

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA

Editorial Board Members

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen 

TU Dortmund University, Dortmund, Germany

Gerhard Woeginger 

RWTH Aachen, Aachen, Germany

Moti Yung

Columbia University, New York, NY, USA

More information about this subseries at <http://www.springer.com/series/8637>


Abdelkader Hameurlain ·
A Min Tjoa · Richard Chbeir (Eds.)

Transactions on Large-Scale Data- and Knowledge- Centered Systems XLVII

Special Issue on Digital Ecosystems
and Social Networks

Editors-in-Chief
Abdelkader Hameurlain
IRIT, Paul Sabatier University
Toulouse, France

A Min Tjoa
IFS, Technical University of Vienna
Vienna, Austria

Guest Editor
Richard Chbeir 
University of Pau and the Adour Region
Anglet, France

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISSN 1869-1994 ISSN 2510-4942 (electronic)
Transactions on Large-Scale Data- and Knowledge-Centered Systems
ISBN 978-3-662-62918-5 ISBN 978-3-662-62919-2 (eBook)
<https://doi.org/10.1007/978-3-662-62919-2>

© Springer-Verlag GmbH Germany, part of Springer Nature 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-Verlag GmbH, DE
part of Springer Nature
The registered company address is: Heidelberger Platz 3, 14197 Berlin, Germany

Preface

With the rapid advancements of Internet technologies, there is a shift in the focus of online applications towards more interaction and collaboration. Nowadays, there is a move from the Internet as a place of producers and consumers of content to a place of communities where everyone can publish information, interconnect, communicate, collaborate, and share. Moving from services provided by a single entity to more complex or integrated multi-stakeholder services requires new approaches for effective consideration of collaboration.

In this context, Digital Ecosystems have emerged to allow many digital entities/subsystems to interact by exchanging information in a wide variety of ways (Web, Cloud, etc.). They support in-between cooperation and promote collective knowledge sharing in order to provide mutual benefits, as a new way to handle collaboration in a distributed and heterogeneous environment. Interdependencies between entities can be based on automated, semiautomated, or manual relationships. The individual entities have their own purposes to achieve and could be managed locally. However, the efficiency of the whole Digital Ecosystem depends on the consistency of its use and a global, intelligent, balanced coordination of the various resources.

To model, develop, simulate, and validate such complex systems, several challenges remain. The aim of this special issue is to show several current studies addressing these challenges and evincing interesting research directions. The special issue is organized in self-contained papers to provide the greatest reading flexibility. It includes nine papers that have been selected after a very tight peer review, in which each paper has been reviewed by three reviewers. Several topics are addressed in the special issue, but mainly: **Social Big Data, Data Analysis, Cloud-based Feedback, Experience ecosystems, Pervasive Environments, and Smart Systems**. It is organized as follows.

The first paper is titled “Mapping Experience Ecosystems as Emergent Actor-Created Spaces” and is authored by *Andrea Resmini* and *Bertil Lindenfalk*. It introduces a conceptualization of experience ecosystems as semantic blended spaces instantiated by the activities carried out by independent actors moving freely and at will between different products, services, devices, people, and locations in pursuit of individual goals. This conceptualization is anchored to three distinct cultural and socio-technical shifts that characterize the current postdigital condition: the displacement of postmodernism as the cultural dominant; the embodiment of digitality and the emergence of a blended space of action; the occurrence of a postdigital society. It contributes to ongoing conversations on ecosystem-level and systemic design from the point of view of information architecture and user experience in five distinct ways: by centering the discourse on the actor-driven individual experience made possible by the postdigital condition; by framing the problem space from an embodied, spatial, and architectural perspective; by considering the environment systemically as a blend of digital and physical non-contiguous spaces; by recasting the object of design to be the semantic and spatial relationships that exist or could exist between the elements of the actor-centered

eco-system; by introducing a mapping methodology that can be used to capture and spatially describe the relational complexity of said ecosystems for further intervention.

