Slimane Hammoudi Christoph Quix Jorge Bernardino (Eds.)

Communications in Computer and Information Science

1446

Data Management Technologies and Applications

9th International Conference, DATA 2020 Virtual Event, July 7–9, 2020 Revised Selected Papers



Communications in Computer and Information Science 1446

Editorial Board Members

Joaquim Filipe D Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh Indian Statistical Institute, Kolkata, India

Raquel Oliveira Prates *Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil*

Lizhu Zhou

Tsinghua University, Beijing, China

More information about this series at http://www.springer.com/series/7899

Slimane Hammoudi · Christoph Quix · Jorge Bernardino (Eds.)

Data Management Technologies and Applications

9th International Conference, DATA 2020 Virtual Event, July 7–9, 2020 Revised Selected Papers



Editors Slimane Hammoudi MODESTE/ESEO Angers, France

Jorge Bernardino University of Coimbra Coimbra, Portugal Christoph Quix Fraunhofer FIT and RWTH Aachen University Aachen, Germany

 ISSN 1865-0929
 ISSN 1865-0937 (electronic)

 Communications in Computer and Information Science
 ISBN 978-3-030-83013-7 ISBN 978-3-030-83014-4 (eBook)

 https://doi.org/10.1007/978-3-030-83014-4

© Springer Nature Switzerland AG 2021

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

The present book includes extended and revised versions of a set of selected papers from the 9th International Conference on Data Science, Technology and Applications (DATA 2020), exceptionally held as a web-based event, due to the COVID-19 pandemic, during July 7–9, 2020.

DATA 2020 received 70 paper submissions from 31 countries, of which 20% were included in this book. The papers were selected by the event chairs and their selection is based on a number of criteria that include the classifications and comments provided by the Program Committee members, the session chairs' assessment and also the program chairs' global view of all papers included in the technical program. The authors of selected papers were then invited to submit a revised and extended version of their papers having at least 30% innovative material.

The purpose of the 9th International Conference on Data Science, Technology and Applications (DATA) was to bring together researchers, engineers and practitioners interested in databases, big data, data mining, data management, data security and other aspects of information systems and technology involving advanced applications of data.

The papers selected to be included in this book contribute to the understanding of relevant trends of current research on data science, technology and applications, especially of approaches required to tackle current and future challenges in data science and data management. Thus, this book covers diverse but complementary topics such as data management and quality, new computational models for big data, big data search and mining, statistics exploratory data analysis, predictive modelling, big data infrastructure and architecture, data privacy and security, data and big data in Industry 4.0.

We would like to thank all the authors for their contributions and all the reviewers who have helped ensure the quality of this publication.

July 2020

Slimane Hammoudi Christoph Quix Jorge Bernardino

Organization

Conference Chair

Program Co-chairs

Slimane Hammoudi	ESEO, Franc	e			
Christoph Quix	Hochschule	Niederrhein,	University	of	Applied
Sciences/Fraunhofer FIT, Germany					

Program Committee

Maha Amami	University of Milan-Bicocca, Italy
Christos Anagnostopoulos	University of Glasgow, UK
Gustavo Arroyo-Figueroa	Instituto Nacional de Electricidad y Energías Limpias,
	Mexico
Karim Benouaret	Université Claude Bernard Lyon 1, France
Jan Bohacik	University of Zilina, Slovak Republic
Gloria Bordogna	ICAR-CNR, Italy
Nieves R. Brisaboa	University of A Coruña, Spain
Cinzia Cappiello	Politecnico di Milano, Italy
Paola Carrara	IREA-CNR, Italy
Richard Chbeir	Université de Pau et des Pays de l'Adour, France
Antonio Corral	University of Almeria, Spain
Gianni Costa	ICAR-CNR, Italy
Shruti Daggumati	University of Nebraska-Lincoln, USA
Theodore Dalamagas	Athena Research and Innovation Center, Greece
Bruno Defude	Institut Mines Telecom, France
Steven Demurjian	University of Connecticut, USA
Martin Drlik	Constantine the Philosopher University in Nitra, Slovak
	Republic
Fabien Duchateau	Université Claude Bernard Lyon 1/LIRIS, France
John Easton	University of Birmingham, UK
Markus Endres	University of Augsburg, Germany
Francesco Folino	ICAR-CNR, Italy
Pedro Furtado	University of Coimbra, Portugal
Jérôme Gensel	Université Grenoble Alpes, France
Paola Giannini	University of Piemonte Orientale, Italy
John Gibson	Telecom SudParis, France
Janis Grabis	Riga Technical University, Latvia

Francesco Guerra Rihan Hai Raju Halder Andreas Henrich Jose Herrera Jang-Eui Hong Tsan-Sheng Hsu Sergio Ilarri Ivan Ivanov Nikos Karacapilidis Pawel Kasprowski Takahiro Kawamura David Kensche Angeliki Kitsiou Kostas Kolomvatsos Martin Krulis Vladimir Kurbalija Jean-Charles Lamirel Wolfgang Lehner Raimondas Lencevicius Christos Makris Yannis Manolopoulos Miguel Martínez-Prieto Florent Masseglia Amin Mesmoudi Yasser Mohammad Stefano Montanelli Mirella Moro Erich Neuhold Riccardo Ortale George Papastefanatos Jeffrey Parsons Luca Piovesan Nirvana Popescu **Dimitrios Rafailidis** Paraskevi Raftopoulou Werner Retschitzegger José Ríos Viqueira Colette Rolland Gustavo Rossi Mercedes Ruiz Gunter Saake

