Lecture Notes in Computer Science **11621**

Commenced Publication in 1973
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Computational Science and Its Applications – ICCSA 2019

19th International Conference
Saint Petersburg, Russia, July 1–4, 2019
Proceedings, Part III

Springer

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ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-24301-2 ISBN 978-3-030-24302-9 (eBook)
https://doi.org/10.1007/978-3-030-24302-9

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

These six volumes (LNCS volumes 11619–11624) consist of the peer-reviewed papers from the 2019 International Conference on Computational Science and Its Applications (ICCSA 2019) held in St. Petersburg, Russia during July 1–4, 2019, in collaboration with the St. Petersburg University, St. Petersburg, Russia.

ICCSA 2019 was a successful event in the International Conferences on Computational Science and Its Applications (ICCSA) series, previously held in Melbourne, Australia (2018), Trieste, Italy (2017), Beijing, China (2016), Banff, Canada (2015), Guimaraes, Portugal (2014), Ho Chi Minh City, Vietnam (2013), Salvador, Brazil (2012), Santander, Spain (2011), Fukuoka, Japan (2010), Suwon, South Korea (2009), Perugia, Italy (2008), Kuala Lumpur, Malaysia (2007), Glasgow, UK (2006), Singapore (2005), Assisi, Italy (2004), Montreal, Canada (2003), and (as ICCS) Amsterdam, The Netherlands (2002) and San Francisco, USA (2001).

Computational science is a main pillar of most of the current research, industrial and commercial activities, and plays a unique role in exploiting ICT innovative technologies. The ICCSA conference series have been providing a venue to researchers and industry practitioners to discuss new ideas, to share complex problems and their solutions, and to shape new trends in computational science.

Apart from the general track, ICCSA 2019 also included 33 workshops, in various areas of computational sciences, ranging from computational science technologies, to specific areas of computational sciences, such as software engineering, security, artificial intelligence, and blockchain technologies. We accepted 64 papers distributed in the five general tracks, 259 in workshops and ten short papers. We would like to show our appreciations to the workshop chairs and co-chairs.

The success of the ICCSA conference series, in general, and ICCSA 2019, in particular, is due to the support of many people: authors, presenters, participants, keynote speakers, workshop chairs, Organizing Committee members, student volunteers, Program Committee members, Advisory Committee members, international liaison chairs, reviewers and people in other various roles. We would like to thank them all.

We also thank our publisher, Springer, for accepting to publish the proceedings, for sponsoring part of the best papers awards and for their kind assistance and cooperation during the editing process.

We cordially invite you to visit the ICCSA website http://www.iccsa.org where you can find all relevant information about this interesting and exciting event.

July 2019

Osvaldo Gervasi
Beniamino Murgante
Sanjay Misra

Welcome to St. Petersburg

Welcome to St. Petersburg, the Venice of the North, the city of three revolutions, creation of czar Peter the Great, the most European city in Russia. ICCSA 2019 was hosted by St. Petersburg State University, during July 1–4, 2019.

St. Petersburg is the second largest city in Russia after Moscow. It is the former capital of Russia and has a lot of attractions related to this role in the past: imperial palaces and parks both in the city center and suburbs, respectable buildings of nobles and state institutions, multitude of rivers and canals with more than 300 bridges of various forms and sizes. Extraordinary history and rich cultural traditions of both imperial Russia and the Soviet Union attracted and inspired many examples of world's greatest architecture, literature, music, and visual art, some of which can be found in the famous Hermitage and State Russian Museum located in the heart of the city. Late June and early July is the season of white nights where the sun sets only for a few hours, and the nighttime is covered with mysterious twilight.