In the second paper of this special issue, *Kurosh Madani, Antonio M. Rinaldi, and Cristiano Russo* propose “A Semantic-Based Strategy to Model Multimedia Social Networks”. Here, the authors explore the decisive role of the social facet of information in our quotidian life. An abstract representation and a proper management of Online Social Networks (OSNs) constitute a new challenge for communities of researchers. In addition, the need to extend OSNs to Multimedia Social Networks (MSNs) comes from the fact that the vast majority of data is unstructured and heterogeneous, making the reuse and integration of information effortful. In this paper, the authors propose a general high-level model to represent and manage MSNs. The proposed approach is based on property graphs represented by a hypergraph structure due to the intrinsically multidimensional nature of social networks and semantic relations to better represent the network’s contents. Using the proposed graph structure singles out several levels of knowledge and helps in analysis of the relationships defined between nodes of the same type or different types. Moreover, the introduction of low-level multimodal features and a formalization of their semantic meanings give a more comprehensive view of the social network structure and content. The proposed data model could be useful for several applications. A case study is proposed in the cultural heritage domain.

In the third paper, titled “Social Big Data: Concepts and Theory”, *Hiroshi Ishikawa and Yukio Yamamoto* explain the basic concepts of social big data and its integrated analysis. First, they explain the outline and examples of the real-world data, open data, and social data that compose social big data. They then describe interactions among the real-world data, open data, and social data. They also introduce basic concepts of an integrated analysis based on the “Ishikawa concept.” Furthermore, after explaining the flow of integrated analysis in line with the basic concept, a data model approach for integrated analysis is introduced.

Hiroshi Ishikawa and Yasushi Miyata propose “Social Big Data: Case Studies” in the fourth paper. Based on the concepts and theory introduced in the previous paper “Social Big Data: Concepts and Theory”, the authors concretely explain hypothesis generation and integrated analysis through several use cases.

In the fifth paper, “Data Analysis in Social Network: A Case Study” is proposed by *Mou De, Anirban Kundu, and Nivedita Ray De Sarkar*. Here, the authors propose a structural design of social networks to study the architecture of social networking sites and its working principles. Typical social networking sites have a three-tier architecture which induces higher searching time for user queries. The proposal presents a load-balancing module for protecting user enquiries before spreading them to the data server. In this paper, query optimization of user queries for faster results is discussed. Experimentation results exhibit possibilities of data (user queries) failure reduction due to external disturbances. The authors have analyzed large-scale data of a social network through a graph to reduce data loss and minimize network failure to maintain scale-free growth in the social network. Properties of the interface module and growth coefficient are analyzed to exhibit benefits of the proposed system architecture for balancing the load from the web server to the data server through the Hash table cache, Log table and index control module with scale-free query optimization.

“Smart Services Using Voice and Images” is proposed as the sixth paper by *Alexander I. Iliev* and *Peter L. Stanchev*. Here, the authors emphasize some of the most prominent advances in smart technologies that formulate the smart city ecosystem. They highlight the automation of numerous developments based on the extraction and analysis of digital media, using speech and images. At present, a multitude of practical systems is used for personalization and recommendation of different media. On the other hand, assorted types of services in different areas directly benefit from these advancements. Most of them were created with human-machine interaction methodology in mind, where people have to interact with the machines in various ways. In the past, this type of interaction has been completed through the use of conventional interfaces such as a mouse and a keyboard, where the user had to type a response manually, which was in turn recorded by the machine for subsequent analysis. Therefore, in order to simplify these types of interactions and lead to improvement of services, new methodologies must be studied, discovered, and developed so as to improve services such as recommendation and personalization services.

The seventh paper is dedicated to “Big Spatial and Spatio-Temporal Data Analytics Systems”, authored by *Polychronis Velentzas*, *Antonio Corral*, and *Michael Vassilakopoulos*. It is true that we are living in the era of Big Data, and Spatial and Spatio-temporal Data are not an exception. Mobile apps, cars, GPS devices, ships, airplanes, medical devices, IoT devices, etc. are generating explosive amounts of data with spatial and temporal characteristics. Social networking systems also generate and store vast amounts of geo-located information, like geo-located tweets, or mobile users’ captured locations. To manage this huge volume of spatial and spatio-temporal data, we need parallel and distributed frameworks. For this reason, modeling, storing, querying, and analyzing big spatial and spatio-temporal data in distributed environments is an active area for research with many interesting challenges. In recent years, a lot of spatial and spatio-temporal analytics systems have emerged. This paper provides a comparative overview of such systems based on a set of characteristics (data types, indexing, partitioning techniques, distributed processing, query language, visualization, and case-studies of applications). The authors present selected systems (the most promising and/or most popular ones), considering their acceptance in the research and advanced-applications communities. More specifically, they present two systems handling spatial data only (SpatialHadoop and GeoSpark) and two systems able to handle spatio-temporal data, too (ST-Hadoop and STARK) and compare their characteristics and capabilities. Moreover, they present in brief other recent/emerging spatial and spatio-temporal analytics systems with interesting characteristics. The paper closes with conclusions arising from investigation of the rather new, though quite large world of ecosystems supporting management of big spatial and spatio-temporal data.

