Proceedings

2013 10th International Conference on Fuzzy Systems and Knowledge Discovery

FSKD 2013

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Editors

Jianhua Chen

Xingwei Wang

Lipo Wang

Jinguang Sun

Xiangfu Meng

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Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA

+1 845 758 0440
+1 845 758 2633 (FAX)
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Preface

FSKD 2013

The 2013 10th International Conference on Fuzzy Systems and Knowledge Discovery (FSKD 2013) was held from 23-25 July 2013 in Shenyang, China, jointly with the 2013 9th International Conference on Natural Computation (ICNC 2013). On behalf of the organizing team of FSKD 2013, we would like to extend a warm welcome to all the participants from across the world to this premier international forum. This significant event provides participants a great opportunity to present state-of-the-art research development and exchange ideas in the rapidly developing research fields of data mining, fuzzy systems and computational intelligence.

The explosive growth of the Web and computing technologies have fundamentally revolutionized the way people live, learn, work, entertain and socialize by making it possible for human users to access, create and share in real time huge amount of heterogeneous data anywhere in the world. Opportunities as well as great challenges are abundant, calling for new theories and applications for mining massive data sets which are often complex, distributed, heterogeneous, dynamic and noisy. At this juncture of change, it is timely that ICNC-FSKD 2013 offers researchers in data mining and related fields a unique occasion to meet and reflect on the past, showcase the present research accomplishments, and develop visions for future research directions.

These proceedings contain the papers selected for presentation at the FSKD 2013 conference. We have received a large number of submissions. Each submitted paper has been rigorously reviewed by at least three reviewers from the program committee and external reviewers. Papers were evaluated based on a combination of criteria, including originality, significance and quality of the research, clarity of the presentation, and relevance to the conference theme. The authors, the program committee and the external reviewers all deserve credit for their collective efforts that result in a high quality program for the FSKD 2013 conference.

It would be impossible to successfully organize the FSKD 2013 conference without the generous contributions and joint team work of many people. We sincerely thank the program committee members and reviewers for their extraordinary dedication and service in the reviewing work. We gratefully acknowledge IEEE and IEEE Circuits and Systems Society for their technical sponsorship and support, which is indispensable for the success of the conference. We are immensely grateful to the keynote speakers for their insight, support and outstanding contributions. We appreciate and thank the Proceedings Chairs, the Publicity Chairs and the Sponsorship Chairs for their dedicated hard work. Our special thanks go to local organizers and volunteers from Northeastern University, Liaoning Technical University, and Shenyang Aerospace University, China, for their great efforts and long hours of hard work that make the conference and the participants' stay in Shenyang an enjoyable experience.

Editors: Jianhua Chen, Xingwei Wang, Lipo Wang, Jinguang Sun, and Xiangfu Meng

July 2013

Keynote Lectures

(in alphabetical order)

C. L. Philip Chen

University of Macau

C. L. Philip Chen received his M.S. degree from the University of Michigan, Ann Arbor, Michigan, U.S.A. in 1985, and his Ph.D. degree from Purdue University, West Lafayette, Indiana, U.S.A., in 1988, both degrees in Electrical Engineering. He was with Wright State University, Department of Computer Science and Engineering, from 1989 to 2002 as an assistant, an associate, and a full professor before he joined the University of Texas, San Antonio, where he has been a Professor and Chair of the Department of Electrical and Computer Engineering, the Associate Dean for Research and Graduate Studies of the College of Engineering. Since 2010, he is Chair Professor and the Dean of Faculty of Science and Technology, University of Macau. (http://www.fst.umac.mo/index.php)

Dr. Chen has been a visiting research scientist, at the Materials Directorate, Wright Laboratory, Wright-Patterson Air Force Base. He has been a senior research fellow sponsored by the NationalResearch Council, National Academy of Sciences. He is a Chair professor ofNational Chung-Hsing University, Taiwan, 2009-2011, the HiaTien Chair Professor inDalian University of Technology, China since 2011, and an Honorary Professor in Obuda University, Hungary since 2011. He also has been a research faculty fellow at NASA Glenn Research Center for several years. His researchinterests and projects, supported by the NSF, Air Force Office Scientific Researchand the U.S. Air Force, Office of Naval Research, NASA, and State of Ohio, include computer networking, intelligent systems, neural networks, fuzzy-neural systems, robotics, and CAD/CAM. His current research areas include design computational intelligent systems, networking, and video data indexing, retrieval, and communications; and a research project funded by the NASA GlennResearch Center on data mining on aircraft flight and maintenance data, aircraft engine life prediction, life extending control, diagnosis and prognosis, and health monitoring. As a result of his research contribution and academic recognition, he was elected to a Fellow of the IEEE (www.ieee.org) and AAAS (American Association for the Advancement of Science, www.aaas.org).

