Lecture Notes in Business Information Processing 354

Series Editors

Wil van der Aalst
RWTH Aachen University, Aachen, Germany

John Mylopoulos
University of Trento, Trento, Italy

Michael Rosemann
Queensland University of Technology, Brisbane, QLD, Australia

Michael J. Shaw
University of Illinois, Urbana-Champaign, IL, USA

Clemens Szyperski
Microsoft Research, Redmond, WA, USA

More information about this series at http://www.springer.com/series/7911

Witold Abramowicz · Rafael Corchuelo (Eds.)

Business Information Systems

22nd International Conference, BIS 2019
Seville, Spain, June 26–28, 2019
Proceedings, Part II

Springer

Editors
Witold Abramowicz
Poznań University of Economics
and Business
Poznań, Poland

Rafael Corchuelo
ETSI Informática
University of Seville
Seville, Spain

ISSN 1865-1348 ISSN 1865-1356 (electronic)
Lecture Notes in Business Information Processing
ISBN 978-3-030-20481-5 ISBN 978-3-030-20482-2 (eBook)
https://doi.org/10.1007/978-3-030-20482-2

© 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

During the 22 years of the International Conference on Business Information Systems, it has grown to be a well-renowned event of the scientific community. Every year the conference joins international researchers for scientific discussions on modeling, development, implementation, and application of business information systems based on innovative ideas and computational intelligence methods. The 22nd edition of the BIS conference was jointly organized by the University of Seville, Spain, and Poznań University of Economics and Business, Department of Information Systems, Poland, and was held in Seville, Spain.

The exponential increase in the amount of data that is generated every day and an ever-growing interest in exploiting this data in an intelligent way has led to a situation in which companies need to use big data solutions in a smart way. It is no longer sufficient to focus solely on data storage and data analysis. A more interdisciplinary approach allowing one to extract valuable knowledge from data is required for companies to make profits, to be more competitive, and to survive in the even more dynamic and fast-changing environment. Therefore, the concept of data science has emerged and gained the attention of scientists and business analysts alike.

Data science is the profession of the present and the future, as it seeks to provide meaningful information from processing, analyzing, and interpreting vast amounts of complex and heterogeneous data. It combines different fields of work, such as mathematics, statistics, economics, and information systems and uses various scientific and practical methods, tools, and systems. The key objective is to extract valuable information and infer knowledge from data that then may be used for multiple purposes, starting from decision-making, through product development, up to trend analysis and forecasting. The extracted knowledge allows also for a better understanding of actual phenomena and can be applied to improve business processes. Therefore, enterprises in different domains want to benefit from data science, which entails technological, industrial, and economic advances for our entire society. Following this trend, the focus of the BIS conference has also migrated toward data science.

The BIS 2019 conference fostered the multidisciplinary discussion about data science from both scientific and practical sides, and its impact on current enterprises. Thus, the theme of BIS 2019 was "Data Science for Business Information Systems." Our goal was to inspire researchers to share theoretical and practical knowledge of the different aspects related to data science, and to help them transform their ideas into the innovations of tomorrow.

The first part of the BIS 2018 proceedings is dedicated to Big Data, Data Science, and Artificial Intelligence. This is followed by other research directions that were discussed during the conference, including ICT Project Management, Smart Infrastructures, and Social Media and Web-based Systems. Finally, the proceedings

end with Applications, Evaluations, and Experiences of the newest research trends in various domains.

The Program Committee of BIS 2018 consisted of 78 members who carefully evaluated all the submitted papers. Based on their extensive reviews, 67 papers were selected.

We would like to thank everyone who helped to build an active community around the BIS conference. First of all, we want to express our appreciation to the reviewers for taking the time and effort to provide insightful comments. We wish to thank all the keynote speakers who delivered enlightening and interesting speeches. Last but not least, we would like to thank all the authors who submitted their papers as well as all the participants of BIS 2019.

June 2019 Witold Abramowicz

Organization

BIS 2019 was organized by the University of Seville and Poznań University of Economics and Business, Department of Information Systems.

