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Working with Preferences: Less Is More

Springer

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To my parents

Preface

Because preferences naturally arise and play an important role in many real-life decisions, they are the backbone of various fields. Preferences are fundamental in scientific research frameworks such as artificial intelligence, economics, and social choice theory, as well as applications, e.g., recommender systems, and e-commerce. Although preferences have been developed in diverse disciplines, their different usages share a common purpose, namely, to identify appealing choices from among those available.

In particular, preferences are a core and hot topic in artificial intelligence, for which we are witnessing plenty of work and dedicated international events. I have been involved with preferences for many years. My contributions to this topic were guided by two important questions I attempted to answer: *"How does one deal with users' preferences?"* and *"How can work on preferences in artificial intelligence be successfully exported to fields dealing with preferences?"* Each of these questions has motivated significant work. In particular, artificial intelligence researchers have extensively addressed the first question from representation issues when the number of choices is large. This led to a large number of different frameworks for preference representation. I contributed to this topic with new insights into preference representation. Nevertheless, I refrained from committing to any specific proposal (including mine). Instead, I studied, analyzed and compared the different frameworks and concluded that they are not competing but complementary. In fact, each has its merits but cannot adequately and/or naturally cope with all problems related to preference representation. Having studied different frameworks for preference representation allowed me to broaden my research contributions and address the second question. The purpose of this question is twofold. First, I aimed at understanding the usage of preferences in both artificial intelligence and other disciplines. Then, I aimed at highlighting the benefits of various successful preference representations developed in artificial intelligence and exporting them to other fields, allowing efficient handling of preferences. We promote the use of simple but satisfactory compact preference representation languages (less is more). This topic is of growing importance in the artificial intelligence community.

As I had always been keen on problems related to preferences, I moved for one year to a psychology lab (Cognition, Langues, Langage, Ergonomie, CLLE, Toulouse) as a researcher visitor. Preferences are not new topic in psychology. Different problems related to preferences have been identified and studied in this field. However, the relevance of the works in this field for artificial intelligence is largely unexplored. My collaboration with psychologists aims at exploring the connection between theoretical sciences and experimental sciences for preference handling in order to highlight the beneficial synergies among these fields.

Given that preferences have been extensively investigated from different perspectives, clearly a complete synthesis of this work does not fit in one book. On the other hand, one may wish to have an overview of these works. This book grew from an attempt to offer a coherent exposition of some problems related to preferences. The core part of this book is dedicated to preference representation and related problems. The second part is dedicated to the use of preference representation in various preference-based frameworks.

The book is reader-friendly. All concepts, definitions and results are explained in a simple way and illustrated with examples. The intended audience is students, novice researchers, and senior researchers in various fields, such as artificial intelligence, database management, operations research and psychology.

Lens, *Souhila Kaci*
October 2010

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Acronyms

List of abbreviations.

QCL	Qualitative Choice Logic
GAI	Generalized Additive Independence
GAI-net	Generalized Additive Independence Network
CPT	Conditional Preference Table
CP-net	Conditional Preference Network
CI-net	Conditional Importance Network
TCP-net	Conditional Preference Network with Tradeoffs
UCP-net	Conditional Preference Network with Utilities
CSP	Constraint Satisfaction Problem
SCSP	Soft Constraint Satisfaction Problem

List of symbols.

$\in$	membership
$\subseteq$	subset
$\subset$	proper subset
$\cap$	intersection
$\cup$	union
$\setminus$	difference
$\emptyset$	emptyset
$2^{\mathscr{A}}$	power set
$\times$	cartesian product
$\models$	satisfaction
$\neg$	negation
$\vee$	disjunction
$\hat{\times}$	ordered disjunction
$\wedge$	conjunction
$\forall$	universal quantifier
$\exists$	existential quantifier
$\top$	tautology

$\succeq$	at least as preferred as
$\succ$	strictly preferred to
$\sim$	incomparable with
$\approx$	as preferred as
min	minimal value
max	maximal value
$\geq$	greater than or equal
$>$	strictly greater
$\leq$	smaller than or equal
$<$	strictly smaller