

Lecture Notes in Artificial Intelligence

8903

Subseries of Lecture Notes in Computer Science

LNAI Series Editors

Randy Goebel

University of Alberta, Edmonton, Canada

Yuzuru Tanaka

Hokkaido University, Sapporo, Japan

Wolfgang Wahlster

DFKI and Saarland University, Saarbrücken, Germany

LNAI Founding Series Editor

Joerg Siekmann

DFKI and Saarland University, Saarbrücken, Germany

More information about this series at <http://www.springer.com/series/1244>

Silvia Miksch · David Riaño
Annette ten Teije (Eds.)

Knowledge Representation for Health Care

6th International Workshop, KR4HC 2014
Held as Part of the Vienna Summer of Logic, VSL 2014
Vienna, Austria, July 21, 2014
Revised Selected Papers

Editors

Silvia Miksch
Vienna University of Technology
Vienna
Austria

Annette ten Teije
Vrije Universiteit Amsterdam
Amsterdam
The Netherlands

David Riaño
Universitat Rovira i Virgili
Tarragona
Spain

ISSN 0302-9743

ISSN 1611-3349 (electronic)

Lecture Notes in Artificial Intelligence

ISBN 978-3-319-13280-8

ISBN 978-3-319-13281-5 (eBook)

DOI 10.1007/978-3-319-13281-5

Library of Congress Control Number: 2014956509

LNCS Sublibrary: SL7 – Artificial Intelligence

Springer Cham Heidelberg New York Dordrecht London

© Springer International Publishing Switzerland 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media
(www.springer.com)

Preface

As computerized healthcare support systems are rapidly becoming more knowledge intensive, the representation of medical knowledge in a form that enables reasoning is growing in relevance and taking a more central role in the area of Medical Informatics. In order to achieve a successful decision support and knowledge management approach to medical knowledge representation, the scientific community has to provide efficient representations, technologies, and tools to integrate all the important elements that healthcare providers work with: electronic health records and healthcare information systems, clinical practice guidelines and standardized medical technologies, codification standards, etc.

Synergies to integrate the above-mentioned elements and types of knowledge must be sought both in the medical problems (e.g., prevention, diagnosis, therapy, prognosis, etc.) and in the Computer Science and Artificial Intelligence technologies (e.g., natural language processing, digital libraries, knowledge representation, knowledge integration and merging, decision support systems, machine learning, e-learning, etc.). The sixth international KR4HC workshop aimed at attracting the interest of novel research and advances contributing in the definition, representation, and exploitation of healthcare knowledge in medical informatics.

Historical Remark of the Workshop: The first KR4HC workshop, held in conjunction with the 12th Artificial Intelligence in Medicine conference (AIME09), brought together members of two existing communities: the clinical guidelines and protocols community, which held a line of four workshops (European Workshop on Computerized Guidelines and Protocols CPG2000 and CPG2004; AI Techniques in Health Care: Evidence-based Guidelines and Protocols 2006, and Computer-based Clinical Guidelines and Protocols 2008), and a related community which held a series of three workshops devoted to the formalization, organization, and deployment of procedural knowledge in health care (CBMS07 Special Track on Machine Learning and Management of Health Care Procedural Knowledge 2007; From Medical Knowledge to Global Health Care 2007; Knowledge Management for Health Care Procedures 2008). Since then, two more KR4HC workshops were held KR4HC 2010 and KR4HC 2011, in conjunction with the ECAI10 and the AIME11 conferences. In 2012, the fourth KR4HC workshop was organized in conjunction with ProHealth as part of the BPM12 conference. We are continuing the efforts with a second Joint Workshop on Knowledge Representation for Health Care and Process-Oriented Information Systems in Health Care (KR4HC/ProHealth) in the 14th Artificial Intelligence in Medicine conference (AIME13).

The Sixth International Workshop on Knowledge Representation for Health Care was organized together with the 14th International Conference on Principles of Knowledge Representation and Reasoning (KR14), within the Vienna Summer of Logic 2014.

Twenty-six papers were submitted to KR4HC 2014, among which eighteen were full research papers, and eight were short papers describing short research, position papers, problem analyses, or demonstrations of implemented systems. Seven were selected for full presentation (39%) and nine for short presentation, among which four were short papers (50%) and five were full research papers (28%). One of the accepted long papers was withdrawn by the authors.

We would also like to acknowledge Stefania Montani (Università degli Studi del Piemonte Orientale “Amedeo Avogadro”) for her implication in the proposal and preparation of the keynote talk. Unfortunately she finally had to excuse her participation. This drove us to agree on Giorgio Leonardi (Università degli Studi del Piemonte Orientale “Amedeo Avogadro”) to present Stefania’s talk, which resulted on a challenging presentation under the title “Knowledge-Intensive Medical Process Similarity.”