The eighth paper addresses “Cloud Based e-Feedback Services Using Performance Analysis: A Linear Approach”, authored by *Ayan Banerjee* and *Anirban Kundu*. Here, the authors propose an online feedback system having distinct layers to access frameworks through multiple entry points such as student module, administration module, and teacher module which can be operated from any geographically distributed locations. There is no need to install software-based applications and no need for extra hardware expenses to access the proposed cloud-based system, due to the usage of software-as-a-service and platform-as-a-service. Students provide specific

information to the server-side for authenticity regarding entry to feedback questionnaires. Administrative authorities analyze teacher performance based on students' feedback. A teacher observes individual performance from the server. Human effort and human activities have been reduced due to usage of paperless feedback. Teacher performance is measured using preparedness, class-performance, responsiveness, effectiveness, and overall grade. Different nodes are required in the proposed system for distributing and replicating server-side data storage. Time consumption and load distribution of servers are analyzed based on the number of users and servers. Different nodes are accessed by multiple users working with different or the same modules of the system. An energy-efficient framework is incorporated into the proposed system to enhance system performance. The authors have incorporated different weighting factors in the energy efficient framework using distinct layers of the proposed system. Time complexity and space complexity are measured using proposed algorithms. A Web-based approach is required in the proposed system to reduce manpower consumption and workload. A comparative study between existing feedback systems and the proposed feedback system is established based on different characteristics.

The last paper of this special issue is titled "Semantic-Based Automatic Generation of Reconfigurable Distributed Mobile Applications in Pervasive Environments" and is written by *Abderrahim Lakehal*, *Adel Alti*, and *Philippe Roose*. It addresses a practical problem related to mobile applications available through interconnected smart connected objects. Several existing research works suffer from a lack of a distributed semantic-based agile strategy to improve accuracy and increase the system's efficiency. To address this problem, this paper comes up with a new flexible, modular, and hierarchical loosely coupled framework to efficiently generate context-aware applications based on a user's location and his situation. The classification of the user's situations reveals new insight on identifying efficiently hierarchical composite situations in order to meet the quality of the user's constraints. It ensures minimum execution time for context-aware distributed mobile applications using a parallel and distributed strategy. Firstly, the framework filters the contextual user's constraints of different smart-domains into domain-specific user's context. Then, it detects parallel incoming events captured by sensors that are able to identify factorized composite situations. Based on these identifications, the authors automatically generate the application reconfiguration as a collection of adapted services that are deployed on available distributed devices. They compare the situation identification performance of the proposed reasoning approach to efficient map-reduce implementations for healthcare systems. Experimental results show the effectiveness, reusability, and scalability of the proposed approach.

We hope this special issue motivates researchers to take the next step beyond building models to implement, evaluate, compare, and extend proposed approaches. Many people worked long and hard to help this edition become a reality. We gratefully acknowledge and sincerely thank all the editorial board members and reviewers for their timely and insightful valuable comments and evaluations of the manuscripts that greatly improved the quality of the final versions. Of course, we offer thanks to all the authors for their contribution and cooperation. Finally, we express our thanks to the editors of TLDKS for their support and trust in us. Special thanks go to Gabriela

Wagner for her high availability and her valuable work in the realization of this TLDKS volume.

