Lecture Notes in Artificial Intelligence 11529

Subseries of Lecture Notes in Computer Science

Series Editors

Randy Goebel University of Alberta, Edmonton, Canada Yuzuru Tanaka Hokkaido University, Sapporo, Japan Wolfgang Wahlster DFKI and Saarland University, Saarbrücken, Germany

Founding Editor

Jörg Siekmann DFKI and Saarland University, Saarbrücken, Germany More information about this series at http://www.springer.com/series/1244

Alfredo Cuzzocrea · Sergio Greco · Henrik Legind Larsen · Domenico Saccà · Troels Andreasen · Henning Christiansen (Eds.)

Flexible Query Answering Systems

13th International Conference, FQAS 2019 Amantea, Italy, July 2–5, 2019 Proceedings



Editors Alfredo Cuzzocrea University of Calabria Rende, Italy

Henrik Legind Larsen Legind Technologies Esbjerg, Denmark

Troels Andreasen Roskilde University Roskilde, Denmark Sergio Greco University of Calabria Rende, Italy

Domenico Saccà University of Calabria Rende, Italy

Henning Christiansen Roskilde University Roskilde, Denmark

ISSN 0302-9743 ISSN 1611-3349 (electronic) Lecture Notes in Artificial Intelligence ISBN 978-3-030-27628-7 ISBN 978-3-030-27629-4 (eBook) https://doi.org/10.1007/978-3-030-27629-4

LNCS Sublibrary: SL7 - Artificial Intelligence

© Springer Nature Switzerland AG 2019

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, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This volume contains the papers presented at the 13th International Conference on Flexible Query Answering Systems (FQAS 2019), held during July 2–5, 2019, in Amantea, Calabria.

FQAS is the premier conference focusing on the key issue in the information society of providing easy, flexible, and intuitive access to information to everybody. In targeting this issue, the conference draws on several research areas, such as information retrieval, database management, data science, information filtering, knowledge representation, knowledge discovery, analytics, soft computing, management of multimedia information, and human-computer interaction. The guiding topic of the FQAS conferences are innovative query systems aimed at providing easy, flexible, and human-friendly access to information. Such systems are becoming increasingly important due to the huge and always growing number of users, as well as the growing amount of available information. Thus, works related to the concepts of data science, data streams querying etc., were welcomed. This year, FQAS had a special theme: "flexible querying and analytics for smart cities and smart societies in the age of big data." This provided a unique opportunity to focalize on emerging research trends that have been leading the research scene for several years.

This year FQAS received a significant number of submissions from over several countries. Most papers were reviewed by three Program Committee members. The committee finally decided to accept 33 papers. We are thankful to all the researchers that helped in the review process and made this possible. The conference program featured three invited talks, namely: "Logic, Machine Learning, and Security" by V. S. Subrahmanian, Dartmouth College, Nil, USA; "Personal Big Data, GDPR and Anonymization" by Josep Domingo-Ferrer, Universitat Rovira i Virgili, Spain; and "Querying Databases with Ontologies: 17 Years Later" by Enrico Franconi, Free University of Bozen-Bolzano, Italy. In addition to this, the conference program was also comprised of two tutorials, namely: "Supervised Learning for Prevalence Estimation" by Alejandro Moreo and Fabrizio Sebastiani, ISTI-CNR, Pisa, Italy; and "Approaches to Computational Models of Argumentation" by Matthias Thimm, Universitat Koblenz-Landau, Germany.

We are very grateful to our institutions that actively supported the organization of the conference. These were:

- Dipartimento di Science Politiche e Sociali, University of Calabria, Italy;
- Dipartimento di Ingegneria Informatica, Modellistica, Elettronica e Sistemistica, University of Calabria, Italy;
- Department of Electronic Systems, Aalborg University, Denmark;
- Istituto di Calcolo e Reti ad Alte Prestazioni, National Research Council, Italy;

vi Preface

- Centro di Competenza, ICT-SUD, Italy;
- Dipartimento di Ingegneria e Architettura, University of Trieste, Italy.

