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RUTA: a framework for assessing and selecting additive value functions on the basis of rank related requirements

We present a new preference disaggregation method, called RUTA, which infers a set of additive value functions from the preference information referring to the desired ranks of some reference alternatives. Real-life experience indicates that people willingly refer to the range of allowed ranks that a particular alternative should attain, or to constraints on the final scores of the alternatives. We develop a mathematical model for incorporating such preference information via Mixed Integer Linear Programming. Then, we adapt existing UTA-like methods to the proposed framework. Precisely, we show how decision making could be supported by the use of a single value function or a set of value functions that are compatible with the new type of preference information. In particular, we refer to the necessary and possible preference relations stemming from robust ordinal regression, and to the results of extreme ranking analysis, i.e. to the best and worst ranks gained by each alternative over the set of compatible instances of the preference model.

We also propose a new interactive UTA-like technique, which aims at selecting a single value function representing the outcomes of extreme ranking analysis. In the interactive process, the DM in assigning priorities to different pre-defined targets, which are built on results of extreme ranking analysis, and refer to the comparison of the best and/or worst ranks for pairs of alternatives. In particular, the DM may choose to emphasize or neglect the advantage of some alternatives over the others, in terms of results of extreme ranking analysis. The selected value function constitutes synthetic representation of extreme ranking analysis at a higher level of abstraction. Note that the introduced procedure is irrespective of the type of preference information considered in this paper, and remains valid for "traditional" preference information in the form of, e.g., pairwise comparisons of reference alternatives.