Preface

Under the rational agent approach, the goal of artificial intelligence is to design rational agents that must take the best actions given the information available, their prior knowledge, and their goals. In many cases, the information and knowledge is incomplete or unreliable, and the results of their decisions are not certain, that is, they have to make decisions under uncertainty. An intelligent agent should try to make the *best* decisions based on limited information and limited resources. *Decision Theory* provides a normative framework for decision making under uncertainty. It is based on the concept of *rationality*, that is that an agent should try to maximize its utility or minimize its costs. Decision theory was initially developed in economics and operations research, but in recent years has attracted the attention of artificial intelligence researchers interested in understanding and building intelligent agents.

Decision Theory Models for Applications in Artificial Intelligence: Concepts and Solutions provides an introduction to different types of decision theory techniques, and illustrates their application in artificial intelligence. This book provides insights into the advantages and challenges of using decision theory models for developing intelligent systems. It includes a general and comprehensive overview of decision theoretic models in artificial intelligence, with a review of the basic solution techniques, a sample of more advanced approaches, and examples of some recent real world applications.

The book is divided into three parts: *Fundamentals, Concepts,* and *Solutions*. Section 1 provides a general introduction to the main decision-theoretic techniques used in artificial intelligence: Influence Diagrams, Markov Decision Processes and Reinforcement Learning. It also reviews the bases of probability and decision theory, and provides a general overview of probabilistic graphical models. Section 2 presents recent theoretical developments that extend some of the techniques in Section 1 to deal with computational and representational issues that arise in artificial intelligence. Section 3 describes a wide sample of applications of decision-theoretic models in different areas of artificial intelligence, including: intelligent tutors and intelligent assistants, power plant control, medical assistive technologies, spoken dialog systems, service robots, and multi-robot systems.

This book is intended for students, researchers and practitioners of artificial intelligence that are interested in decision-theoretic approaches for building intelligent systems. Besides providing a comprehensive introduction to the theoretical bases and computational techniques, it includes recent developments in representation, inference and learning. It is also useful for engineers and other professionals in different fields interested in understanding and applying decision-theoretic techniques to solve practical problems in education, health, robotics, industry and communications, among other application areas. The book includes a wide sample of applications that illustrate the advantages as well as the challenges involved in applying these techniques in different domains.