Lecture Notes in Artificial Intelligence 7735

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Conceptual Structures for STEM Research and Education

20th International Conference
on Conceptual Structures, ICCS 2013
Mumbai, India, January 10-12, 2013
Proceedings

Springer

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Randy Goebel, University of Alberta, Edmonton, Canada
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Volume Editors

Heather D. Pfeiffer
Akamai Physics, Inc., Las Cruces, NM 88005, USA
Email: hdp@cs.nmsu.edu

Dmitry I. Ignatov
National Research University Higher School of Economics
Moscow 109028, Russia
E-mail: dignatov@hse.ru

Jonas Poelmans
Katholieke Universiteit Leuven, Leuven 3000, Belgium
E-mail: jonas.poelmans@econ.kuleuven.be

Nagarjuna Gadiraju
Tata Institute of Fundamental Reseach
Mumbai 400088, India
E-mail: nagarjun@gnowledge.org

ISSN 0302-9743 e-ISSN 1611-3349
ISBN 978-3-642-35785-5 e-ISBN 978-3-642-35786-2
DOI 10.1007/978-3-642-35786-2

Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012954289

CR Subject Classification (1998):
I.2.3-4, I.2.6, I.2.8, G.2.2, H.2.4, H.2.8, H.3.4, I.5.4, I.5.1

LNCS Sublibrary: SL 7 – Artificial Intelligence

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Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

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

Preface

This volume contains the proceedings of the 20th International Conference on Conceptual Structures (ICCS 2013), the latest in a series of annual conferences that have been held in Europe, Asia, Australia, and North America since 1993. Details of these events are available at www.conceptualstructures.org, and www.iccs.info points to the current conference in this prestigious series. ICCS focuses on the useful representation and analysis of conceptual knowledge with research and business applications. It brings together some of the world's best minds in information technology, arts, humanities, and social science to explore novel ways that information and communication technologies can leverage tangible business or social benefits. This is because conceptual structures (CS) harmonize the creativity of humans with the productivity of computers. CS recognizes that organizations work with concepts; machines like structures.

ICCS advances the current theory and practice in connecting the user's conceptual approach to problem solving with the formal structures that computer applications need to bring their productivity to bear. Arising originally out of the work of John Sowa while at IBM and his work on conceptual graphs, over the years ICCS has broadened its scope to include a wider range of theories and practices, among them formal concept analysis (FCA), description logics (DL), the Semantic Web, the pragmatic Web, ontologies, multi-agent systems, concept mapping, relationships to uses in STEM education and more. Accordingly CS represent a family of approaches that builds on the successes of artificial intelligence (AI), conceptual modeling, information and Web technologies, and knowledge management.

The theme for this year's conference was "Knowledge Representation for STEM Research and Education." Science, technology, engineering, and mathematics (STEM) have, in recent decades, emerged as a lively new research areas. More and more data are being captured in these areas (particularly through the Web) and how to represent these data for useful research, searching, and education is a real challenge. These data now represent our business, economic, arts, social, and scientific endeavors to such an extent that we require smart applications that can discover the hitherto hidden knowledge and how to represent this mass of data. By bringing together the way computers work with the way humans think, conceptual structures align the productivity of computer processing with the ingenuity of individuals and organizations in addressing these highly mathematical data. The representation of these data can be used for both research areas and for collecting data for improved teaching techniques in these areas.

The ICCS papers that appear in this volume represent the rich variety of topics on CS. There were 43 submitted papers that were rigorously reviewed anonymously by at least three members of the Program Committee. An Editorial Board

member oversaw each paper processed, and worked together with the organizers on making the final decisions. About 50% of submitted papers deemed relevant to the conference were accepted as both long and short papers. There were also three invited papers. As is evident in this volume, the number of accepted papers reflects the high quality of submissions, and the proceedings appear as volume LNAI 7735 of Springer's *Lecture Notes in Artificial Intelligence*, a subseries of the LNCS series. In addition to the ICCS 2013 main conference, there was an associated workshop—Workshop on Modeling States, Events and Processes (MSEPS). The papers from this workshop appear in their own proceedings.

We wish to express our thanks to all the authors of the submitted papers, the speakers, workshop organizers, and the members of the ICCS Editorial Board and Program Committee. We would like to thank Simon Andrews and Simon Polovina, who organized the anonymous reviewers of papers submitted by the ICCS Chairs. We wish to express our gratitude for the support we received from the Homi Bhabha Centre for Science Education, TIFR, by hosting the event and providing the facilities. With special thanks to the Dean of Science Education, Chitra Natarajan, and several personnel, Jayashree Ramadas, Madhavi Gaitonde, Rashmi Shrotri, Sumana Amin, Smitha Burli, Manoj Nair, Anil Kumar Shankhwar, and V.P. Raul. We also extend our thanks to the Local Organizing Chair, Meena Kharatmal, and to the staff of the Homi Bhabha Centre for Science Education, TIFR, for managing the production of the workshop proceedings. Lastly, we thank the very helpful people at Springer, to whom we owe our gratitude.

October 2012

Heather D. Pfeiffer
Dmitry I. Ignatov
Jonas Poelmans
Nagarjuna G.

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