

Relationships between Qualitative and Quantitative Scales for Aggregation Operations: The Example of Sugeno Integrals

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In decision applications, especially multicriteria decision-making, numerical approaches are often questionable because it is hard to elicit numerical values quantifying preference, criteria importance or uncertainty. More often than not, multicriteria decision-making methods come down to number-crunching recipes with debatable foundations. One way out of this difficulty is to adopt a qualitative approach where only maximum and minimum are used. Such methods enjoy a property of scale invariance that insures their robustness. One of the most sophisticated aggregation operation making sense on qualitative scales is Sugeno integral. It is not purely ordinal as it assumes commensurability between preference intensity and criteria importance or similarly, utility and uncertainty. However, since absolute qualitative value scales must have few levels so as to remain cognitively plausible, there are as many classes of equivalent decisions as value levels. Hence this approach suffers from a lack of discrimination power. In particular, qualitative aggregations such as Sugeno integrals cannot be strictly increasing and violate the strict Pareto property. In this talk, we report results obtained when trying to increase the discrimination power of Sugeno integrals, generalizing such refinements of the minimum and maximum as leximin and leximax. The representation of leximin and leximax by sums of numbers of different orders of magnitude (forming a super-increasing sequence) can be generalized to weighted max and min (yielding a “big-stepped” weighted average) and Sugeno integral (yielding a “big-stepped” Choquet integral). This methodology also requires qualitative monotonic set-functions to be refined by numerical set-functions, and we show they can always be belief or plausibility functions in the sense of Shafer.

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