

A PROMETHEE-BELIEF Approach for Multi-Criteria Decision Making Problems with Incomplete Information

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Abstract : Multi-criteria decision aid methods consider decision problems where numerous alternatives are evaluated on several criteria. These methods are used to deal with perfect information. However, in practice, it is obvious that this information requirement is too much strict. In fact, the imperfect data provided by more or less reliable decision makers usually affect decision results since any decision is closely linked to the quality and availability of information. In this paper, a PROMETHEE-BELIEF approach is proposed to help multi-criteria decisions based on incomplete information. This approach solves problems with incomplete decision matrix and unknown weights within PROMETHEE method. On the base of belief function theory, our approach first determines the distributions of belief masses based on PROMETHEE's net flows and then calculates weights. Subsequently, it aggregates the distribution masses associated to each criterion using Murphy's modified combination rule in order to infer a global belief structure. The final action ranking is obtained via pignistic probability transformation. A case study of real-world application concerning the location of a waste treatment center from healthcare activities with infectious risk in the center of Tunisia is studied to illustrate the detailed process of the BELIEF-PROMETHEE approach.

Keywords : belief function theory, incomplete information, multiple criteria analysis, PROMETHEE method

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