

Zadeh's computing with words: an effective and efficient tool for implementing the "human/society-in-the-loop" paradigm?

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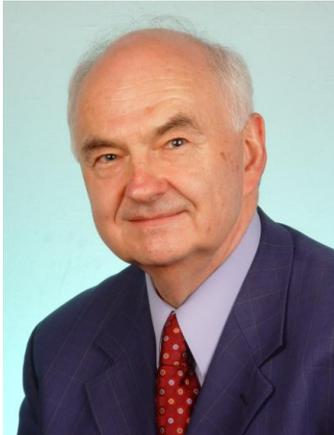
Abstract. We consider some issues related to one of the grand challenges of science that can be briefly stated as to make the computer to be a cognitive partner to the human being. We mainly consider some novel concepts of a more implicit and proactive involvement the human being in the modeling, simulation, learning, decision making, etc. processes, the so called "human-in-the-loop" (HITL) paradigm (model) which boils down to the necessity to have the human being as an essential active part of the process without whom the solution could be inefficient or even ineffective. This implies a need for transparency and comprehensibility in the analyses, presentation of results, etc. We also mention a new scaled up extension of this paradigm, developed at MIT, the so-called "society-in-the-loop" in which some interaction with the society occurs.

We concentrate on a way to implement the above human centric type paradigms mainly by trying to bridge the gap between the human being and computer, and concentrate on the one related to the fact that for the human being natural language is the only fully natural means of articulation and communication which is not the case for the computer.

We present Zadeh's computing with words (CWW) as an effective and efficient tool to operationalize the above paradigm. We concentrate on constraints and their propagation as the main tool in CWW, and in particular emphasize the role of modalities exemplified by: usuality – how frequently something occurs, probability, possibility or certainty – the likelihood of something happening or being the case, obligation or necessity – how necessary it is for things to be done or to be a certain way, and ability – the ability of someone or something, to do something. We concentrate on usuality and present it in the perspective of usuality qualification in constraints and constrain propagation schemes. We also mention many other modalities that are known in linguistics and indicate their usefulness and implementability.

We show that a convenient and operational way of handling usuality qualification is via a calculus of linguistically quantified propositions that involves fuzzy linguistic quantifiers. We show some examples of the use of usuality qualification, notably via linguistic data summaries and association rules, both of static and dynamic data. Then, we concentrate on a more sophisticated case of multistage decision processes over a finite and infinite planning horizon and present usuality qualification which involves discounting. We indicate serious problems in case of an infinite horizon.

We conclude with some remarks on challenges and perspectives, notably in terms of the transparency and comprehensibility of the aggregation operators and solution procedures employed.



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