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Advances in Intelligent Networking and Collaborative Systems

The 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019)

Springer

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Welcome Message from the INCoS-2019 Organizing Committee

Welcome to the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), which is held from 5–7 September 2019, at Oita University, Japan.

INCoS is a multidisciplinary conference that covers latest advances in intelligent social networks and collaborative systems, intelligent networking systems, mobile collaborative systems, secure intelligent cloud systems, etc. Additionally, the conference addresses security, authentication, privacy, data trust and user trustworthiness behaviour, which have become crosscutting features of intelligent collaborative systems. With the fast development of the Internet, we are experiencing a shift from the traditional sharing of information and applications as the main purpose of the networking systems to an emergent paradigm, which locates people at the very centre of networks and exploits the value of people's connections, relations and collaboration. Social networks are playing a major role as one of the drivers in the dynamics and structure of intelligent networking and collaborative systems.

Virtual campuses, virtual communities and organizations strongly leverage intelligent networking and collaborative systems by a great variety of formal and informal electronic relations, such as business-to-business, peer-to-peer and many types of online collaborative learning interactions, including the virtual campuses and e-learning and MOOCs systems. Altogether, this has resulted in entangled systems that need to be managed efficiently and in an autonomous way. In addition, the conjunction of the latest and powerful technologies based on cloud, mobile and wireless infrastructures is currently bringing new dimensions of collaborative and networking applications a great deal by facing new issues and challenges. INCoS-2019 conference paid a special attention to cloud computing services, storage, security and privacy, data mining, machine learning and collective intelligence, cooperative communication and cognitive systems, management of virtual organization and enterprises, big data analytics, e-learning, virtual campuses and MOOCs, among others.

The aim of this conference is to stimulate research that will lead to the creation of responsive environments for networking and, at longer-term, the development of adaptive, secure, mobile and intuitive intelligent systems for collaborative work and learning.

This edition the conference received 107 submissions, and based on the review results, we accepted 30 regular papers (28% acceptance ratio). Additionally, five workshops were organized in conjunction with the conference.

The successful organization of the conference is achieved thanks to the great collaboration and hard work of many people and conference supporters. First and foremost, we would like to thank all the authors for their continued support to the conference by submitting their research work to the conference, for their presentations and discussions during the conference days. We would like to thank TPC members and external reviewers for their work by carefully evaluating the submissions and providing constructive feedback to authors. We would like to thank the track chairs for their work on setting up the tracks and the respective TPCs and also for actively promoting the conference and their tracks. We would like to appreciate the work of PC Co-chairs and Workshops' Co-chairs for the successful organization of workshops in conjunction with main conference.

We would like to acknowledge the excellent work and support by the International Advisory Committee. Also, we would like to thank the conference keynote speakers for their interesting and inspiring keynote speeches.

We greatly appreciate the support by Web Administrator Co-chairs and the local organizing committee from Oita University, Japan, for excellent arrangements for the conference. We are very grateful to Springer as well as several academic institutions for their endorsement and assistance.

Finally, we hope that you will find these proceedings to be a valuable resource in your professional, research and educational activities!

Hiroaki Nishino
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General Co-chairs

Hiroyoshi Miwa
Flora Amato
Programme Co-chairs

Message from the INCoS-2019 Workshops Chairs

Welcome to the Workshops of the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), which is held from 5–7 September 2019, at Oita University, Japan.

In this edition of the conference, there are held five workshops, which complemented the INCoS main themes with specific themes and research issues and challenges, as follows:

1. The 11th International Workshop on Information Network Design (WIND-2019)
2. The 7th International Workshop on Frontiers in Intelligent Networking and Collaborative Systems (FINCoS-2019)
3. The 5th International Workshop on Theory, Algorithms and Applications of Big Data Science (BDS-2019)
4. The 5th International Workshop on Collaborative e-business Systems (e-Business-2019)
5. The 2nd International Workshop on Machine Learning in Intelligent and Collaborative Systems (MaLICS-2019)

We would like to thank the workshop organizers for their great efforts and hard work in proposing the workshop, selecting the papers, the interesting programmes and for the arrangements of the workshop during the conference days. We are grateful to the INCoS-2019 Conference Chairs for inviting us to be the Workshops Co-chairs of the conference.

We hope you will enjoy the workshop programmes.

Masato Tsuru
Jakub Nalepa
INCoS-2019 Workshops Co-chairs

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Welcome Message from WIND-2019 Workshop Organizers

Welcome to the 11th International Workshop on Information Network Design (WIND-2019), which is held in conjunction with the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), which is held from 5–7 September 2019, at Oita University, Japan.

