

Lecture Notes in Artificial Intelligence

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Computational Collective Intelligence

12th International Conference, ICCCI 2020
Da Nang, Vietnam, November 30 – December 3, 2020
Proceedings

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Preface

This volume contains the proceedings of the 12th International Conference on Computational Collective Intelligence (ICCCI 2020), which was at first planned to be held in Danang, Vietnam. However, due to the COVID-19 pandemic the conference date was first postponed to November 30 – December 3, 2020, and then moved to virtual space.

The conference was co-organized jointly by The University of Danang, Vietnam, Korea University of Information and Communication Technology, Vietnam, Wrocław University of Science and Technology, Poland, International University - VNU-HCM, Vietnam, and the Wrocław University of Economics and Business, Poland, in cooperation with the IEEE Systems, Man, and Cybernetics Society (SMC) Technical Committee on Computational Collective Intelligence, European Research Center for Information Systems (ERCIS), and Nguyen Tat Thanh University, Vietnam.

Following the successes of the first ICCCI (2009) held in Wrocław, Poland, the second ICCCI (2010) in Kaohsiung, Taiwan, the third ICCCI (2011) in Gdynia, Poland, the 4th ICCCI (2012) in Ho Chi Minh City, Vietnam, the 5th ICCCI (2013) in Craiova, Romania, the 6th ICCCI (2014) in Seoul, South Korea, the 7th ICCCI (2015) in Madrid, Spain, the 8th ICCCI (2016) in Halkidiki, Greece, the 9th ICCCI (2017) in Nicosia, Cyprus, the 10th ICCCI (2018) in Bristol, UK, and the 11th ICCCI (2019) in Hendaye, France, this conference continued to provide an internationally respected forum for scientific research in the computer-based methods of collective intelligence and their applications.

Computational collective intelligence (CCI) is most often understood as a subfield of artificial intelligence (AI) dealing with soft computing methods that facilitate group decisions or processing knowledge among autonomous units acting in distributed environments. Methodological, theoretical, and practical aspects of CCI are considered as the form of intelligence that emerges from the collaboration and competition of many individuals (artificial and/or natural). The application of multiple computational intelligence technologies such as fuzzy systems, evolutionary computation, neural systems, consensus theory, etc., can support human and other collective intelligence, and create new forms of CCI in natural and/or artificial systems. Three subfields of the application of computational intelligence technologies to support various forms of collective intelligence are of special interest but are not exclusive: the Semantic Web (as an advanced tool for increasing collective intelligence), social network analysis (as the field targeted at the emergence of new forms of CCI), and multi-agent systems (as a computational and modeling paradigm especially tailored to capture the nature of CCI emergence in populations of autonomous individuals).

The ICCCI 2020 conference featured a number of keynote talks and oral presentations, closely aligned to the theme of the conference. The conference attracted a

substantial number of researchers and practitioners from all over the world, who submitted their papers for the main track and four special sessions.

The main track, covering the methodology and applications of CCI, included: knowledge engineering and Semantic Web, social networks and recommender systems, collective decision making, applications of collective intelligence, data mining methods and applications, machine learning methods, computer vision techniques, biosensors and biometric techniques, natural language processing, as well as innovations in intelligent systems. The special sessions, covering some specific topics of particular interest, included: applications of collective intelligence, deep learning and applications for Industry 4.0, experience enhanced intelligence to IoT, intelligent management information systems, intelligent modeling and simulation approaches for games and real-world systems, low resource languages processing, computational collective intelligence and natural language processing, computational intelligence for multimedia understanding, and intelligent processing of multimedia in Web systems.

We received more than 310 submissions from 47 countries all over the world. Each paper was reviewed by two to four members of the International Program Committee (PC) of either the main track or one of the special sessions. Finally, we selected 70 best papers for oral presentation and publication in one volume of the *Lecture Notes in Artificial Intelligence* series and 68 papers for oral presentation and publication in one volume of the *Communications in Computer and Information Science* series.

We would like to express our thanks to the keynote speakers: Richard Chbeir from Université de Pau et des Pays de l'Adour (UPPA), France, Thanh Thuy Nguyen from VNU University of Engineering and Technology, Vietnam, Klaus Solberg Söilen from Halmstad University, Sweden, and Takako Hashimoto from Chiba University of Commerce, Japan, for their world-class plenary speeches.

