

# Preface

In many application areas natural models of the domains require the ability to express knowledge about two important relations: is-a and part-of. The is-a relation allows us to organize objects with similar properties in the domain into types. Part-of allows us to organize the objects in terms of composite objects. The is-a relation has received a lot of attention and is well-understood, while part-of has not been studied as extensively. The interaction between these two relations has not been studied in any detail either.

In this book we propose an object-centered framework with specialized support for part-of. The framework is based on description logics. Description logics are a family of object-centered knowledge representation languages tailored for describing knowledge about concepts and is-a hierarchies of these concepts. In addition to the representation and reasoning facilities that description logics provide for is-a, we add representation and reasoning facilities for part-of. We also show the usefulness and feasibility of our approach in a number of application areas.

The work described in this book is based partly on my PhD thesis and partly on recent work within the Laboratory for Intelligent Information Systems at the Department of Computer and Information Science at the University of Linköping. The two persons who have had the largest influence on my work are Lin Padgham and Nahid Shahmehri. A large part of the work reported in this book has been done in cooperation with them.

Erik Sandewall, Per-Olof Fjällström, Maurizio Lenzerini, Bernhard Nebel, Ralph Rönningquist, Johan Åberg, Cécile Boisson, Silvia Coradeschi, Mats Gustafsson, Anders Haraldsson, Pierpaolo Larocchia, and Ivan Rankin read a previous draft of the book and provided many valuable comments.

As part of our work we extended the CLASSIC description logic system. AT&T Bell Labs provided us with the CLASSIC source code. Deborah McGuinness and Lori Alperin Resnick were very helpful in answering our modeling questions.

The examples in chapters 5 and 6 are based on discussions with Kathleen Lambrix. She clarified for me the workings of a distribution company.

As a basis for the application in chapter 8 we used an existing implementation from the Australian Artificial Intelligence Institute. They provided us with their databases. In particular, we received help from and had interesting discussions with David Kinny, Mike Georgeff, and Ralph Rönningquist.

The application in chapter 9 is based on a manual for project management from Telia Research AB. Peter Lord provided us with this manual.

The work on machine learning described in chapter 10 was carried out in cooperation with Jalal Maleki. Nada Lavrač gave useful comments on an earlier version and encouraged us to pursue this work.

A number of people have contributed to parts of the model and the system described in chapter 11: Jonas Almfeldt, Svend Jacobsen, Johan Lövdahl, Niclas Wahllöf, and Johan Åberg.

The drawings in this book have been made by my friend Hilde Adé.

Part of this work was done during a visit to the Artificial Intelligence Lab of the Computer Science Department at RMIT University, Melbourne, Australia. The Department of Computer and Information Science of the University of Linköping and the Department of Computer Science of RMIT University made this visit possible.

Finally, we acknowledge the financial support of the Swedish Research Council for Engineering Sciences and the Swedish Foundation for Strategic Research.

*December 1999*

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Are You one of these people who have to talk to a machine quite often? Did you ever have problems explaining to a machine that the tank in a propellant tank assembly is always a propellant tank or that the title in a document has a larger font than the text in the sections or indeed did you need to convey any information about a relation between an entity and its parts to a machine? In the case You answered 'yes' to both questions, this work is written especially for You. In this work we present You with a language for talking to a machine about part-of. The framework we propose supports representing and automated reasoning about part-of. Thereby we support users in modeling domains with part-of, relieve them from implementing some reasoning tasks and relieve them from some of the maintenance of the domain knowledge base.

