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Leonard Barolli · Farookh Khadeer Hussain ·
Makoto Ikeda
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Complex, Intelligent, and Software Intensive Systems

Proceedings of the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019)

Springer

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Welcome Message of CISIS-2019 International Conference Organizers

Welcome to the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019), which will be held from July 3 to July 5, 2019, at University of Technology Sydney (UTS), Sydney, Australia in conjunction with the 13th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS-2019).

The aim of the conference is to deliver a platform of scientific interaction between the three interwoven challenging areas of research and development of future ICT-enabled applications: software intensive systems, complex systems, and intelligent Systems.

Software intensive systems are systems, which heavily interact with other systems, sensors, actuators, devices, other software systems, and users. More and more domains are involved with software intensive systems, e.g., automotive, telecommunication systems, embedded systems in general, industrial automation systems, and business applications. Moreover, the outcome of Web services delivers a new platform for enabling software intensive systems. The conference is thus focused on tools, practically relevant and theoretical foundations for engineering software intensive systems.

Complex systems research is focused on the overall understanding of systems rather than its components. Complex systems are very much characterized by the changing environments in which they act by their multiple internal and external interactions. They evolve and adapt through internal and external dynamic interactions.

The development of intelligent systems and agents which is each time more characterized by the use of ontologies and their logical foundations build a fruitful impulse for both software intensive systems and complex systems. Recent researches in the field of intelligent systems, robotics, neuroscience, artificial intelligence, and cognitive sciences are very important factor for the future development and innovation of software intensive and complex systems.

CISIS-2019 is aiming at delivering a forum for in-depth scientific discussions among the three communities. The papers included in the proceedings cover all aspects of theory, design, and application of complex systems, intelligent systems,

and software intensive systems. The conference received 166 papers and accepted 45 papers (about 27% acceptance rate), which were selected after a careful review process.

We are very proud and honored to have two distinguished keynote talks by Prof. Wanlei Zhou, University of Technology Sydney, Australia, and Dr. Nadeem Javaid, COMSATS University Islamabad, Pakistan, who will present their recent work and will give new insights and ideas to the conference participants.

The organization of an international conference requires the support and help of many people. A lot of people have helped and worked hard to produce a successful CISIS-2019 technical program and conference proceedings. First, we would like to thank all the authors for submitting their papers, the Program Committee Members, and the reviewers who carried out the most difficult work by carefully evaluating the submitted papers. We are grateful to Honorary Co-Chairs Prof. Makoto Takizawa, Hosei University, Japan, and Prof. Jie Lu, University of Technology Sydney, Australia, for their guidance and advice.

This year in conjunction with CISIS-2019 we have seven international workshops that complemented CISIS-2019 program with contributions for specific topics. We would like to thank the Workshops Co-Chairs and all Workshops Organizers for organizing these workshops.

Finally, we would like to thank Web Administrator Co-Chairs and Local Arrangement Co-Chairs for their excellent and timely work.

We hope you will enjoy the conference and have a great time in Sydney, Australia.

Leonard Barolli
Farookh Khadeer Hussain
CISIS-2019 General Co-Chairs

Omar Hussain
Hiroaki Nishino
Kin Fun Li
CISIS-2019 Program Committee Co-chairs

Welcome Message from CISIS-2019 Workshops Co-chairs

Welcome to the Workshops of the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019), which will be held from July 3 to July 5, 2019, at University of Technology Sydney, Sydney, Australia.

We are pleased that for this edition of CISIS International Conference we have seven international workshops. Some of these workshops are in 9th, 10th, 11th, 12th, and 13th editions. The objective was to complement as much as possible the main theme of CISIS-2019 with specific topics of different workshops in order to cover topics from the three challenging areas of ICT-enabled applications: software intensive systems, complex systems, and intelligent systems.

The list of workshops is as follows:

1. The 13th International Workshop on Engineering Complex Distributed Systems (ECDS-2019)
2. The 12th International Workshop on Intelligent Informatics and Natural Inspired Computing (IINIC-2019)
3. The 10th International Workshop on Frontiers in Complex, Intelligent and Software Intensive Systems (FCISIS-2019)
4. The 10th International Workshop on Virtual Environment and Network-Oriented Applications (VENOA-2019)
5. The 9th Semantic Web/Cloud Information and Services Discovery and Management (SWISM-2019)
6. The 6th International Workshop on Hybrid/Cloud Computing Infrastructure for E-Science Application (HCCIEA-2019)
7. The 1st International Workshop on Knowledge Creation and Innovation in Digital World (IKIDW-2019)

These workshops bring to the researchers conducting research in specific themes the opportunity to learn from this rich multidisciplinary experience. The Workshop Co-Chairs would like to thank CISIS-2019 International Conference Organizers for their help and support. We are grateful to the Workshops Organizers for their great

efforts and hard work in proposing the workshops, selecting the papers, the interesting programs, and the arrangements of the workshops during the conference days. We are grateful to Web Administrator Co-Chairs for their excellent work and support.

