology, a multi objective genetic algorithm for path planning, and a cooperative coevolving genetic strategy for solving the optimal cooperation problem between drones. The framework allows for mission re-planning with changes to drone fleet status and environmental changes as a part of making a fully autonomous system of drones.

**Distributed Decision Making and Control for Cooperative Transportation Using Mobile Robots**

*Henrik Ebel and Peter Eberhard*
Abstract. This paper introduces a distributed control scheme tailor-made to the task of letting a swarm of mobile robots push an object through a planar environment. Crucially, there is no centralized control instance or inter-robot hierarchy, and therefore, all decisions are made in a distributed manner. For being able to cooperate, the robots communicate, although the communication sampling time may be several times longer than the control sampling time. Most characteristic for the approach, distributed model predictive controllers are used to achieve a smooth transportation performance with the predicted control errors utilized to plan a suitable object trajectory. Challenging simulation scenarios show the applicability of the approach to the transportation task.

Deep-Sarsa based Multi-UAV Path Planning and Obstacle Avoidance in a Dynamic Environment
Wei Luo, Qirong Tang, Changhong Fu and Peter Eberhard

Abstract. This study presents a Deep-Sarsa based path planning and obstacle avoidance method for unmanned aerial vehicles (UAVs). Deep-Sarsa is an on-policy reinforcement learning approach, which gains information and rewards from the environment and helps UAV to avoid moving obstacles as well as finds a path to a target based on a deep neural network. It has a significant advantage over dynamic environment compared to other algorithms. In this paper, a Deep-Sarsa model is trained in a grid environment and then deployed in an environment in ROS-Gazebo for UAVs. The experimental results show that the trained Deep-Sarsa model can guide the UAVs to the target without any collisions. This is the first time that Deep-Sarsa has been developed to achieve autonomous path planning and obstacle avoidance of UAVs in a dynamic environment.

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Genetic Algorithms and Ant Colony Optimization
June 19, 2018(Tuesday) 09:50-11:30 Room A

Solving Vehicle Routing Problem Through a Tabu Bee Colony-Based Genetic Algorithm
Lingyan Lv, Yuxin Liu, Chao Gao, Jianjun Chen and Zili Zhang

Abstract. Vehicle routing problem (VRP) is a classic combinatorial optimization problem and has many applications in industry. Solutions of VRP have significant impact on logistic cost. In most VRP models, the shortest distance is used as the objective function, which is not the case in many real-word applications. To this end, a VRP model with fixed and fuel cost is proposed. Genetic algorithm (GA) is a common approach for solving VRP. Due to the premature issue in GA, a tabu bee colony-based GA is employed to solve this model. The improved GA has three characteristics that differentiate from other similar algorithms: (1) The maximum preserved crossover is proposed, to protect the outstanding sub-path and avoid the phenomenon that two identical individuals cannot create new individuals; (2) The bee evolution mechanism is introduced. The optimal solution is selected as the queen-bee and a number of outstanding individuals are as the drones. The utilization of excellent individual characteristics is improved through the crossover of queen-bee and drones; (3) The tabu search is applied to optimize the queen-bee in each generation of bees and improve the quality of excellent individuals. Thus the population quality is improved. Extensive experiments were conducted. The experimental results show the rationality of the model and the validity of the proposed algorithm.

Generation of Walking Motions for the Biped Ascending Slopes Based on Genetic Algorithm
Lulu Gong, Ruowei Zhao, Jinye Liang, Lei Li, Ming Zhu, Ying Xu, Xiaolu Tai, Xinchen Qiu, Haiyan He, Fangfei Guo, Jindong Yao, Zhihong Chen and Chao Zhang

Abstract. This study aims to generate the optimal trajectories for the biped walking up sloping surfaces after ensuring the minimum energy consumption by using genetic algorithm (GA) and motion / force control scheme. During optimization, the step length, the maximum height of swing foot and walking speed were optimized with the seven-link biped model. The impactless bipedal walking were investigated for walking on the ground level and slopes with different gradients, respectively. The results showed that the biped consumed more energy when the optimal walking speed increased for walking on the same slopes. There were no great differences in optimal step length when the biped
changed the walking speed. The results showed that the proposed approach is able to generate optimal gaits for the biped simply by changing boundary conditions with GA.

**On the Application of a Modified Ant Algorithm to Optimize the Structure of a Multiversion Software Package**

*Mikhail Saramud, Igor Kovalev, Vasiliy Losev, Margarita Karaseva and Dmitry Kovalev*

**Abstract.** The article considers the possibility of applying an optimization algorithm based on the behavior of an ant colony to the problem of forming a multiversion fault-tolerant software package. The necessary modifications of the basic algorithm and a model of graph construction for the implementation of the ant algorithm for the chosen problem are proposed. The optimization takes into account such features as cost, reliability and evaluation of the successful implementation of each version with the specified characteristics. A certain combination of versions in each module affects the characteristics of the module, and each characteristic of the module affects the characteristics of the system, so it is important to choose the optimal structure for each module to ensure the required characteristics of the system as a whole. The program system that implements the proposed algorithm is considered. The simulation results obtained with the help of the proposed software tool are considered. The results confirm the applicability of the ant algorithms to the problem of forming a multiversion software package, and they show their effectiveness.

**ACO Based Core-Attachment Method to Detect Protein Complexes in Dynamic PPI Networks**

*Jing Liang, Xiujuan Lei, Ling Guo and Ying Tan*

**Abstract.** Proteins complexes accomplish biological functions such as transcription of DNA and translation of mRNA. Detecting protein complexes correctly and efficiently is becoming a challenging task. This paper presents a novel algorithm, core-attachment based on ant colony optimization (CA-ACO), which detects complexes in three stages. Firstly, initialize the similarity matrix. Secondly, complexes are predicted by clustering in the dynamic PPI networks. In the step, the clustering coefficient of every node is also computed. A node whose clustering coefficient is greater than the threshold is added to the core protein set. Then we mark every neighbor node of core proteins with unique core label during picking and dropping. Thirdly, filtering processes are carried out to obtain the final complex set. Experimental results show that CA-ACO algorithm had great superiority in precision, recall and f-measure compared with the state-of-the-art methods such as ClusterONE, DPclus, MCODE and so on.

**Information-Centric Networking Routing Challenges and Bio/ACO-inspired Solution: A Review**

*Qingyi Zhang, Xingwei Wang, Min Huang and Jianhui Lv*

**Abstract.** Information-Centric Networking (ICN) aims to distribute and retrieve the content by name. In this paper, we review and approve the feasible Ant Colony Optimization (ACO)-inspired ICN routing solutions, i.e., applying ACO to solve ICN routing problem. At first, some significant challenges with respect to ICN routing are analyzed, such as explosive increasing of Forwarding Information Base (FIB), retrieval of closest content copy, uniform distribution of content and mobility support. Then, the solutions inspired by biology feature and behavior is reviewed. In addition, a general design thought of ACO-inspired solution is presented. Finally, the feasibility of ACO-inspired ICN routing solution is evaluated.

**Fuzzy Logic Approaches and Hydrologic Cycle Optimization**

*June 19, 2018(Tuesday) 09:50-11:30 Room B*

**Fuzzy Logic Applied to the Performance Evaluation. Honduran Coffee Sector Case**

*Omar Duque, Ameloc Viloria, Noel Varela Izquierdo, Omar Bonerge Pineda Lezama, Rafael Gomez Dorta, Ivan Deras and Lissette Hernandez-Fernandez*

**Abstract.** Every day organizations pay more attention to Human Resources Management, because
this human factor is preponderant in the results of it. An important policy is the Performance Evaluation (ED), since it allows the control and monitoring of management indicators, both individual and by process. To analyze the results, decision making in many organizations is done in a subjective manner and in consequence it brings serious problems to them. Taking into account this problem, it is decided to design and apply diffuse mathematical procedures and tools to reduce subjectivity and uncertainty in decision-making, creating work algorithms for this policy, which includes multifactorial weights and analysis with measurement indicators that they allow tangible and reliable results. Statistical techniques (ANOVA) are also used to establish relationships between work groups and learn about best practices.

