Advances in Intelligent Systems and Computing

Volume 875

Series editor

Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland
e-mail: kacprzyk@ibspan.waw.pl

The series "Advances in Intelligent Systems and Computing" contains publications on theory, applications, and design methods of Intelligent Systems and Intelligent Computing. Virtually all disciplines such as engineering, natural sciences, computer and information science, ICT, economics, business, e-commerce, environment, healthcare, life science are covered. The list of topics spans all the areas of modern intelligent systems and computing such as: computational intelligence, soft computing including neural networks, fuzzy systems, evolutionary computing and the fusion of these paradigms, social intelligence, ambient intelligence, computational neuroscience, artificial life, virtual worlds and society, cognitive science and systems, Perception and Vision, DNA and immune based systems, self-organizing and adaptive systems, e-Learning and teaching, human-centered and human-centric computing, recommender systems, intelligent control, robotics and mechatronics including human-machine teaming, knowledge-based paradigms, learning paradigms, machine ethics, intelligent data analysis, knowledge management, intelligent agents, intelligent decision making and support, intelligent network security, trust management, interactive entertainment, Web intelligence and multimedia.

The publications within "Advances in Intelligent Systems and Computing" are primarily proceedings of important conferences, symposia and congresses. They cover significant recent developments in the field, both of a foundational and applicable character. An important characteristic feature of the series is the short publication time and world-wide distribution. This permits a rapid and broad dissemination of research results.

Ajith Abraham · Sergey Kovalev
Valery Tarassov · Vaclav Snasel
Andrey Sukhanov
Editors

Proceedings of the Third International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'18)

Volume 2

Springer

Editors
Ajith Abraham
Scientific Network for Innovation
and Research Excellence
Machine Intelligence Research Labs
(MIR Labs)
Auburn, WA, USA

Sergey Kovalev
Rostov State Transport University
Rostov-on-Don, Russia

Valery Tarassov
Bauman Moscow State Technical University
Moscow, Russia

Vaclav Snasel
VSB-Technical University of Ostrava
Ostrava, Czech Republic

Andrey Sukhanov
Rostov State Transport University
Rostov-on-Don, Russia

ISSN 2194-5357 ISSN 2194-5365 (electronic)
Advances in Intelligent Systems and Computing
ISBN 978-3-030-01820-7 ISBN 978-3-030-01821-4 (eBook)
https://doi.org/10.1007/978-3-030-01821-4

Library of Congress Control Number: 2018958808

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This volume of Advances in Intelligent Systems and Computing contains papers presented in the main track of IITI 2018, the Third International Scientific Conference on Intelligent Information Technologies for Industry held in September 17–21 in Sochi, Russia. The conference was jointly co-organized by Rostov State Transport University (Russia) and VŠB-Technical University of Ostrava (Czech Republic) with the participation of Russian Association for Artificial Intelligence (RAAI).

IITI 2018 is devoted to practical models and industrial applications related to intelligent information systems. It is considered as a meeting point for researchers and practitioners to enable the implementation of advanced information technologies into various industries. Nevertheless, some theoretical talks concerning the state of the art in intelligent systems and soft computing were also included in proceedings.

There were 160 paper submissions from 11 countries. Each submission was reviewed by at least three Chairs or PC members. We accepted 94 regular papers (58%). Unfortunately, due to the limitations of conference topics and edited volumes the Program Committee was forced to reject some interesting papers, which did not satisfy these topics or publisher requirements. We would like to thank all the authors and reviewers for their work and valuable contributions. The friendly and welcoming attitude of conference supporters and contributors made this event a success!

The conference was supported by Russian Fund for Basic Research (grant no. 18-07-20024 G).

September 2018

Ajith Abraham
Sergey M. Kovalev
Valery B. Tarassov
Václav Snášel
Andrey V. Sukhanov

Organization

Organizing Institutes

Rostov State Transport University, Russia
VŠB-Technical University of Ostrava, Czech Republic
Russian Association for Artificial Intelligence, Russia

Conference Chairs

Sergey M. Kovalev	Rostov State Transport University, Russia
Alexander N. Guda	Rostov State Transport University, Russia

Conference Vice-chair

Valery B. Tarassov	Bauman Moscow State Technical University, Russia

International Program Committee

Alexander I. Dolgiy	JSC "NIIAS", Rostov branch, Russia
Alexander L. Tulupyev	St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, Russia
Alexander N. Shabelnikov	JSC "NIIAS", Russia
Alexander N. Tselykh	Southern Federal University, Russia
Alexander P. Eremeev	Moscow Power Engineering Institute, Russia
Alexander V. Smirnov	St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, Russia