We hope you enjoy the workshops program and proceedings.

Mohammad Alshehri
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Welcome Message from ECDS-2019 International Workshop Co-chairs

It is our great pleasure to welcome you to the 13th International Workshop on Engineering Complex Distributed Systems (ECDS-2019), which will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

In the past, this field included technology concerns related to middleware solutions, dealing with the heterogeneity of the miscellaneous hardware and software environments and computing infrastructure. These technologies have been used to address the integration of existing legacy applications and improve the interoperability between applications across enterprises. The advances in wireless communication and pervasive computing extend this traditional wired area of distributed systems and make the new advanced application possible. The complexity of today's applications requires additional approaches to be able to realize an enterprise application time- and cost-saving. This includes the ability to model business processes, business policies, and event-oriented aspects of large systems and express these models through design solutions to address the complexity of enterprise applications and ease software design efforts. In addition, the engineering of complex distributed systems also requires a good understanding of the problem areas of concern for information systems and business administration, such as process management, supply chain management, security issues, and electronic business. These topics need to be addressed in order to deal with the complexity of today's increasingly dynamic, mobile, cross-organizational, and cross-jurisdictional systems.

In this workshop, various aspects of the design and implementation of distributed systems will be discussed. The scope of the presented papers ranges from engineering approaches and techniques to applications.

This workshop would not have been possible without the help of many people. First of all, we would like to thank all the authors for submitting their papers to our workshop. We also like to thank the Program Committee Chair, Program

Committee Members, and additional reviewers, who carefully evaluated the submitted papers.

We hope that you find the ECDS-2019 program inspiring and that the workshop provides you with the opportunity to interact, share ideas with, and learn from other distributed systems researchers from around the world. We also encourage you to continue to participate in future ECDS workshops, to increase its visibility, and to interest others in contributing to this growing community.

Leonard Barolli
Makoto Takizawa
ECDS-2019 Workshop Co-chairs

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Takuo Suganuma	Tohoku University, Japan
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Message from IINIC-2019 International Workshop Organizers

Advanced information processing technologies have the potential to significantly accelerate research in different fields. In particular, techniques from artificial intelligence, machine learning, and data mining can assist researchers in the discovery of new knowledge for next-generation applications. This workshop aims to attract state-of-the-art solutions and novel attempts in this direction.

The 12th International Workshop on Intelligent Informatics and Natural Inspired Computing (IINIC-2019) will provide a platform for researchers to meet and exchange their thoughts. IINIC-2019 will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

Many people contributed to the success of IINIC-2019. We wish to thank the Program Committee Members for their great effort. We also would like to express our gratitude to the main organizers of CISIS-2019 for their excellent work in organizing the conference. Last but not least, we would like to thank and congratulate all the contributing authors for their support to the workshop.

Takahiro Uchiya
Leonard Barolli
IINIC-2019 Workshop Co-chairs

IINIC-2019 Organizing Committee

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Takahiro Uchiya	Nagoya Institute of Technology, Japan
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Fatos Xhafa	Technical University of Catalonia, Spain
Santi Caballé	Open University of Catalonia, Spain
Farookh Hussain	University of Technology Sydney, Australia

Message from FCISIS-2019 International Workshop Organizers

It is our great pleasure to welcome you for the 10th International Workshop on Frontiers in Complex, Intelligent and Software Intensive Systems (FCISIS-2019). The workshop will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

The objective of FCISIS Workshop is to foster the discussion in a rich inter-disciplinary context of the three challenging areas of ICT-enabled applications: software intensive systems, complex systems, and intelligent systems. FCISIS-2019 is conceived in terms of special papers, which were also carefully selected, from the organizers.

We would like to thank all participants of the workshop for submitting their research works and for their participation and look forward to meet you again in forthcoming editions of the workshop.