Nowadays, the Internet is playing a role of social and economical infrastructure and is expected to support not only comfortable communication and information dissemination but also any kind of intelligent and collaborative activities in a dependable manner. However, the explosive growth of its usage with diversifying the communication technologies and the service applications makes it difficult to manage efficient sharing of the Internet. In addition, an inconsistency between Internet technologies and the human society forces a complex and unpredictable tension among end-users, applications and Internet service providers (ISPs).

It is thought, therefore, that the Internet is approaching a turning point and there might be the need for rethinking and redesigning the entire system composed of the human society, nature and the Internet. To solve the problems across multiple layers on a large-scale and complex system and to design the entire system of systems towards future information networks for human/social orchestration, a new tide of multiperspective and multidisciplinary research is essential. It will involve not only the network engineering (network routing, mobile and wireless networks, network measurement and management, high-speed networks, etc.) and the networked applications (robotics, distributed computing, human–computer interactions, Kansei information processing, etc.), but the network science (providing new tools to understand and control the huge-scale complex systems based on theories, e.g. graph theory, game theory, information theory, learning theory and statistical physics) and the social science (enabling safe, secure and human-centric application principles and business models).

The Information Network Design Workshop aims at exploring ongoing efforts in the theory and application on a wide variety of research fields related to the design of information networks and resource sharing in the networks. The workshop provides an opportunity for academic/industry researchers and professionals to share, exchange and review recent advances on information network design

research. Original contribution describing recent modelling, analysis and experiment on network design research with particular, but not exclusive, regard to:

- Large-scale and/or complex networks;
- Cross-layered networks;
- Overlay and/or P2P networks;
- Sensor and/or mobile ad hoc networks;
- Delay-/disruption-tolerant networks;
- Social networks;
- Applications on networks;
- Fundamental theories for network design.

We would like to thank the organizing committee of INCoS-2019 International Conference for giving us the opportunity to organize the workshop. We also like to thank our Programme Committee members and referees and of course, all authors of the workshop for submitting their research works and for their participation.

We wish all participants and contributors to spend an event with high research impact, interesting discussions, exchange of research ideas, to pave future research cooperations.

Masaki Aida
Mario Koeppen
Hiroyoshi Miwa
Masato Tsuru
Masato Uchida
Neng-Fa Zhou
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Welcome Message from FINCoS-2019 Workshop Organizer

Welcome to the 7th International Workshop on Frontiers in Intelligent Networking and Collaborative Systems (FINCoS-2019), which is held in conjunction with the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), from 5–7 September 2019, at Oita University, Japan.

The FINCoS-2019 covers the latest advances in the interdisciplinary fields of intelligent networking, social networking, collaborative systems, cloud-based systems and business intelligence, which lead to gain competitive advantages in business and academia scenarios. The ultimate aim is to stimulate research that will lead to the creation of responsive environments for networking and, at longer-term, the development of adaptive, secure, mobile and intuitive intelligent systems for collaborative work and learning.

Industry and academic researchers, professionals and practitioners are invited to exchange their experiences and present their ideas in this field. Specifically, the scope of FINCoS-2019 comprises research work and findings on intelligent networking, cloud and fog distributed infrastructures, security and privacy and data analysis. We would like to thank all authors of the workshop for submitting their research works and their participation. We would like to express our appreciation to the reviewers for their timely review and constructive feedback to authors.

We are looking forward to meeting you again in the forthcoming editions of the workshop.

Leonard Barolli
FINCoS-2019 Workshop Organizer

FINCoS-2019 Organizing Committee

Workshop Organizer

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Makoto Ikeda	Fukuoka Institute of Technology, Japan
Kin Fun Li	University of Victoria, Canada
Shengli Liu	Shanghai Jiaotong University, China
Janusz Kacpryzk	Polish Academy of Science, Poland
Hiroaki Nishino	University of Oita, Japan
Makoto Takizawa	Hosei University, Japan
David Taniar	Monash University, Australia
Xu An Wang	CAPF Engineering University, P.R. China

Welcome Message from BDS-2019 Workshop Organizers

Welcome to the 5th International Workshop on Theory, Algorithms and Applications of Big Data Science (BDS-2019), which is held in conjunction with the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), from 5–7 September 2019, at Oita University, Japan.

Diverse multidisciplinary approaches are being continuously developed and advanced to address the challenges that big data research raises. In particular, the current academic and professional environments are working to produce algorithms, theoretical advance in big data science, to enable the full utilization of its potential, and better applications.