Fault Diagnosis on Electrical Distribution Systems based on Fuzzy Logic

Ramon Perez, Amelec Viloria, Esteban Inga, Alexander Aguila, Carmen Vasquez, Liliana Lima and Maury-Ardila Henry

Abstract. The occurrence of faults in distribution systems has a negative impact on society, and their effects can be reduced by fast and accurate diagnostic systems that allow to identify, locate, and correct the failures. Since the 1990s, fuzzy logic and other artificial intelligence techniques have been implemented to identify faults in distribution systems. The main objective of this paper is to perform fault diagnoses based on fuzzy logic. For conducting the study, the IEEE 34-Node Radial Test Feeder is used. The data was obtained from ATPDraw-based fault simulation on different nodes of the circuit considering three different fault resistance values of 0, 5, and 10 ohms. The fuzzy rules to identify the type of fault are defined using the magnitudes of the phase and neutral currents. All measurements are taken at the substation, and the results show that the proposed technique can perfectly identify and locate the type of failure.

A Hybrid GA-PSO Adaptive Neuro-Fuzzy Inference System for Short-Term Wind Power Prediction

Rendani Mbuvha, Ilyes Boulkaibet, Tshilidzi Marwala and Fernando Buarque De Lima-Neto

Abstract. The intermittency of wind remains the greatest challenge to its large scale adoption and sustainability of wind farms. Accurate wind power predictions therefore play a critical role for grid efficiency where wind energy is integrated. In this paper, we investigate two hybrid approaches based on the genetic algorithm (GA) and particle swarm optimisation (PSO). We use these techniques to optimise an Adaptive Neuro-Fuzzy Inference system (ANFIS) in order to perform one-hour ahead wind power prediction. The results show that the proposed techniques display statistically significant out-performance relative to the traditional backpropagation least-squares method. Furthermore, the hybrid techniques also display statistically significant out-performance when compared to the standard genetic algorithm.

Hydrologic Cycle Optimization Part I: Background and Theory

Xiaohui Yan and Ben Niu

Abstract. A novel Hydrologic cycle Optimization (HCO) is proposed by simulating the natural phenomena of the hydrologic cycle on the earth. Three operators are employed in the algorithm: flow, infiltration, evaporation and precipitation. Flow step simulates the water flowing to lower areas and makes the population converge to better areas. Infiltration step executes neighborhood search. Evaporation and precipitation step could keep diversity and escape from local optima. The proposed algorithm is verified on ten benchmark functions and applied to a real-world problem named Nurse Scheduling Problem (NSP) with several comparison algorithms. Experiment results show that HCO performs better on most benchmark functions and in NSP than the comparison algorithms. In Part I, the background and theory of HCO are introduced firstly. And then, experimental studies on benchmark and real world problems are given in Part II.

Hydrologic Cycle Optimization Part II: Experiments and Real-World Application

Ben Niu, Huan Liu and Xiaohui Yan

Abstract. A novel Hydrologic Cycle Optimization (HCO) is proposed by simulating the natural
phenomena of the hydrologic cycle on the earth. Three operators are employed in the algorithm: flow, infiltration, evaporation and precipitation. Flow step simulates the water flowing to lower areas and makes the population converge to better areas. Infiltration step executes neighborhood search. Evaporation and precipitation step could keep diversity and escape from local optima. The proposed algorithm is verified on ten benchmark functions and applied to a real-world problem named Nurse Scheduling Problem (NSP) with several comparison algorithms. Experiment results show that HCO performs better on most benchmark functions and in NSP than the other algorithms. In Part I, the background and theory of HCO are introduced firstly. And then, experimental studies on benchmark and real world problems are given in Part II.

Finding Patterns and Recommendation II/II
June 19, 2018(Tuesday) 09:50-11:30 Room C

A Personalized Recommendation Algorithm based on MOEA-ProbS
Xiaoyan Shi, Wei Fang and Guizhu Zhang

Abstract. As a technology based on statistics and knowledge discovery, recommendation system can automatically provide appropriate recommendations to users, which is considered as a very effective tool for reducing information load. The accuracy and diversity of recommendation are important objectives of evaluating an algorithm. In order to improve the diversity of recommendation, a personalized recommendation algorithm Multi-Objective Evolutionary Algorithm with Probabilistic-spreading and Genetic Mutation Adaptation (MOEA-PGMA) based on Personalized Recommendation based on Multi-Objective Evolutionary Optimization (MOEA-ProbS) is proposed in this paper. Low-grade and unpurchased items are preprocessed before predicting the scores to avoid recommending low-grade items to users and improve recommendation accuracy. By introducing adaptive mutation, the better individuals will survive in the evolution with a smaller mutation rate, and worse individuals will eliminate. The experimental results show that MOEA-PMGA has a higher population search ability compared to MOEA-ProbS, and has improved the accuracy and diversity on the optimal solution set.

A Personalized Friend Recommendation Method Combining Network Structure Features and Interaction Information
Chen Yang, Tingting Liu, Lei Liu, Xiaohong Chen and Zhiyong Hao

Abstract. With the popularity of social network platforms in the crowd, more and more platforms begin to develop friend recommendation services to fit the users’ demands. Current research on friend recommendation strategies are mainly based on the nodes structural characteristics and path information of the friendship network. The recommendation strategies that consider node information are more efficient for large-scale networks, such as the Adamic-Adar Index. However, it solely utilizes the degree information of common neighbors and ignores the structural characteristics of the target nodes themselves. In this paper we attempted to improve the friend recommendation performance by incorporating the structural characteristics of the target nodes and the interactions between these nodes into the Adamic-Adar Index. In order to verify the effectiveness of our proposed algorithms, we conducted several groups of comparative experiments. The experimental results show that our proposed algorithm can effectively improve the recommendation performance comparing with the benchmark.

A Hybrid Movie Recommendation Method Based on Social Similarity and Item Attributes
Chen Yang, Xiaohong Chen, Lei Liu, Tingting Liu and Shuang Geng

Abstract. With the increasing demand for personalized recommendation, traditional collaborative filtering cannot satisfy users’ needs. Social behaviors such as tags, comments and likes are becoming more and more popular among the recommender system users, and are attracting the attentions of the researchers in this domain. The behavior characteristics can be integrated with traditional interest community and some content features. In this paper, we put forward a hybrid recommendation approach that combines social behaviors, the genres of movies and existing collaborative filtering
algorithms to perform movie recommendation. The experiments with MovieLens dataset show the advantage of our proposed method comparing to the benchmark method in terms of recommendation accuracy.

Multi-feature Collaborative Filtering Recommendation For Sparse Dataset
Zengda Guan

Abstract. Collaborative filtering algorithms become losing its effectiveness on case that the dataset is sparse. When user ratings are scared, it’s difficult to find real similar users, which causes performance reduction of the algorithm. We here present a 3-dimension collaborative filtering framework which can use features of users and items for similarity computation to deal with the data sparsity problem. It uses feature and rating combinations instead of only ratings in collaborative filtering process and performs a more complete similarity computation. Specifically, we provide a weighted feature form and a Bayesian form in its implementation. The results demonstrate that our methods can obviously improve the performance of collaborative filtering when datasets are sparse.

Tag Prediction in Social Annotation Systems Based on CNN and BiLSTM
Baiwei Li, Qingchuan Wang, Xiaoru Wang and Wei Li

Abstract. Social annotation systems enable users to annotate large-scale texts with tags which provide a convenient way to discover, share and organize rich information. However, manually annotating massive texts is in general costly in manpower. Therefore, automatic annotation by tag prediction is of great help to improve the efficiency of semantic identification of social contents. In this paper, we propose a tag prediction model based on convolutional neural networks (CNN) and bi-directional long short term memory (BiLSTM) network, through which, tags of texts can be predicted efficiently and accurately. By Experiments on real-world datasets from a social Q&A community, the results show that the proposed CNN-BiLSTM model achieves state-of-the-art accuracy for tag prediction.

Differential Evolution and Particle Swarm Optimization
June 19, 2018(Tuesday) 13:00-14:20 Room A

Particle Swarm Optimization Based on Pairwise Comparisons
Junqi Zhang, Jianqing Chen, Xizun Zhu and Chunhui Wang

Abstract. Particle swarm optimization (PSO) is a widely-adopted optimization algorithm which is based on particles’ fitness evaluations and their swarm intelligence. However, it is difficult to obtain the exact fitness evaluation value and is only able to compare particles in a pairwise manner in many real applications such as dose selection, tournament, crowdsourcing and recommendation. Such ordinal preferences from pairwise comparisons instead of exact fitness evaluations lead the traditional PSO to fail. This paper proposes a particle swarm optimization based on pairwise comparisons. Experiments show that the proposed method enables the traditional PSO to work well by using only ordinal preferences from pairwise comparisons.

