Information Granularity in Intelligent Data Analysis: Design Considerations

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Abstract

Information granules play a pivotal role in acquiring, representing, processing, and communicating knowledge at a suitable level of abstraction. Designing information granules is paramount to all pursuits of Granular Computing, especially information granules formalized as fuzzy sets and rough sets.

This presentation offers a comprehensive and systematically structured overview of methodologies and algorithms of designing information granules along with a suite of representative applications in data analysis and decision-making. The taxonomy embraces two main categories of data-driven and knowledge-oriented approaches. We introduce and discuss a principle of justifiable granularity, which serves as a key design vehicle facilitating a formation of information granules completed on a basis of available experimental evidence. Recent advances of the principle are discussed including (i) a collaborative version of the principle supporting data analysis carried out in the presence of distributed data, (ii) context-based version of the principle incorporating auxiliary sources of knowledge, and (iii) its hierarchical version facilitating handling experimental evidence being available at several levels of specificity (abstraction). A collection of design scenarios supporting a formation of hierarchies of information granules of higher type and higher order is presented.

In the realm of data analysis, we discuss a collaborative mode of discovery of relationships, a granular summarization of findings quantified in the language of information granules and a role of granular parameter and output spaces.

Speaker Bio

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. Witold Pedrycz has been a member of numerous program committees of IEEE conferences in the area of fuzzy sets and neurocomputing. 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 mining, fuzzy control, pattern recognition, knowledge-based neural networks, relational computing, and Software Engineering. He has published numerous papers in this area. He is also an author of 15 research monographs 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 ***Int. J. of Granular Computing*** (Springer). He serves on an Advisory Board of ***IEEE Transactions on Fuzzy Systems*** and is a member of a number of editorial boards of other international journals.