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Harrie de Swart Ewa Orłowska
Gunther Schmidt Marc Roubens (Eds.)

Theory and Applications of Relational Structures as Knowledge Instruments

COST Action 274, TARSKI
Revised Papers

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Volume Editors

Harrie de Swart
Tilburg University, Faculty of Philosophy
P.O. Box 90153, 5000 LE Tilburg, The Netherlands
E-mail: H.C.M.deSwart@uvt.nl

Ewa Orłowska
National Institute of Telecommunications
ul. Szachowa 1, 04-894 Warsaw, Poland
E-mail: orlowska@itl.waw.pl

Gunther Schmidt
Universität der Bundeswehr München
Fakultät für Informatik, Institut für Softwaretechnologie
85577 Neubiberg, Germany
E-mail: Schmidt@informatik.unibw-muenchen.de

Marc Roubens
University of Liège, Department of Mathematics
Sart Tilman Building, 14 Grande Traverse, B37, 4000 Liège 1, Belgium
E-mail: M.Roubens@ulg.ac.be

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Preface

Relational structures abound in the daily environment: relational databases, data mining, scaling procedures, preference relations, etc. Reasoning about and with relations has a long-standing European tradition. Today, there are strong European research groups in the theoretical as well as the applied branches.

European research in the field may be divided into three broad areas:
1. Algebraic Logic: algebras of relations, relational semantics, and algebras and logics derived from information systems.
2. Computational Aspects of Automated Relational Reasoning: decidability and complexity of algorithms, network satisfaction.
3. Applications: Linguistics, Psychology, Economics, etc.

While there is a wealth of theoretical knowledge to be used, there has been little interaction between basic and applied research in the field. For this reason, a European Concerted Research Action has been implemented, designated as COST Action 274: TARSKI (Theory and Applications of Relational Structures as Knowledge Instruments).

The main objective of this book is to advance the understanding of relational structures and the use of relational methods in applicable object domains. There are the following sub-objectives:
1. to study the semantical and syntactical aspects of relational structures arising from 'real world' situations;
2. to investigate automated inference for relational systems, and, where possible or feasible, develop deductive systems which can be implemented into industrial applications, such as diagnostic systems;
3. to develop non-invasive scaling methods for predicting relational data; and
4. to make software for dealing with relational systems commonly available.

We are confident that the present book will further the understanding of interdisciplinary issues involving relational reasoning. The study and possible integration of different approaches to the same problem, which may have arisen at different locations, will be of practical value to the developers of information systems.

The first five papers concern the *mechanization of relational reasoning*. This group of mechanization papers starts with a comparative report on two already existing systems by Rudolf Berghammer, Gunther Schmidt, and Michael Winter. The GUHA article by Petr Hájek, Martin Holeňa, and Jan Rauch refers to the well-developed system in Prague which derives information relations from information systems and is therefore some sort of a program for relational data mining. While there have been extensive studies in automated reasoning for propositional logics, Renate Schmidt and Ullrich Hustadt give a respective overview for modal and description logic reasoning systems. An attempt to develop a for-

mal basis for theory extraction from relational data guided by some ontology is undertaken by Gunther Schmidt. Pasquale Caianiello, Stefania Costantini, and Eugenio Omodeo focus on definitional extensions applied to relational formalisms as a way of overcoming expressive limitations of logical formalisms.

The next three papers concern the field of *relational scaling and preferences*. Kim Cao-Van and Bernard De Baets discuss how a proper definition of a ranking can be introduced into the framework of supervised learning. Agnieszka Rusinowska gives an overview of axiomatic and strategic approaches to bargaining problems. Harrie de Swart et al. give an overview of the four major categories of voting procedures and their flaws.

The last four papers deal with the *algebraic and logical foundations of real world relations*. Wojciech Buszkowski presents relational representability results for the classes of algebras related to the Lambek syntactic calculus. Ivo Düntsch and Günther Gediga study modal-like approximation operators determined by binary relations and present their applications to practical problems that require a qualitative data analysis. Ivo Düntsch, Ewa Orłowska and Anna Radzikowska introduce and study a class of weak relation algebras based on not necessarily distributive lattices. Ingrid Rewitzky developed a relational model of programming languages whose commands may involve both angelic and demonic non-determinism.

Referees

Ricardo Caferra
Jules Desharnais
Sašo Džeroski
Marcelo Frias
Günther Gediga
Wendy MacCaull
Roger Maddux
Ewa Orłowska
Irina Perfilieva
Marc Roubens
Gunther Schmidt
Harrie de Swart
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Editors

Prof. Harrie de Swart, Chair, Tilburg University, The Netherlands
Prof. Ewa Orłowska, Institute for Telecommunications, Warsaw, Poland
Prof. Gunther Schmidt, Universität der Bundeswehr, München, Germany
Prof. Marc Roubens, Université de Liège and Faculté Polytechnique de Mons, Belgium

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