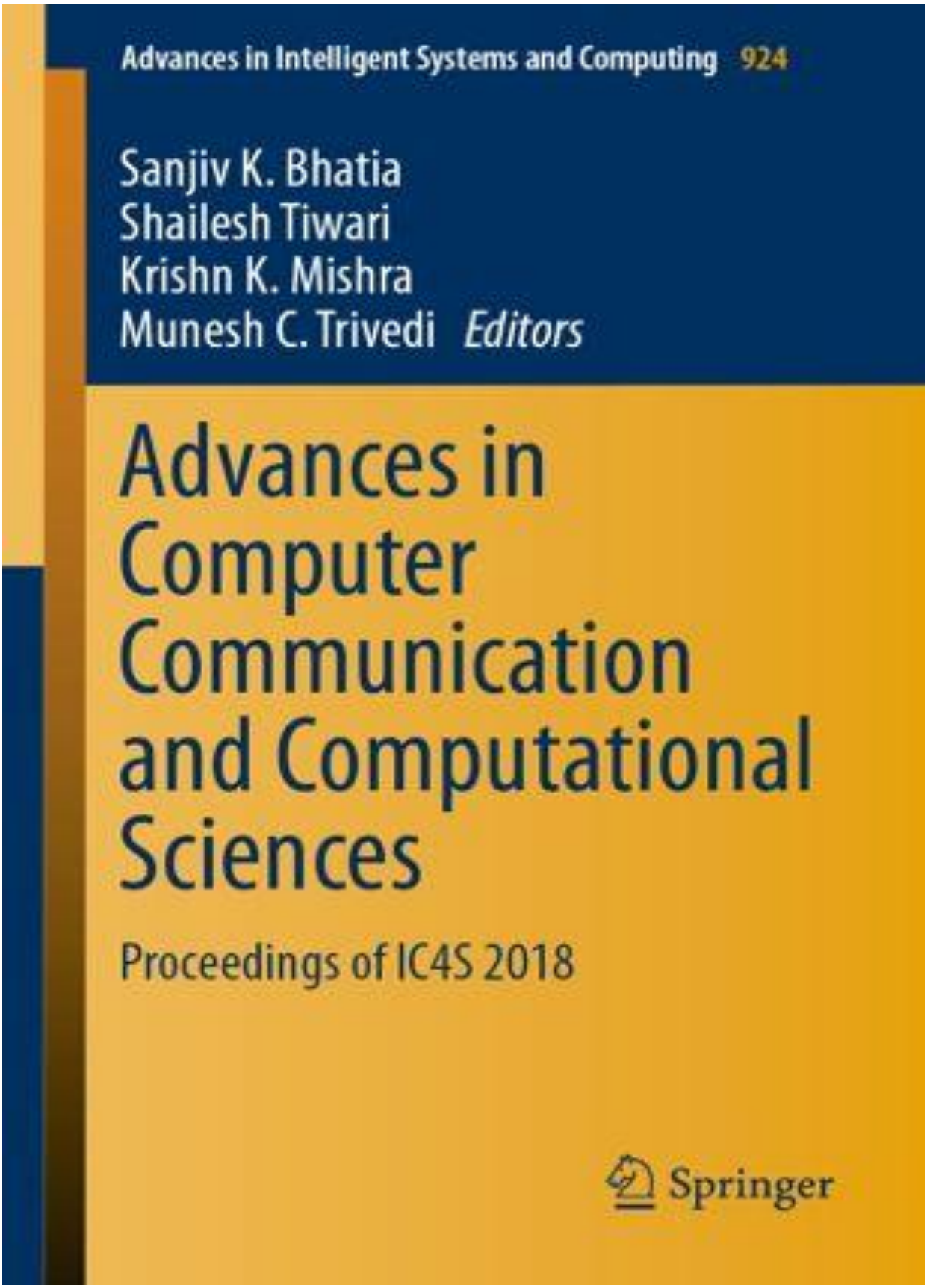

Advances in Intelligent Systems and Computing

Volume 924

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.

**** Indexing: The books of this series are submitted to ISI Proceedings, EI-Compendex, DBLP, SCOPUS, Google Scholar and Springerlink ****

More information about this series at http://www.springer.com/series/11156

Sanjiv K. Bhatia · Shailesh Tiwari ·
Krishn K. Mishra · Munesh C. Trivedi
Editors

Advances in Computer Communication and Computational Sciences

Proceedings of IC4S 2018

Springer

Editors
Sanjiv K. Bhatia
Department of Mathematics
and Computer Science
University of Missouri–St. Louis
St. Louis, MO, USA

Shailesh Tiwari
CSED
ABES Engineering College
Ghaziabad, Uttar Pradesh, India

Krishn K. Mishra
Department of Computer Science
and Engineering
Motilal Nehru National Institute
of Technology
Allahabad, Uttar Pradesh, India

Munesh C. Trivedi
Department of Information Technology
Rajkiya Engineering College
Azamgarh, Uttar Pradesh, India

ISSN 2194-5357 ISSN 2194-5365 (electronic)
Advances in Intelligent Systems and Computing
ISBN 978-981-13-6860-8 ISBN 978-981-13-6861-5 (eBook)
https://doi.org/10.1007/978-981-13-6861-5

Library of Congress Control Number: 2019932704

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

IC4S is a major multidisciplinary conference organized with the objective of bringing together researchers, developers, and practitioners from academia and industry working in all areas of computer and computational sciences. It is organized specifically to help the computer industry to derive the advances of next-generation computer and communication technology. Researchers invited to speak will present the latest developments and technical solutions.

