

Lecture Notes in Artificial Intelligence

12876

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Computational Collective Intelligence

13th International Conference, ICCCI 2021
Rhodes, Greece, September 29 – October 1, 2021
Proceedings

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ISSN 0302-9743

ISSN 1611-3349 (electronic)

Lecture Notes in Artificial Intelligence

ISBN 978-3-030-88080-4

ISBN 978-3-030-88081-1 (eBook)

<https://doi.org/10.1007/978-3-030-88081-1>

LNCS Sublibrary: SL7 – Artificial Intelligence

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

Preface

This volume contains the proceedings of the 13th International Conference on Computational Collective Intelligence (ICCCI 2021), held in Rhodes, Greece, during September 29 – October 1, 2021. Due to the COVID-19 pandemic the conference was organized in a hybrid mode which allowed for both on-site and online paper presentations. The conference was hosted by the Democritus University of Thrace, Greece, and jointly organized by Wrocław University of Science and Technology, Poland, in cooperation with the IEEE SMC Technical Committee on Computational Collective Intelligence, the European Research Center for Information Systems (ERCIS), the University of Piraeus, Greece, and the International University-VNU-HCM, Vietnam.

Following the successes of the first ICCCI (2009) 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, the 11th ICCCI (2019) in Hendaye, France, and the 12th ICCCI (2020) in Da Nang, Vietnam, 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 sub-field 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 2021 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 nine 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, data mining and machine learning, computer vision techniques, and natural language processing, as well as the Internet of Things: technologies and

applications. The special sessions, covering some specific topics of particular interest, included cooperative strategies for decision making and optimization, IoT and computational technologies for collective intelligence, smart industry and management systems, machine learning in real-world data, knowledge-intensive smart services and their applications, swarms of UAVs, low resource languages processing, computational collective intelligence and natural language processing, and computational intelligence for multimedia understanding.

We received over 230 papers submitted by authors coming from 45 countries around the world. Each paper was reviewed by at least three members of the international Program Committee (PC) of either the main track or one of the special sessions. Finally, we selected 60 best papers for oral presentation and publication in one volume of the Lecture Notes in Artificial Intelligence series and 58 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: Plamen Angelov from Lancaster University, UK, Yannis Manolopoulos from the Open University of Cyprus, Cyprus, Daniele Nardi from Sapienza Università di Roma, Italy, and Andrzej Skowron from the Systems Research Institute of Polish Academy of Sciences, Poland, 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 nine 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 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 2021 contributed significantly to the academic excellence of the field and will lead to the even greater success of ICCCI events in the future.

September 2021

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Thi My Hang Vu	University of Science, Ho Chi Minh City, Vietnam
Nam Le Nguyen Hoai	University of Science, Ho Chi Minh City, Vietnam
Nizar Bouguila	Concordia University, Canada
Jolita Ralyté	University of Geneva, Switzerland
Trung Bui	Adobe Research, USA
Elaine Mosconi	Université de Sherbrooke, Canada
Abdelaziz Khadraoui	University of Geneva, Switzerland

LRLP 2021: Special Session on Low Resource Languages Processing

Miguel A. Alonso	Universidade da Coruna, 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 Miłośz	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

MLRWD 2021: Special Session on Machine Learning in Real-World Data

Rafał Skinderowicz	University of Silesia, Poland
Grzegorz Dzikowski	University of Economics in Katowice, Poland
Marcin Grzegorzek	University of Lübeck, Germany
Ignacy Kaliszewski	Systems Research Institute, Polish Academy of Sciences, Poland
Krzysztof Kania	University of Economics in Katowice, Poland
Jan Kozak	University of Economics in Katowice, Poland
Przemysław Juszczuk	University of Economics in Katowice, Poland
Janusz Miroforidis	Systems Research Institute, Polish Academy of Sciences, Poland
Agnieszka Nowak-Brzezińska	University of Silesia, Poland
Dmitry Podkopaev	Systems Research Institute, Polish Academy of Sciences, Poland
Tomasz Jach	University of Economics in Katowice, Poland
Tomasz Staś	University of Economics in Katowice, Poland
Magdalena Tkacz	University of Silesia, Poland
Barbara Probiez	University of Economics in Katowice, Poland
Wojciech Wieczorek	University of Bielsko-Biała, Poland

SIMS 2021: Special Session on Smart Industry and Management Systems

Adam Ziębiński	Silesian University of Technology, Poland
Anne-Lena Kampen	Western Norway University of Applied Sciences, Norway
Artur Rot	Wrocław University of Economics and Business, Poland
Bogdan Franczyk	University of Leipzig, Germany
Damian Grzechca	Silesian University of Technology, Poland
Dariusz Frejlichowski	West Pomeranian University of Technology, Poland

Dariusz Mrozek	Silesian University of Technology, Poland
Helena Dudycz	Wrocław University of Economics and Business, Poland
Jarosław Wątróbski	University of Szczecin, Poland
Jerry Chun-Wei Lin	Western Norway University of Applied Sciences, Norway
Knut Øvsthus	Western Norway University of Applied Sciences, Norway
Marcin Fojcik	Western Norway University of Applied Sciences, Norway
Marcin Hernes	Wrocław University of Economics and Business, Poland
Mieczysław Owoc	Wrocław University of Economics and Business, Poland
Mykola Dyvak	Ternopil National Economic University, Ukraine
Paweł Weichbroth	Gdańsk University of Technology, Poland
Piotr Gaj	Silesian University of Technology, Poland
Rafał Cupek	Silesian University of Technology, Poland
Krzysztof Hauke	Wrocław University of Economics and Business, Poland
Łukasz Łysik	Wrocław University of Economics and Business, Poland
Piotr Tutak	Wrocław University of Economics and Business, Poland
Maciej Huk	Wrocław University of Science and Technology, Poland
Piotr Biernacki	Silesian University of Technology, Poland
Ewa Walaszczyk	Wrocław University of Economics and Business, Poland
Krzysztof Lutosławski	Wrocław University of Economics and Business, Poland
Krzysztof Tokarz	Silesian University of Technology, Poland

SUAV 2021: Special Session on Swarms of UAVs

Pierre Avanzini	Squadron System, France
Pascal Bouvry	University of Luxembourg, Luxembourg
Serge Chaumette	University of Bordeaux, France
Grégoire Danoy	University of Luxembourg, Luxembourg
Simon G. Fabri	University of Malta, Malta
Isabelle Fantoni	CNRS, Nantes, France
Paola Flocchini	University of Ottawa, Canada
Antonio Franchi	University of Twente, The Netherlands
François Guérin	Normandy University, France
Frédéric V. G. Guinand	Normandy University, France
Chouaib El Houssein Harik	NIBIO, Norway

Samira Hayat
Sanaz Mostaghim
Giuseppe Prencipe

University of Klagenfurt, Austria
Otto-von-Guericke University, Germany
University of Pisa, Italy

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