Program Committee

Witold Abramowicz (Co-chair)	Poznań University of Economics and Business, Poland
Rafael Corchuelo (Co-chair)	University of Seville, Spain
Rainer Alt	Leipzig University, Germany
Dimitris Apostolou	University of Piraeus, Greece
Timothy Arndt	Cleveland State University, USA
Sören Auer	TIB Leibniz Information Center Science and Technology and University of Hannover, Germany
Eduard Babkin	LITIS Laboratory, INSA Rouen; TAPRADESS Laboratory, State University – Higher School of Economics (Nizhny Novgorod), Russia
Morad Benyoucef	University of Ottawa, Canada
Matthias Book	University of Iceland, Iceland
Dominik Bork	University of Vienna, Austria
Alfonso Briones	BISITE Research Group, Spain
François Charoy	Université de Lorraine – LORIA – Inria, France
Juan Manuel Corchado Rodríguez	University of Salamanca, Spain
Beata Czarnacka-Chrobot	Warsaw School of Economics, Poland
Christophe Debruyne	Trinity College Dublin, Ireland
Renata De Paris	Pontifical Catholic University of Rio Grande do Sul, Brazil
Yuemin Ding	Tianjin University of Technology, China
Suzanne Embury	The University of Manchester, UK
Jose Emilio Labra Gayo	Universidad de Oviedo, Spain
Werner Esswein	Technische Universität Dresden, Germany
Charahzed Labba	Université de Lorraine, France
Agata Filipowska	Poznań University of Economics and Business, Poland
Ugo Fiore	Federico II University, Italy
Adrian Florea	'Lucian Blaga' University of Sibiu, Romania
Johann-Christoph Freytag	Humboldt Universität Berlin, Germany
Naoki Fukuta	Shizuoka University, Japan
Claudio Geyer	UFRGS, Brazil
Jaap Gordijn	Vrije Universiteit Amsterdam, The Netherlands

Volker Gruhn	Universität Duisburg-Essen, Germany
Francesco Guerra	Università di Modena e Reggio Emilia, Italy
Hele-Mai Haav	Institute of Cybernetics at Tallinn University of Technology, Estonia
Axel Hahn	University of Oldenburg, Germany
Constantin Houy	Institute for Information Systems at DFKI (IWi), Germany
Christian Huemer	Vienna University of Technology, Austria
Björn Johansson	Lund University, Sweden
Monika Kaczmarek	University of Duisburg Essen, Germany
Pawel Kalczynski	California State University, Fullerton, USA
Kalinka Kaloyanova	University of Sofia, Bulgaria
Marite Kirikova	Riga Technical University, Latvia
Gary Klein	University of Colorado Boulder, USA
Ralf Klischewski	German University in Cairo, Germany
Ralf Knackstedt	University of Hildesheim, Germany
Agnes Koschmider	Karlsruhe Institute of Technology, Germany
Marek Kowalkiewicz	Queensland University of Technology, Australia
Elżbieta Lewańska	Poznań University of Economics and Business, Poland
Dalia Kriksciuniene	Vilnius University
Jun-Lin Lin	Yuan Ze University, Taiwan
Peter Lockemann	Universität Karlsruhe, Germany
Fabrizio Maria Maggi	Institute of Computer Science, University of Tartu, Estonia
Andrea Marrella	Sapienza University of Rome, Italy
Raimundas Matulevicius	University of Tartu, Estonia
Andreas Oberweis	Karlsruhe Institute of Technology, Germany
Toacy Oliveira	COPPE/UFRJ, Brazil
Eric Paquet	National Research Council, Canada
Adrian Paschke	Freie Universität Berlin, Germany
Marcelo Pimenta	Universidade Federal do Rio Grande do Sul, Brazil
Biswajeet Pradhan	University of Technology, Sydney, Australia
Birgit Proell	Johannes Kepler University Linz, Austria
Luise Pufahl	Hasso Plattner Institute, University of Potsdam, Germany
Elke Pulvermueller	Institute of Computer Science, University of Osnabrück, Germany
António Rito Silva	Universidade de Lisboa, Portugal
Duncan Ruiz	Pontificia Universidade Católica do Rio Grande do Sul, Brazil
Virgilijus Sakalauskas	Vilnius University, Lithuania
Sherif Sakr	The University of New South Wales, Australia
Demetrios Sampson	Curtin University, Australia
Elmar Sinz	University of Bamberg, Germany
Alexander Smirnov	SPIIRAS, Russia
Stefan Smolnik	University of Hagen, Germany