Feature Subset Selection using a Self-Adaptive Strategy based Differential Evolution Method
Ben Niu, Xuesen Yang, Hong Wang, Kaishan Huang and Sung-Shun Weng

Abstract. Feature selection is a key step in classification task to prune out redundant or irrelevant information and improve the pattern recognition performance, but it is a challenging and complex combinatorial problem, especially in high dimensional feature selection. This paper proposes a self-adaptive strategy based differential evolution feature selection, abbreviated as SADEFS, in which the self-adaptive elimination and reproduction strategies are used to introduce superior features by considering their contributions in classification under historical records and to replace the poor performance features. The processes of the elimination and reproduction are self-adapted by learning from their experiences to reduce search space and improve classification accuracy rate. Twelve high dimensional
cancer micro-array benchmark datasets are introduced to verify the efficiency of SADEFS algorithm. The experiments indicate that SADEFS can achieve higher classification performance in comparison to the original DEFS algorithm.

**Applying a multi-objective differential evolution algorithm in translation control of an immersed tunnel element**

**Qing Liao and Qinqin Fan**

**Abstract.** Translation control of an immersed tunnel element under the water current flow is a typical optimization problem, which always emphasizes on short duration and high translation security. Various optimization approaches have been proposed to address this issue in previous works, but most of them take only one objective into consideration. Thus, it is solved as a single objective optimization problem. However, the translation control of the immersed tunnel element usually involves two or more conflicting objectives in actual situation. It is necessary to convert the translation control problem into a multi-objective optimization problem to obtain effective solutions. Therefore, a recently proposed multi-objective differential evolution algorithm is employed to solve the problem in the present work. The translation model of the immersed tunnel element is introduced with three sub-objectives. Results indicate that a multi-objective differential evolution algorithm can provide a set of non-dominated solutions for assisting decision makers to complete the translation of the immersed tunnel element according to different targets and changing environment.

**Path Planning on Hierarchical Bundles with Differential Evolution**

**Victor Parque and Miyashita Tomoyuki**

**Abstract.** Computing hierarchical routing networks in polygonal maps is significant to realize the efficient coordination of agents, robots and systems in general; and the fact of considering obstacles in the map, makes the computation of efficient networks a relevant need for cluttered environments. In this paper, we present an approach to compute the minimal-length hierarchical topologies in polygonal maps by Differential Evolution and Route Bundling Concepts. Our computational experiments in scenarios considering convex and non-convex configuration of polygonal maps show the feasibility of the proposed approach.

**A Building Energy Saving Software System based on Configuration**

**Jinlong Chen, Qinghao Zeng, Hang Pan, Xianjun Chen and Rui Zhang**

**Abstract.** A design method of building energy saving software system based on configuration is proposed, it can meet the needs of large-scale building energy efficiency through this method. The software system utilizes the configuration design concept to realize the process monitoring, analysis and evaluation functions for large-scale building energy consumption. It can find abnormal energy consumption equipment within the building, and reduce the peak power consumption to achieve the purpose of building energy efficiency. This paper first introduces the process control software development based on the idea of configuration, the overall framework of the building energy-saving configuration software system and the design process of each module is described in detailed. The software design practice validates the availability and good scalability of process control software based on configuration ideas. This system meets the needs of large building energy consumption monitoring and building energy efficiency.

**The Analysis of Image Enhancement for Target Detection**

**Rui Zhang, Yongjun Jia, Lihui Shi, Huang Pan, Jinlong Jinlong and Xianjun Chen**

**Abstract.** In the process of automatic detection and recognition based on image, the quality of the detected images affects the target detection and recognition results. To solve the problem of low contrast and high signal-to-noise ratio of the target image in the target detection process,
this paper introduces two types of image detail enhancement algorithms which are widely used in recent years, including brightness contrast image enhancement algorithm and HSV color space based enhancement algorithm, and its impact on the target detection. Experiments show that the image detail enhancement can improve the overall and local contrast of the image, highlight the details of the image, and the enhanced image can effectively improve the number and accuracy of the target detection.

Image filtering enhancement

Zhen Guo, Hang Pan, Jinlong Chen and Xianjun Chen

Abstract. With the development of science and technology, mankind has entered the information age. Image has become the main source of human access to information. However, in the actual process of image signal transmission, the loss and damage of data packet are inevitable due to the physical defects of the channel, which lead to a serious decline in the quality of the video stream. So it is necessary and even urgent now to do some research work on image enhancement technology. In this paper, the image enhancement algorithms that are commonly used, such as bilateral filtering algorithm, homomorphic filtering algorithm, are analyzed in image processing. In the design of the image enhancement, the best modeling and design schemes are chosen according to the comparison. The experimental results demonstrate that the bilateral filtering algorithm can effectively maintain the details of the image edges and make the image more smooth; the homomorphic filtering algorithm can effectively adjust the image gray range, so that the image details on the image area can be increased, and the algorithm can handle the image with inhomogeneous intensity. This work will lay a good foundation of further research.

Random Forest based Gesture Segmentation from Depth Image

Renjun Tang, Hang Pan, Xianjun Chen and Jinlong Chen

Abstract. Gesture image segmentation is a challenge task due to the high degree of freedom of human gestures, large differences in shape and high flexibility, traditional pattern recognition and image processing methods are not effective in gesture detection. The traditional image segmentation based on the detection of skin color and the image of the depth image are limited by the effects of ambient light, skin color difference and image depth variation, resulting in unsatisfactory results. Therefore, we propose a hand gesture depth image segmentation method based on random forest. The method learns the gesture image feature representation of the depth image by supervising learning. Experiments show that the proposed method segments the gestures’ pixels from the backgrounds area of the depth image. The proposed method potential has widely usages in gesture tracking, gesture recognition and human computer interaction.

Artificial Bee Colony Algorithm and Fruit Fly Optimization Algorithm

June 19, 2018(Tuesday) 13:00-14:20 Room C

New Binary Artificial Bee Colony for the 0-1 Knapsack Problem

Mourad Nouioua, Zhiyong Li and Shilong Jiang

Abstract. The knapsack problem is one of the well known NP-Hard optimization problems. Because of its appearance as a sub-problem in many real world problems, it attracts the attention of many researchers on swarm intelligence and evolutionary computation community. In this paper, a new binary artificial bee colony called NB-ABC is proposed to solve the 0-1 knapsack problem. Instead of the search operators of the original ABC, new binary search operators are designed for the different phases of the ABC algorithm, namely the employed, the onlooker and the scout bee phases. Moreover, a novel hybrid repair operator called (HRO) is proposed to repair and improve the infeasible solutions. To assess the performance of the proposed algorithm, NB-ABC is compared with two other existing algorithms , namely GB-ABC and BABC-DE, for solving the 0-1 knapsack problem. Based on a set of 15 0-1 high dimensional knapsack problems classified in three categories, the experimental results in view of many criteria show the efficiency and the robustness of the proposed NB-ABC.
Teaching-learning-based artificial bee colony

Xu Chen and Bin Xu

Abstract. This paper proposes a new hybrid metaheuristic algorithm called teaching-learning artificial bee colony (TLABC) for function optimization. TLABC combines the exploitation of teaching learning based optimization (TLBO) with the exploration of artificial bee colony (ABC) effectively, by employing three hybrid search phases, namely teaching-based employed bee phase, learning-based onlooker bee phase, and generalized oppositional scout bee phase. The performance of TLABC is evaluated on 30 complex benchmark functions from CEC2014, and experimental results show that TLABC exhibits better results compared with previous TLBO and ABC algorithms.