July 2019

Alfredo Cuzzocrea Sergio Greco Henrik Legind Larsen Domenico Saccà Troels Andreasen Henning Christiansen

Organization

General Chairs

Henrik Legind Larsen	Aalborg University, Denmark
Domenico Saccà	University of Calabria, Italy

Program Chairs

Alfredo Cuzzocrea	University of Calabria, Italy
Sergio Greco	University of Calabria, Italy

Special Session Chairs

Nicolas Spyratos	University of Paris-South, France
Volker Hoffmann	SINTEF Digital, Norway

Panel Chair

ЗA

Tutorial Chairs

Ladjel Bellatreche	ENSMA, France
Carson Leung	University of Manitoba, Canada

Industrial Track Chair

Hassane Essafi	CEA, France
----------------	-------------

Publicity Chair

Wookey Lee	INHA	University.	South	Korea
Wookey Lee	11 (111 1	omversny,	ooum	ixorea

Local Organization Chairs

Marco Calautti	The University of Edinburgh, UK,
	and University of Calabria, Italy
Enzo Mumolo	University of Trieste, Italy

Steering Committee

Henrik Legind Larsen, Denmark Henning Christiansen, Denmark Troels Andreasen, Denmark

International Advisory Board

Adnan Yazici, Turkey Fred Petry, USA Gabriella Pasi, Italy Henri Prade, France Janusz Kacprzyk, Poland Jesus Cardenosa, Spain Jorgen Fischer Nilsson, Denmark Maria Amparo Vila, Spain Maria J. Martin-Bautista, Spain Nicolas Spyratos, France Olivier Pivert, France Panagiotis Chountas, UK Slawomir Zadrozny, Poland Zbigniew W. Raś, USA

Program Committee

Gianvincenzo Alfano University of Calabria, Italy Giovanni Amendola University of Calabria, Italy Troels Andreasen Roskilde University, Denmark Ignacio J. Blanco University of Granada, Spain Patrice Buche **INRA**, France Roskilde University, Denmark Henrik Bulskov Marco Calautti The University of Edinburgh, UK, and University of Calabria, Italy Panagiotis Chountas University of Westminster, UK Henning Christiansen Roskilde University, Denmark University of Calabria, Italy Alfredo Cuzzocrea Florian Daniel Politecnico di Milano, Italy Agnieszka Bialystok University of Technology, Poland Dardzinska-Glebocka Guy De Tre Ghent University, Belgium University of Calabria, Italy Sergio Greco Allel Hadjali LIAS/ENSMA, France Hlne Jaudoin **IRISA-ENSSAT**, France Etienne Kerre Ghent University, Belgium Warsaw University of Technology, Poland Marzena Kryszkiewicz

Henrik Legind Larsen Anne Laurent Nicolas Marin Christophe Marsala Francesco Parisi Simona Perri Zbigniew Ras Marek Reformat Francisco P. Romero Miguel-Angel Sicilia Andrzej Skowron **Grgory Smits** Umberto Straccia Letizia Tanca Riccardo Torlone Farouk Toumani Irina Trubitsyna Jef Wijsen Adnan Yazici Wlodek Zadrozny

Legind Technologies, Denmark LIRMM UM. France University of Granada, Spain Université Pierre et Marie Curie Paris 6, France University of Calabria, Italy University of Calabria, Italy The University of North Carolina at Chapel Hill, USA University of Alberta, Canada UCLM. Spain University of Alcala, Spain Warsaw University, Poland IRISA/University of Rennes 1, France ISTI-CNR, Italy Politecnico di Milano, Italy Roma Tre University, Italy Limos, Blaise Pascal University, France University of Calabria, Italy University of Mons, Belgium Middle East Technical University, Turkey UNCC, USA

Contents

Invited Talks	
Logic, Machine Learning, and Security	3
Personal Big Data, GDPR and Anonymization	7
Tutorials	
Tutorial: Supervised Learning for Prevalence Estimation Alejandro Moreo and Fabrizio Sebastiani	13
Algorithmic Approaches to Computational Models of Argumentation Matthias Thimm	18
Introduction	
Flexible Querying and Analytics for Smart Cities and Smart Societies in the Age of Big Data: Overview of the FQAS 2019 International Conference	25
Flexible Database Management and Querying	
Indexing for Skyline Computation: A Comparison Study	31
A Simple Data Structure for Optimal Two-Sided 2D Orthogonal Range Queries	43
Optimizing the Computation of Approximate Certain Query Answers over Incomplete Databases Nicola Fiorentino, Cristian Molinaro, and Irina Trubitsyna	48