What to do in the city:

- Enjoy the white nights, see the open bridges during the night and cargo ships passing by from Ladoga Lake to the Gulf of Finland and back. Dvortsovy bridge is open at about 1am. Be sure to stay on the correct side of the river when the bridges open!
- Visit Hermitage (Winter palace) and State Russian Museum to see great examples of international and Russian art, and the Kunstkammer, the oldest museum of St. Petersburg founded by Peter the Great.
- Travel to St. Petersburg suburbs Peterhof and Tsarskoe Selo to see imperial palaces and splendid parks, famous Peterhof fountains.
- Eat Russian food: borsch (beetroot soup), pelmeni and vareniki (meat and sweet dumplings), bliny (pancakes), vinegret (beetroot salad), drink kvas and maybe some vodka.
- Walk around and inside the Peter and Paul Fortress, the place where the city began in 1703.
- Visit the Mariinsky Theater for famous Russian ballet and opera.
- Have a boat tour along the Neva River and canals to look at the city from the water.
- Walk along Nevsky Prospect, the main street of the city.
- Climb St. Isaac's Cathedral colonnade to enjoy great city views.
- Go down to the Metro, the city's underground train network with some Soviet-style museum-like stations.
- Pay a visit to the recently renovated Summer Garden, the oldest park of St. Petersburg.
- Visit a new modern open space on the New Holland Island to see modern art exhibitions, performances and just to relax and enjoy sitting on the grass with an ice cream or lemonade during a hot summer day.

St. Petersburg State University is the oldest university in Russia, an actively developing, world-class center of research and education. The university dates back to 1724, when Peter the Great founded the Academy of Sciences and Arts as well as the first Academic University and the university preparatory school in Russia. At present there are over 5,000 academic staff members and more than 30,000 students, receiving education in more than 400 educational programs at 25 faculties and institutes.

The venue of ICCSA is the Faculty of Economics located on Tavricheskaya Street, other faculties and university buildings are distributed all over the city with the main campus located on Vasilievsky Island and the natural science faculties (Mathematics and Mechanics, Applied Mathematics and Control Processes, Physics, Chemistry) located on the campus about 40 kilometers away from the city center in Peterhof.

Elena Stankova
Vladimir Korkhov
Nataliia Kulabukhova

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ICCSA 2019 was organized by St. Petersburg University (Russia), University of Perugia (Italy), University of Basilicata (Italy), Monash University (Australia), Kyushu Sangyo University (Japan), University of Minho, (Portugal).

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Contents – Part III

Computational and Applied Statistics (CAS 2019)

Application of DOE for the Study of a Multiple Jet Impingement System . . . 3
Flávia V. Barbosa, Sérgio D. T. Sousa, Senhorinha F. C. F. Teixeira, and José C. F. Teixeira

Computing Topics on Multiple Imputation in Big Identifiable Data Using R: An Application to Educational Research . . . 12
Maria Eugénia Ferrão and Paula Prata

Comparing Empirical ROC Curves Using a Java Application: CERCUS 25
Daniel Moreira and Ana C. Braga

A Nonlinear Dynamical System Perspective on Team Learning: The Role of Team Culture and Social Cohesion . . . 38
Isabel Dórdio Dimas, Teresa Rebelo, Paulo Renato Lourenço, and Humberto Rocha

Demand Forecasting: A Case Study in the Food Industry . . . 50
Juliana C. Silva, Manuel C. Figueiredo, and Ana C. Braga

Periodic INAR(1) Models with Skellam-Distributed Innovations . . . 64
Cláudia Santos, Isabel Pereira, and Manuel Scotto

Computational Mathematics, Statistics and Information Management (CMSIM 2019)

A Spatio-Temporal Auto-regressive Model for Generating Savings Calls to a Health Line . . . 81
Paula Simões, M. Lucília Carvalho, Sandra Aleixo, Sérgio Gomes, and Isabel Natário

Knowledge of the Boarded Population About Zika Virus . . . 97
João Faria, Rosa Teodósio, and M. Filomena Teodoro

Study About Pediatric Hypertension in *Lisboa and Vale do Tejo* . . . 111
M. Filomena Teodoro and Carla Simão

Some Issues About Iberian Energy Prices . . . 122
M. Filomena Teodoro and Marina A. P. Andrade

A Nonlinear Subgrid Stabilization Parameter-Free Method to Solve Incompressible Navier-Stokes Equations at High Reynolds Numbers 134
Riedson Baptista, Sérgio S. Bento, Leonardo M. Lima, Isaac P. Santos, Andrea M. P. Valli, and Lucia Catabriga