An Improved Artificial Bee Colony Algorithm for the Task Assignment in Heterogeneous Multicore Architectures

Tao Zhang, Xuan Li and Ganjun Liu

Abstract. The Artificial Bee Colony (ABC) algorithm is a new kind of intelligent optimization algorithm. Due to the advantages of few control parameters, computed conveniently and carried out easily, ABC algorithm has been applied to solve many practical optimization problems. But the algorithm also has some disadvantages, such as low precision, slow convergence, poor local search ability. In view of this, this article proposed an improved method based on adaptive neighborhood search and the improved algorithm is applied to the task assignment in Heterogeneous Multicore Architectures. In the experiments, although the numbers of iteration decreases from 1000 to 900, the quality of solution has been improved obviously, and the times of expenditure is reduced. Therefore, the improved ABC algorithm is better than the original ABC algorithm in optimization capability and search speed, which can improve the efficiency of heterogeneous multicore architectures.

Parameters Optimization of PID Controller Based on Improved Fruit Fly Optimization Algorithm

Xiangyin Zhang, Guan Chen and Songmin Jia

Abstract. Fruit fly optimization algorithm (FOA) is a novel bio-inspired technique, which has attracted a lot of researchers’ attention. In order to improve the performance of FOA, a modified FOA is proposed which adopts the phase angle vector to encoded the fruit fly location and brings in the double sub-swarms mechanism. This new strategies can enhance the search ability of the fruit fly and helps find the better solution. Simulation experiments have been conducted on fifteen benchmark functions and the comparisons with the basic FOA show that theta-DFOA performs better in terms of solution accuracy and convergence speed. In addition, the proposed algorithm is used to optimization the PID controller, and the promising performance is achieved.

Fireworks Algorithm and Bacterial Foraging Optimization

June 19, 2018(Tuesday) 14:50-16:30 Room A

Accelerating the Fireworks Algorithm with an Estimated Convergence Point

Jun Yu, Hideyuki Takagi and Ying Tan

Abstract. We propose an acceleration method for the fireworks algorithms which uses a convergence point for the population estimated from moving vectors between parent individuals and their sparks. To improve the accuracy of the estimated convergence point, we propose a new type of firework, the synthetic firework, to obtain the correct of the local/global optimum in its local area’s fitness landscape. The synthetic firework is calculated by the weighting moving vectors between a firework and each of its sparks. Then, they are used to estimate a convergence point which may replace the worst firework individual in the next generation. We design a controlled experiment for evaluating the proposed strategy and apply it to 20 CEC2013 benchmark functions of 2-dimensions (2-D), 10-D and 30-D with 30 trial runs each. The experimental results and the Wilcoxon signed-rank test confirm that the proposed method can significantly improve the performance of the canonical firework algorithm.
Discrete Fireworks Algorithm for Clustering in Wireless Sensor Networks
Fengzeng Liu, Bing Xiao, Hao Li and Li Cai

Abstract. Grouping the sensor nodes into clusters is an approach to save energy in wireless sensor networks (WSNs). We proposed a new solution to improve the performance of clustering based on a novel swarm intelligence algorithm. Firstly, the objective function for clustering optimization is defined. Secondly, discrete fireworks algorithm for clustering (DFWA-C) in WSNs is designed to calculate the optimal number of clusters and to find the cluster-heads. At last, simulation is conducted using the DFWA-C and relevant algorithms respectively. Results show that the proposed algorithm could obtain the number of clusters which is close to the theoretical optimal value, and can effectively reduce energy consumption to prolong the lifetime of WSNs.

Bare Bones Fireworks Algorithm for Capacitated p-Median Problem
Eva Tuba, Ivana Strumberger, Nebojsa Bacanin and Milan Tuba

Abstract. The p-median problem represents a widely applicable problem in different fields such as operational research and supply chain management. Numerous versions of the p-median problem are defined in literature and it has been shown that it belongs to the class of NP-hard problems. In this paper a recent swarm intelligence algorithm, the bare bones fireworks algorithm, which is the latest version of the fireworks algorithm is proposed for solving capacitated p-median problem. The proposed method is tested on benchmark datasets with different values for p. Performance of the proposed method was compared to other methods from literature and it exhibited competitive results with possibility for further improvements.

Differential Evolution Structure-Redesigned-Based Bacterial Foraging Optimization
Lu Xiao, Jinsong Chen, Lulu Zuo, Huan Wang and Lijing Tan

Abstract. This paper proposes an improved bacterial forging optimization with differential tumble, perturbation, and cruising mechanisms, abbreviated as DPCBFO. In DPCBFO, the differential information between the population and the optimal individual is used to guide the tumble direction of the bacteria. The strategy of perturbation is employed to enhance the global search ability of the bacteria. While a new cruising mechanism is proposed in this study to improve the possibility of searching for the optimal by comparing the current position with the others obtained in the next chemotaxis steps. In addition, to reduce the computation complexity, the vectorized parallel evaluation is applied in the chemotaxis process. The performance of the proposed DPCBFO is evaluated on eight well-known benchmark functions. And the simulation results illustrate that the proposed DPCBFO achieves the superior performance on all functions.

An algorithm based on the bacterial swarm and its application in autonomous navigation problems
Fredy Martinez, Angelica Rendon and Mario Ricardo Arbulo Saavedra

Abstract. Path planning is a very important problem in robotics, especially in the development of Automatic Guided Vehicles (AGVs). These problems are usually formulated as search problems, so many search algorithms with a high level of intelligence are evaluated to solve them. We propose a navigation algorithm based on bacterial swarming from a simplified model of bacterium that promises simple designs both at the system level and at the agent level. The most important feature of the algorithm is the inclusion of bacterial Quorum Sensing (QS), which reduces the convergence time, which is the major disadvantage of the scheme. The results in both simulation and real prototypes show not only stability but higher performance in convergence speed, showing that the strategy is feasible and valid for decentralized autonomous navigation.
A Classification Method for Micro-blog Popularity Prediction: Considering the Semantic Information
Lei Liu, Chen Yang, Tingting Liu, Xiaohong Chen and Sung-Shun Weng

Abstract. Predicting the scale and quantity of reposting in micro-blog network have significances to the future network marketing, hot topic detection and public opinion monitor. This study proposed a novel two-stage method to predict the popularity of a micro-blog prior to its release. By focusing on the text content of the specific micro-blog as well as its source of publication (user’s attributes), a special classification method—Labeled Latent Dirichlet allocation (LLDA) was trained to predict the volume range of future reposts for a new message. To the authors’ knowledge, this paper is the first research to utilize this multi-label text classifier to investigate the influence of one micro-blog’s topic on its reposting scale. The experiment was conducted on a large scale dataset, and the results show that it’s possible to estimate ranges of popularity with an overall accuracy of 72.56%.

VPSO-based CCR-ELM for Imbalanced Classification
Yinan Guo, Pei Zhang, Jian Cheng, Cui Ning and Chen Jingjing

Abstract. In class-specific cost regulation extreme learning machine (CCR-ELM) for the class imbalance problems, the key parameters, including the number of hidden nodes, the input weights, the hidden biases and the tradeoff factors are normally chosen randomly or preset by human. This made the algorithm responding slowly and generalization worse. Unsuitable quantity of hidden nodes might form some useless neuron nodes and make the network complex. So an improved CCR-ELM based on particle swarm optimization with variable length is present. Each particle consists of above key parameters and its length varies with the number of hidden nodes. The experimental results for nine imbalance dataset show that particle swarm optimization with variable length can find better parameters of CCR-ELM and corresponding CCR-ELM had better classification accuracy. In addition, the classification performance of the proposed classification algorithm is relatively stable under different imbalance ratios.

A Large-Scale Data Clustering Algorithm based on BIRCH and Artificial Immune Network
Yangyang Li, Guangyuan Liu, Peidao Li and Licheng Jiao

Abstract. This paper describes a large-scale data clustering algorithm which is a combination of Balanced Iterative Reducing and Clustering using Hierarchies Algorithm (BIRCH) and Artificial Immune Network Clustering Algorithm (aiNet). Compared with traditional clustering algorithms, aiNet can better adapt to non-convex datasets and does not require a given number of clusters. But it is not suitable for handling large-scale datasets for it needs a long time to evolve. Besides, the aiNet model is very sensitive to noise, which greatly restricts its application. Contrary to aiNet, BIRCH can better process large-scale datasets but cannot deal with non-convex datasets like traditional clustering algorithms, and requires the cluster number. By combining these two methods, a new large-scale data clustering algorithm is obtained which inherits the advantages and overcomes the disadvantages of BIRCH and aiNet simultaneously.