Milena Stróżyna	Poznań University of Economics and Business, Poland
York Sure-Vetter	Karlsruhe Institute of Technology, Germany
Herve Verjus	Universite Savoie Mont Blanc – LISTIC, France
Krzysztof Węcel	Poznań University of Economics and Business, Poland
Hans Weigand	Tilburg University, The Netherlands
Benjamin Weinert	University of Oldenburg, Germany
Mathias Weske	University of Potsdam, Germany
Anna Wingkvist	Linnaeus University, Sweden
Julie Yu-Chih Liu	Yuan Ze University, Taiwan

Organizing Committee

Milena Stróżyna (Chair)	Poznań University of Economics and Business, Poland
Barbara Gołębiewska	Poznań University of Economics and Business, Poland
Inmaculada Hernández	University of Seville, Spain
Patricia Jiménez	University of Seville, Spain
Piotr Kałużny	Poznań University of Economics and Business, Poland
Elżbieta Lewańska	Poznań University of Economics and Business, Poland
Włodzimierz Lewoniewski	Poznań University of Economics and Business, Poland

Additional Reviewers

Simone Agostinelli
Asif Akram
Christian Anschuetz
Kimon Batoulis
Ilze Birzniece
Victoria Döller
Katharina Ebner
Filip Fatz
Lauren S. Ferro
Umberto Fiaccadori
Dominik Filipiak
Szczepan Górtowski
Lars Heling
Olivia Hornung
Amin Jalali
Maciej Jonczyk
Piotr Kałużny
Adam Konarski
Izabella Krzemińska
Vimal Kunnummel
Meriem Laifa
Pepe Lopis
Ronald Lumper
Pavel Malyzhenkov
Sławomir Mazurowski
Odd Steen
Piotr Stolarski
Ewelina Szczekocka
Marcin Szmydt
Jakub Szulc
Patrick Wiener

Contents – Part II

Social Media and Web-Based Systems

Trends in CyberTurfing in the Era of Big Data 3
Hsiao-Wei Hu, Chia-Ning Wu, and Yun Tseng

Keyword-Driven Depressive Tendency Model for Social Media Posts 14
Hsiao-Wei Hu, Kai-Shyang Hsu, Connie Lee, Hung-Lin Hu, Cheng-Yen Hsu, Wen-Han Yang, Ling-yun Wang, and Ting-An Chen

Exploring Interactions in Social Networks for Influence Discovery 23
Monika Ewa Rakoczy, Amel Bouzeghoub, Katarzyna Wegrzyn-Wolska, and Alda Lopes Gancarski

A Literature Review on Application Areas of Social Media Analytics 38
Kirsten Liere-Netheler, León Gilhaus, Kristin Vogelsang, and Uwe Hoppe

Personalized Cloud Service Review Ranking Approach Based on Probabilistic Ontology 50
Emna Ben-Abdallah, Khouloud Boukadi, and Mohamed Hammami

Influential Nodes Detection in Dynamic Social Networks 62
Nesrine Hafiene, Wafa Karoui, and Lotfi Ben Romdhane

A Fuzzy Modeling Approach for Group Decision Making in Social Networks 74
Gulsum Akkuzu, Benjamin Aziz, and Mo Adda

System Modeling by Representing Information Systems as Hypergraphs 86
Bence Sarkadi-Nagy and Bálint Molnár

Development of a Social Media Maturity Model for Logistics Service Providers 96
Axel Jacob and Frank Teuteberg

Potential Benefits of New Online Marketing Approaches 109
Ralf-Christian Härting, Christopher Reichstein, and Andreas Müller

Applications, Evaluations and Experiences

Using Blockchain Technology for Cross-Organizational Process Mining – Concept and Case Study 121
Stefan Tönnissen and Frank Teuteberg

Modeling the Cashflow Management of Bike Sharing Industry 132
Binrui Shen, Yu Shan, Yunyu Jia, Dejun Xie, and Shengxin Zhu

Predicting Material Requirements in the Automotive Industry Using Data Mining 147
Tobias Widmer, Achim Klein, Philipp Wachter, and Sebastian Meyl

Are Similar Cases Treated Similarly? A Comparison Between Process Workers 162
Mark Pijnenburg and Wojtek Kowalczyk

Mining Labor Market Requirements Using Distributional Semantic Models and Deep Learning 177
Dmitriy Botov, Julius Klenin, Andrey Melnikov, Yuri Dmitrin, Ivan Nikolaev, and Mikhail Vinel