Leonard Barolli
FCISIS-2019 Workshop Chair

FCISIS-2019 Organizing Committee

Workshop Chair

Leonard Barolli Fukuoka Institute of Technology, Japan

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Evjola Spaho	Polytechnic University of Tirana, Albania
Noriki Uchida	Fukuoka Institute of Technology, Japan
Hiroshi Maeda	Fukuoka Institute of Technology, Japan

Message from VENOA-2019 International Workshop Organizers

Welcome to the 10th International Workshop on Virtual Environment and Network-Oriented Applications (VENOA-2019), which will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

The past eight workshops were very successful, and many high-quality papers were presented and published in these workshops. We are pleased to announce the continuation of this workshop for serving as a forum for the exchange of information and ideas in the field of 3D computer graphics, virtual reality (VR), augmented reality (AR), mobile communications, IoT, and Web and network applications. We again received many unique and high-quality paper submissions in this workshop. We strictly followed the CISIS review procedures and finally selected excellent papers for publication and presentation. The program shows a variety of research activities with high relevance to the scope of the workshop.

This workshop cannot be organized without hard and excellent work of CISIS-2019 conference organizers. We would like to express our sincere appreciation to VENOA-2019 Program Committee Members and reviewers for their cooperation in completing their efforts under a very tight schedule. We also give our special thanks to all authors for their valuable contributions. We hope that these papers will have significant impacts and stimulate future research activities.

Yong-Moo Kwon
Hiroaki Nishino
VENOA-2019 Workshop Co-chairs

VENOA-2019 Organizing Committee

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Kenzi Watanabe	Hiroshima University, Japan
Kazuyuki Yoshida	Oita University, Japan

Message from SWISM-2019 International Workshop Organizers

Welcome to the 9th International Workshop on Semantic Web/Cloud Information and Services Discovery and Management (SWISM-2019), which is held in conjunction with the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

SWISM-2019 will bring together scientists, engineers, computer users, and students to exchange and share their experiences, new ideas, and research results about all aspects (theory, applications, and tools) of intelligent and semantic methods applied to Web- and Cloud-based systems, and to discuss the practical challenges encountered and the solutions adopted.

The program of SWISM-2019 includes papers related to information retrieval, ontologies, intelligent agents, intelligent techniques for management and programming of Cloud services and business processes. The program for the conference is the result of the excellent work of reviewers and Program Committee Members. We hope you will find the final program enriching and stimulating.

We believe that all the papers and topics will provide novel ideas, new theoretical and experimental results, and will stimulate the future research activities in this area.

The papers collected in this international workshop were carefully reviewed by reviewers. According to the review results, the Program Committee Members selected high-quality papers to be presented in this workshop.

We would like to express our sincere appreciation to all Program Committee Members for their cooperation. We are thankful to Honorary Co-Chairs, General Co-Chairs, Program Committee Co-Chairs, and Workshops Co-Chairs of CISIS-2019 for excellent conference organization. It was a great pleasure in working with them.

Last but not least, we are grateful to all authors for their valuable contributions and attendees who contributed to the success of the program with their papers and speeches on their research results, and with their participation in the conference.

We hope you will enjoy the workshop and conference and have a great time in Sydney, Australia.

Beniamino Di Martino
Salvatore Venticinque
Antonio Esposito
SWISM-2019 Workshop Co-chairs

SWISM-2019 Organizing Committee

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Salvatore Venticinque	University of Campania Luigi Vanvitelli, Italy
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Thomas Fahringer	University of Innsbruck, Austria
Vincenzo Loia	University of Salerno, Italy

Welcome Message from HCCIEA-2019 International Workshop Chair

On behalf of the Organizing Committee, we would like to welcome you to the 6th International Workshop on Hybrid/Cloud Computing Infrastructure for E-Science Application (HCCIEA-2019) which will be held in conjunction with the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Australia.

The workshop aims to promote research and development activities focused on E-science applications using distributed computing infrastructure, such as grid, Cloud computing, and hybrid system. With the rapid emergence of software systems and their applicability, the amount of data is growing exponentially. Existing computing infrastructure, software system designs, and use cases must take into account the enormity in volume of requests, size of data, and computing load. A complementary goal is to identify the open issues and the challenges to fix them, especially on security, flexibility, reliability, and privacy aspects.

Cloud computing has become a scalable services consumption and delivery platform in the field of services computing. Cloud is a platform or infrastructure that allows execution of code in a managed and elastic way. We want to put the emphasis of scientific and technologies progress on Cloud solutions and infrastructures, in particular concerning research activities on scalability and adaptability using effective scheduling for the virtualization.

All people involved in this workshop (authors and PC members) are researchers with high expertise, working on related research areas and projects. We are really grateful for their support, and we thank them for contributing their knowledge toward a successful event.