Dr. Chen has been involving in professional service for more than twenty years. He has served as a member of organizing committee for many IEEE conferences under different capacities, including IEEE International Conference on Robotics and Automation, IEEE WCCI, IEEE Int'l Conf. on Intelligent Robotics and Systems (IROS), IEEE Int'l Conf. on SMC, IEEE Int'l Conf. on System of Systems. Notably, he also has been a Conference Co-Chair of the International Conference on Artificial Neural Networks in Engineering (ANNIE), 1995 and 1996; the Program Co-Chairs of 2006 IEEE/SMC Int'l Conference on System of Systems Engineering (SoSE);a Program Co-Chair of 2008 & 2010 ICMLC, General Co-Chair of 2008 IEEE Int'l Conference on Secure Systems Integration and Reliability Improvement (SSIRI 2008); General Chair of 2009 IEEE Int'l Conf. on Systems, Man, and Cybernetics (SMC);and General Chair (Co-Chair) of 2011 (2012) IEEE Int'l Conference on Systems Science and Engineering. Currently, he is the President of IEEE SMC Society (2012-2013) and has been the Vice President on Conferences and Meetings and President-Elect, the Vice President on Technical Activities inSystems Science and Engineering, a member of Board of Governors, the Treasurer; and serves as a Distinguished Lecturer, an Associate Editor of IEEE Transactions on SMC-C (2006-) and IEEE Systems Journal (2008-2010). He is the founding faculty advisor of the IEEE Computer Society Student Chapter while at Wright State University; the founding Chair of IEEE SMCS Central Texas Section; founding Co-Chair of IEEE SMCS Macau Chapter, and founding co-chairs of three SMCS Technical Committees (SoS, Enterprise Information Systems,and Information Assurance). With this recognition, he received Outstanding Contribution Award from IEEE SMCS in 2008 and 2010. Dr. Chen is a member of Tau Beta Pi and Eta Kappa Nu honor societies and has been the faculty advisor for Tau Beta Pi Engineering honor society. In addition, he is an ABET (Accreditation Board of Engineering and Technology Education) Program Evaluator for Computer Engineering, Electrical Engineering, and Software Engineering programs.

Fuzzy Multi-Attribute Decision Making Algorithm for Vehicle Routing in Personalized Intelligent Vehicle Assistance Environment

Abstract - In this talk, the focus is to discuss traffic navigation in a large-scale wireless sensor traffic network, where collecting and processing of the global real-time traffic information are often unreliable. Making real-time navigation decision becomes an arduous task. The vehicle navigation here is considered as a multi-attribute decision making (MADM) problem. To address this issue, an efficient Wireless-Sensor-Network-based real-time vehicle navigation algorithm is proposed, in which multiple local traffic information are considered to make navigation decision in a quick and accurate way. Taking advantages sensor networks and multiple criteria decision making, this model offers the automobiles on the road the capability of real-time route selection, which bring less driving time, less travel distance, more fuel efficiency, or comprehensive consideration of multiple requests.

Because real-time traffic information involved in the navigation decision making should not be all denoted by exact data, some of them are more suitable to be denoted by fuzzy data, a general distance metric is presented for the processing of both exact and fuzzy data in MADM. The proposed algorithm can provide various navigation decisions according to the choice of different attributes to meet the diverse navigation requirements of drivers. Simulation results show the suitability and efficiency of the proposed algorithm. The proposed approach offers more selections and flexibility and can be integrated together with current vehicle routing applications such as found in Google or Baidu.

Pau-Choo Chung
National Cheng Kung University (NCKU)

Pau-Choo (Julia) Chung (S'89-M'91-SM'02-F'08) received the Ph.D. degree in electrical engineering from Texas Tech University, USA, in 1991. She then joined the Department of Electrical Engineering, National Cheng Kung University (NCKU), Taiwan, in 1991 and has become a full professor in 1996. She served as the Director of Institute of Computer and Communication Engineering (2008-2011), the Vice Dean of College of Electrical Engineering and Computer Science (2011), the Director of the Center for Research of E-life Digital Technology (2005-2008), and the Director of Electrical Laboratory (2005-2008), NCKU. She was elected Distinguished Professor of NCKU in 2005. She currently serves as Chair of Department of Electrical Engineering, NCKU. She is currently the Director of Intelligent Computing Division of National Science Council, Taiwan.

