Keynote Speech 1

From Data to Symbols: A Unified Perspective Through Information Granules

Prof. Witold Pedrycz

University of Alberta, Canada

Abstract

Some of the recent advancements in Artificial Intelligence (AI) fall under the umbrella of industrial developments (which are predominantly driven by numeric data) and explainable AI (XAI). We advocate that in the realization of these two timely pursuits, information granules and Granular Computing play a significant role. First, it is shown that information granularity is of paramount relevance in building linkages between real-world data and symbols commonly encountered in AI processing. Second, we stress that a suitable level of abstraction (specificity of information granularity) becomes essential to support user-oriented framework of design and functioning AI artifacts. In both cases, central to all pursuits is a process of formation of information granules and their prudent characterization. We discuss a comprehensive approach to the development of information granules by means of the principle of justifiable granularity. Here various construction scenarios are discussed including those engaging conditioning and collaborative mechanisms incorporated in the design of information granules. The mechanisms of assessing the quality of granules are presented. In the sequel, we look at the generative and discriminative aspects of information granules supporting their further usage in the formation of granular models. A symbolic manifestation of information granules is put forward and analyzed from the perspective of semantically sound descriptors of data and relationships among data. With this regard, selected aspects of stability and summarization of symbol-oriented information are discussed.

Witold Pedrycz (IEEE Fellow, 1998) is Professor and Canada Research Chair (CRC) in Computational Intelligence in the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada. He is also with the Systems Research Institute of the Polish Academy of Sciences, Warsaw, Poland. In 2009 Dr. Pedrycz was elected a foreign member of the Polish Academy of Sciences. In 2012 he was elected a Fellow of the Royal Society of Canada. In 2007 he received a prestigious Norbert Wiener award from the IEEE Systems, Man, and Cybernetics Society. He is a recipient of the IEEE Canada Computer Engineering Medal, a Cajastur Prize for Soft Computing from the European Centre for Soft Computing, a Killam Prize, and a Fuzzy Pioneer Award from the IEEE Computational Intelligence Society.

His main research directions involve Computational Intelligence, fuzzy modeling and Granular Computing, knowledge discovery and data science, pattern recognition, data science, knowledge-based neural networks and control engineering. He has published numerous papers in these areas; the current h-index is 102 (Google Scholar). He is also an author of 18 research monographs and edited volumes covering various aspects of Computational Intelligence, data mining, and Software Engineering.

Dr. Pedrycz is vigorously involved in editorial activities. He is an Editor-in-Chief of Information Sciences, Editor-in-Chief of WIREs Data Mining and Knowledge Discovery (Wiley), and Co-editor-in-Chief of Int. J. of Granular Computing (Springer) and J. of Data Information and Management (Springer). He serves on an Advisory Board of IEEE Transactions on Fuzzy Systems and is a member of a number of editorial boards of international journals.

Keynote Speech 2

Talent Analytics: Prospects and Opportunities

Prof. Hui Xiong

The State University of New Jersey at Rutgers, USA

Abstract

The big data trend has made its way to talent management. Indeed, the availability of large-scale human resources (HR) data provide unparalleled opportunities for business leaders to understand talent behaviors and generate useful talent knowledge, which in turn deliver intelligence for real-time decision making and effective people management at work. In this talk, we introduce the powerful set of innovative big data techniques developed for intelligent human resource management, such as recruiting, performance evaluation, talent retention, talent development, job matching, team management, leadership development, and organization culture analysis. In addition, we will also demonstrate how the results of talent analytics can be used for other business applications, such as market trend analysis and financial investment.

Hui Xiong is a Professor at Rutgers University, and is currently on leave and serving as head of Business Intelligence Lab and Talent Intelligence Center at Baidu Inc.. His research interests include data mining, mobile computing, and their applications in business. He has authored over 200 research articles, and Co-

edited or coauthored 4 books including the widely used Encyclopedia of GIS, which has been recognized as the Top 10 Most Popular Computer Science Book authored by Chinese scholars at Springer. Dr. Xiong has served as chair/Co-chair for many international conferences in data mining, including a Program Co-Chair (2013) and a General Co-Chair (2015) for the IEEE International Conference on Data Mining (ICDM), and a Program Co-Chair of the Research Track (2018) and the Industry Track (2012) for the ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD). Dr. Xiong's research has generated substantive impact beyond academia. He is an ACM distinguished scientist and has been honored by the 2018 Ram Charan Management Practice Award as the Grand Prix winner from the Harvard Business Review, the 2017 IEEE ICDM Outstanding Service Award, and the ICDM-2011 Best Research Paper Award.

Keynote Speech 3

Future Perspectives of Machine Learning

Prof. Zhihua Zhou

Nanjing University, China

Abstract

Machine learning has achieved great success during the past decade. In this talk, we will discuss on some future perspectives. First, we will talk about the holy grail AI problem of bridging machine learning and logical reasoning, and present the abductive learning, a recently proposed paradigm which leverages machine learning and logical reasoning in a balanced way, neither "light-learning heavy-reasoning" nor "heavy-learning light-reasoning". Second, we will talk about learnware, which may enable machine learning to be more convenient to common users, where the core components are a well-performed pre-trained learning model with a specification explaining its purpose and/or specialty.