The proposed workshop focuses on the dissemination of original contributions to discuss and explore theoretical concepts, principles, tools, techniques and deployment models in the context of big data. Via the contribution of both academics and industry practitioners, the current approaches for the acquisition, interpretation and assessment of relevant information will be addressed to advance the state-of-the-art big data technology.

The workshop covers the following topics:

- Contributions should focus on (but not limited to) the following topics:
- Statistical and dynamical properties of big data;
- Applications of machine learning for information extraction;
- Hadoop and big data;
- Data and text mining techniques for big data;
- Novel algorithms in classification, regression, clustering and analysis;
- Distributed systems and cloud computing for big data;
- Big data applications;
- Theory, applications and mining of networks associated with big data;
- Large-scale network data analysis;
- Data reduction, feature selection and transformation algorithms;
- Data visualization;
- Distributed data analysis platforms;
- Scalable solutions for pattern recognition;

- Stream and real-time processing of big data;
- Information quality within big data;
- Threat detection in big data.

We would like to thank the organizing committee of INCoS-2019 International Conference for giving us the opportunity to organize the workshop and the Local Arrangement Chairs for facilitating the workshop organization.

We are looking forward to meeting you again in the forthcoming editions of the workshop.

Marcello Trovati
Mark Liptrott
Jeffrey Ray
Workshop Organizers

BDS-2019 Organizing Committee

Workshop Organizers

Marcello Trovati	Edge Hill University, UK
Mark Liptrott	Edge Hill University, UK
Jeffrey Ray	Edge Hill University, UK

Programme Committee

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Richard Conniss	University of Derby, UK
Ovidiu Bagdasar	University of Derby, UK
Peter Larcombe	University of Derby, UK
Stelios Sotiriadis	University of Toronto, Canada
Jer Hayes	IBM Research, Dublin Lab, Ireland
Xiaolong Xu	Nanjing University of Post and Telecommunications, China
Nan Hu	Nanjing University of Post and Telecommunications, China
Tao Lin	Nanjing University of Post and Telecommunications, China

Welcome Message from e-Business-2019 International Workshop Organizers

Welcome to the 5th International Workshop on Collaborative e-business Systems (e-Business-2019), which is held in conjunction with the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), at Oita University, Japan, during 5–7 September 2019.

The rapid expansion of business relationships and processes involved led to the emerging standards and infrastructure for business collaborations. Business large or small can no longer survive alone. The efficient and effective links with the business partners and consumers become critical. Overall, the collaborations occur between the communities of buyers, i.e. service consumers and sellers, i.e. service providers.

As much of the competition occurs between service providers and service consumers along the e-business value chains, the main theme of IWCBS is on collaborative e-business systems through aspects of business-IT alignment, business process integration, mobility, technology and tools, platforms and architectures, and applications.

The workshop aims to address the resource planning, modelling, coordination and integration in order to develop long-term sustainable and beneficial business relationships among all the partners and consumers along the value chains. Development of well-cooperated and coordinated e-business environment is crucial. Information technology has significant roles in supporting more competitive collaborative and integrated e-business systems. For business stakeholders, the long-term sustainability and efficiency are to be increasingly important. Indeed, to appropriately address the balance between the community of buyers and sellers through collaboration and support is becoming urgent. The technology trend of supply chain management and logistics is heading towards all aspects of the integration, coordination and intelligent use of the network-based resources. In practical deployment of the solutions, mobility and handheld devices are to be involved.

We are looking forward to meeting you again in the forthcoming editions of the workshop.

Leonard Barolli
Natalia Kryvinska
e-Business-2019 International Workshop Organizers

e-Business-2019 Organizing Committee

Workshop Organizers

Leonard Barolli	Fukuoka Institute of Technology, Japan
Natalia Kryvinska	Comenius University in Bratislava, Slovakia

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Corinna Engelhardt-Nowitzki	University of Applied Sciences, Austria
Max Lackner	University of Applied Sciences, Austria
Olha Fedevych	Lviv Polytechnic National University, Ukraine

Welcome Message from MaLICS-2019 International Workshop Organizer

Welcome to the 2nd International Workshop on Machine Learning in Intelligent and Collaborative Systems (MaLICS-2019), which is held in conjunction with the 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), from 5–7 September 2019, at Oita University, Japan.

The era of big data is here and now. The amount of data produced every day grows tremendously in most real-life domains, including medical imaging, genomics, text categorization and computational biology. Hence, data-driven machine learning-powered approaches are consistently gaining research attention, and they are applied in multiple fields, with intelligent and collaborative systems not being an exception. In this workshop, we strive to present current advances on novel ideas and practical aspects concerning intelligent and collaborative systems, which benefit from machine learning, and deep learning in particular. Also, we hope to identify and highlight challenges, which are being faced by research and industrial communities in the field.