Dr. Chung's research interests include image/video analysis and pattern recognition, biosignal analysis and machine learning. She applies most of her research results to innovative healthcare and medical applications. Dr. Chung served as the program committee member in many international conferences. She was a Member on IEEE International Steering Committee, IEEE Asian Pacific Conference on Circuits and Systems (2006-2008), the Special Session Co-Chair of ISCAS 2009 and 2010, the Special Session Co-Chair of ICECS 2010, and the TPC of APCCAS 2010. Dr. Chung was the Chair of IEEE Computational Intelligence Society (CIS) (2004-2005), Tainan Chapter. She was the Chair of the IEEE Life Science Systems and Applications Technical Committee (2008-2009) and Vice Chair of Neural Network Technical Committee of IEEE CIS Society. She also serves as the Associate Editor of IEEE Transactions on Neural Networks and Learning Systems and served as the Editor of Journal of Information Science and Engineering, Associate Editor of Soft Computing, Associate Editor of Multidimensional Signal Processing, the Guest Editor of IEEE Transactions on Circuits and Systems-I, and the Secretary General of Biomedical Engineering Society of the Republic of China. She is one of the co-founders of Medical Image Standard Association (MISA) in Taiwan and is currently on the Board of Directors of MISA.

Pau-Choo Chung was a member in Board of Governor (BoG) of CAS Society (2007-2009, 2010-2012). She served as an IEEE CAS Society Distinguished Lecturer (2005-2007). She is an ADCOM member of IEEE CIS and the Chair of Distinguished Lecturer Program of IEEE CIS. She is a Member of Phi Tau Phi honor society and is an IEEE Fellow since 2008.

Processing the Imprecision and Ambiguity in Medical Image Analysis

Abstract - Medical imaging is one of the most popular examinations for disease diagnosis. A high quality of diagnostic radiology depends on the advance of image processing techniques in finding the subtle diagnostic features. As such all of the medical devices are embedded with medical image processing and analysis software. The advance of the processing and analysis techniques therefore decides the value of the imaging devices. Because of this reason, medical image analysis consistently plays one important role in radiology and disease diagnosis and the technique has evolved dramatically for addressing such a need.

There are many various imaging modalities for different diagnosis purposes, such as functional examination or anatomical examination. The intrinsic characteristics of medical images are the imprecision of image gray levels and organ positions and the ambiguity resulted from such imprecision due to individual diversity and the interferences from surrounding tissues.

In this talk we will present some approaches for handling the imprecision and ambiguity in the processing and analysis of medical images. We will also show that the adoption of a priori knowledge associated with the target medical images improves the effectiveness of the techniques in tackling such challenging issues.

Chih-Min Lin
Yuan Ze University

Prof. Chih-Min Lin is currently a Chair Professor and the Dean of Electrical and Communication College, Yuan Ze University, Taiwan. He is also an Honorary Professor of Obuda University in Hungary. He also serves as an Associate Editor of IEEE Trans. on Systems, Man, and Cybernetics, Part B; Asian Journal of Control; International Journal of Fuzzy Systems; and International Journal of Machine Learning and Cybernetics. He has been the Chair of IEEE Computational Intelligence Society Taipei Chapter, the Chair of IEEE Systems, Man, and Cybernetics Society Taipei Chapter, a Board of Governor of IEEE Taipei Session. He has gotten the Distinguished Research Award from National Science Council in Taiwan both in 2008 and 2009. He was also awarded with the Distinguished Engineering Professor from China Engineering Society and the Distinguished Electrical Engineering Professor from Chinese Electrical Engineering Society in Taiwan. He has been invited to give 7 keynote speeches in the international conferences. He is now a Board of Governor of IEEE Systems, Man, and Cybernetics Society. His research interests include fuzzy systems, neural network, cerebellar model neural network, and intelligent control systems. He is an IEEE Fellow and IET Fellow. Till now he has published 137 journal papers and 154 conference papers.

Development of Fuzzy Cerebellar Model Neural Network

Abstract - Based on biological prototype of human brain and improved understanding of the functionality of the neurons and the pattern of their interconnections in the brain, a theoretical model used to explain the information-processing characteristics of the cerebellum was developed independently by Marr (1969) and Albus (1971). Cerebellar model neural network (CMNN) was first proposed by Albus in 1974. CMNN is a learning structure that imitates the organization and functionality of the cerebellum of the human brain. That model revealed the structure and functionality of the various cells and fibers in the cerebellum. The core of CMNN is an associative memory which has the ability to approach complex nonlinear functions. CMNN takes advantage of the input-redundancy by using distributed storage and can learn nonlinear functions extremely quickly due to the on-line adjustment of its system parameters. CMNN is classified as a non-fully connected perceptron-like associative memory network with overlapping receptive-fields. It has good generalization capability and fast learning property and is suitable for a lot of applications. This speech will introduce several new CMNN-based adaptive learning systems proposed by me; these systems combine the advantages of CMNN identification, adaptive learning, control technique, signal processing and image classification. In these systems, the on-line parameter training methodologies, using the Lyapunov theorem, are proposed to guarantee the stability and convergence of these systems. Moreover, the applications of these systems in nonlinear systems control, biped robot control, signal processing of communication system, and computer-aided diagnosis of breast nodules are demonstrated.

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