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Panel title: IEEE SMC Society Founders' Forum

Summary: The Founders' Forum is a moderated panel held at each IEEE SMC Society annual flagship conference since 2017. It features former SMC Society leaders as panelists invited to share thoughts, vision, and ideas about the Society and its future, including remarks on select SMC Society technical fields of interest. For the SMC Society, it serves to maintain its legacy, engage with its history, and acquire friendly advice toward its future.

Moderator: Imre J. Rudas, President, IEEE SMC Society

Organizer: Eddie Tunstel, Jr. Past President, IEEE SMC Society

Panelists

Machine Learning and Complex Networks

Ljiljana Trajkovic

Abstract:

The Internet, social networks, power grids, gene regulatory networks, neuronal systems, food webs, social systems, and networks emanating from augmented and virtual reality platforms are all examples of complex networks. Collection and analysis of data from these networks is essential for their

understanding. Traffic traces collected from various deployed communication networks and the Internet have been used to characterize and model network traffic, analyze network topologies, and classify network anomalies. Data mining and statistical analysis of network data have been employed to determine traffic loads, analyze patterns of users' behavior, and predict future network traffic while spectral graph theory has been applied to analyze network topologies and capture historical trends in their development. Recent machine learning techniques have proved valuable for predicting anomalous traffic behavior and for classifying anomalies in complex networks. Further applications of these tools will help improve our understanding of the underlying mechanisms that govern behavior, improve their performance, and enhance their security of social networks such as Facebook, LinkedIn, Twitter, Internet blogs, forums, and websites.



Ljiljana Trajkovic received the Dipl. Ing. degree from University of Pristina, Yugoslavia, in 1974, the M.Sc. degrees in electrical engineering and computer engineering from Syracuse University, Syracuse, NY, in 1979 and 1981, respectively, and the Ph.D. degree in electrical engineering from University of California at Los Angeles, in 1986.

She is currently a Professor in the School of Engineering Science at Simon Fraser University, Burnaby, British Columbia, Canada. From 1995 to 1997, she was a National Science Foundation (NSF) Visiting Professor in the Electrical Engineering and Computer Sciences Department, University of California, Berkeley. She was a Research Scientist at Bell Communications Research, Morristown, NJ, from 1990 to 1997, and a Member of the Technical Staff at AT&T Bell Laboratories, Murray Hill, NJ, from 1988 to 1990. Her research interests include high-performance communication networks, control of communication systems, computer-aided circuit analysis and design, and theory of nonlinear circuits and dynamical systems.

Dr. Trajkovic serves as IEEE Division X Delegate/Director (2019–2020) and served as IEEE Division X Delegate-Elect/Director-Elect (2018). She served as Senior Past President (2018–2019), Junior Past President (2016–2017), President (2014–2015), President-Elect (2013), Vice President Publications (2012–2013, 2010–2011), Vice President Long-Range Planning and Finance (2008–2009), and a Member at Large of the Board of Governors (2004–2006) of the IEEE Systems, Man, and Cybernetics Society. She served as 2007 President of the IEEE Circuits and Systems Society and a member of its Board of Governors (2004–2005, 2001–2003). She is Chair of the IEEE Circuits and Systems Society joint Chapter of the Vancouver/Victoria Sections. She was Chair of the IEEE Technical Committee on Nonlinear Circuits and Systems (1998). She is General Co-Chair of SMC 2020 and SMC 2020 Workshop on BMI Systems and served as General Co-Chair of SMC 2019 and SMC 2018 Workshops on BMI Systems, SMC 2016, and HPSR 2014, Special Sessions Co-Chair of SMC 2017, Technical Program Chair of SMC 2017 and SMC 2016 Workshops on BMI Systems, Technical Program Co-Chair of ISCAS 2005, and Technical Program Chair and Vice General Co-Chair of ISCAS 2004. She served as an Associate Editor of the IEEE Transactions on Circuits and Systems (Part I) (2004–2005, 1993–1995), the IEEE Transactions on Circuits and Systems (Part II) (2018, 2002–2003, 1999–2001), and the IEEE Circuits and Systems Magazine (2001–2003). She is a Distinguished Lecturer of the IEEE Systems, Man, and Cybernetics Society (2020–2021) and the IEEE Circuits and Systems Society (2010–2011, 2002–2003). She is a Professional Member of IEEE-HKN and a Life Fellow of the IEEE.



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From Fuzzy Sets to Information Granules: New Frontiers of Human-Centric Computing

Witold Pedrycz

Abstract:

With the omnipresence of complex systems and enormous masses of data which become commonly encountered in everyday life, emerges an evident challenge to carry out numerous tasks of modeling, data interpretation, analysis, and control. Evidently, all of those pursuits exhibit an ultimate feature of human centricity. Interpretability, explainability, and the involvement of suitable abstraction levels are crucial to the delivery of efficient design and analysis activities.

We advocate that information granules, information granularity and Granular Computing arise as an appealing conceptual and algorithmic framework. Granular Computing has led to the paradigm shift. It has opened up new directions of data analytics, system modeling, computer vision and explainable Artificial Intelligence (XAI). As exemplified by numerous studies, the realization of the timely pursuits of XAI, information granules and Granular Computing (embracing pioneering and seminal concepts of fuzzy sets and rough sets) play a significant role in human-centric systems. The profound features that facilitate explanation and interpretation go hand in hand with an accommodation of the logic fabric of modeling constructs, a selection of a suitable level of abstraction, and modularity requirements paving a way of splitting complex problems into a collection of manageable subtasks. Information granularity is of paramount relevance in building linkages between real-world data and concepts and symbols commonly present in AI constructs. We emphasize the need for quantifiable and interpretable measures of credibility of the results. In these situations, central to all pursuits is a process of formation of information granules and their prudent characterization. Various construction scenarios of information granules are discussed along with a way of assessing their quality. Generative and discriminative aspects of information granules supporting their usage in the user-centric architectures 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, a Fuzzy Pioneer Award from the IEEE Computational Intelligence Society, and 2019 Meritorious Service Award from the IEEE Systems, Man, and Cybernetics Society. He served as Editor-in-Chief of IEEE Transactions on SMC-Systems. He was a program chair of the IEEE SMC-2017.

His main research directions involve Computational Intelligence, fuzzy modeling and Granular Computing, knowledge discovery, pattern recognition, data science, knowledge-based neural networks, and control



engineering. Dr. Pedrycz is 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.