Zhihua Zhou is a Professor, Head of the Department of Computer Science and Technology, Dean of the School of Artificial Intelligence, and Founding Director of the LAMDA Group, Nanjing University. His main research interests are in artificial intelligence, machine learning and data mining. He authored the books "Ensemble Methods: Foundations and Algorithms (2012)", "Machine Learning (in Chinese, 2016)", "Evolutionary Learning: Advances in Theories and Algorithms

(2019)", and published more than 200 papers in top-tierinternational journals/conferences. According to Google Scholar, his publications have received more than 40,000 citations, with an H-index of 92. He also holds 24 patents and has rich experiences in industrial applications. He has received various awards, including the IEEE Computer Society Edward J. McCluskey Technical Achievement Award, PAKDD Distinguished Contribution Award, IEEE ICDM Outstanding Service Award, National Natural Science Award of China, etc.. He serves as the Editor-in-Chief of Frontiers of Computer Science, Associate Editor-in-Chief of Science China Information Sciences, and Action/Associate Editor of Machine Learning, IEEE PAMI, ACM TKDD, etc.. He founded ACML (Asian Conference on Machine Learning) and served as Chair for many prestigious conferences, such as Program Chair of AAAI 2019, General Chair of IEEE ICDM 2016, Area Chair of NeurIPS, ICML, KDD, etc., and will serve as Program Chair of IJCAI 2021. He is a foreign member of the Academy of Europe, and a Fellow of the ACM, AAAI, AAAS, IEEE, IAPR, CCF and CAAI.

Keynote Speech 4

On new connections between deep learning and the theory of belief functions

Prof. Thierry Denoeux

Université de Technologie de Compiègne, France

Abstract

The Dempster-Shafer theory of belief functions is a formal framework for modeling and reasoning with uncertainty. It is based on the representation of independent pieces of evidence by belief functions, and on their combination by an operator called Dempster's rule. In this talk, I show that the weighted sum and softmax operations performed in the output layer of feedforward neural networks can be interpreted in terms of evidence aggregation using Dempster's rule of combination. From that perspective, the output probabilities computed by such classifiers can be seen as being derived from some belief functions, which can be laid bare and used for decision making or classifier fusion. The same analysis pertains to other classifiers such as Support Vector Machines. This finding suggests that the links between machine learning and belief functions are closer than is usually assumed, and that Dempster-Shafer theory provides a suitable framework for developing new machine learning algorithms.

Thierry Denoeux is a Full Professor (Exceptional Class) with the Department of Information Processing Engineering at the Université de Technologie de Compiègne

(UTC), France. He has been the Vice President of the Scientific Council of UTC in 2012-2014 and he is currently the head of the Laboratory of Excellence "Technological Systems of Systems". His research interests concern reasoning and decision-making under uncertainty and more generally, the management of uncertainty in intelligent systems. His main contributions are in the theory of belief functions with applications to statistical inference, pattern recognition, machine learning and information fusion. He is the author of more than 200 papers in journals and conference proceedings and he has supervised more than 30 PhD theses. He is the Editor-in-Chief of two Elsevier journals: 'International Journal of Approximate Reasoning' and 'Array', and an Associate Editor of several journals including 'Fuzzy Sets and Systems' and 'International Journal on Uncertainty, Fuzziness and Knowledge-Based Systems'.

Keynote Speech 5

A 30+ year road: bidirectional learning, bidirectional intelligence, and IA5A system

Prof. Lei Xu

Shanghai Jiao Tong University, China

Abstract

1. Degenerated bidirectional cases: Deep learning, generative learning, MMI, and BSO
2. Bidirectional learning for cognition/reconstruction: Autoencoder, Lmser, and recent developments
3. Bidirectional learning for image thinking: String-to-string, pic-to-string, pic-to-pic, deepfake, and string-to-pic
4. Bidirectional Intelligence for abstract think: Reasoning, searching, AlphaGo, and DSM optimization
5. IA5A intelligent system: Matching vs harmony, RHT vs A5, and F-enrichment/E-combination/GAN-verification

Lei Xu, Zhiyuan Chair Professor of Shanghai Jiao Tong Univ. (SJTU); Chief Scientist, SJTU AI Research Institute; Director of Neural Computation Research Centre in Brain and Intelligence Science-Technology Institute, ZhangJiang Lab. Also, Emeritus Profess of Chinese Univ. Hong Kong.

