Abstract: In many practical situations, we encounter physical quantities like time for which there is no fixed starting point for measurements: physical properties do not change if we simply change (shift) the starting point. To describe knowledge about such properties, it is desirable to select membership functions which are similarly shift-invariant. We show that while we cannot require that each membership function is shift-invariant, we can require that the linear space of all linear combinations of given membership functions is shift-invariant. We describe all such shift-invariant families of membership functions, and we show that they are naturally related to the corresponding formulas of chemical kinetics.

5. Computing with Words: Towards a New Tuple-Based Formalization
Olga Kosheleva, Vladik Kreinovich, Ariel Garcia, Felipe Jovel, Luis Torres Escobedo, Thavatchai Ngamsantivong

Abstract: An expert opinion describes his or her opinion about a quantity by using imprecise ("fuzzy") words from a natural language, such as "small", "medium", "large", etc. Each of these words provides a rather crude description of the corresponding quantity. A natural way to refine this description is to assign degrees to which the observed quantity fits each of the selected words. For example, an expert can say that the value is reasonable small, but to some extent it is medium. In this refined description, we represent each quantity by a tuple of the corresponding degrees. Once we have such a tuple-based information about several quantities $x_1, ..., x_m$, and we know that another quantity $y$ is related to $x_i$ by a known relation $y=f(x_1,...,x_m)$, it is desirable to come up with a resulting tuple-based description of $y$. In this paper, we describe why a seemingly natural idea for computing such a tuple does not work, and we show how to modify this idea so that it can be used.

6. Analysis of Fuzzy Decision Trees on Expert Fuzzified Heart Failure Data
Jan Bohacik, Chandra Kambhampati, Darryl Davis, John Cleland

Abstract: The prevalence of heart failure is 2-3% of the adult population and it is expected to grow. Half of all patients diagnosed with it die within four years. To minimize life-threatening situations and to minimize costs, it is interesting to predict mortality rates for a patient with heart failure. In this paper, a fuzzy decision tree based on classification ambiguity and a fuzzy decision tree based on cumulative information estimations are presented. They are employed on a heart failure data fuzzified on the basis of medical expert knowledge. After a transformation of fuzzy decision trees, the use of medical expert knowledge allows us to create a group of fuzzy rules that is easily interpretable by medical experts. Our study shows that different types of fuzzy decision trees can have significantly different accuracy results and interpretability.
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