Enhancing Supply Chain Risk Management by Applying Machine Learning to Identify Risks 191
Ahmad Pajam Hassan

Deep Neural Networks for Driver Identification Using Accelerometer Signals from Smartphones 206
Sara Hernández Sánchez, Rubén Fernández Pozo, and Luis Alfonso Hernández Gómez

Dynamic Enterprise Architecture Capabilities: Conceptualization and Validation 221
Rogier van de Wetering

Re-engineering Higher Education Learning and Teaching Business Processes for Big Data Analytics 233
Meena Jha, Sanjay Jha, and Liam O'Brien

Real-Time Age Detection Using a Convolutional Neural Network 245
Siphesihle Sithungu and Dustin Van der Haar

An Inventory-Based Mobile Application for Warehouse Management to Digitize Very Small Enterprises 257
Daniel Staegemann, Matthias Volk, Christian Lucht, Christian Klie, Michael Hintze, and Klaus Turowski

Collaboration in Mixed Homecare – A Study of Care Actors' Acceptance Towards Supportive Groupware 269
Madeleine Renyi, Melanie Rosner, Frank Teuteberg, and Christophe Kunze

Stress-Sensitive IT-Systems at Work: Insights from an Empirical Investigation 284
Michael Fellmann, Fabienne Lambusch, and Anne Waller

Data Quality Management Framework for Smart Grid Systems 299
Mouzhi Ge, Stanislav Chren, Bruno Rossi, and Tomas Pitner

Balancing Performance Measures in Classification Using Ensemble Learning Methods 311
Neeraj Bahl and Ajay Bansal

Machine Learning for Engineering Processes 325
Christian Koch

Author Index 337

Contents – Part I

Big Data and Data Science

Decision-Support for Selecting Big Data Reference Architectures 3
Matthias Volk, Sascha Bosse, Dennis Bischoff, and Klaus Turowski

In-Memory Big Graph: A Future Research Agenda 18
Deepali Jain, Ripon Patgiri, and Sabuzima Nayak

Modelling Legal Documents for Their Exploitation as Open Data 30
John Garofalakis, Konstantinos Plessas, Athanasios Plessas, and Panoraia Spiliopoulou

Time Series Forecasting by Recommendation: An Empirical Analysis on Amazon Marketplace 45
Álvaro Gómez-Losada and Néstor Duch-Brown

A Comparative Application of Multi-criteria Decision Making in Ontology Ranking 55
Jean Vincent Fonou-Dombeu

Method of Decision-Making Logic Discovery in the Business Process Textual Data 70
Nina Rizun, Aleksandra Revina, and Vera Meister

Prediction of Productivity and Energy Consumption in a Consteel Furnace Using Data-Science Models 85
Panagiotis Sismanis

Understanding Requirements and Benefits of the Usage of Predictive Analytics in Management Accounting: Results of a Qualitative Research Approach 100
Rafi Wadan and Frank Teuteberg

Deriving Corporate Social Responsibility Patterns in the MSCI Data 112
Zina Taran and Boris Mirkin

Profile Inference from Heterogeneous Data: Fundamentals and New Trends . . . 122
Xin Lu, Shengxin Zhu, Qiang Niu, and Zhiyi Chen

Triggering Ontology Alignment Revalidation Based on the Degree of Change Significance on the Ontology Concept Level. 137
Adrianna Kozierkiewicz and Marcin Pietranik

Challenging SQL-on-Hadoop Performance with Apache Druid 149
José Correia, Carlos Costa, and Maribel Yasmina Santos

The Impact of Imbalanced Training Data on Local Matching Learning of Ontologies 162
Amir Laadhar, Faiza Ghozzi, Imen Megdiche, Franck Ravat, Olivier Teste, and Faiez Gargouri

A DMN-Based Method for Context-Aware Business Process Modeling Towards Process Variability 176
Rongjia Song, Jan Vanthienen, Weiping Cui, Ying Wang, and Lei Huang

The Shift from Financial to Non-financial Measures During Transition into Digital Retail – A Systematic Literature Review 189
Gültekin Cakir, Marija Bezbradica, and Markus Helfert

Artificial Intelligence

A Maturity Model for IT-Related Security Incident Management 203
Gunnar Wahlgren and Stewart Kowalski