A Distance-based Term Weighting Method for Text Clustering
Chien-Hsing Chen

Abstract. null

Deep Learning
June 19, 2018(Tuesday) 14:50-16:10 Room C

A Deep Learning Model for Predicting Movie Box Office Based on Deep Belief Network
Wei Wang and Jiapeng Xiu

Abstract. For the limitation that Chinese movie box office forecasting accuracy is not high in the long-term prediction research, based on the research of the Chinese movie market, this paper proposes a long-term prediction model for movie box office based on the deep belief network. The new model
improved the movie box office influence model of Barry, screened out the effective box office impact factor, normalized the quantitative factor and formed a measurement system which is suitable for the Chinese movie market. Based on this measurement system, the characteristics of the data set in the original space are transferred to the space with semantic features and a hierarchical feature representation by deep learning, thus the accuracy of box office prediction was improved. Experimental evaluation results show that, in view of the 439 movie data, the DBN prediction model of movie box office has better prediction performance, and has good application value in the field of film box office.

A Deep-layer Feature Selection Method Based on Deep Neural Networks
Chen Qiao, Kefeng Sun and Bin Li

Abstract. Inspired by the sparse mechanism of the biological nervous system, we propose a novel feature selection algorithm: features back-selection (FBS) method, which is based on the deep learning architecture. Compared with the existing feature selection method, this method is no longer a shallow layer approach, since it is from the global perspective, which traces back step by step to the original key feature sites of the raw data by the abstract features learned from the top of the deep neural networks. For MNIST data, the FBS method has quite well performance on searching for the original important pixels of the digit data. It shows that the FBS method not only can determine the relevant features for learning task with keeping a quite high prediction accuracy, but also can reduce the space of data storage as well as the computational complexity.

Video Vehicle Detection and Recognition Based on MapReduce and Convolutional Neural Network
Chen Mingsong, Wang Weiguang, Dong Shi and Zhou Xinling

Abstract. With the rapid growth of traffic video data, it is necessary to improve the computing power and accuracy of image processing. In this paper, a video vehicle detection and recognition system based on MapReduce and convolutional neural network is proposed to reduce the time-consume and improve the recognition accuracy in video analysis. First, a fast and reliable deep learning algorithm based on YOLOv2 is used to detect vehicle in real-time. And then the license plate recognition algorithm based on improved convolutional neural network is presented to recognize the license plate image extracted from the detected vehicle region. Finally, the Hadoop Video Processing Interface (HVPI) and MapReduce framework are combined to apply the video vehicle detection and recognition algorithms for parallel processing. Experimental results are presented to verify that the proposed scheme has advantages of high detection rate and high recognition accuracy, and strong ability of data processing in large-scale video data.

A Uniform Approach for the Comparison of Opposition-Based Learning
Qingzheng Xu, Heng Yang, Na Wang, Rong Fei and Guohua Wu

Abstract. Although remarkable progress has been made in the application of opposition-based learning in recent years, the complete theoretical comparison is seldom reported. In this paper, an evaluation function of opposition strategy is defined and then a uniform evaluation approach to compute the mean minimum Euclidean distance to the optimal solution is proposed for one dimensional case. Thus different opposition strategies can be compared easily by means of the mathematical expectation of these evaluation functions. Theoretical analysis and simulation experiments can support each other, and also show the effectiveness of this method for sampling problems.

Data Preprocessing & Data Analysis
June 18, 2018(Monday) 13:00-14:40 Room D

Label Propagation Algorithm based on adaptive H index
Xiaoxiang Zhu and Zhengyou Xia

Abstract. Label propagation algorithm is a part of semi-supervised learning method, which is widely applied in the field of community partition. The algorithm is simple and fast, especially in the large
complex community network. The algorithm shows nearly linear time complexity, but it has great instability and randomness. Many scholars make their improvements on the original label propagation, but most of them are not suitable for large community network discovery, which usually have higher time complexity. Therefore, we propose a label propagation algorithm based on adaptive H index, which improves the stability and accuracy of LPA by using the refined H index as a measure of node importance. Finally, the algorithm is tested by public standard dataset and synthetic benchmark network dataset, and the test result shows that the proposed algorithm has better stability and accuracy than some existing classic algorithms.

A Comparative Study between Feature Selection Algorithms
Victor Hugo Medina Garcia, Jorge Enrique Rodriguez Rodriguez and Miguel Angel Ospina Usaquen

Abstract. In this paper, we show a comparative study between four algorithms used in features selection; these are: decision trees, entropy measure for ranking features, estimation of distribution algorithms, and the bootstrapping algorithm. Likewise, the features selection is highlighted as the most representative task in the elimination of noise, in order to improve the quality of the dataset. Subsequently, each algorithm is described in order that the reader understands its function. Then the algorithms are applied using different data sets and obtaining the results in the selection. Finally, the conclusions of this investigation are presented.

An Entropy-based Similarity Measure for Collaborative Filtering
Soojung Lee

Abstract. Collaborative filtering is a successfully utilized technique in many online commercial recommender systems. Similarity measures play an important role in this technique, as items preferred by similar users are to be recommended. Although various similarity measures have been developed, they usually treat each pair of user ratings separately without considering the global rating behavior of the users or simply combine additional heuristic information with traditional similarity measures. This paper addresses this problem and suggests a new similarity measure which interprets user ratings in view of the global rating behavior on items by exploiting information entropy. Performance of the proposed measure is investigated through various experiments to find that it outperforms the existing similarity measures especially in a small-scaled sparse dataset.

Combination of Case-Based Reasoning and Data Mining through Integration with the Domain Ontology
Tatiana Avdeenko, Ekaterina Makarova and Samal Begenova

Abstract. In present paper we consider a combination of CBR with the Domain Ontology and Data Mining. The proposed approach to integration CBR with the Ontology, as a result, gives a numerical matrix that characterize the semantic relationship of cases with the domain concepts. Then it is possible to apply methods of cluster analysis, classification and regression to this data matrix in order to organize semantic space of cases and thus increase the relevance of their retrieval. We explore possibilities of fuzzy logic approaches for building fuzzy rules and classification trees.

Profiling Analysis of 10 years of Rare Disease Research Using Scientific Literature
Hongmei Guo, Na Hong, Zhesi Shen, Wenfei Duan and Zhixiong Zhang

Abstract. In this paper, profiling methods are used to review the scientific literature that has been published on rare disease research between 2007 and 2016. In total of 15228 articles from Web of Science and 21638 articles from PubMed were collected for analysis. During this 10-year retrospective review, we profiled the rare disease research from 3 perspectives: the scale of publications, the research domains along with key topics of rare diseases research, and the research network through collaboration and citation activities. The most prolific counties, institutes and the most active research domains have been particularly measured. These profiling analyses used different methods provide a multiple perspectives overlook of rare disease research.
A Comparative Study of Network Embedding Based on Matrix Factorization

Xin Liu and Kyoung-Sook Kim

Abstract. In the era of big data, the study of networks has received an enormous amount of attention. Of recent interest is network embedding—learning representations of the nodes of a network in a low dimensional vector space, so that the network structural information and properties are maximally preserved. In this paper, we present a review of the latest developments on this topic. We compare modern methods based on matrix factorization, including GraRep, HOPE, DeepWalk, and node2vec, in a collection of 12 real-world networks. We find that the performance of methods depends on the applications and the specific characteristics of the networks. There is no clear winner for all of the applications and in all of the networks. In particular, node2vec exhibits relatively reliable performance in the multi-label classification application, while HOPE demonstrates success in the link prediction application. Moreover, we provide suggestions on how to choose a method for practical purposes in terms of accuracy, speed, stability, and prior knowledge requirement.

Explainable Matrix Factorization with Constraints on Neighborhood in the Latent Space

Shuo Wang, Hui Tian, Xuzhen Zhu and Zhipeng Wu

Abstract. Nowadays, recommender systems are widely used to solve the problem of information overload in modern society. And most of the previous studies focus overwhelmingly on high accuracy in the recommender systems. But in a real system, the high accuracy does not always satisfy overall user experience. The explainability has a great impact on the user experience. We mainly focus on the explainability of recommender systems in this paper. To the best of our knowledge, it is the first time that the neighborhood information in the latent space is integrated into the Explainable Matrix Factorization. We change the method of calculation of the explainability matrix and consider the neighbors’ weight to further improve performance. We use the benchmark data set (MovieLens) to demonstrate the effectiveness of the proposed Neighborhood-based Explainable Matrix Factorization. And the result shows a great improvement for accuracy and explainability.