Alexey B. Petrovsky	Institute for Systems Analysis of Russian Academy of Sciences, Russia
Alexey N. Averkin	Dorodnitsyn Computing Centre of Russian Academy of Sciences
Alla V. Zaboleeva-Zotova	Volgograd State Technical University, Russia
Anton Beláň	Slovak University of Technology in Bratislava, Slovakia
Dusan Husek	Institute of Computer Science, Academy of Sciences of the Czech Republic
Eid Emary	Cairo University, Egypt
Eliska Ochodkova	VSB-Technical University of Ostrava, Czech Republic
František Janíček	Slovak University of Technology in Bratislava, Slovakia
Gennady S. Osipov	Institute for Systems Analysis of Russian Academy of Sciences, Russia
Georgy B. Burdo	Tver State Technical University, Russia
Habib M. Kammoun	University of Sfax, Tunisia
Hussein Soori	VSB-Technical University of Ostrava, Czech Republic
Igor B. Fominykh	Moscow Power Engineering Institute, Russia
Igor D. Dolgiy	Rostov State Transport University, Russia
Igor N. Rozenberg	JSC "NIIAS", Russia
Igor V. Kotenko	St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, Russia
Ildar Batyrshin	National Polytechnic Institute, Mexico
Ivan Zelinka	VSB-Technical University of Ostrava, Czech Republic
Jana Nowakova	VSB-Technical University of Ostrava, Czech Republic
Jaroslav Kultan	University of Economics in Bratislava, Slovakia
Jiří Bouchala	VŠB-Technical University of Ostrava, Czech Republic
Jiří Hammerbauer	University of West Bohemia, Czech Republic
Josef Paleček	VŠB-Technical University of Ostrava, Czech Republic
Juan Velasquez	University of Chile, Chile
Konrad Jackowski	Wrocław University of Technology, Poland
Leszek Pawlaczk	Wrocław University of Technology, Poland
Marcin Paprzycki	IBS PAN and WSM, Poland
Michal Wozniak	Wroclaw University of Technology, Poland
Milan Dado	University of Žilina, Slovakia
Mohamed Mostafa	Arab Academy for Science, Technology, and Maritime Transport, Egypt

Nadezhda G. Yarushkina	Ulyanovsk State Technical University, Russia
Nashwa El-Bendary	Scientific Research Group in Egypt (SRGE), Egypt
Nour Oweis	VSB-Technical University of Ostrava, Czech Republic
Oleg P. Kuznetsov	Institute of Control Sciences of Russian Academy of Sciences
Pavol Špánik	University of Žilina, Slovakia
Petr I. Sosnin	Ulyanovsk State Technical University, Russia
Petr Saloun	VSB-Technical University of Ostrava, Czech Republic
Santosh Nanda	Eastern Academy of Science and Technology, Bhubaneswar, Odisha, India
Sergey D. Makhortov	Voronezh State University, Russia
Stanislav Kocman	VŠB-Technical University of Ostrava, Czech Republic
Stanislav Rusek	VŠB-Technical University of Ostrava, Czech Republic
Svatopluk Stolfa	VSB-Technical University of Ostrava, Czech Republic
Tarek Gaber	VSB-Technical University of Ostrava, Czech Republic
Teresa Orłowska-Kowalska	Wrocław University of Technology, Poland
Vadim L. Stefanuk	Institute for Information Transmission Problems, Russia
Vadim N. Vagin	Moscow Power Engineering Institute, Russia
Vladimir V. Golenkov	Belarus State University of Informatics and Radioelectronics, Belarus
Vladimír Vašinek	VŠB-Technical University of Ostrava, Czech Republic
Yuri I. Rogozov	Southern Federal University, Russia
Zdeněk Peroutka	University of West Bohemia, Czech Republic

Organizing Committee Chair

Alexander N. Guda	Rostov State Transport University, Russia

Organizing Vice-chair

Andrey V. Sukhanov	Rostov State Transport University, Russia

Local Organizing Committee

Andrey V. Chernov	Rostov State Transport University, Russia
Anna E. Kolodenkova	Samara State Technical University, Russia
Ivan A. Yaitskov	Rostov State Transport University, Russia
Jan Platoš	VSB-Technical University of Ostrava, Czech Republic
Maria A. Butakova	Rostov State Transport University, Russia
Maya V. Sukhanova	Azov-Black Sea State Engineering Institute, Russia
Pavel Krömer	VSB-Technical University of Ostrava, Czech Republic
Vitezslav Styskala	VSB-Technical University of Ostrava, Czech Republic
Vladislav S. Kovalev	JSC “NIIAS”, Russia

Contents