We would like to thank CISIS organizers for giving us the opportunity to organize HCCIEA Workshop series. We hope that the results of this event will advance the related research in multifold ways.

Olivier Terzo
HCCIEA-2019 chairs

HCCIEA-2019 Organizing Committee

Workshop Chair

Olivier Terzo	LINKS Foundation, Italy

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Giuseppe Caragnano	LINKS Foundation, Italy
Alberto Scionti	LINKS Foundation, Italy
Klodiana Goga	LINKS Foundation, Italy
Leonard Barolli	Fukuoka Institute of Technology, Japan
Vincenzo Romano	INGV, Italy

Welcome Message from IKIDW-2019 International Workshop Co-chairs

Welcome to the 1st International Workshop on Knowledge Creation and Innovation in Digital World (IKIDW-2019). The workshop will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) at University of Technology Sydney, Australia, from July 3rd to July 5th, 2019.

The value of most organizations today greatly exceeds their net tangible assets. The IKIDW-2019 workshop aims to address contemporary issues in managing knowledge, intellectual capital, and other intangible assets in the digital world with the help of IT application. The digital era contributes to the amount of knowledge available in various qualities. This is a challenge for business people in strategic decision making. IT application is expected to reduce knowledge ambiguity so that it will improve the quality of organizational decisions. Beginning with a view that knowledge becomes strategic assets, the workshop will discuss the fundamentals of managing knowledge and intellectual capital, understanding some of the measurement issues, processes, and cycles involved in their management and the specific issues in managing knowledge, especially with the availability of big data and with the help of IT application.

We would like to express our sincere gratitude to the members of the Program Committee for their efforts. We thank the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019) for co-hosting IKIDW-2019. Most importantly, we thank all the authors for their submission and contribution to the workshop.

We hope all of you will enjoy IKIDW-2019 and find this a productive opportunity to exchange ideas with many researchers.

Olivia Fachrunnisa
Ardian Adhiatma
IKIDW-2019 Workshop Co-chairs

IKIDW-2019 Organizing Committee

Workshop Co-chairs

Olivia Fachrunnisa	UNISSULA, Indonesia
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Chih-Peng Chu	National Dong Hwa University, Taiwan
Shu-Ling Chen	National Dong Hwa University, Taiwan
Farookh Hussain	University of Technology Sydney (UTS), Australia
Omar Hussain	University of New South Wales, Canberra, Australia

CISIS-2019 Keynote Talks

Trust, Security and Privacy in Low-Cost RFID Systems

Wanlei Zhou

University of Technology Sydney, Sydney, Australia

Abstract. Radio Frequency Identification (RFID) enables the automatic identification of objects using radio waves without the need for physical contact with the objects. RFID has been widely used in various fields such as logistics, manufacturing, pharmaceutical, supply chain management, healthcare, defense, aerospace and many other areas, apart from touching our everyday lives through RFID enabled car keys, ePassports, clothing, electronic items and others. However, the wide adoptions of RFID technologies also introduce serious security and privacy risks as the information stored in RFID tags can easily be retrieved by any malicious party with a compatible reader. In this talk, we will introduce some trust, security and privacy challenges in RFID technologies, and based on our research, we will outline a number of schemes for authentication, ownership transfer, secure search and grouping proof in Low-cost RFID systems.

Intelligent Context Awareness in Internet of Agricultural Things

Nadeem Javaid

COMSATS University Islamabad, Islamabad, Pakistan

Abstract. Variability in climate and recession in water reservoirs, diminishing the agrarian sector ecosystem production day by day. There is an imperative requirement to restore robustness and ensure high production rate with the use of smart communication infrastructure. Moreover, the farmers will be able to make resource efficient decisions with the availability of modern monitoring systems like Internet of agricultural things (IoAT). However, the data generated through IoAT devices is disparate which needs to be handled intelligently to bring artificial intelligence (AI), machine learning (ML) and data analytic (DA) techniques into play. In this talk, we will recommend the intensive use of coordination between AI, ML and DA at middleware to optimize the performance of IoAT system along with context awareness. Additionally, it will enable horizontal functionality for diverse services to mitigate the problem of inter-operability. An analysis is carried out using TOWS matrix to consider the effects of internal and external factors on the performance of automation techniques collaboration. This analysis points out various opportunities to innovate the livelihood of agrarian society around the globe.