This workshop covers the latest advances in machine- and deep learning-powered intelligent systems that lead to gain competitive advantages in business and academia scenarios. The ultimate aim is to stimulate research that will lead to the creation of robust intelligent and collaborative systems applicable in a variety of fields (ranging from medical image analysis to smart delivery systems).

The workshop covers the topics of:

- Deep learning and neural Networks: applications, techniques and tools;
- Soft computing techniques for design of intelligent and collaborative systems;
- Computer vision and image processing in intelligent and collaborative systems;
- Bio-inspired algorithms for intelligent and collaborative systems;
- Hybrid algorithms for intelligent and collaborative systems;
- Heuristic and meta-heuristic algorithms in intelligent and collaborative systems;
- Machine learning in intelligent and collaborative systems;
- Advanced data analysis in intelligent and collaborative systems;
- Approaches, techniques and challenges in parallelizing machine learning-powered intelligent systems;

- Practical applications of intelligent and collaborative systems;
- Automated design and auto-tuning of deep learning and machine learning systems;
- Smart delivery systems (incl. autonomous vehicles);
- Medical image analysis in intelligent decision-support systems;
- Learning systems: approaches, techniques and tools;
- Multi- and hyperspectral imaging, analysis and processing.

We are looking forward to meeting you again in the forthcoming editions of the workshop.

Jakub Nalepa
MaLICS-2019 Workshop Organizer

MaLICS-2019 Organizing Committee

Workshop Organizer

Jakub Nalepa	Silesian University of Technology & Future Processing, Poland

Programme Committee

Aneta Poniszewska-Maranda	Lodz University of Technology, Poland
Leonard Barolli	Fukuoka Institute of Technology, Japan
Fatos Xhafa	Technical University of Catalonia, Spain
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Evjola Spaho	Polytechnic University of Tirana, Albania
Xu An Wang	Engineering University of CAPF, China

INCoS-2019 Keynote Talks

3D Graphics Applications for Education and Visualization

Yoshihiro Okada

Kyushu University, Kyushu, Japan

Abstract. In this talk, I will introduce the research activities about 3D graphics applications. We have developed environments for 3D graphics applications for many years. We have proposed a new system for 3D graphics applications called IntelligentBox. I will present the IntelligentBox and several applications especially for education and visualization. There are many education applications such as collaborative dental training system, Tai Chi-based physical therapy game and so on. While as visualization applications, we can mention room layout system, Time-tunnel (a visual analytics tool for multi-dimensional data), Treecube (a visualization tool for browsing 3D multimedia data), and so on. I will introduce the development activities of our laboratory for e-learning materials using 3D graphics and VR/AR, such as web-based interactive educational materials for Japanese history and IoT security, and games for medical education.

Secure Resilient Edge Cloud Designed Network

Tarek Saadawi

The City University of New York, City College, New York, USA

Abstract. IoT systems have put forth new requirements in all aspects of their existence: a diverse QoS requirements, resiliency of computing and connectivity, and the scalability to support massive number of end devices in a plethora of envisioned applications. The trustworthy IoT/cyber physical system (CPS) networking for smart and connected communities will be realized by distributed secure resilient Edge Cloud (EC). This distributed EC system will be a network of geographically distributed EC nodes, brokering between end-devices and Backend Cloud (BC) servers. In this talk, I will present three main topics in secure resilient cloud designed network: (1) resource management in mobile cloud computing; (2) information management in dynamic distributed databases; and (3) biological-inspired intrusion detection system (IDS). A focus in the presentation will be on the biological-inspired IDS.

Container-Leveraged Service Realization Challenges for Cloud-Native Computing

JongWon Kim

Gwangju Institute of Science & Technology (GIST), Gwangju, Korea

Abstract. Cloud-native computing, employing container-based microservices architecture, is accelerating its adoption for agile and scalable service deployment over worldwide multi-cloud infrastructure. In order to transparently enable diversified interconnections for container-based cloud-native computing, by leveraging SDN/NFV technology, we need to tie distributed IoT things through multi-site edge clouds to hyper-scale core clouds. Thus, in this talk, I first attempt to relate the open-source-driven development for CNI (Container Networking Interface) and CSI (Container Storage Interface) to the required container-enabled cloud-native computing/storage with end-to-end (i.e., IoT–SDN/NFV–Cloud) interconnections. Then, selected container-leveraged service realization challenges such as multi-tenant/multi-cluster Kubernetes orchestration, pvc (physical+virtual+containerized) harmonization, kernel-friendly accelerated and secured networking, and network-aware service meshes will be briefly discussed.

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