

# Communications in Computer and Information Science

926

*Commenced Publication in 2007*

Founding and Former Series Editors:

Phoebe Chen, Alfredo Cuzzocrea, Xiaoyong Du, Orhun Kara, Ting Liu,  
Dominik Ślęzak, and Xiaokang Yang

## Editorial Board

Simone Diniz Junqueira Barbosa

*Pontifical Catholic University of Rio de Janeiro (PUC-Rio),  
Rio de Janeiro, Brazil*

Joaquim Filipe

*Polytechnic Institute of Setúbal, Setúbal, Portugal*

Ashish Ghosh

*Indian Statistical Institute, Kolkata, India*

Igor Kotenko

*St. Petersburg Institute for Informatics and Automation of the Russian  
Academy of Sciences, St. Petersburg, Russia*

Krishna M. Sivalingam

*Indian Institute of Technology Madras, Chennai, India*

Takashi Washio

*Osaka University, Osaka, Japan*

Junsong Yuan

*University at Buffalo, The State University of New York, Buffalo, USA*

Lizhu Zhou

*Tsinghua University, Beijing, China*


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

Jonice Oliveira · Claudio M. Farias  
Esther Pacitti · Giancarlo Fortino (Eds.)

# Big Social Data and Urban Computing

First Workshop, BiDU 2018  
Rio de Janeiro, Brazil, August 31, 2018  
Revised Selected Papers

### *Editors*

Jonice Oliveira   
Universidade Federal do Rio de Janeiro  
Rio de Janeiro, Rio de Janeiro, Brazil

Esther Pacitti  
Inria/CNRS  
University of Montpellier  
Montpellier, France

Claudio M. Farias  
Universidade Federal do Rio de Janeiro  
Rio de Janeiro, Brazil

Giancarlo Fortino  
University of Calabria (Unical)  
Rende (CS), Italy

ISSN 1865-0929 ISSN 1865-0937 (electronic)  
Communications in Computer and Information Science  
ISBN 978-3-030-11237-0 ISBN 978-3-030-11238-7 (eBook)  
<https://doi.org/10.1007/978-3-030-11238-7>

Library of Congress Control Number: 2018967045

© 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, express 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

## **BiDU – Workshop on Big Social Data and Urban Computing**

In urban spaces, there is a huge amount of heterogeneous data being generated by a diversity of sources, such as sensors, devices, vehicles, smart buildings, and others. Although they are used to monitor basic services, they can provide significant information about human interactions and populational dynamics. Moreover, people constantly interact with each other through social media services, and much of interpersonal interaction is nowadays mediated by information technology. Citizens consume and share information about their cities—such as problems, events, ideas, suggestions, criticisms, and demands—acting as “human sensors,” forming opinions and participating in the city evolution.

This data explosion has resulted in the emerging topic of “Big Social Data.” Broadly speaking, big social data refers to large data volumes that relate to people interactions or describe their behaviors, needs, and patterns. The volume, the production and spreading velocity, and the variety (providing semantic richness) of such data open up enormous possibilities to utilize and analyze them for the understanding of urban spaces, tackling the major issues that these localities face, and helping in the creation of smarter and sustainable cities.

Urban computing is a process of acquisition, treatment, and analysis of big and heterogeneous data to better understand how city ecosystems work. This understanding can remedy a wide range of issues affecting the everyday lives of citizens and the long-term health and efficiency of cities. The use of big social data in urban computing helps us to understand the nature of urban phenomena and even predict the future of cities, creating solutions to reduce costs and optimize resource consumption, improve population mobility, provide higher human life quality, enhance decision-making in emergency scenarios, and engage more effectively with citizens for a continuous city planning.