Contents

The 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019)

Implementation of a Fuzzy-Based Simulation System and a Testbed for Improving Driving Conditions in VANETs 3
Kevin Bylykbashi, Donald Elmazi, Keita Matsuo, Makoto Ikeda, and Leonard Barolli

Performance Analysis of WMNs by WMN-PSOHC-DGA Simulation System Considering Random Inertia Weight and Linearly Decreasing Vmax Router Replacement Methods 13
Admir Barolli, Shinji Sakamoto, Seiji Ohara, Leonard Barolli, and Makoto Takizawa

IoT Node Selection and Placement: A New Approach Based on Fuzzy Logic and Genetic Algorithm 22
Miralda Cuka, Donald Elmazi, Makoto Ikeda, Keita Matsuo, and Leonard Barolli

Day Ahead Electric Load Forecasting by an Intelligent Hybrid Model Based on Deep Learning for Smart Grid 36
Ghulam Hafeez, Nadeem Javaid, Muhammad Riaz, Ammar Ali, Khalid Umar, and Zafar Iqbal

Subprocess Transmission Strategies for Recovering from Faults in the Tree-Based Fog Computing (TBFC) Model 50
Ryuji Oma, Shigenari Nakamura, Dilawaer Duolikun, Tomoya Enokido, and Makoto Takizawa

Message Ordering Based on the Object-Based-Causally (OBC) Precedent Relation 62
Takumi Saito, Shigenari Nakamura, Tomoya Enokido, and Makoto Takizawa

A Comparative Analysis of Neural Networks and Enhancement of ELM for Short Term Load Forecasting 73
Rahim Ullah, Nadeem Javaid, Ghulam Hafeez, Salim Ullah, Fahad Ahmad, and Ashraf Ullah

Cognitive Personal Security Systems 87
Marek R. Ogiela and Lidia Ogiela

Incremental Patent Semantic Annotation Based on Keyword Extraction and List Extraction 91
Xu Chen, Weixian Zong, Na Deng, Shudong Liu, and Yipeng Li

Blueprint of Driving Without Emission: EV with Intelligent Charging Stations Network 102
Xu Chen, Deliang Zhong, Shuhong You, Shuqi Yang, Na Deng, Shudong Liu, and Yipeng Li

Realtime Road State Decision System Based on Multiple Sensors and AI Technologies 114
Yoshitaka Shibata, Akira Sakuraba, Goshi Sato, and Noriki Uchida

From BPMN Models to SoaML Models 123
Abderrahmane Leshob, Redouane Blal, Hafedh Mili, Pierre Hadaya, and Omar Khadeer Hussain

Message Dissemination Using Nomadic Lévy Walk on Unit Disk Graphs 136
Koichiro Sugihara and Naohiro Hayashibara

Modelling a Smart Motorway 148
Edward Richardson, Philip Davies, and David Newell

Personalized Protocols for Data Division and Knowledge Management 159
Lidia Ogiela, Makoto Takizawa, and Urszula Ogiela

The Spatiotemporal Prediction Model of Opioids Spread Trend Based on Grey Correlation 165
Tingting Rao, Caiquan Xiong, Yi Liang, and Shishuang Deng

Transferring Informal Text in Arabic as Low Resource Languages: State-of-the-Art and Future Research Directions 176
Ebtesam H. Almansor, Ahmed Al-Ani, and Farookh Khadeer Hussain

Consumers' Attitude Toward Cloud Services: Sentiment Mining of Online Consumer Reviews 188
Asma Musabah Alkalbani

HPC, Cloud and Big-Data Convergent Architectures: The LEXIS Approach 200
Alberto Scionti, Jan Martinovic, Olivier Terzo, Etienne Walter, Marc Levrier, Stephan Hachinger, Donato Magarielli, Thierry Goubier, Stephane Louise, Antonio Parodi, Sean Murphy, Carmine D'Amico, Simone Ciccia, Emanuele Danovaro, Martina Lagasio, Frederic Donnat, Martin Golasowski, Tiago Quintino, James Hawkes, Tomas Martinovic, Lubomir Riha, Katerina Slaninova, Stefano Serra, and Roberto Peveri

Knowledge Sharing System Database Architecture for Global Knowledge Sharing 213
Alsaleh Saad and Haryani Haron

An Intelligent Predictive Analytics System for Transportation Analytics on Open Data Towards the Development of a Smart City 224
Abdul-Rasheed A. Audu, Alfredo Cuzzocrea, Carson K. Leung, Keaton A. MacLeod, Nibrasul I. Ohin, and Nadège C. Pulgar-Vidal

Multi-criteria Group Decision Making and Group Agreement Quotient Analysis Based on the Delphi Method 237
Song Lin, Li Shen, Caiquan Xiong, and Xuan Li

