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Computational Science and Its Applications – ICCSA 2019

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

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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 V

Software Engineering Processes and Applications (SEPA 2019)

A Microservice-Based Health Information System for Student-Run Clinics 3
Itamir de Morais Barroca Filho, Silvio Costa Sampaio, Gibeon Soares Aquino Junior, Rafael Fernandes de Queiroz, Dannylo Johnathan Bernardino Egidio, Ramon Santos Malaquias, and Larissa Gilliane Melo de Moura

A Systematic Mapping Study on Software Architectures Description Based on ISO/IEC/IEEE 42010:2011. 17
Ademir A. C. Júnior, Sanjay Misra, and Michel S. Soares

ArchCaMO - A Maturity Model for Software Architecture Description Based on ISO/IEC/IEEE 42010:2011. 31
Ademir A. C. Júnior, Sanjay Misra, and Michel S. Soares

A Survey on the Skills, Activities and Role of the Software Architect in Brazil. 43
Manoela R. Oliveira, Felipe J. R. Vieira, Sanjay Misra, and Michel S. Soares

Technical and Managerial Difficulties in Postmortem Analysis in Software Projects 59
Felipe J. R. Vieira, Manoela R. Oliveira, Rogério P. C. do Nascimento, and Michel S. Soares

Customer Feedback Prioritization Technique: A Case Study on Lean Startup 70
Syeda Sumbul Hossain, S. A. M. Jubayer, Shadikur Rahman, Touhid Bhuiyan, Lamisha Rawshan, and Saiful Islam

Meta-Analysis of Researches of STEAM with Coding Education – in Korea. 82
Jeong Ah Kim and HeeJin Kim

Component Architecture of mHealth Service Platform 90
Jeong Ah Kim and DongGi Kim

An Architectural Approach to the Precedent-Oriented Solution of Tasks in Designing a Software Intensive System. 97
Petr Sosnin, Sergey Shumilov, and Aleksandr Ivasev

Galactic Swarm Optimization Applied to Reinforcement of Bridges by Conversion in Cable-Stayed Arch 108
Camilo Vásquez, Broderick Crawford, Ricardo Soto, José Lemus-Romani, Gino Astorga, Sanjay Misra, Agustín Salas-Fernández, and José-Miguel Rubio

A Systematic Literature Review for Service-Oriented Architecture and Agile Development 120
James Taylor Faria Chaves and Sergio Antônio Andrade de Freitas

Integrating the Scrum Framework and Lean Six Sigma 136
Anacleto Correia, António Gonçalves, and Sanjay Misra

Hardware and Software System for Hydric Estimation and Crop Irrigation Scheduling 150
Karen Daza, Jorge Hernandez, and Hector Florez

Electronic Medical Information Encryption Using Modified Blowfish Algorithm 166
Noah Oluwatobi Akande, Christiana Oluwakemi Abikoye, Marion Olubunmi Adebiyi, Anthonia Aderonke Kayode, Adekanmi Adeyinka Adegun, and Roseline Oluwaseun Ogundokun

A Deep Convolutional Encoder-Decoder Architecture for Retinal Blood Vessels Segmentation 180
Adegun Adekanmi Adeyinka, Marion Olubunmi Adebiyi, Noah Oluwatobi Akande, Roseline Oluwaseun Ogundokun, Anthonia Aderonke Kayode, and Tinuke Omolewa Oladele

Context Data Preprocessing for Context-Aware Smartphone Authentication 190
Sangjin Nam, Suntae Kim, Jung-Hoon Shin, Jeong Ah Kim, and Sooyong Park

Extending and Instantiating a Software Reference Architecture for IoT-Based Healthcare Applications 203
Itamir de Morais Barroca Filho, Gibeon Soares Aquino Junior, and Thais Batista Vasconcelos

Artificial Intelligence Techniques for Electrical Load Forecasting in Smart and Connected Communities 219
Victor Alagbe, Segun I. Popoola, Aderemi A. Atayero, Bamidele Adebisi, Robert O. Abolade, and Sanjay Misra

Computational Investigation of Consistency and Performance of the Biochemical Network of the Malaria Parasite, *Plasmodium falciparum* 231
Marion Adebiyi, Bolaji Famuyiwa, Abayomi Mosaku, Roseline Ogundokun, Olaolu Arowolo, Noah Akande, Adekanmi Adegun, Aderonke Kayode, Ayodele Adebiyi, and Ezekiel Adebiyi

Investigating Evolution in Open Source Software 242
Jordan McDonald and Des Greer

Development of an Alumni Feedback System for Curriculum Improvement in Building Technology Courses 257
Adedeji Afolabi, Emmanuel Eshofonie, and Faith Akinbo

e-Maintenance Framework for Strategic Asset Management in Tertiary Institutions 266
Adedeji Afolabi, Ibukun Afolabi, Emmanuel Eshofonie, and Faith Akinbo

Scenes Segmentation in Self-driving Car Navigation System Using Neural Network Models with Attention 278
Kirill Sviatov, Alexander Miheev, Daniil Kanin, Sergey Sukhov, and Vadim Tronin

Evolutionary and Adaptive Elderly Care Ecosystem. 290
Thais A. Baldissera and Luis M. Camarinha-Matos

Software Engineering Methodologies for the Evaluation and Monitoring of Projects of Higher Education Students 306
Susana Flores, Claudia Torrero, Everardo Torrero, Lamia Handam, and Silvana Flores

A Web Framework for Online Peer Tutoring Application in a Smart Campus 316
David Akobe, Segun I. Popoola, Aderemi A. Atayero, Olasunkanmi F. Oseni, and Sanjay Misra

Use of Blockchain Smart Contracts in Software Engineering: A Systematic Mapping. 327
Faizan Tariq and Ricardo Colomo-Palacios