Optimization Matrix Factorization Recommendation Algorithm Based on Rating Centrality

Zhipeng Wu, Hui Tian, Xuzhen Zhu and Shuo Wang

Abstract. Matrix factorization (MF) is extensively used to mine the user preference from explicit ratings in recommender systems. However, the reliability of explicit ratings is not always consistent, because many factors may affect the user’s final evaluation on an item, including commercial advertising and a friend’s recommendation. Therefore, mining the reliable ratings of user is critical to further improve the performance of the recommender system. In this work, we analyze the deviation degree of each rating in overall rating distribution of user and item, and propose the notion of user-based rating centrality and item-based rating centrality, respectively. Moreover, based on the rating centrality, we measure the reliability of each user rating and provide an optimized matrix factorization recommendation algorithm. Experimental results on two popular recommendation datasets reveal that our method gets better performance compared with other matrix factorization recommendation algorithms, especially on sparse datasets.

Multi-Question Negative Surveys

Hao Jiang and Wenjian Luo

Abstract. The negative survey is an emerging method of collecting sensitive information. It could obtain the distribution of sensitive information while preserving the personal privacy. When collecting sensitive information, several questions are often provided together to the respondents. However, when reconstructing positive survey results of multiple questions, previous reconstruction methods have some shortcomings. In this paper, we propose a new reconstruction method for multi-question negative surveys. Experimental results show that our method could obtain more reasonable results.
Processing Missing Information in Big Data Environment

Yuxin Chen, Shun Li and Jiahui Yao

Abstract. How to handle missing information is essential for system efficiency and robustness in the field of the database. Missing information in big data environment tends to have richer semantics, leading to more complex computational logic, as well as affecting operations and implement. The existing methods either have limited semantic expression ability or do not consider the influence of big data environment. To solve these problems, this paper proposes a novel missing information processing method. Combining the practical case of the big data environment, we summary the missing information into two types: unknown and nonexistent value, and define four-valued logic to support the logic operation. The relational algebra is extended systematically to describe the data operations. We implement our approach on the dynamic table model in the self-developed big data management system Muldas. Experimental results on real large-scale sparse data sets show the proposed approach has the good ability of semantic expression and computational efficiency.

Knowledge Management Model to Support Software Development

Victor Hugo Medina Garcia, Edwin Rivas Rivas Trujillo and Jose Ignacio Rodriguez

Abstract. This article shows the connection and interrelation between complexity theory and knowledge management. It is planned to find mechanisms to communicate and share knowledge efficiently, improving knowledge management in a complex system such as the development software factories. As a result, it proposes a model of knowledge management, taking into account notions of complexity theory applied to a development system software factory, where normal development involves different forms of complexity, which must be managed properly to help solve. Of course, the results of the application can be seen in the medium term best practices and lessons learned.

Mining High Utility Sequential Patterns Using Maximal Remaining Utility

Wei Song and Keke Rong

Abstract. Mining high utility sequential pattern is an interesting problem in data mining. In this paper, we propose a new algorithm called high utility sequential pattern mining based on maximal remaining utility (HUSP-MRU). In HUSP-MRU, the maximal remaining utility (MRU) is defined as tighter upper bound of candidates. Representing the search space with lexicographic sequential pattern tree, the matrix structures are used for MRU storage, and branch as well as node pruning based on MRU are used for improving mining efficiency. Extensive tests conducted on publicly available datasets show that the proposed algorithm outperforms USpan algorithm in terms of mining efficiency.

Stance Detection on Microblog Focusing on Syntactic Tree Representation

Umme Aynun Siddiqua, Abu Nowshed Chy and Masaki Aono

Abstract. Microblog, especially Twitter, has become an integral part of our daily life, where millions of users expressing their opinions daily towards various target entities. Detecting and analyzing user stances from such massive opinion-oriented twitter posts provide enormous opportunities to journalists, governments, companies, and other organizations. However, the short length characteristics and frequent use of idiosyncratic abbreviations in tweets make this task challenging to infer the users’ stance automatically towards a particular target. In this paper, we leverage the syntactic tree representation of tweets to detect the tweet stance. We devise a new parts-of-speech (POS) generalization technique and employ the hashtag segmentation for effective tree representation. Then, we make use of support vector machine (SVM) classifier with three different tree kernel functions including subtree (ST) kernel, subset tree (SST) kernel, and partial tree (PT) kernel as the base-classifiers. Finally, a majority voting count based prediction scheme is employed to identify the tweet stance. We conducted our experiments using SemEval-2016 twitter stance detection dataset. Experimental results demonstrate...
the effectiveness of our proposed method over the baseline and the state-of-the-art related works.

Application of Data Mining for Behavior Pattern Recognition in Telecommunication
Xingshen Wu, Yu Zhao, Qiang Gu and Li Gao

Abstract. In telecom industry, mobile subscribers produce data traffic while online every day. These data traffic suggests that certain characteristics of the behavior. The application of data mining helped to analyze and identify the features from the data traffic. In this paper, we use exponential binning of data preprocessing technology to smooth the data sets and keep reduce the noise. By using K-means algorithm to cluster the data traffic stream, we aim to mining subscribers’ behavior characteristics from clusters, provide support for churn prediction, target marketing, and fraud detection.

Big Data Tools for Smart Cities
Jose Ignacio Rodriguez Molano, Leonardo Emiro Contreras Bravo and Eduyn Ramiro Lopez Santana

Abstract. The continuous technological evolution and the significant increase of connected devices in urban cities, has led to an increasing complexity of the sources and variety of data types, creating challenges for cities that wish to become smart cities. If there is no control of these volumes of data of increasing behavior, they will be increasingly uncertain and more difficult to interpret, so it is necessary to know the tools that are available for this purpose. This article contains information about the relationship between the use of Big Data technologies and Smart Cities, highlighting specific the tools that allow an adequate management of data and thus contribute to a better functioning of cities. In the first part the concepts of Smart City and Big Data are covered, together with the requirements and applications of Big Data in the Smart Cities, in the following section we talk about the most common tools that are currently used for control, analysis and processing of large volumes of data, highlighting the advantages and cases for which its implementation would be better, as well as solutions for some of its disadvantages.

Research on the Calculation of Urban Transport Carbon Dioxide Emissions: a Case Study of Guangzhou City
Haixia Zhang and Wenyuan Liao

Abstract. Taking Guangzhou as an example, the calculation formula of low carbon transport has been improved by calibrating the energy consumption coefficient in this paper. On this basis, the annual transport carbon emissions of Guangzhou from 2011 to 2015 based on the statistical data has been calculated. At the same time, the transport carbon emissions in 2015 based on the data of Guangzhou Traffic Planning Model has been also calculated in this paper. By comparing these two kinds of calculation method, calculation method based on the data of Guangzhou Traffic Planning Model can measure the carbon emission of cross boundary transport and the carbon emission of small passenger cars more accurately. This method is also easier to measure the carbon reduction caused by the transfer of individual transportation to intensive transportation. Finally, it is concluded that the calculation method based on the Guangzhou Traffic Planning Model data source is more suitable for the study of carbon reduction in micro level transport.

Classification
June 19, 2018(Tuesday) 09:50-11:50 Room D

Relation Classification via BiLSTM-CNN
Lei Zhang and Fusheng Xiang

Abstract. In sentence-level relation classification field, both recurrent neural networks (RNN) and conventional neural networks (CNN) have won tremendous success. These methods do not rely on NLP systems like named entity recognizers (NER). However either CNN or RNN has its advantages and disadvantages for relation classification. For example, CNN is good at capturing local feature, but RNN is good at capturing temporal features, particularly handling long-distance dependency between nominal pairs. This paper proposes BiLSTM-CNN model combining CNN and RNN, and compares it...
with CNN and RNN respectively. BiLSTM-CNN utilizes LSTM to extract series of higher level phrase representations, and then fed into CNN to do the relation classification. We conducted exhaustive research on two datasets: SemEval-2010 Task 81 dataset and KBP372 dataset. The result strongly indicates the BiLSTM-CNN has the best performance among models in the literature, particularly for long-span relations. And on KBP37 dataset, we achieve the state-of-the-art F1-score.