Graph-Based Semantic Query Optimization for Intensional XML Data 247
Abdullah Alrefae, Jinli Cao, and Eric Pardede

Design and Implementation of Security System for IPv6 Sensor Networks 257
Di Luo, Hao Wang, Shengwei Yi, and Qiao Wang

A UML Profile for the Service Discovery in the Enterprise Cloud Bus (ECB) Framework 269
Misbah Zahoor, Farooque Azam, Muhammad Waseem Anwar, Nazish Yousaf, and Muhammad Kashif

HPC-as-a-Service via HEAppE Platform 280
Vaclav Svaton, Jan Martinovic, Jan Krenek, Thomas Esch, and Pavel Tomancak

A Distributed Environment for Traffic Navigation Systems 294
Jan Martinovič, Martin Golasowski, Kateřina Slaninová, Jakub Beránek, Martin Šurkovský, Lukáš Rapant, Daniela Szturcová, and Radim Cmar

Smart Scheduling Strategy for Lightweight Virtualized Resources Towards Green Computing 305
Alberto Scionti, Carmine D'Amico, Simone Ciccia, Yuanyuan Li, and Oliver Terzo

IoT Cloud Platform Based on Asynchronous Processing for Reliable Multi-user Health Monitoring 317
Nur Hakim Arif and Nico Surantha

Towards Cloud-Based Personalised Student-Centric Context-Aware e-Learning Pedagogic Systems 331
Philip Moore, Zhili Zhao, and Hai Van Pham

Learning Agile Scrum Methodology Using the Groupware Tool Trello® Through Collaborative Working 343
Nitin Naik, Paul Jenkins, and David Newell

Self-Explanatory Capabilities in Intelligent Decision Support Systems in Resource Management 356
Maneerat Rumsamrong, Andrew Chiou, and Lily Li

A Model-Driven Approach for Load-Balanced MQTT Protocol in Internet of Things (IoT) 368
Humaira Anwer, Farooque Azam, Muhammad Waseem Anwar, and Muhammad Rashid

From an Annotated BPMN Model to a Use Case Diagram: DESTINY Methodology 379
Nourchène Elleuch Ben Ayed and Hanêne Ben Abdallah

Intelligent Fall Detection with Wearable IoT 391
Farhad Ahamed, Seyed Shahrestani, and Hon Cheung

Peer-to-Peer Based Web of Things Resource Management 402
Yangqun Li

A Machine Learning Architecture Towards Detecting Denial of Service Attack in IoT 417
Yahya Al-Hadhrami and Farookh Khadeer Hussain

Pipelined FPGA Implementation of a Wave-Front-Fetch Graph Cut System 430
Naofumi Yoshinaga, Ryo Kamasaka, Yuichiro Shibata, and Kiyoshi Oguri

A Self-partial Reconfiguration Framework with Configuration Data Compression for Intel FPGAs 442
Shota Fukui, Yuichi Kawamata, and Yuichiro Shibata

A Simple Heterogeneous Redundant Design Method for Finite State Machines on FPGAs 453
Takanori Itagawa, Ryo Kamasaka, and Yuichiro Shibata

A Method of Collecting Four Character Medicine Effect Phrases in TCM Patents Based on Semi-supervised Learning 462
Deng Na, Chen Xu, Xiong Caiquan, Wang Chunzhi, Zhang Mingwu, Ye Zhiwei, Li Desheng, and Yang Xuehong

Smart Fire-Alarm System for Home 474
Jihoon Kang, Shreya Basnet, and Sardar M. Farhad

A Framework for Early Detection of Antisocial Behavior on Twitter Using Natural Language Processing 484
Ravinder Singh, Jiahua Du, Yanchun Zhang, Hua Wang, Yuan Miao, Omid Ameri Sianaki, and Anwaar Ulhaq

Optimizing the Waiting Time for Airport Security Screening Using Multiple Queues and Servers 496
Mohamad Naji, Ali Braytee, Ali Anaissi, Omid Ameri Sianaki, and Ahmed Al-Ani

Video Classification Using Deep Autoencoder Network 508
Farshid Hajati and Mohammad Tavakolian

The 13th International Workshop on Engineering Complex Distributed Systems (ECDS-2013)

An Approximate Forecasting of Electricity Load and Price of a Smart Home Using Nearest Neighbor 521
Muhammad Nawaz, Nadeem Javaid, Fakhar Ullah Mangla, Maria Munir, Farwa Ihsan, Atia Javaid, and Muhammad Asif