Local Preconditioning Techniques Coupled with a Variational Multiscale Method to Solve Compressible Steady Flows at Low Mach Numbers 149
Sérgio Souza Bento, Leonardo Muniz de Lima, Isaac P. Santos, and Lucia Catabriga

Computational Optimization and Applications (COA 2019)

Forecasting Wheat Prices Based on Past Behavior: Comparison of Different Modelling Approaches 167
Joana Dias and Humberto Rocha

Dynamic Facility Location Problem with Stochastic Setup Times 183
Maria do Céu Marques and Joana Dias

An Optimization Approach for Noncoplanar Intensity-Modulated Arc Therapy Trajectories 199
Humberto Rocha, Joana Dias, Tiago Ventura, Brígida Ferreira, and Maria do Carmo Lopes

A Network Flow Based Construction for a GRASP + SA Algorithm to Solve the University Timetabling Problem 215
Edmar Hell Kampke, Leonardo Moreli Scheideger, Geraldo Regis Mauri, and Maria Claudia Silva Boeres

Orthogonal Bandit Learning for Portfolio Selection Under Cardinality Constraint 232
Mahdi Moeini

On Trajectory Optimization of an Electric Vehicle 249
Eligius M. T. Hendrix, Ana Maria A. C. Rocha, and Inmaculada García

A Multi-objective Approach to Solve the Build Orientation Problem in Additive Manufacturing 261
Marina A. Matos, Ana Maria A. C. Rocha, Lino A. Costa, and Ana I. Pereira

Optimizing the Kidney Exchange Problem with a Budget for Simultaneous Crossmatch Tests 277
Valeria Romanciuc and Filipe Alvelos

Computational Astrochemistry (CompAstro 2019)

Analytical Potential Energy Formulation for a New Theoretical Approach in Penning Ionization 291
Stefano Falcinelli, Marzio Rosi, Franco Vecchiocattivi, and Fernando Pirani

Electronic Structure and Kinetics Calculations for the Si+SH Reaction, a Possible Route of SiS Formation in Star-Forming Regions. 306
Marzio Rosi, Dimitrios Skouteris, Nadia Balucani, Luca Mancini, Noelia Faginas Lago, Linda Podio, Claudio Codella, Bertrand Lefloch, and Cecilia Ceccarelli

A Computational Study of the Reaction $N(^2D) + C_6H_6$ Leading to Pyridine and Phenylnitrene 316
Nadia Balucani, Leonardo Pacifici, Dimitrios Skouteris, Adriana Caracciolo, Piergiorgio Casavecchia, Stefano Falcinelli, and Marzio Rosi

Cities, Technologies and Planning (CTP 2019)

A Simulation Model Perspective on Social Capital 327
Andreas Koch

Informal Settlements Spatial Analysis Using Space Syntax and Geographic Information Systems. 343
Valerio Cutini, Valerio Di Pinto, Antonio M. Rinaldi, and Francesco Rossini

The Electronic Government of St.-Petersburg as Relevant Experience of Construction of Digital Economy 357
Galina S. Tibilova, Andrey V. Ovcharenko, Elena N. Stankova, and Natalya V. Dyachenko

CO-TAMP: Transnational Platform for Territorial Attractiveness Monitoring in the Danube Region 372
Ljiljana Živković and Blaž Barborič

An Agent-Based Model (ABM) for the Evaluation of Energy Redevelopment Interventions at District Scale: An Application for the San Salvario Neighborhood in Turin (Italy) 388
Caterina Caprioli, Marta Bottero, and Marialisa Pellegrini

Future Computing System Technologies and Applications (FISTA 2019)

Hardware Acceleration of Language Processing in Scripting Programming Languages 407
Hiroyuki Maeda and Kazuaki Tanaka

A Machine Learning Framework for Edge Computing to Improve Prediction Accuracy in Mobile Health Monitoring 417
Sigdel Shree Ram, Bernady Apduhan, and Norio Shiratori

Geographical Analysis, Urban Modeling, Spatial Statistics (GEO-AND-MOD 2019)

An Unsupervised Machine Learning Approach in Remote Sensing Data 435
Mauro Mazzei

Spatial Patterns of Development of Mobile Technologies for 5G Networks 448
Piotr A. Werner and Mariusz Porczek