**A Transfer Learning Based Hierarchical Attention Neural Network for Sentiment Classification**  
*Zhaowei Qu, Yuan Wang, Xiaoru Wang and Shuqiang Zheng*

**Abstract.** The purpose of document-level sentiment classification in social network is to predict users’ sentiment expressed in the document. Traditional methods based on deep neural networks rely on unsupervised word vectors. However, the word vectors cannot exactly represent the contextual relationship of context. On the other hand, Recurrent Neural Networks (RNNs) generally used to process the sentiment classification problem have complex structures, numerous model parameters and RNNs are hard to train. To address above issues, we propose a Transfer Learning based Hierarchical Attention Neural Network (TLHANN). Firstly, we train an encoder to understand in the context with machine translation task. Secondly, we transfer the encoder to sentiment classification task by concatenating the hidden vector generated by the encoder with the corresponding unsupervised vector. Finally, for the sentiment classification task, we apply a two-level hierarchical network. A simplified RNN unit called the Minimal Gate Unit (MGU) is arranged at each level. We use the attention mechanism at each level. Experimental results on several datasets show that the TLHANN model has excellent performance.

**A Generic Model Based on Multiple Domains for Sentiment Classification**  
*Zhaowei Qu, Yanjiao Zhao, Xiaoru Wang and Chunye Wu*

**Abstract.** Traditional models for sentiment classification are trained and tested on the same dataset. However, the model parameters trained on one dataset are not suitable for another dataset and it takes much time to train a new model. In this paper, we propose a generic model based on multiple domains for sentiment classification (DCSen). In DCSen, domain classification is used to generalize the sentiment classification model, so the trained model’s parameters can be applied to different datasets in given domains. Specifically, the document is first mapped to the domain distribution which is used as a bridge between domain classification and sentiment classification, and then sentiment classification is completed. In order to make DCSen more generic, the sentiment lexicon is introduced to select the sentences in a document and the more representative datasets are obtained. For the purpose of improving accuracy and reducing training time, transfer learning based on neutral networks is used to get the document embeddings. Extensive experiments on the datasets of 15 different domains show that DCSen can achieve better performance compared with traditional models in the aspect of generality.

**Identification of Sentiment Labels based on Self-training**  
*Zhaowei Qu, Chunye Wu, Xiaoru Wang and Yanjiao Zhao*

**Abstract.** Traditional methods for sentiment classification based on supervised learning require a large amount of labeled data for training. However, It is hard to obtain enough labeled data because it can be too expensive compared with unlabeled data. In this paper, we propose an identification of sentiment labels based on self-training (ISLS) method that can make full use of the large number of labeled data. We extract sentiment expressions based on sentiment seeds by self-training, learn sentiment words on unlabeled data and annotate unlabeled data. The sentiment expressions include processing and extracting for the negative meaning of the text. The ISLS method avoids the subjective problems of manual annotation. Experiments validate the effectiveness of the proposed ISLS method.

**A Self-Training Method for Detection of Phishing Websites**  
*Xuepeng Jia and Xiaofeng Rong*

**Abstract.** Phishing detection based on machine learning always lacks training data with high confidence labels. In order to reduce the impact of lack of labels on training set on performance to
phishing detection, this paper proposes an improved self-training method of semi-supervised learning. It uses the divide-and-conquer principle and decomposes the original problem into a number of smaller but similar sub-problems to the original one. We compare model classification quality among supervised learning, traditional semi-supervised learning and new proposal method by using four classifiers, as well as the running time between two kinds of semi-supervised methods. The running time of can be reduced by 50% by using the improve method which divides unlabeled dataset equally, on the basis of ensuring the classification effect is equal to the traditional self-training method. Furthermore, the running time of model is continue reducing significantly by increasing the number of dividing unlabeled data set. The experiments results show our proposal, the improved self-training method outperformed the traditional self-training method.

A Rule-Based System to Classify Scheduling Problems and Solution Techniques for Service Systems

Eduyn Lopez-Santana, German Mendez Giraldo and Jose Ignacio Rodriguez Molano

Abstract. This paper studies the problem of knowledge acquisition to classify scheduling problems, its performance measures and solution techniques for service systems. The classification of service systems is a difficult task since the service is described in a confused and ambiguous language. This confusion makes it difficult to analyze, mainly in the making decisions at operative level. We propose a new notation for service systems that consist in three fields: customer, resources and flow control. From this notation, we propose an integrated three rule-based systems (RBS). The first identify the type of scheduling problem according with scheduling, routing and routing-scheduling. With the results a second RBS identifies the performance measures. And finally, a third RBS determines the best solution techniques to solve the problem. We show an application of our proposed method in a maintenances service problem.

Multiple Kernel Shadowed Clustering in Approximated Feature Space

Yin-Ping Zhao, Long Chen and C. L. Philip Chen

Abstract. Compared to conventional fuzzy clustering, shadowed clustering possesses several advantages, such as better modeling of the uncertainty for the overlapped data, reduction of computation and more robust to outliers because of the generated shadowed partitions. Based on the construction of a set of pre-specific kernels, multiple kernel fuzzy clustering presents more flexibility in fuzzy clustering than kernel fuzzy clustering. However, it is unattainable to large dataset because of its high computational complexity. To solve this problem, a new multiple kernel shadowed clustering in approximated feature space is proposed herein, using Random Fourier Features and Spherical Random Fourier Features to approximate radial basis kernels and polynomial kernels, respectively. To optimize the kernel weight, maximum-entropy regularization is used. The results of our proposed algorithm on Iris and Letter Recognition datasets show better performance than other algorithms in comparison.

Data Mining Using Clustering Techniques as Leprosy Epidemiology Analyzing Model

Ygor Eugenio Dutra Da Silva, Claudio Guedes Salgado, Valney Mara Gomes Conde and Guilherme Augusto Barros Conde

Abstract. Leprosy remains a public health problem in the world and also in Brazil. The people’s living conditions, especially of the most socially vulnerable, dramatically influence the risk of contagion of the disease. In this context, this study aimed to analyze the epidemiology of leprosy through the list of patients and the environment of these using data mining techniques with clustering methods. In the process of creating of clusters, best results were obtained with Self-Organizing Maps of Kohonen with information organized into 6 clusters. A set of data with SINAN patients and new cases of leprosy found in an active search carried out in the municipality of Santarém in the year 2014. The results were analyzed, draws attention the values found for the Anti PGL-1 in cluster 4 first set of data analysis which indicates very high values of positive, indicating a high load of the leprosy bacillus, and therefore
a high risk for communicating. The study demonstrated that the identification of leprosy patient’s relationship profile with your family and your household appear as promising tools like leprosy control strategy.

**Determination of Dimensionality of the Psychosocial Risk Assessment of Internal, Individual, Double Presence and External Factors in Work Environments**

*Nunziatina Bucci, Marisabel Luna, Amelec Viloria, Jenny Lis, Alexander Parody, Darwin Solano and Luz Borrero*

**Abstract.** In the present work, the dimensions of the psychosocial risk assessment instrument are defined considering internal, individual, double presence and external factors for work environments. Those corresponding to internal, individual and double presence factors are not subject to a process of validation of content since they come from the ISTAS 21 model validated by the Trade Union Institute of Labor, Environment and Health of Spain. The variables corresponding to external factors are obtained from the Social Determinants of Health Model of the World Health Organization. These measurement tools are used for companies with a high number of workers, so a large amount of data is generated. The construct validity of the external factors is carried out by calculating the sample adequacy measure of Kaiser-Meyer-Olkin together with the Bartlett sphericity test and the communalities analysis. Of the internal and individual variables there are twenty dimensions and of the external variables, are reduced to 14.

**A Novel SPITterson Detection Approach with Unsupervised Density-based Clustering**

*Jianzhong Zhang, Jingjing Wang, Yu Zhang, Jingdong Xu and Huan Wu*

**Abstract.** With the rapid popularity of VoIP, SPIT (Spam over Internet Telephony) based VoIP has become a security problem that cannot be ignored and SPITtersons detection turns into an urgent issue. Data mining is a practical method of SPITterson detection. This paper considers three commonly used characteristics of VoIP users and presents the fact that the characteristic data distribution of SPITtersons in real data space is non-globular and irregular. Moreover, a novel approach is introduced to identify SPITtersons employing density-based clustering algorithm DBSCAN. The results on real dataset are superior to other commonly used unsupervised clustering algorithm in terms of the recall and precision of SPITterson cluster.