Survey on Intelligent Chatbots: State-of-the-Art and Future Research Directions 534
Ebtesam H. Almansor and Farookh Khadeer Hussain

A Novel Approach to Extend KM Models with Object Knowledge Model (OKM) and Kafka for Big Data and Semantic Web with Greater Semantics 544
CSR Prabhu, R. Venkateswara Gandhi, Ajeet K. Jain, Vaibhav Sanjay Lalka, Sree Ganesh Thottempudi, and PVRD Prasad Rao

Evaluation of Performance on N-Wavelength V2X Wireless Network in Actual Road Environment 555
Akira Sakuraba, Yoshitaka Shibata, Noriki Uchida, Goshi Sato, and Kazuaki Ozeki

The 12th International Workshop on Intelligent Informatics and Natural Inspired Computing (IINIC-2019)

Evaluation of Mobile Health Services in Health Organizations 569
Alsaleh Saad

Intelligent Student Attendance Management System Based on RFID Technology 578
Bektassov Dias, Asif Mohammad, He Xu, and Ping Tan

An Agent-Based Intelligent Data Presentation Mechanism for Multifaceted Analysis 587
Kazuto Sasai, Hiroshi Matsumura, Ryota Fukutani, Gen Kitagata, and Tetsuo Kinoshita

Application of Improved Ant Colony Algorithm in Path Planning 596
Zhe Li, Ruilian Tan, and Baoxiang Ren

An Innovative Model Based on FCRBM for Load Forecasting in the Smart Grid 604
Ghulam Hafeez, Nadeem Javaid, Muhammad Riaz, Khalid Umar, Zafar Iqbal, and Ammar Ali

Proposal of Recollection Support System After Motorcycle Touring with Eye Tracking 618
Takahiro Uchiya, Shotaro Sugiura, and Ichi Takumi

The 10th International Workshop on Frontiers on Complex, Intelligent and Software Intensive Systems (FCISIS-2019)

Design and Implementation of Cloud Service System Based on Face Recognition 629
Hao Wu, He Xu, and Peng Li

Analysis and Design of Group RFID Tag Security Authentication Protocol 637
Ke Zang, He Xu, Feng Zhu, and Peng Li

Overcoming Data Security Challenges of Cloud of Things: An Architectural Perspective 646
Farhad Daneshgar, Omid Ameri Sianaki, and Amnna Ilyas

Construction and Parallel Implementation of Homomorphic Arithmetic Unit Based on NuFHE 660
Liu Wenchao, Pan Feng, Wang Xu'an, Tu Guangsheng, and Zhong Weidong

The 10th International Workshop on Virtual Environment and Network-Oriented Applications (VENOA-2019)

A Proposal of Code Correction Problem for Java Programming Learning Assistant System 671
Nobuo Funabiki, Sai He, Htoo Htoo Sandi Kyaw, and Wen-Chun Kao

A Study for Investigating Driver's Condition by Radar 681
Toshiyuki Haramaki and Hiroaki Nishino

Evaluation of Searching Method for Various Contents Using Cache Routers with Transmission Records in Unstructured Peer-to-Peer Networks 691
Daiki Takeda and Shinji Sugawara

A Piano Performance Training System Based on Visual and Tactile Guidance 702
Hokuto Tsutsumi and Hiroaki Nishino

Study on Autonomous Outing Support Service for the Visually Impaired 713
Eiji Aoki, Shinji Otsuka, Takeshi Ikenaga, Hideaki Kawano, and Masaaki Yatsuzuka

Classification of Arteriovenous Fistula Stenosis Using Shunt Murmur Analysis and Random Forest 723
Fumiya Noda, Daisuke Higashi, Keisuke Nishijima, and Ken'ichi Furuya

Effects of Equivalent Sources Arrangement on Spatial Interpolation of Impulse Responses 733
Masashi Yoshino and Ken'ichi Furuya

Automatic Determination of the Optimum Number of Updates in Synchronized Joint Diagonalization 743
Taiki Izumi, Yuuki Tachioka, Shingo Uenohara, and Ken'ichi Furuya

Practice of Programming Education Using Scratch and NekoBoard2 for High School Student 752
Kazuaki Yoshihara and Kenzi Watanabe

IntelligentBox for Web: A Constructive Visual Development System for Interactive Web 3D Graphics Applications 757
Kohei Noguchi and Yoshihiro Okada

Web-Based Collaborative VR Training System for Operation of Radiation Therapy Devices 768
Kotaro Kuroda, Kosuke Kaneko, Toshioh Fujibuchi, and Yoshihiro Okada

