

Foreword

Philosophy and Mathematics sections in libraries worldwide, are not in short supply of titles on rationality. When rationality delves into decision making, the offers easily fold and this is relatively easy to figure out because these topics are not only theoretically intriguing but encompass endless practical implications. For that reason, discussions on rationality and decision making will not to be exhausted any time soon. Nonetheless, the ideas and skilful approach taken by Tshilidzi Marwala, in his new book, “Artificial Intelligence for Rational Decision Making”, to say the least, are highly refreshing and inspiring. The text is indeed quite readable, very stimulating and often teasing. The contextual elements, down-to-earth examples, and extensive list of further references are a rare asset to the readers who certainly will enjoy the broad overview on Rational Decision Making provided in Chap. 1.

Rationality can be tackled and discussed from many different perspectives. In a rather simplistic manner, it can be seen as the “distance” from beliefs to reasons within a coherent system. Regardless of the reader's purpose for reading this book, be it for further understanding of the topic and/or for application purposes, the difficult formalization of such a subject and the lucid explanations provided here for all circumventing concepts are not only necessary but highly welcome. For example, in Chaps. 2 and 3, rough set and support vector machines, respectively, are instrumental for creating causal and correlation functions. Analogously, missing data and counterfactuals, of Chaps. 4 and 5 are implemented using sound artificial intelligence methods and this is precisely where this book excels as it offers formal but creative and palatable perspectives on rationality.

The key-concepts of “flexibly-bounded rationality”, “flow of information” and “marginalization of irrelevance”, presented in Chaps. 6 and 7, are seminal and master-strokes for one more securely now (together with the other previous propositions) to be able to ascribe either causality or mere correlation i.e., some information has to flow (or emanate-flexibly) among relating concepts in order for any cause/correlation to be reputed. A generalization, so to say on rational decision making is then on offer in Chap. 8—group decision, when ensembles and mixtures of techniques are concocted graciously.

In all, it was a most fortunate and enjoyable task for me to write this foreword as the book surely fills a gap in the long-standing and profuse discussions about

rationality. I personally appreciated greatly how the author engaged on the key aspects, without taking camps, but rather, offering new avenues for one to take up the subject, yet using sound methods from artificial intelligence. Remarkable is also the direction put forward for feeding the reader's thoughts, regardless of whether they are for abstract or real purposes. Concomitant ideas comprised in this book quite certainly will inspire scientists and engineers to produce computable embodiments of rationality. Interested readers will surely profit, seamlessly, to readily delve into the associated logic-philosophical debate, mathematically formulated and computationally exemplified.

I conclude by assuring the lucky readers that the topic of rationality for decision making will be reasoned very differently in their minds after learning the complexly-simple rationale here conceived by Tshilidzi Marwala. I can foresee that after exposure to this text: philosophers will feel the need to (re-)think, scientists will be urged to (re-)write, engineers will wish to (re-)build and for sure lecturers will be highly rewarded when they (re-)ad.

Recife
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Preface

This book is on decision making, which is a complex process, that has confounded intellectuals since time immemorial. For instance, to make decisions rationally, one must take into account that others may be acting irrationally. In this instance, the rational decision that is taken will feature into account the irrational reaction from the other role player. As an example, a doctor prescribes medicine to a superstitious individual. That decision making process (rational) of prescribing medicine might take into account of the individual's superstitious inclinations (irrational) and, therefore, also prescribes that the patient should be supervised on taking the medication. So in essence the decision taken has factored into account the possibility the patient might act irrationally.

This book proposes that the basic elements of rational decision making are causality and correlation functions. Correlation is important because it fills in the gaps that exist in information needed for decision making because of the limitation of information available in decision making. Causality is important in decision making because it is through causal loops (if this then act so) that an appropriate cause of action is chosen from many possible causes of actions, based on the principle of the maximization of utility.

This book defines a causal function and builds it using rough sets and successfully applies it for decision making. This book defines a correlation function and builds it using support vector machines and applies these to model epileptic activity. Missing data approach which is based on the multi-layer perceptron autoassociative network and genetic algorithm is proposed and applied for decision making in antenatal data set and is then used for HIV prediction. Furthermore, this book introduces the theory of rational counterfactuals and applies this concept using neuro-fuzzy system and genetic algorithm for interstate conflict management. Furthermore, this book applies the theory of flexibly-bounded rationality for decision making by studying the problem of imperfect and incomplete information and its impact on decision making within the context of the theory of bounded rationality. To achieve this a multi-layer perceptron and particle swarm optimization are used in interstate conflict.

The theory of the marginalization of irrelevant information is studied for decision making. In this regard four techniques are considered and these are the

marginalization of irrationality approach, automatic relevance determination, principal component analysis and independent component analysis. These techniques are applied for condition monitoring, credit scoring, interstate conflict and face recognition.

Finally, this book studies the concept of group decision making and how artificial intelligence is used to facilitate decision making in a group. Four group based decision making techniques are considered and these are ensemble of support vector machines which are applied to land cover mapping incremental learning using genetic algorithm which is applied to optical character recognition, dynamically weighted mixtures of experts which are applied to platinum price prediction as well as the Learn++ which is applied to wine recognition.

This book is of value to students and professionals in the areas of engineering, politics and medicine.

Artificial Intelligence Techniques for Rational Decision
Making

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