**Visualization & Recommendation System in Social Media**

*June 19, 2018(Tuesday) 14:50-16:30 Room D*

**Image Processing Pipeline for Web-Based Real-Time 3D Visualization of Teravoxel Volumes**

*Akanaksha Ashwini and Jaerock Kwon*

**Abstract.** With high-throughput and high-resolution imaging technologies such as Knife-Edge Scanning Microscopy (KESM), it is possible to acquire teravoxel sized three-dimensional neuronal and microvascular images of the whole mouse brain with sub-micrometer resolution. It is imperative to be able to visualize and share these teravoxel volumes efficiently, to facilitate group efforts from research communities. However, due to the immense size of the data sets, sharing and managing them have always been a big challenge. This paper describes an image processing pipeline for a real-time 3D visualization framework that allows research groups to work in collaboration. The proposed work can visualize and share terabyte-sized three-dimensional images for study and analysis of mammalian brain morphology. Although the image processing pipeline used a KESM data set to show the feasibility of it, the proposed pipeline can also be used for other larger data sets. We believe that this novel framework for Web-based real-time 3D visualization can facilitate data sharing of teravoxel volumes across research communities.

**Big Data Visualization of the Alcohol Expenses in Taiwan**

*Chien-Wen Shen, Thai-Ha Luong, Li-An Chien and Jung-Tsung Ho*
Abstract. This study develops visual analytics of alcohol expenditure in multiple geographic areas using electronic-invoice (e-invoice) data. A data-cleansing technique is applied to extract alcohol-related transactions from more than 20 billion e-invoices in 2014 and 2015. Visual analytics are applied to summarize the intricate numeric and text information into various visual settings. The findings from this study suggest the CPI proportions with the country’s alcohol expenditure on monthly consideration. Alcohol expenditure in Taiwan sharply increases during summer and winter seasons. Although northern metropolitan cities/counties such as Taipei city have the highest alcohol expenditure per-capita among inland cities/counties; the average alcohol expenditure per e-invoice of northern cities/counties is among the lowest in the country. E-invoice data enables the memory-recall bias to be avoided, thereby enhancing the accuracy of research outcome. Visual analytics systemize transaction information from billions of data into mappings, thereby elucidating the alcohol expenditure pattern of Taiwanese consumers.

Efficiency Analysis of the Visibility of Latin American Universities and Their Impact on the Ranking Web
Maritza Torres, Carmen Vasquez, Amelec Viloria, Tito Crissien Borrero, Noel Varela, Danelys Cabrera, Mercedes Gaitan-Angulo and Jenny Paola

Abstract. The study analyzes the factors that contribute to the technical efficiency of the visibility of the universities included in the Top100 of the Latin American Universities Ranking Web published by Webometrics database in January, 2017. Data Envelopment Analysis (DEA) was used to calculate the contributions of input variables to efficiency. As data sources for inputs, the study considers the academic data published on the web of each university, the content and profiles displayed from Google Scholar (GS), data by university published in ResearchGate as a scientific network, and finally, data from social networks as Twitter and Facebook accounts of the respective institutions. The postgraduate offer, visibility in GS, and the use of scientific and social networks contribute favorably to the web positioning of Latin American universities.

Public Opinion toward Social Business from a Social Media Perspective
Chien-Wen Shen and Jung-Tsung Ho

Abstract. Social media has become a crucial tool used by social businesses (SBs) to manage their public relationships. Hence, understanding what SB means to the public would provide businesses with additional insights that they could apply to social promotion and marketing. We retrieved more than 200,000 tweets containing the words “social business” and utilized text mining algorithms to extract the SB status. The mining results provide marketers with insights that they can apply when making decisions about SB marketing and promotion and provide policymakers with the information necessary to design an SB ecosystem. Our approach contributes a broad view on SB to the literature and differs from conventional methods, such as case studies, surveys, and statistical analyses.

An Energy-aware Routing Protocol with Small Overhead for Wireless Sensor Networks
Yu Yadong and Liu Jun

Abstract. Wireless Sensor Networks(WSNs) is always paid attention to by researchers. Power dissipation of a node is an important quota in WSNs. It influences the network lifetime. For extending the lifetime of WSNs researchers used many methods to save the energy of nodes. For example the energy of nodes was saved by reducing the amount of transmission data by means of data fusion. Another content which is usually researched to save the energy of nodes was routing protocol. This paper presented Small Overhead Routing Protocol(SORP) to increase the efficiency of transmission which could prolong the lifetime of nodes of WSNs while its’ amount is less than 254. And the minimum residual energy was treated as a key factor to decide the routing table together with hop count. It could avoid some nodes which were often used to relay message die much faster than the other nodes. The simulation results show that SORP could prolong the lifetime of most node in the network.
**Bibliometric Analysis of the Deep Learning Research Status with the Data from Web of Science**

*Meixin Mao, Zili Li, Zhao Zhao and Zeng Li*

**Abstract.** By using the 3599 papers obtained from the Web of Science database from 1968 to 2018 as the research sample, this paper demonstrates a comprehensive Bibliometric analysis of the research status, trends and hotspots in the domain of Deep Learning. The results indicate that the current global deep learning research is of great value; most of the institution cooperation are conducted with different characteristics by colleges and universities in China and Western Countries, respectively; the international academic communications in the deep learning field are pretty prosperous, which are concentrated on three major region: East Asia, North America, and West Europe. In addition, the current research hotspots, such as modeling and algorithm research can be shown in a keywords clustering mapping, and the current research fronts can be categorized into three layers: the application research of computer vision technology, the algorithm research, and the modeling research.

**A Data-driven Path Planner for Small Autonomous Robots using Deep Regression Models**

*Fredy Martinez, Angelica Rendon and Mario Arbulu*

**Abstract.** This paper proposes a navigation scheme for robots in indoor environments which uses real-time analysis of raw data captured by an infra-red sensor. The infra-red sensor captures distance data in real time producing a large database that the robot analyzes according to previous experiences to directly define its movement strategy. Observing the dependence of data with the topology of the environment, this research proposes models based on a Long Short-Term Memory (LSTM) network. We demonstrate not only that the navigation scheme works successfully on a real prototype, but also that the strategy can be used in new unknown navigation environments with a high success rate.

**Design Tool of Deep Convolutional Neural Network for Visual Inspection**

*Fusaomi Nagata, Kenta Tokuno, Akimasa Otsuka, Takeshi Ikeda, Hiroaki Ochi, Hisami Tamano, Hitoshi Nakamura, Keigo Watanabe and Maki K. Habib*

**Abstract.** In this paper, a design tool for deep convolutional neural network (DCNN) is considered and developed. As a test trial, a DCNN designed by using the tool is applied to visual inspection system of resin molded articles. The defects to be inspected are crack, burr, protrusion and chipping phenomena that occur in the manufacturing process of resin molded articles. An image generator is also developed to systematically generate many similar images for training. Similar images are easily produced by rotating, translating, scaling and transforming an original image. The designed DCNN is trained using the produced images and is evaluated through classification experiments. The usefulness of the proposed design tool has been confirmed through the test trial.

**A Deep Point-of-Interest Recommendation System in Location-Based Social Networks**

*Yuehua Wang, Zhinong Zhong, Anran Yang and Ning Jing*

**Abstract.** Point-of-interest (POI) recommendation is an important part of recommendation systems in location-based social networks. Most existing POI recommendation systems, such as collaborative filtering based and context-aware methods, usually use hand-designed or manually selected features to achieve the recommendation. However, the information in the location-based social networks has very complicated relationships with each other, e.g., the latent relationships among users, POIs and user preferences, thus leading to poor recommendation accuracy. We propose a two-stage method to address this problem. In the first stage, user and POI profiles are abstracted using statistical methods. Then in the second stage, a deep neural network (DNN) is used to predict ratings on these candidate POIs, and finally the topN list of POIs is obtained. Experimental results on the Gowalla and Brightkite dataset show the effectiveness of our DNN based recommendation method.
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