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Multiple Criteria Decision Aiding by Constructive Preference Learning (Keynote Lecture – Extended Abstract)

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The notion of preference is relevant across a variety of scientific disciplines, including economics and social sciences, operational research and decision sciences, artificial intelligence, psychology, and philosophy. Preferences provide a means for specifying desires in a declarative and intelligible way, a key element for the effective representation of knowledge and reasoning respecting the value systems of Decision Makers (DMs) [1].

Recognizing the preferences of DMs is also crucial for multi-criteria decision aiding. We present a constructive preference learning methodology, called robust ordinal regression (ROR) [2]. This methodology links operational research (OR) with artificial intelligence (AI), and as such, it confirms the current trend in mutual relations between OR and AI [3].

The lecture starts from an observation that the dominance relation established in the set of alternatives evaluated on multiple attributes (criteria, or voters, or states of the nature) is the only objective information that stems from the formulation of a multiple attribute decision problem (ordinal classification, or ranking, or choice – with multiobjective optimization being a particular case). While it permits to eliminate many irrelevant (i.e., dominated) alternatives, it leaves many alternatives incomparable. This situation may be addressed by taking into account preferences of the DM. Therefore, decision aiding methods require some preference information exhibiting a value system of a single or multiple DMs.

In ROR, the preference information has the form of decision examples. They may either be provided by the DM on a set of real or hypothetical alternatives, or may come from observation of DM's past decisions. This information is used to build a preference model, which is then applied on a non-dominated set of alternatives to arrive at a recommendation presented to the DM(s).

In practical decision aiding, the process composed of preference elicitation, preference modeling, and DM's analysis of a recommendation, loops until the DM (or a group of DMs) accepts the recommendation or decides to change the problem setting. Such an interactive process is called constructive preference learning. We describe this process for three types of preference models:

1) utility functions,
2) outranking relations, and
3) sets of monotonic decision rules.

The case of a hierarchical structure of the set of criteria will be discussed [4], and the transparency and explainability features required from preference learning will be discussed on the example of interactive multiobjective optimization [5].

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