This workshop, which was held in conjunction with 44th International Conference on Very Large Data Bases (VLDB), in Rio de Janeiro, and connected works about the use and treatment of big social data in multidisciplinary research spanning across computer science. All papers went through a double-blind review process, with at least three reviewers, and were reviewed according to the following criteria: adequacy of workshop scope, relevance, technical quality, clarity, originality, and evaluation of results. The papers were categorized in: full papers (Research, Experiments and Case Studies, Industry and Application, and Dataset papers) and short papers (Vision Papers). We received 40 submissions (full papers: 30, vision papers: 10), of which we selected 11 full papers and 16 posters. All the full papers were orally presented and distributed in the sections: Session 1 – Urban Mobility, Session 2 – Urban Sensing, Session 3 – Contemporary Social Problems, and Session 4 – Collaboration and Crowdsourcing.

Moreover, the BiDU workshop had a keynote entitled “Landscape of Practical Blockchain Systems and Their Applications” by Dr. C. Mohan (IBM Almaden Research Center & Tsinghua University). Also, the panel “Social Computing for Smarter Cities” featured Sihem Amer-Yahia (Laboratoire d’Informatique de Grenoble), Elaine Rabello (FIOCRUZ and Universidade do Estado do Rio de Janeiro), Gabriela Ruberg (Central Bank of Brazil), Bill Howe (University of Washington), and moderated by Mirella Moro (Universidade Federal de Minas Gerais). We thank these inspiring speakers for accepting our invitation and enlightening this event.

We would like to sincerely thank the VLDB organization for the constant help and support, the Program Committee members and reviewers for their excellent work and invaluable support during the review process, and the authors of the submitted papers for their very interesting and high-quality contributions. Most importantly, we thank all the attendees who ensured BiDU could be an appropriate forum where the sharing of knowledge and experiences of big social data and urban computing promoted new advances in both research and development. We also thank the Springer team, especially Mr. Jorge Nakahara.

We hope that readers enjoy the papers included in the proceedings.

December 2018

Jonice Oliveira  
Claudio M. Farias  
Esther Pacitti  
Giancarlo Fortino

# Organization

## Program Chairs

Jonice Oliveira	Universidade Federal do Rio de Janeiro, Brazil
Claudio Miceli	Universidade Federal do Rio de Janeiro, Brazil
Esther Pacitti	Inria/CNRS, University of Montpellier, France
Giancarlo Fortino	Università della Calabria, Italy

## Program Committee

Adriano Pereira	Universidade Federal de Minas Gerais, Brazil
Ahmed Elmisery	Universidad Técnica Federico Santa María, Chile
Antonio Liota	Technische Universiteit Eindhoven, Netherlands
Arthur Zivianni	Laboratório Nacional de Computação Científica, Brazil
Carlos Sarraute	Instituto Tecnológico de Buenos Aires, Argentina
Chiara Renso	ISTI Institute of CNR, Italy
Chico Camargo	University of Oxford, UK
Claudio Miceli	Universidade Federal do Rio de Janeiro, Brazil
Eduardo Ogasawara	Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, Brazil
Elisabeth Lex	Graz University of Technology, Know-Center, Austria
Esther Pacitti	Inria/CNRS, University of Montpellier, France
Flavia Bernardini	Universidade Federal Fluminense, Brazil
Flávia Coimbra Delicato	Universidade Federal do Rio de Janeiro, Brazil
Giancarlo Fortino	Università della Calabria, Italy
Giseli Rabello Lopes	Universidade Federal do Rio de Janeiro, Brazil
Giuseppe Di Fatta	University of Reading, UK
Grazziela Figueredo	University of Nottingham, UK
Haibin Zhu	Nipissing University, Canada
Igor Santos	Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, Brazil
Javier Baliosian	Universidad de la República, Uruguay
Jonice Oliveira	Universidade Federal do Rio de Janeiro, Brazil
José Viterbo	Universidade Federal Fluminense, Brazil
Juan Antonio Lossio Ventura	University of Florida, USA
Karima Boudaoud	Ecole Polytechnique de l'Université de Nice Sophia Antipolis, France
Lívia Ruback	Universidade Federal do Rio de Janeiro, Brazil
Manel Zarrouk	Insight Centre, NUIG, Ireland
Marcelo Mendoza	Universidad Técnica Federico Santa María, Chile

