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The explanation of mined knowledge by fuzzy logic

The problem of explainability is pivotal in any knowledge discovery task, particularly in the medical domain [1]. AI/machine learning demonstrates great successes these days, but is unable to explain the solution. The users of solutions are mainly domain experts e.g., medical doctors, who often face the lack of a certain level of in general mathematical and in particular and statistical literacy. However, the solutions of machine learning algorithms are usually presented in a mathematical-statistical way. On the other hand, the *computing with words* concept [2] offers methods for explaining and disseminating mined knowledge from the data by expressions of natural language [3]. To reflect the elasticity of adverbs, adjectives and verbal quantifiers, fuzzy sets offer a “sliding scale” definition of linguistic terms by membership functions. In addition, fuzzy logic offers a large scale of aggregation functions (e.g., variants of conjunction, disjunction and mixed functions) to support fitting the input data with their respective outputs. The powerful way for expressing relations among attributes is linguistic summary, usually a short quantified sentence of natural language. The solution depends only on the intensities of belonging to fuzzy sets and therefore we can summarize from the diverse data types. To avoid summaries based on outliers or low data coverage, quality criteria adjusted to the particularities of considered tasks are indispensable. The solutions are usually delivered by poorly designed, yet often disappointingly presented user-interfaces. Developing both easy-to-use and robust interfaces is a challenging task, because they should reflect users’ needs efficiently. This talk revolves around the aforementioned challenges.

Miroslav Hudec is an associate professor at the University of Economics in Bratislava (Slovakia), Faculty of Economic Informatics. He received the Master and PhD degrees from the University of Belgrade (Serbia), where he recently got the position of visiting professor. His work is mainly focused on fuzzy logic, aggregation functions, knowledge discovery, and information systems. He is a member of program committees of several international conferences and serves as an editorial board member in several journals including Applied Soft Computing (SCI Impact Factor 3.907). Miroslav has published more than 50 scientific articles including a monograph with Springer [4]. In the FP7 project Blue-ETS he focused on the modernising official statistics, and he was leader of two work packages. His research interests are in a future combination of logical approaches with probabilistic-statistical machine learning.

[1] Andreas Holzinger, Bernd Malle, Peter Kieseberg, Peter M. Roth, Heimo Müller, Robert Reihs & Kurt Zatloukal 2017. Towards the Augmented Pathologist: Challenges of Explainable-AI in Digital Pathology. arXiv:1712.06657.

[2] Lotfi A. Zadeh 1996. Fuzzy logic= computing with words. IEEE transactions on fuzzy systems, 4, (2), 103-111.

[3] Miroslav Hudec, Erika Bednárová & Andreas Holzinger 2018. Augmenting Statistical Data Dissemination by Short Quantified Sentences of Natural Language. 34, (4), 981, doi /10.2478/jos-2018-0048.

[4] Miroslav Hudec 2016. Fuzziness in Information Systems. Springer International Publishing.