Deck-of-Card-based Membership Functions: A Socio-Technical Approach

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This contribution introduces a novel approach to constructing interpretable fuzzy sets, rooted in a socio-technical framework. It emphasizes collaborative interaction between two key actors: the decision analyst and the decision-maker. Together, they co-create membership functions tailored to accurately reflect the decision-maker's nuanced semantics, even amidst diverse scales. Our methodology fosters a dynamic process of social interaction, where the analyst simplifies technical complexities for the decision-maker's comprehension through an iterative process that not only refines the decision-maker's preferences but also enhances their understanding of the problem at hand. Leveraging the well-established deck of cards method for assessing parameters in multiple criteria decision-making, our approach yields what we term "DoC-MFs" (Deck of Cards-based Membership Functions). Formally, DoC-MFs are a subclass of piece-wise linear fuzzy numbers, which allows providing simple computational rules based on fuzzy arithmetic to aggregate them for multi-criteria decision problems. To illustrate practical utility, we provide a case study in the realm of sustainability demonstrating the efficacy of our proposed methodology.

Keywords: Multiple Criteria Analysis Co-constructive Process Construction of Fuzzy Numbers Deck of Cards Membership Function Aggregation