Worked in several AI areas for 37+ years, with influential contributions on RHT, classifier combining, LMSER, nonlinear PCA, MoE, RPCL, EM algorithm, RBF nets, BYY theory. Received several national and international academic awards, including 1993 National Nature Science Award, 1995 Leadership Award from International Neural Networks Society (INNS) and 2006 APNNA Outstanding Achievement Award. Highlighted by being one of few earliest PRC researchers (1) who got PhD education from China (e.g., the only one from AI fields among 40 recipients of the first FOK YING TUNG award in1988); (2) who published papers in NIPS (e.g., one paper per year during 1992-95); (3) who received thousands of SCI citations in fields of information and computer sciences; (4) who were elected to Fellow of IEEE and of IAPR (e.g., 2001 & 2002 respectively); (5) who served in the editorial boards of Neural Networks (1995-2016) and of IEEE Trans. Neural Networks (1994-98), also in the INNS governing board (2001-03) and the Fellow committee of IEEE Computational Intelligence society (2006-07).

Tutorial 1

Computing with Words in Decision Making and Consensus Reaching Processes, from Fuzzy Linguistic Variable to Elicit Information. Software for Developing Real World Applications

Prof. Luis Martínez López

University of Jaén, Spain

Abstract

The concept of computing usually implies calculation processes either by mathematical means of numbers and symbols or by a computer. The computing processes done by human beings employ frequently words in computing and reasoning, arriving at linguistic results from linguistic premises. Hence, Computing with Words (CW) applies a similar view to their computing processes aim at obtaining linguistic outcomes from linguistic inputs. Due to the fact that words have fuzzy denotations when they are used by human beings, the paradigm of CW was clearly stated as a branch of fuzzy logic by Zadeh in which CW was defined as "A methodology in which words are used in place of numbers for computing and reasoning." Later on, Zadeh added that "CW is a methodology in which the objects of computation are words and propositions drawn from a natural language."

Decision makers involved in complex decision making problems usually provide information about their preferences by eliciting their knowledge with different assessments. Usually, the complexity of these decision problems implies uncertainty that in many occasions has been successfully modelled by means of linguistic information, mainly based on fuzzy based linguistic approaches. This tutorial will provide a comprehensive overview of the fuzzy linguistic approach and its extensions from linguistic 2-tuple to ELICIT information passing by Hesitant Linguistic term sets among others that have successfully used for CW in Decision Making also during the tutorial FLINSTONES (Fuzzy LINguisTic DeciSion TOols eNhacemEnt Suite) software that has been developed to deal in decision making under linguistic contexts.

Luis Martínez was born in 1970. He received the M.Sc. and Ph.D. degrees in Computer Sciences, both from the University of Granada, Spain, in 1993 and 1999, respectively. He is Full Professor of Computer Science Department at the University of Jaén and Lecturing Professor under the "Chutian Scholar Program" in Wuhan University of Technology. His current research interests fuzzy multi-criteria decision making, data driven decision support, computing with words and recommender systems. He co-edited 15 journals special issues on related topics to his interests and published more than 130 papers in journals indexed by the SCI as well as 33 book chapters and more than 150 contributions in International Conferences related to his areas. He has been main researcher in 14 R&D projects. He is the member of the European Society for Fuzzy Logic and Technology (EUSFLAT) and of IEEE. Co-Editor in Chief of the International Journal of Computational Intelligence Systems and an Associated Editor of the journals IEEE Transactions on Fuzzy Systems, Information Fusion, etc.. He received twice the IEEE Transactions on Fuzzy Systems Outstanding Paper Award 2008 and 2012 (bestowed in 2011 and 2015 respectively) and the Da Ruan's Award in the FLINS Conference 2016. He is also Visiting Professor in University of Technology Sydney and University of Portsmouth, Guest Professor in the Southwest Jiaotong University and honourable professor in Xihua University both in Chengdu (China). Eventually, he has been appointed as Highly Cited Researcher since 2017.

Tutorial 2

How to Publish a High-Quality Journal Paper

Prof. Jie Lu

University of Technology Sydney, Australia

Abstract

This tutorial aims to help young researchers to prepare and publish papers in top journals. It will use the journal "Knowledge-Based Systems" as an example to first introduce editorial issues such as paper review process and how reviewers look at. It will then talk about the preparation of a journal paper, main types of journal papers, and quality of a work. It will particularly present the structure of a journal paper and how to write each part of the paper. Finally, how to revise a paper based on reviewers' comments is discussed in details.

Distinguished Professor Jie Lu is an internationally renowned scientist in the areas of decision support systems, fuzzy transfer learning, concept drift, and recommender systems. She is an IEEE fellow, IFSA fellow and Australian Laureate fellow; the Director of the Centre for Artificial Intelligence and the Associate Dean (Research Excellence) in the Faculty of Engineering and Information Technology at the University of Technology Sydney.

She has published six research books and over 400 papers in refereed journals and conference proceedings; has won 20 ARC DPs and industry projects; supervised 40 PhD students to completion. She serves as Editor-In-Chief for Knowledge-Based Systems (Elsevier) and Editor-In-Chief for International journal of computational intelligence systems. She has received various awards and delivered over 25 keynote speeches at international conferences.