This volume contains a selection of the 11 best papers presented in the KR4HC 2014 workshop, together with a paper by the keynote speaker.

September 2014

Silvia Miksch
David Riaño
Annette ten Teije

Organization

KR4HC 2014 was organized by Silvia Miksch, Vienna University of Technology, Austria, David Riaño, Universitat Rovira i Virgili, Spain, and Annette ten Teije, Vrije Universiteit Amsterdam, The Netherlands.

Program Committee

Samina Abidi	Dalhousie University, Canada
Syed Sibte Raza Abidi	Dalhousie University, Canada
Roberta Annicchiarico	IRCCS Fondazione Santa Lucia, Italy
Luca Anselma	Università di Torino, Italy
Joseph Barjis	Delft University of Technology, The Netherlands
Paul De Clercq	Medecs BV, The Netherlands
Arturo Gonzlez Ferrer	University of Haifa, Israel
Adela Grando	Arizona State University, USA
Robert Greenes	Arizona State University, USA
Femida Gwadry-Sridhar	University of Western Ontario, Canada
David Isern	Universitat Rovira i Virgili, Spain
Patty Kostkova	City University, UK
Vassilis Koutkias	INSERM, France
Peter Lucas Radboud	University Nijmegen, The Netherlands
Wendy MacCaull	St. Francis Xavier University, Canada
Ronny Mans	Eindhoven University of Technology, The Netherlands
Mar Marcos	Universitat Jaume I, Spain
Stefania Montani	Università degli Studi del Piemonte Orientale “Amedeo Avogadro”, Italy
Leon Osterweil	University of Massachusetts Amherst, USA
Mor Peleg	University of Haifa, Israel
Manfred Reichert	University of Ulm, Germany
Hajo A. Reijers	Eindhoven University of Technology, The Netherlands
Danielle Sent	AMC/UvA, The Netherlands
Brigitte Seroussi	Hôpitaux de Paris, France
Andreas Seyfang	Vienna University of Technology, Austria
Paolo Terenziani	Università degli Studi del Piemonte Orientale “Amedeo Avogadro”, Italy
Frank van Harmelen	Vrije Universiteit Amsterdam, The Netherlands
Dongwen Wang	University of Rochester, USA

Contents

Modeling Clinical Guidelines and Comorbidity

Knowledge-Intensive Medical Process Similarity	1
<i>Stefania Montani, Giorgio Leonardi, Silvana Quaglini, Anna Cavallini, and Giuseppe Miceli</i>	
Preliminary Result on Finding Treatments for Patients with Comorbidity	14
<i>Yuanlin Zhang and Zhizheng Zhang</i>	
Towards a Conceptual Model for Enhancing Reasoning About Clinical Guidelines	29
<i>Veruska Zamborlini, Marcos da Silveira, Cédric Pruski, Annette ten Teije, and Frank van Harmelen</i>	
Using First-Order Logic to Represent Clinical Practice Guidelines and to Mitigate Adverse Interactions	45
<i>Szymon Wilk, Martin Michalowski, Xing Tan, and Wojtek Michalowski</i>	

Exploring and Assessing Clinical Guidelines

Conformance Analysis of the Execution of Clinical Guidelines with Basic Medical Knowledge and Clinical Terminology	62
<i>Matteo Spiotta, Alessio Bottrighi, Laura Giordano, and Daniele Theseider Dupré</i>	
Semantic Representation of Evidence-Based Clinical Guidelines	78
<i>Zhisheng Huang, Annette ten Teije, Frank van Harmelen, and Salah Ait-Mokhtar</i>	
META-GLARE: A Meta-System for Defining Your Own CIG System: Architecture and Acquisition	95
<i>Paolo Terenziani, Alessio Bottrighi, Irene Lovotti, and Stetania Rubrichi</i>	
Assessment of Clinical Guideline Models Based on Metrics for Business Process Models	111
<i>Mar Marcos, Joaquín Torres-Sospedra, and Begoña Martínez-Salvador</i>	
An Algorithm for Guideline Transformation: From BPMN to PROforma	121
<i>Begoña Martínez-Salvador, Mar Marcos, and Anderson Sánchez</i>	

Methods and Applications

A Process-Oriented Methodology for Modelling Cancer Treatment
Trial Protocols 133
*Aisan Maghsoodi, Anca Bucur, Paul de Bra, Norbert Graf,
and Martin Stanulla*

Training Residents in the Application of Clinical Guidelines for Differential
Diagnosis of the Most Frequent Causes of Arterial Hypertension
with Decision Tables 147
Francis Real, David Riaño, and José Ramón Alonso

Exploiting the Relation Between Environmental Factors and Diseases:
A Case Study on Chronic Obstructive Pulmonary Disease 160
David Riaño and Agusti Solanas

Author Index 175