A Framework to Monitor Machine Learning Systems Using Concept Drift Detection 218
Xianzhe Zhou, Wally Lo Faro, Xiaoying Zhang, and Ravi Santosh Arvapally

Determining Optimal Multi-layer Perceptron Structure Using Linear Regression 232
Mohamed Lafif Tej and Stefan Holban

An Effective Machine Learning Framework for Data Elements Extraction from the Literature of Anxiety Outcome Measures to Build Systematic Review 247
Shubhaditya Goswami, Sukanya Pal, Simon Goldsworthy, and Tanmay Basu

A Model for Inebriation Recognition in Humans Using Computer Vision. . . . 259
Zibusiso Bhango and Dustin van der Haar

Interaction of Information Content and Frequency as Predictors of Verbs' Lengths 271
Michael Richter, Yuki Kyogoku, and Max Kölbl

Automated Prediction of Relevant Key Performance Indicators for Organizations 283
Ünal Aksu, Dennis M. M. Schunselaar, and Hajo A. Reijers

Genetic Programming over Spark for Higgs Boson Classification 300
Hmida Hmida, Sana Ben Hamida, Amel Borgi, and Marta Rukoz

Genetic Algorithms for the Picker Routing Problem in Multi-block Warehouses. 313
Jose Alejandro Cano, Alexander Alberto Correa-Espinal, Rodrigo Andrés Gómez-Montoya, and Pablo Cortés

ICT Project Management

Subject-Orientation as a Means for Business Information System Design – A Theoretical Analysis and Summary 325
Matthes Elstermann and Jivka Ovtcharova

Quality of Research Information in RIS Databases: A Multidimensional Approach 337
Otmane Azeroual, Gunter Saake, Mohammad Abuosba, and Joachim Schöpfel

Modifying Consent Procedures to Collect Better Data: The Case of Stress-Monitoring Wearables in the Workplace 350
Stéphanie Gauttier

Cyber Treat Intelligence Modeling 361
Adiel Aviad and Krzysztof Węcel

The Long Way from Science to Innovation – A Research Approach for Creating an Innovation Project Methodology 371
Zornitsa Yordanova, Nikolay Stoimenov, Olga Boyanova, and Ivan Ivanchev

A COSMIC-Based Approach for Verifying the Conformity of BPMN, BPEL and Component Models 381
Wiem Khlif, Hanêne Ben-Abdallah, Asma Sellami, and Mariem Haoues

Information Systems Planning and Success in SMEs: Strategizing for IS 397
Maria Kamariotou and Fotis Kitsios

An ICT Project Case Study from Education: A Technology Review for a Data Engineering Pipeline 407
Ioana Ciuciu, Augusta Bianca Ene, and Cosmin Lazar

Smart Infrastructure

Business Challenges for Service Provisioning in 5G Networks 423
Alexandros Kostopoulos, Ioannis P. Chochliouros, and Maria Rita Spada

Towards an Optimized, Cloud-Agnostic Deployment of Hybrid Applications 435
Kyriakos Kritikos and Paweł Skrzypek

Deep Influence Diagrams: An Interpretable and Robust Decision Support System. 450
Hal James Cooper, Garud Iyengar, and Ching-Yung Lin

A Reference Architecture Supporting Smart City Applications 463
Stanimir Stoyanov, Todorka Glushkova, Asya Stoyanova-Doycheva, and Vanya Ivanova

Explaining Performance Expectancy of IoT in Chilean SMEs 475
Patricio E. Ramírez-Correa, Elizabeth E. Grandón, Jorge Arenas-Gaitán, F. Javier Rondán-Cataluña, and Alejandro Aravena

Blockchain-Based Platform for Smart Learning Environments. 487
Rawia Bdiwi, Cyril de Runz, Arab Ali Cherif, and Sami Faiz

Improving Healthcare Processes with Smart Contracts 500
Aleksandr Kormiltsyn, Chibuzor Udokwu, Kalev Karu, Kondwani Thangalimodzi, and Alex Norta

Energy Efficient Cloud Data Center Using Dynamic Virtual Machine Consolidation Algorithm. 514
Cheikhou Thiam and Fatoumata Thiam

Safety Is the New Black: The Increasing Role of Wearables in Occupational Health and Safety in Construction 526
João Barata and Paulo Rupino da Cunha

Author Index 539