Cognitive Technologies

Oleg Anshakov · Tamás Gergely

Cognitive Reasoning

A Formal Approach

With 6 Figures and 13 Tables

Springer

Authors
Prof. D.Sc. Oleg M. Anshakov
Institute for Linguistics
Intelligent Systems Department
Russian State University
for the Humanities
6 Miusskaya Square
Moscow, 125993
Russia
oansh@yandex.ru

Prof. D.Sc. Tamás Gergely
Applied Logic Laboratory
H-1022 Budapest
Hankoczy u. 7
Hungary
gergely@all.hu

Managing Editors
Prof. Dov M. Gabbay
Augustus De Morgan Professor of Logic
Department of Computer Science
King's College London
Strand, London WC2R 2LS, UK

Prof. Dr. Jörg Siekmann
Forschungsbereich Deduktions- und
Multiagentensysteme, DFKI
Stuhlsatzenweg 3, Geb. 43
66123 Saarbrücken, Germany

Cognitive Technologies ISSN 1611-2482
ISBN 978-3-540-43058-2 e-ISBN 978-3-540-68875-4
DOI 10.1007/978-3-540-68875-4
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2009940796

ACM Computing Classification (1998): I.2, F.4, F.1, F.2, H.1, I.1, J.4

Cover design: KünkelLopka GmbH, Heidelberg

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

Understanding cognition and modelling, designing and building artificial cognitive systems are challenging and long-term research problems. In this book authors wish to take a step towards a better understanding of cognition and its modelling by providing a well-founded integrated theory. Though this book is primarily not on cognitive system development, the need for an account of a genuine, logically well-founded formal framework seems to us especially important for system designers too. The authors' belief is that the practice of even those who most explicitly reject the need for theoretical foundation of intelligent systems on a constructive cognitive reasoning framework inevitably involves tacit appeal to insights and modes of reasoning that can be understood, designed and implemented.

This book had a long prehistory intertwined with the development of an important new method of plausible reasoning. The authors both participated in the development of the plausible reasoning technique which was called by its initiator V. K. Finn the JSM method of automatic generation of hypotheses in honour of the British thinker John Stuart Mill. This development has a long history of several decades, having already started in the former Soviet Union at the All-Russia Institute of Scientific and Technical Information (VINITI), Russian Academy of Sciences, Moscow. Some intensive periods of this development took place in cooperation with VINITI and the Applied Logic Laboratory, Budapest, Hungary.

The authors not only participated in the development of this method but also played key roles in the elaboration of the main results of this method.

Earlier, around the millennium, a book was planned to be written on the results obtained in the area of plausible reasoning provided by this method. Intensive and productive joint work was started with the participation of V. K. Finn, T. Gergely, S. O. Kuznetsov and D. P. Skvortsov on the preparation of the manuscript. It proved difficult at first, because coherence among the different viewpoints and techniques was not easy to establish. Soon after O. M. Anshakov joined the author team, replacing D. P. Skvortsov. The authors of this present book felt a pressing demand for the development of a new integrated approach that could provide a logic foundation for the entire area of cognitive reasoning. While working on the manuscript this feeling became stronger and stronger. Finally, having almost completed the manuscript,

work on it was suspended and the two authors started to realise their general goals. This took place around 2006. From then on the majority of the work was done in Budapest at the Applied Logic Laboratory. Authors wished to contribute to a better understanding of cognition and its modelling by developing a formal approach. This could provide a platform on which various existing approaches could be presented and handled.

Acknowledgements

We appreciate the long-standing cooperation and fruitful discussions we have had with Professor V.K. Finn and his research team.

We also thank the Applied Logic Laboratory for providing all the facilities and conditions for writing this book.

Special thanks go to Springer for its endless patience in every sense, as well as to the team that supported us to shape the final version.

Budapest–Moscow,
October 2009

Tamás Gergely
Oleg Anshakov

Contents