November 2020

Richard Chbeir

Organization

Guest Editor of this Special Issue SI on *Digital Ecosystems and Social Networks*

Richard Chbeir

University of Pau and the Adour Region, France
Richard.chbeir@univ-pau.fr
University Pau & Pays Adour, LIUPPA,
Parc de Montaury, 64600 Anglet, France

Editors-in-Chief

Abdelkader Hameurlain
A Min Tjoa

IRIT, Paul Sabatier University, France
IFS, Technical University of Vienna, Austria

Editorial Board

Reza Akbarinia

Inria, France

Dagmar Auer

FAW, Austria

Djamal Benslimane

Claude Bernard University Lyon 1, France

Stéphane Bressan

National University of Singapore, Singapore

Mirel Cosulschi

University of Craiova, Romania

Dirk Draheim

University of Innsbruck, Austria

Johann Eder

Alpen Adria University Klagenfurt, Austria

Anastasios Gounaris

Aristotle University of Thessaloniki, Greece

Theo Härder

Technical University of Kaiserslautern, Germany

Sergio Ilarri

University of Zaragoza, Spain

Petar Jovanovic

Univ. Politècnica de Catalunya, BarcelonaTech, Spain

Aida Kamišalić Latifić

University of Maribor, Slovenia

Dieter Kranzlmüller

Ludwig-Maximilians-Universität München, Germany

Philippe Lamarre

INSA Lyon, France

Lenka Lhotská

Czech Technical University in Prague, Czech Republic

Vladimir Marik

Czech Technical University in Prague, Czech Republic

Jorge Martinez Gil

Software Competence Center Hagenberg, Austria

Franck Morvan

Paul Sabatier University, IRIT, France

Torben Bach Pedersen

Aalborg University, Denmark

Günther Pernul

University of Regensburg, Germany

Soror Sahri

LIPADE, Paul Descartes University, France

Shaoyi Yin

Paul Sabatier University, France

Feng “George” Yu

Youngstown State University, Youngstown, USA

SI Editorial Board

Abdelkader Hameurlain	Paul Sabatier University, France
Adel Alti	Const. Univ., Algeria
Anastasios Gounaris	Aristotle University of Thessaloniki, Greece
Anna Formica	Istituto di Analisi dei Sistemi ed Informatica-CNR Italy, Italy
Anne Laurent	Univ. Montpellier, France
Apostolos Papadopoulos	Aristotle University of Thessaloniki, Greece
Aristidis Likas	UOI, Greece
Demetris Trihinas	University of Nicosia, Cyprus
Elio Mansour	Université de Pau & des Pays de l'Adour, France
Georgia Koloniari	UOM, Greece
Helen Karatza	Aristotle University of Thessaloniki, Greece, Greece
Hiroshi Ishikawa	Tokyo Metropolitan University, Japan
Joe Tekli	Lebanese American University, Lebanon
Jose R. R. Viqueira	USC, Spain
Joyce El Haddad	UDO, France
Khouloud Salameh	American University of Ras Al Khaimah, UAE
Maria Luisa Sapino	Università degli Studi di Torino, Italy
Masaharu Hirota	Okayama University of Science, Japan
Michael Granitzer	University of Passau, Germany
Ramzi Haraty	Lebanese American University, Lebanon
Richard Chbeir	University Pau & Pays Adour, France
Sabri Allani	University Pau & Pays Adour, France
Salma Sassi	University of Jendouba, Tunisia
Sergio Ilarri	University of Zaragoza, Spain
Yannis Manolopoulos	Open University of Cyprus, Cyprus

Contents

Mapping Experience Ecosystems as Emergent Actor-Created Spaces	1
<i>Andrea Resmini and Bertil Lindenfalk</i>	
A Semantic-Based Strategy to Model Multimedia Social Networks	29
<i>Kurosh Madani, Antonio M. Rinaldi, and Cristiano Russo</i>	
Social Big Data: Concepts and Theory.	51
<i>Hiroshi Ishikawa and Yukio Yamamoto</i>	
Social Big Data: Case Studies.	80
<i>Hiroshi Ishikawa and Yasushi Miyata</i>	
Data Analysis in Social Network: A Case Study	112
<i>Mou De, Anirban Kundu, and Nivedita Ray De Sarkar</i>	
Smart Services Using Voice and Images	137
<i>Alexander I. Iliev and Peter L. Stanchev</i>	
Big Spatial and Spatio-Temporal Data Analytics Systems.	155
<i>Polychronis Velentzas, Antonio Corral, and Michael Vassilakopoulos</i>	
Cloud Based e-Feedback Services Using Performance Analysis: A Linear Approach	181
<i>Ayan Banerjee and Anirban Kundu</i>	
Semantic-Based Automatic Generation of Reconfigurable Distributed Mobile Applications in Pervasive Environments	213
<i>Abderrahim Lakehal, Adel Alti, and Philippe Roose</i>	
Author Index	235