Designing a Simplified User Interface System for Smartphone Natives to Facilitate PC Operations 779
Keiji Urawaki and Makoto Nakashima

Development of Teaching Materials for Routing of Network Using a Full Color LED Tape as Physical Interface 789
Arisa Ishikawa, Kazuaki Yoshihara, and Kenzi Watanabe

Research of the Harvesting Date Prediction Method Using Deep Learning 798
Yukikazu Murakami, Kengo Miyoshi, and Kazuhiro Shigeta

The 9th Semantic Web/Cloud Information and Services Discovery and Management (SWISM-2019)

Enabling Accountable Collaboration in Distributed, Autonomous Systems by Intelligent Agents 807
Flora Amato, Pasquale Femia, and Francesco Moscato

Semantic Representation of Cloud Manufacturing Services and Processes for Industry 4.0 817
Beniamino Di Martino, Valeria Di Traglia, and Ivan Orefice

Optimization and Validation of eGovernment Business Processes with Support of Semantic Techniques 827
Beniamino Di Martino, Alfonso Marino, Massimiliano Rak, and Paolo Pariso

Analysis of Existing Open Standard Framework and Ontologies in the Construction Sector for the Development of Inference Engines 837
B. Di Martino, C. Mirarchi, S. Ciuffreda, and A. Pavan

Semantic Techniques for Validation of GDPR Compliance of Business Processes 847
Beniamino Di Martino, Michele Mastroianni, Massimo Campaiola, Giuseppe Morelli, and Ernesto Sparaco

The 6th International Workshop on Hybrid/Cloud Computing Infrastructure for E-Science Application (HCCIEA-2019)

Low Power Wireless Networks for Extremely Critical Environments 859
S. Ciccia, A. Scionti, G. Giordanengo, L. Pilosu, and O. Terzo

Unmanned Aerial Vehicle for the Inspection of Environmental Emissions 869
S. Ciccia, F. Bertone, G. Caragnano, G. Giordanengo, A. Scionti, and O. Terzo

A Classification of Distributed Ledger Technology Usages in the Context of Transactive Energy Control Operations 876
Fabrizio Bertone, Giuseppe Caragnano, Mikhail Simonov, Klodiana Goga, and Olivier Terzo

Analysis of Job Scheduling Techniques in a HPC Cluster Deployed in a Public Cloud 886
Francesco Lubrano, Klodiana Goga, Olivier Terzo, Antonio Parodi, and Martina Lagasio

The 1st International Workshop on Knowledge Creation and Innovation in Digital World (IKIDW-2019)

Collective Engagement and Spiritual Wellbeing in Knowledge Based Community: A Conceptual Model 899
Olivia Fachrunnisa, Ardian Adhiatma, and Heru Kurnianto Tjahjono

Financial Technology and E-Corporate Governance Model for Small Medium Enterprises 907
Mutamimah

Digital Knowledge Supply Chain for Creative Industry: A Conceptual Framework 914
Ardian Adhiatma, Olivia Fachrunnisa, and Mustafa

Relational Selling Strategy on SMEs Marketing Performance: Role of Market Knowledge and Brand Management Capabilities 925
Hendar, Ken Sudarti, and Intan Masfufah

Communal Identity and Shared Value Toward Organizational Performance in the Context of Religious Knowledge Management 934
Nurhidayati and Olivia Fachrunnisa

Knowledge Management and Religiosity: A Conceptual Development of Islamic Vanguard Spirit 939
Ken Sudarti and Moch. Zulfa

Effect of Islamic Leadership on Teacher Performance Through It Intervention Competency 946
Siti Sumiati and Erni Yuvitasari

Blue Accounting of the Marine Knowledge and Sustainable Seas: A Conceptual Model 954
Winarsih, Khoirul Fuad, and Hendri Setyawan

Fraud Prevention on Village Government: The Importance of Digital Infrastructure Supervision 959
Provita Wijayanti, Nurhidayati, and Rustam Hanafi

The Role of the Human Capital and Network in Maintaining the Sustainability of IMFI in the Digital Era: An Islamic Perspective 966
Widiyanto bin Mislan Cokrohadisumarto

Collaborative Agility Capital: A Conceptual Novelty to Support Knowledge Management 972
Tri Wikaningrum, Heru Sulistyo, Imam Ghozali, and Ahyar Yuniawan

Fostering Absorptive Capacity and Self-efficacy on Knowledge Sharing Behavior and Innovation Capability: An Empirical Research 981
Heru Sulistyo and Tri Wikaningrum

Author Index 991