SPLide: An Integrated Development Environment Supporting Software Product Lines 338
Ockhyun Paek, Taeho Lee, and Jin-Seok Yang

Analysis of Noise Perturbation on Neural Network Based ECG Classification 349
Abdoul-Dalibou Abdou, Ndeye Fatou Ngom, Oumar Niang, and Mohamed Cheikh Ould Guera

Multi-class Classification of Impulse and Non-impulse Sounds Using Deep Convolutional Neural Network (DCNN). 359
Adebayo Abayomi-Alli, Olusola Abayomi-Alli, Jeffrey Vipperman, Modupe Odusami, and Sanjay Misra

Improving Employability Skills Through a Web-Based Work Integrated Learning Database for Construction Students 372
Adedeji Afolabi, Ibukun Afolabi, Emmanuel Eshofonie, and Faith Akinbo

Using Scope Scenarios to Verify Multiple Variability Models. 383
Matias Pol'la, Agustina Buccella, and Alejandra Cechich

Service Discovery Based on Social Profiles of Objects in a Social IoT Network. 400
Iury Araújo, Mikaelly F. Pedrosa, Jessica Castro, Eudisley G. dos Anjos, and Fernando Matos

Guidelines for Architecture Design of Software Product Line 415
Jeong Ah Kim, DongGi Kim, and JinSeok Yang

HOG Based Facial Recognition Approach Using Viola Jones Algorithm and Extreme Learning Machine 423
Khushwant Sehra, Ankit Rajpal, Anurag Mishra, and Girija Chetty

Automatic Code Generation System for Transactional Web Applications 436
Hector Florez, Edwarth Garcia, and Deisy Muñoz

Computed Tomography of Polymer Composites Reinforced with Natural Short Fiber. 452
César Paltán, Josep Costa, and Jorge Fajardo

Discrete Optimization Based Rail Passengers Safety and Comfort Communication System Configuration Design 468
Adam Galuszka, Tomasz Grzejszczak, Carmen Lungoci, Ewa Gilner, and Tomasz Hejczyk

VIoT – A Step Towards Easing the Interoperability of IoT-Based Applications 482
Dannylo J. B. Egídio and Gibeon S. de Aquino Jr.

Adaptive Channel Borrowing Scheme for Capacity Enhancement in Cellular Wireless Networks 497
Onyinyechi F. Steve-Essi, Francis F. Idachaba, Segun I. Popoola, Aderemi A. Atayero, Bamidele Adebisi, and Craig Nitzsche

Data Analytics: Global Contributions of World Continents to Computer Science Research 512
Segun I. Popoola, Aderemi A. Atayero, Onyinyechi F. Steve-Essi, and Sanjay Misra

Bridges Reinforcement Through Conversion of Tied-Arch Using Crow Search Algorithm 525
Sergio Valdivia, Broderick Crawford, Ricardo Soto, José Lemus-Romani, Gino Astorga, Sanjay Misra, Agustín Salas-Fernández, and José-Miguel Rubio

Software Architecture Enabling Effective Control of Selected Quality Aspects 536
Michal Žemlička and Jaroslav Král

Automation of Workflow Design in an Industrial Enterprise 551
Nikolay Voit, Sergey Kirillov, and Dmitry Kanev

The Method of Translation of the Diagram with One Type Directed Links into the Inhibitor Petri Net 562
Nikolay Voit, Dmitry Kanev, Sergey Kirillov, and Maria Ukhanova

Software Development Activities for Secure Microservices 573
Peter Nkomo and Marijke Coetzee

A Students' Perspective of Native and Cross-Platform Approaches for Mobile Application Development 586
Paulo Meirelles, Carla S. R. Aguiar, Felipe Assis, Rodrigo Siqueira, and Alfredo Goldman

Integration Strategies of Cross-Platform Microarray Data Sets in Multiclass Classification Problem 602
Sebastian Student, Alicja Płuciennik, Krzysztof Łakomiec, Agata Wilk, Wojciech Bensz, and Krzysztof Fujarewicz

Forensic Analysis of Mobile Banking Apps 613
Oluwafemi Osho, Uthman L. Mohammed, Nanfa N. Nimzing, Andrew A. Uduimoh, and Sanjay Misra

Investigating Enterprise Resource Planning (ERP) Effect on Work Environment 627
Quoc Trung Pham, Sanjay Misra, Le Ngoc Huyen Huynh, and Ravin Ahuja

Using Policy Refinement to Assist IoT Device Management in Smart Hospitals 645
Jessica M. de Castro, Luiz Fernando F. P. de Lima, Iury Araújo, Eudisley G. dos Anjos, and Fernando M. Matos

Parallel Symbiotic Organisms Search Algorithm 658
Absalom E. Ezugwu, Rosanne Els, Jean V. Fonou-Dombeu, Duane Naidoo, and Kimone Pillay

Stock Price Forecasting Using Symbiotic Organisms Search Trained Neural Networks 673
Bradley J. Pillay and Absalom E. Ezugwu

A Comparative Analysis of Temporal Changes in Urban Land Use Resorting to Advanced Remote Sensing and GIS in Karaj, Iran and Luxor, Egypt 689
Abdelaziz Elfadaly, Beniamino Murgante, Mohamad Molaei Qelichi, Rosa Lasaponara, and Ali Hosseini

Experimental Comparison of Stochastic Optimizers in Deep Learning 704
Emmanuel Okewu, Philip Adewole, and Oladipupo Sennaike

Application of Data Mining Algorithms for Feature Selection and Prediction of Diabetic Retinopathy 716
Tinuke O. Oladele, Roseline Oluwaseun Ogundokun, Aderonke Anthonia Kayode, Adekanmi Adeyinka Adegun, and Marion Oluwabunmi Adebiyi

Author Index 731