Many people contributed toward the success of the conference. First, we would like to recognize the work of the PC co-chairs and special sessions organizers for taking good care of the organization of the reviewing process, an essential stage in ensuring the high quality of the accepted papers. The workshop and special session chairs deserve a special mention for the evaluation of the proposals and the organization and coordination of the work of seven special sessions. In addition, we would like to thank the PC members, of the main track and of the special sessions, for performing their reviewing work with diligence. We thank the Local Organizing Committee chairs, publicity chair, Web chair, and technical support chair for their fantastic work before and during the conference. Finally, we cordially thank all the authors, presenters, and delegates for their valuable contribution to this successful event. The conference would not have been possible without their support.

Our special thanks are also due to Springer for publishing the proceedings and sponsoring awards, and to all the other sponsors for their kind support.

It is our pleasure to announce that the ICCCI conference series continues to have a close cooperation with the Springer journal *Transactions on Computational Collective Intelligence*, and the IEEE SMC Technical Committee on Transactions on Computational Collective Intelligence.

Finally, we hope that ICCCI 2020 contributed significantly to the academic excellence of the field and will lead to the even greater success of ICCCI events in the future.

December 2020

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DLAI 2020 – Special Session on Deep Learning and Applications for Industry 4.0

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IMIS 2020 – Special Session on Intelligent Management Information Systems

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IMSAGRWS 2020 – Special Session on Intelligent Modeling and Simulation Approaches for Games and Real World Systems

Alabbas Alhaj Ali	Frankfurt University of Applied Sciences, Germany
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Petru Cașcaval	Gheorghe Asachi Technical University of Iași, Romania
Gia Thuan Lam	Vietnamese-German University, Vietnam
Florin Leon	Gheorghe Asachi Technical University of Iași, Romania
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Fitore Muharemi	Frankfurt University of Applied Sciences, Germany
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Paweł Sitek	Kielce University of Technology, Poland
Daniel Stamate	Goldsmiths, University of London, UK

IWCIM 2020 – International Workshop on Computational Intelligence for Multimedia Understanding

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Andras L. Majdik	Hungarian Academy of Sciences, Hungary
Cristina Ribeiro	University of Porto, Portugal
Emanuele Salerno	National Research Council of Italy (CNR), Italy
Ales Prochazka	University of Chemistry and Technology, Czech Republic
Anna Tonazzini	National Research Council of Italy (CNR), Italy
Gabriele Pieri	National Research Council of Italy (CNR), Italy
Gerasimos Potamianos	University of Thessaly, Greece
Gorkem Saygili	Ankara University, Turkey
Josiane Zerubia	Inria, France
Maria Antonietta Pascali	National Research Council of Italy (CNR), Italy
Marie-Colette Vanlieshout	CWI, Amsterdam, The Netherlands

Marco Reggiani	National Research Council of Italy (CNR), Italy
Nahum Kiryati	Tel Aviv University, Israel
Rozenn Dahyot	Trinity College Dublin, Ireland
Sara Colantonio	National Research Council of Italy (CNR), Italy
Shohreh Ahvar	Institut supérieur d'électronique de Paris (ISEP), France
Tamás Szirányi	SZTAKI - Institute for Computer Science and Control, Hungary

LRLP 2020 – Special Session on Low Resource Languages Processing

Miguel A. Alonso	Universidade da Coruña, Spain
Pablo Gamallo	University of Santiago de Compostela, Spain
Nella Israilova	Kyrgyz State Technical University, Kyrgyzstan
Marek Kubis	Adam Mickiewicz University, Poland
Belinda Maia	University of Porto, Portugal
Madina Mansurova	Al-Farabi Kazakh National University, Kazakhstan
Gayrat Matlatipov	Urgench State University, Uzbekistan
Marek Miłosz	Lublin University of Technology, Poland
Diana Rakhimova	Al-Farabi Kazakh National University, Kazakhstan
Altynbek Sharipbay	L. N. Gumilyov Eurasian National University, Kazakhstan
Ualsher Tukeyev	Al-Farabi Kazakh National University, Kazakhstan

WEBSYS 2020 – Intelligent Processing of Multimedia in Web Systems

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Frédéric Amiel	Association ISEP, Paris, France
František Čapkovič	Slovak Academy of Sciences, Slovakia
Kazimierz Choroś	Wrocław University of Science and Technology, Poland
Patricia Conde-Cespedes	Association ISEP, Paris, France
Marek Kopel	Wrocław University of Science and Technology, Poland
Mikołaj Leszczuk	AGH University of Science and Technology, Poland
Bożena Kostek	Gdańsk University of Technology, Poland
Alin Moldoveanu	Politehnica University of Bucharest, Romania
Tarkko Oksala	Helsinki University of Technology, Finland
Andrzej Siemiński	Wrocław University of Science and Technology, Poland
Maria Trocan	Association ISEP, Paris, France
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