Ontologies and Knowledge Bases

Leveraging Ontology to Enable Indoor Comfort Customization	
in the Smart Home	63
Daniele Spoladore, Atieh Mahroo, and Marco Sacco	

xii	Contents	
-----	----------	--

Efficient Ontological Query Answering by Rewriting into Graph Queries Mirko Michele Dimartino, Andrea Calì, Alexandra Poulovassilis, and Peter T. Wood	75
WeLink: A Named Entity Disambiguation Approach for a QAS over Knowledge Bases	85
Argumentation-Based Query Answering	
A Heuristic Pruning Technique for Dialectical Trees on Argumentation-Based Query-Answering Systems Andrea Cohen, Sebastian Gottifredi, and Alejandro J. García	101
A Method for Efficient Argument-Based Inquiry Bas Testerink, Daphne Odekerken, and Floris Bex	114
DAQAP: Defeasible Argumentation Query Answering Platform Mario A. Leiva, Gerardo I. Simari, Sebastian Gottifredi, Alejandro J. García, and Guillermo R. Simari	126
An Efficient Algorithm for Computing the Set of Semi-stable Extensions <i>Gianvincenzo Alfano</i>	139
Data Mining and Knowledge Discovery	
Using Word Embeddings and Deep Learning for Supervised Topic Detection in Social Networks	155
Generalized Association Rules for Sentiment Analysis in Twitter J. Angel Diaz-Garcia, M. Dolores Ruiz, and Maria J. Martin-Bautista	166
Data Exploration in the HIFUN Language Nicolas Spyratos and Tsuyoshi Sugibuchi	176
Advanced Flexible Query Answering Methodologies and Techniques	
Reducing Skyline Query Results: An Approach Based on Fuzzy Satisfaction of Concepts Mohamed Haddache, Allel Hadjali, and Hamid Azzoune	191
Quantify the Variability of Time Series of Imprecise Data Zied Ben Othmane, Cyril de Runz, Amine Aït Younes, and Vincent Mercelot	203

Contents	xiii
Semantic Understanding of Natural Language Stories for Near Human Question Answering	. 215
Flexible Query Answering Methods and Techniques	
Deductive Querying of Natural Logic Bases Troels Andreasen, Henrik Bulskov, Per Anker Jensen, and Jørgen Fischer Nilsson	. 231
Clustering of Intercriteria Analysis Data Using a Health-Related Quality	
of Life Data	. 242
A Flexible Query Answering System for Movie Analytics Carson K. Leung, Lucas B. Eckhardt, Amanjyot Singh Sainbhi, Cong Thanh Kevin Tran, Qi Wen, and Wookey Lee	. 250
Flexible Intelligent Information-Oriented and Network-Oriented Approaches	
Can BlockChain Technology Provide Information Systems with Trusted Database? The Case of HyperLedger Fabric Pablo Garcia Bringas, Iker Pastor, and Giuseppe Psaila	. 265
Anticipating Depression Based on Online Social Media Behaviour Esteban A. Ríssola, Seyed Ali Bahrainian, and Fabio Crestani	. 278
Method for Modeling and Simulation of Parallel Data Integration Processes in Wireless Sensor Networks	. 291
Find the Right Peers: Building and Querying Multi-IoT Networks Based on Contexts	. 302
Big Data Veracity and Soft Computing	

Handling Veracity of Nominal Data in Big Data: A Multipolar Approach . . . 317 Guy De Tré, Toon Boeckling, Yoram Timmerman, and Sławomir Zadrożny

InterCriteria Analysis with Interval-Valued Intuitionistic Fuzzy Evaluations. . . . 329 Krassimir Atanassov, Pencho Marinov, and Vassia Atanassova xiv Contents

Business Dynamism and Innovation Capability in the European Union	
Member States in 2018 Through the Prism of InterCriteria Analysis	339
Vassia Atanassova and Lyubka Doukovska	

Flexibility in Tools

InterCriteria Analysis of the Most Problematic Factors for Doing Business in the European Union, 2017–2018 Lyubka Doukovska and Vassia Atanassova	353
An Effective System for User Queries Assistance Elio Masciari, Domenico Saccà, and Irina Trubitsyna	361
On the Usefulness of Pre-Processing Step in Melanoma Detection Using Multiple Instance Learning Eugenio Vocaturo, Ester Zumpano, and Pierangelo Veltri	374
Systems and Miscellanea	
Towards Flexible Energy Supply in European Smart Environments Stefania Marrara, Amir Topalovíc, and Marco Viviani	385
Intelligent Voice Agent and Service (iVAS) for Interactive and Multimodal Question and Answers	396
A Study on Topic Modeling for Feature Space Reduction in Text Classification Daniel Pfeifer and Jochen L. Leidner	403
Author Index	413