Stochastic Blockmodeling for the Analysis of Big Data 460
Gabriella Schoier and Giuseppe Borruso

Workflow Discovery Through Semantic Constraints: A Geovisualization Case Study 473
Vedran Kasalica and Anna-Lena Lamprecht

A User-Centred Approach to Design Transport Interchange Hubs (TIH): A Discussion Illustrated by a Case Study in the Russian Arctic 489
Clarice Bleil de Souza, Ilya V. Dunichkin, and Camilla Pezzica

A Methodology for Defining Smart Camera Surveillance Locations in Urban Settings 505
Rodrigo Tapia-McClung and Tania Gómez-Fernández

Exploring Specific Features of Transport Interchange Hubs (TIH) Design, Taking into Account the Climatic Conditions of the Russian Arctic 521
Ilya V. Dunichkin, Clarice Bleil de Souza, Konstantin Bogachev, and Camilla Pezzica

Location Theory and Circular Economy. Demolition, Constructions and Spatial Organization of Firms – An Applied Model to Sardinia Region. The Case Study of the New Cagliari Stadium 535
Ginevra Balletto, Giuseppe Borruso, and Giovanni Mei

Modeling the Epidemiological Processes of Economically Significant Infections of Animals 551
Sarsenbay Abdrakhmanov, Ersyn Mukhanbetkalyev, Altay Ussenbayev, Dina Satybaldina, Ablaikhan Kadyrov, and Nurlan Tashatov

Ecosystem Indicators and Landscape Ecology Metrics as a Tool to Evaluate Sustainable Land Planning in ICZM 561
Andrea Fiduccia, Luisa Cattozzo, Leonardo Marotta, Leonardo Filesi, and Luca Gugliermetti

Cumulative Impact of Societal Activities on Marine Ecosystems and Their Services 577
Henning Sten Hansen

Predicting Sediment Concentrations Using a Nonlinear Autoregressive Exogenous Neural Network 591
Vladimir J. Alarcon

Using Gridded Multi-mission Sea Surface Height Data to Estimate Tidal Heights at Columbia River Estuary 602
Vladimir J. Alarcon

Multi-criteria Evaluation vs Perceived Urban Quality: An Exploratory Comparison 612
Ivan Blečić, Alessandra G. Santos, Ana Clara Moura, and Giuseppe A. Trunfio

Situation Analysis of Cities in Ardabil Province in Terms of Health Indicators 628
Amin Safdari Molan, Keramatollah Ziari, Ahmad Pourahmad, Hossein Hataminejad, and Mehdi Parsa

Spatial Analysis of the Proximity Effects of Land Use Planning on Housing Prices (Case Study: Tehran, Iran) 642
Amin Safdari Molan and Ebrahim Farhadi

Providing a Livable Housing Development Model for Increasing Urban Livability (Case Study of Tehran) 660
Amin Safdari Molan, Keramatollah Ziari, Ahmad Pourahmad, and Hossein Hataminejad

Evolution of Soil Consumption in the Municipality of Melfi (Southern Italy) in Relation to Renewable Energy 675
Valentina Santarsiero, Gabriele Nolè, Antonio Lanorte, Biagio Tucci, Pasquale Baldantoni, and Beniamino Murgante

Trend Definition of Soil Consumption in the Period 1994–2014 - Municipalities of Potenza, Matera and Melfi 683
Pasquale Baldantoni, Gabriele Nolè, Antonio Lanorte, Biagio Tucci, Valentina Santarsiero, and Beniamino Murgante

Energy Landscape Fragmentation: Basilicata Region (Italy) Study Case 692
Lucia Saganeiti, Angela Pilogallo, Giuseppe Faruolo, Francesco Scorza, and Beniamino Murgante

Investigating Urban Growth Dynamic – Land Surface Temperature Relationship 701
Angela Pilogallo, Lucia Saganeiti, Francesco Scorza, and Beniamino Murgante

Geospatial Database for the Generation of Multidimensional Virtual City Models Dedicated to Urban Analysis and Decision-Making 711
Andreas Fricke and Hartmut Asche

Author Index 727