

Preface

It has long been a fundamental assumption in the research of autonomous agents and multiagent systems that intelligent agents should be rational—well, at least as rational as possible even if they are handicapped, like lacking access to all information that is needed for rational decision-making. While this assumption is only natural and right, rationality is actually only a better word to use if we try to avoid the use of the word selfishness to describe the deed of concerning only with one's own interests and being regardless of that of others.

When we first decided to work on the issues of fairness and social optimality in multiagent systems, with due respect to individual rationality of agents, we knew that we were facing a nontrivial challenge. The first difficulty that we encountered was the definition of fairness. We did spend some time to investigate this issue, delving into the definitions given by various authoritative dictionaries, hoping to obtain some mathematical formalism that captured the essence of these definitions. Unfortunately, the definitions in most of these dictionaries were not too helpful to us. While all our efforts seemed to have ended up in vain, we found that we had no choice but to start by taking a simplistic approach to reduce fairness to equality of agents' utility values (in some cases with a sufficiently small difference). Such an approach suffers from several drawbacks, as it is not able to capture many real-life situations. For example, in real life some people might consider it fair for rich people to receive less and poor people to receive more concerning the allocation of public resources. To this end, we looked into fairness models considering other types of fairness such as inequity-aversion and reciprocity. We hope the work presented in this book can shed light on this research area, which could attract more people to continue to work on it.

In this book we aim at tackling the issues of fairness and social optimality in multiagent systems from several aspects. We start with a relatively simple setting, in which agents use adaptive periodical strategy for coordination toward fairness. Agents interact with one another and review and adjust their strategies periodically. We then proceed to investigate how agents can coordinate to social optimality with reinforcement social learning in various types of games. After that, we discuss a related scenario of automated agent negotiation and present a

negotiation strategy that aims at achieving a mutually beneficial agreement. We also considered a competitive negotiation problem and present an adaptive negotiation strategy enabling a rational agent to maximize his benefits from negotiation. Finally, we propose the novel idea of decision entrustment in two-agent repeated games—that is, an agent is allowed the option of entrusting his opponent to make joint decisions in bilateral interaction—and show that social optimality sustained by Nash equilibrium can be achieved.

There are several assumptions that we employ in the work presented in this book. The first one is that agents can always learn from their experiences, and the learning is always rational. That is to say, if an agent, through his experience, finds that an action is most likely to bring its best utility under certain conditions, then the agent should in principle use that action when conditions are met. This is most appropriate when the environment is cooperative. Second, agents should be able to observe the other agents—or some of them—in the system, including the other agents' actions and even the utilities they obtain through interaction. Last but not least, we base our work on some principles proposed by cognitive psychologists. For example, we use a theory by Fehr and Schmidt that people are inequality averse under certain conditions, as well as the research result due to Dawes and Thaleri that people are willing to be kind to those who are being kind and harsh to those who are being unkind. These research works provide a solid cognitive psychological basis for many of the assumptions used throughout this book.

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