Marcos Oliveira	GESIS: Leibniz Institute for the Social Sciences, Germany
Maria Luiza Campos	Universidade Federal do Rio de Janeiro, Brazil
Mirella M. Moro	Universidade Federal de Minas Gerais, Brazil
Nazim Agoulmine	Université d'Évry Val d'Essonne, France
Paulo de Figueiredo Pires	Universidade Federal do Rio de Janeiro, Brazil
Reinaldo Bezerra Braga	Instituto Federal do Ceará, Brazil
Reyes Juarez Ramirez	Universidad Autonoma da Baja California, Mexico
Rodrigo de Souza Couto	Universidade Estadual do Rio de Janeiro, Brazil
Rodrigo Santos	Universidade Federal do Estado do Rio de Janeiro, Brazil
Sérgio Lifschitz	PUC-Rio, Brazil
Sergio Ochoa	Universidad de Chile, Chile
Soon Ae Chun	City University of New York, USA
Taniro Rodrigues	Universidade Federal do Rio Grande do Norte, Brazil
Thiago H. Silva	Tecnológica Federal do Paraná, Brazil
Thiago Moreira	Université d'Évry Val d'Essonne, France
Wei Li	University of Sydney, Australia

## Additional Reviewers

Andrea Vinci	Istituto di Calcolo e Reti ad Alte Prestazioni/CNR, Italy
Antonio Guerrieri	Università della Calabria, Italy
Carlos Eduardo Barbosa	Universidade Federal do Rio de Janeiro, Brazil
Claudio Savaglio	Università della Calabria, Italy
Danilo Carvalho	Universidade Federal do Rio de Janeiro, Brazil



# Contents

## Urban Mobility

Characterizing Usage Patterns and Service Demand of a Two-Way Car-Sharing System. . . . .	3
<i>Felipe Rooke, Victor Aquiles, Alex Borges Vieira, Jussara M. Almeida, and Idilio Drago</i>	
MobilityMirror: Bias-Adjusted Transportation Datasets . . . . .	18
<i>Luke Rodriguez, Babak Salimi, Haoyue Ping, Julia Stoyanovich, and Bill Howe</i>	
MODAL - A Platform for Mobility Analyses Using Open Datasets. . . . .	40
<i>Wender Zacarias Xavier and Humberto Torres Marques-Neto</i>	

## Urban Sensing

MENSAGERIA: A Smart City Framework for Real-Time Analysis of Traffic Data Streams . . . . .	59
<i>Marcos Roriz Junior, Rafael Pereira de Oliveira, Felipe Carvalho, Sergio Lifschitz, and Markus Endler</i>	
SLEDS: A DSL for Data-Centric Storage on Wireless Sensor Networks . . . .	74
<i>Marcos Aurélio Carrero, Martin A. Musicante, Aldri Luiz dos Santos, and Carmem S. Hara</i>	
Extraction and Exploration of Business Categories Signatures. . . . .	90
<i>Leonardo de Assis da Silva and Thiago H. Silva</i>	

## Contemporary Social Problems

Comparing Emotional Reactions to Terrorism Events on Twitter. . . . .	107
<i>Jonathas G. D. Harb and Karin Becker</i>	
Using Government Data to Uncover Political Power and Influence of Contemporary Slavery Agents in Brazil . . . . .	123
<i>Letícia Dias Verona, Giseli Rabello Lopes, and Maria Luiza Machado Campos</i>	

**Collaboration and Crowdsourcing**

CidadeSocial: An Application Software for Opportunistic and Collaborative  
Engagement of Urban Populations. . . . . 141

*Ana Clara Correa, Eliel Roger, Tiago Cruz de França, José O. Gomes,  
and Jonice Oliveira*

Structures of Interactions and Data in Urban Networks:  
The Case of PortoAlegre.cc . . . . . 156

*Pablo Vieira Florentino and Gilberto Corso Pereira*

DMEK: Improving Profile Matching in Opportunistic Collaborations. . . . . 171

*José Guilherme Mayworm, Jonice Oliveira, Fabrício Firmino,  
and Claudio M. de Farias*

**Author Index . . . . . 185**