Lecture Notes in Artificial Intelligence
Subseries of Lecture Notes in Computer Science
Edited by J. Siekmann

Lecture Notes in Computer Science
Edited by G. Goos and J. Hartmanis

Editorial

Artificial Intelligence has become a major discipline under the roof of Computer Science. This is also reflected by a growing number of titles devoted to this fast developing field to be published in our Lecture Notes in Computer Science. To make these volumes immediately visible we have decided to distinguish them by a special cover as Lecture Notes in Artificial Intelligence, constituting a subseries of the Lecture Notes in Computer Science. This subseries is edited by an Editorial Board of experts from all areas of AI, chaired by Jörg Siekmann, who are looking forward to consider further AI monographs and proceedings of high scientific quality for publication.

We hope that the constitution of this subseries will be well accepted by the audience of the Lecture Notes in Computer Science, and we feel confident that the subseries will be recognized as an outstanding opportunity for publication by authors and editors of the AI community.

Editors and publisher

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422

Bernhard Nebel

Reasoning and Revision in Hybrid Representation Systems

Springer-Verlag
Berlin Heidelberg New York London Paris Tokyo Hong Kong

Author

Bernhard Nebel
Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI)
Stuhlsatzenhausweg 3, D-6600 Saarbrücken 11, FRG

CR Subject Classification (1987): I.2.3–4

ISBN 3-540-52443-6 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-52443-6 Springer-Verlag New York Berlin Heidelberg

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© Springer-Verlag Berlin Heidelberg 1990
Printed in Germany

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
2145/3140-543210 – Printed on acid-free paper

Preface

The dynamic aspects of knowledge representation systems, namely, *reasoning* with represented knowledge and *revising* represented knowledge, are the most important aspects of such systems. In this book, these aspects are investigated in the context of hybrid representation systems based on KL-ONE.

After a general introduction to knowledge representation, reasoning, and revision, a typical member of the family of hybrid representation systems based on KL-ONE is introduced and analyzed from a semantic and algorithmic point of view. This analysis leads to new complexity results about subsumption determination and a characterization of a proposed hybrid inference algorithm as conditionally complete. Additionally, it is shown that so-called terminological cycles can be integrated smoothly into the framework.

Based on the analysis of representation and reasoning in KL-ONE-based systems, the revision problem is investigated. A survey of some approaches to belief revision leads to a reconstruction of symbol-level belief revision on the knowledge level. A conceptual analysis of terminological revision demonstrates that belief revision techniques developed for the revision of assertional knowledge are not adequate for the revision of terminological knowledge. For this reason, a literal revision approach is adopted. Essentially, it amounts to minimal mutilations in the literal description of definitions. Finally, implementation techniques for terminological revision operations are described, and the interface problem for a knowledge acquisition system is discussed.

This book is a revised version of my doctoral dissertation, accepted by the University of Saarland in June 1989. Most of the work was carried out while I was a member of the KIT-BACK project at the Technical University of Berlin. The final version was written up while I participated in the LILOG project as a guest researcher at the Scientific Center IBM Germany, Institute for Knowledge-Based Systems, Stuttgart.

I am indebted to my thesis advisor Wolfgang Wahlster, who stimulated my interest in knowledge representation in the first place while I was a member of the HAM-ANS project and who encouraged me in the following years to carry out the research described here.

Additionally, I would like to express my thanks to all those people without whom this book would not be what it is now. Foremost, there are my colleagues in the KIT group at the Technical University of Berlin and in the LILOG project at the Scientific Center of IBM Germany, Stuttgart. In particular, working with Kai von Luck, Christof Peltason, and Albrecht Schmiedel in the KIT-BACK project was a pleasure and played a central role in starting the research described here.

Once started, Kai played a driving force by always asking for the next chapter.

Furthermore, I would like to thank Peter Gärdenfors for making available the manuscript of his book and for his comments on some points concerning base revision; Otthein Herzog and Claus Rollinger for inviting me to participate in the LILOG project; Bob MacGregor for a number of discussions and suggestions, including the hint that realization must be easier than subsumption; Bernd Mahr for comments on the semantics of cycles; Peter Patel-Schneider for making the KANDOR system available and for discussions on semantics and complexity; Klaus Schild for showing me that subsumption in general terminological languages is undecidable; Jim Schmolze for pointing out that cycles are a serious problem; Jörg Siekmann, who was the second reader of the thesis, for asking the right questions and giving some valuable hints; Gert Smolka for numerous helpful discussions on semantic specification, algorithms, and the relationship between feature logic and KL-ONE; Norm Sondheimer for inviting me to ISI as a guest researcher and for showing me how to use KL-TWO in a natural language system; Jay Tucker for proof-reading various versions of the thesis (I take credit for any remaining flaws, of course); Marc Vilain for discussions on realization algorithms; and a number of other people too many to be listed here.

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