Dimitris Sacharidis

University of Modena and Reggio Emilia, Italy **RWTH Aachen University, Germany** Indian Institute of Technology Patna, India University of Bamberg, Germany Universidad del Cauca, Colombia Chungbuk National University, South Korea Institute of Information Science, Academia Sinica, Taiwan, Republic of China University of Zaragoza, Spain SUNY Empire State College, USA University of Patras, Greece Silesian University of Technology, Poland Japan Science and Technology Agency, Japan SAP, Germany University of the Aegean, Greece National and Kapodistrian University of Athens, Greece Charles University in Prague, Czech Republic University of Novi Sad, Serbia Loria/University of Strasbourg, France Technische Universität Dresden, Germany Nuance Communications, USA University of Patras, Greece Open University of Cyprus, Cyprus University of Valladolid, Spain Inria. France Université de Poitiers, France Assiut University, Egypt Università degli Studi di Milano, Italy Federal University of Minas Gerais, Brazil University of Vienna, Austria ICAR-CNR, Italy Athena Research and Innovation Center, Greece Memorial University of Newfoundland, Canada Università del Piemonte Orientale, Italy University Politehnica of Bucharest, Romania Maastricht University, The Netherlands University of the Peloponnese, Greece Johannes Kepler University, Austria Universidade de Santiago de Compostela, Spain Université Paris 1 Panthèon Sorbonne, France Lifia, Argentina University of Cadiz, Spain Institute of Technical and Business Information Systems, Germany Technische Universität Wien, Austria

Iulian Sandu Popa	University of Versailles Saint-Quentin-en-Yvelines/Inria, France
Diego Seco	University of Concepción, Chile
Nematollaah Shiri	Concordia University, Canada
Marius Silaghi	Florida Institute of Technology, USA
Stavros Simou	University of the Aegean, Greece
Spiros Skiadopoulos	University of the Peloponnese, Greece
Cosmin Stoica	Romania
Sergey Stupnikov	IPI RAN, Russia
Zbigniew Suraj	University of Rzeszow, Poland
George Tambouratzis	Institute for Language and Speech Processing, Greece
Tatiana Tambouratzis	University of Piraeus, Greece
Horia-Nicolai Teodorescu	Gheorghe Asachi Technical University of Iasi, Romania
Catarci Tiziana	Università degli Studi di Roma La Sapienza, Italy
Maurice van Keulen	University of Twente, The Netherlands
Michael Vassilakopoulos	University of Thessaly, Greece
Thanasis Vergoulis	Athena Research and Innovation Center, Greece
Marco Villani	University of Modena and Reggio Emilia, Italy
Gianluigi Viscusi	EPFL Lausanne, Switzerland
Zeev Volkovich	Ort Braude College, Israel
Leandro Wives	Universidade Federal do Rio Grande do Sul, Brazil
Shengkun Xie	Ryerson University, Canada
Filip Zavoral	Charles University in Prague, Czech Republic
Jiakui Zhao	State Grid Big Data Center of China, China

Additional Reviewers

Michele A. Brandão	IFMG, Brazil
Karam Bou Chaaya	Spider Research Group, France
Athanasios Davvetas	University of the Peloponnese, Greece
Abbas Javadtalab	Concordia University, Canada
Susana Ladra Gonzalez	University of A Coruña, Spain
Stavros Maroulis	Athena Research and Innovation Center, Greece
	•

Invited Speakers

Wil van der Aalst	RWTH Aachen University, Germany
Ioana Manolescu	Inria, France

Contents

Removing Operational Friction Using Process Mining: Challenges	
Provided by the Internet of Production (IoP)	1
Wil M. P. van der Aalst, Tobias Brockhoff,	
Anahita Farhang Ghahfarokhi, Mahsa Pourbafrani, Merih Seran Uysal, and Sebastiaan J. van Zelst	
Efficient Scheduling of Scientific Workflow Actions in the Cloud Based	22
on Required Capabilities	32
iTLM-Q: A Constraint-Based Q-Learning Approach for Intelligent Traffic	
Light Management Christian Roth, Lukas Stöger, Mirja Nitschke, Matthias Hörmann, and Dogan Kesdogan	56
Open Data in the Enterprise Context: Assessing Open Corporate Data's	00
Readiness for Use	80
A Data Science Approach to Explain a Complex Team Ball Game Friedemann Schwenkreis	101
Intelligent Public Procurement Monitoring System Powered by Text	
Mining and Balanced Indicators Nikola Modrušan, Leo Mršić, and Kornelije Rabuzin	115
Catalog Integration of Heterogeneous and Volatile Product Data Oliver Schmidts, Bodo Kraft, Marvin Winkens, and Albert Zündorf	134
Designing an Efficient Gradient Descent Based Heuristic for Clusterwise Linear Regression for Large Datasets	154
Enis Kayış	134
A Policy-Agnostic Programming Language for the International Data	172
Spaces	1/2
Coreset-Based Data Compression for Logistic Regression	195
Nery Riquelme-Granada, Khuong An Nguyen, and Zhiyuan Luo	

Product Classification Using Partially Abbreviated Product Names, Brands and Dimensions	
Oliver Allweyer, Christian Schorr, Andreas Mohr, and Rolf Krieger	
Algebraic Expressions with State Constraints for Causal Relations and Data Semantics	245
An Environmental Study of French Neighbourhoods Nelly Barret, Fabien Duchateau, Franck Favetta, Aurélien Gentil, and Loïc Bonneval	267
Phenomena Explanation from Text: Unsupervised Learning of Interpretable and Statistically Significant Knowledge <i>Giacomo Frisoni and Gianluca Moro</i>	293
Author Index	319