Technological developments all over the world are dependent upon globalization of various research activities. Exchange of information and innovative ideas is necessary to accelerate the development of technology. Keeping this ideology in preference, the International Conference on Computer, Communication and Computational Sciences (IC4S 2018) was organized at Mandarin Hotel Bangkok, Bangkok, Thailand, during October 20–21, 2018.

This is the third time the International Conference on Computer, Communication and Computational Sciences has been organized with a foreseen objective of enhancing the research activities at a large scale. Technical Program Committee and Advisory Board of IC4S include eminent academicians, researchers, and practitioners from abroad as well as from all over the nation.

In this book, selected manuscripts have been subdivided into various tracks named—Intelligent Hardware and Software Design, Advanced Communications, Intelligent Computing Techniques, Web and Informatics, and Intelligent Image Processing. A sincere effort has been made to make it an immense source of knowledge for all, and this book includes 64 manuscripts. The selected manuscripts went through a rigorous review process and are revised by authors after incorporating the suggestions of the reviewers.

IC4S 2018 received around 350 submissions from around 550 authors of 15 different countries such as USA, Iceland, China, Saudi Arabia, South Africa, Taiwan, Malaysia, Indonesia, and Europe. Each submission went through the plagiarism check. On the basis of plagiarism report, each submission was rigorously reviewed by at least two reviewers with an average of 2.7 per reviewer. Even some submissions have more than two reviews. On the basis of these reviews,

64 high-quality papers were selected for publication in this proceedings volume, with an acceptance rate of 18.28%.

We are thankful to the keynote speakers—Prof. Raija Halonen, University of Oulu, Finland; Dr. K. K. Mishra, University of Missouri, St. Louis, USA; Mr. Aninda Bose, Senior Editor, Springer Nature, to enlighten the participants with their knowledge and insights. We are also thankful to delegates and the authors for their participation and their interest in IC4S 2018 as a platform to share their ideas and innovation. We are also thankful to Prof. Dr. Janusz Kacprzyk, Series Editor, AISC, Springer, for providing guidance and support. Also, we extend our heartfelt gratitude to the reviewers and Technical Program Committee members for showing their concern and efforts in the review process. We are indeed thankful to everyone directly or indirectly associated with the Organizing Committee of the conference, leading it toward the success.

Although utmost care has been taken in compilation and editing, a few errors may still occur. We request the participants to bear with such errors and lapses (if any). We wish you all the best.

Bangkok, Thailand

Organizing Committee
IC4S 2018

About This Book

With the advent of technology, intelligent and soft computing techniques came into existence with a wide scope of implementation in engineering sciences. Nowadays, technology is changing with a speedy pace and innovative proposals that solve the engineering problems intelligently are gaining popularity and advantages over the conventional solutions to these problems. It is very important for the research community to track the latest advancements in the field of computer sciences. Keeping this ideology in preference, this book includes the insights that reflect the 'Advances in Computer and Computational Sciences' from upcoming researchers and leading academicians across the globe. It contains the high-quality peer-reviewed papers of 'International Conference on Computer, Communication and Computational Sciences' (IC4S 2018), held during October 20–21, 2018, at Mandarin Hotel Bangkok, Bangkok, Thailand. These papers are arranged in the form of chapters. The content of this book is divided into five broader tracks that cover a variety of topics. These tracks are: *Intelligent Hardware and Software Design, Advanced Communications, Intelligent Computing Technologies, Web and Informatics, and Intelligent Image Processing*. This book helps the prospective readers from computer and communication industry and academia to derive the immediate surroundings' developments in the field of communication and computer sciences and shape them into real-life applications.

Contents

About the Editors

Sanjiv K. Bhatia received his Ph.D. in Computer Science from the University of Nebraska, Lincoln, USA in 1991. He presently works as a Professor and Graduate Director (Computer Science) at the University of Missouri, St.Louis, USA. His primary areas of research include image databases, digital image processing, and computer vision. In addition to publishing over 40 articles in these areas, he has consulted extensively with industry for commercial and military applications of computer vision. He is an expert on system programming and has worked on real-time and embedded applications. He has taught a broad range of courses in computer science and was the recipient of the Chancellor's Award for Excellence in Teaching in 2015. He is a senior member of ACM.

Shailesh Tiwari currently works as a Professor at the Department of Computer Science and Engineering, ABES Engineering College, Ghaziabad, India. He is an alumnus of Motilal Nehru National Institute of Technology Allahabad, India. His primary areas of research are software testing, implementation of optimization algorithms and machine learning techniques in software engineering. He has authored more than 50 publications in international journals and the proceedings of leading international conferences. He also serves as an editor for various Scopus, SCI and E-SCI-indexed journals and has organized several international conferences under the banner of the IEEE and Springer. He is a senior member of the IEEE and a member of the IEEE Computer Society.

Krishn K. Mishra is currently working as an Assistant Professor at the Department of Computer Science and Engineering, Motilal Nehru National Institute of Technology Allahabad, India. He has also been a Visiting Faculty at the Department of Mathematics and Computer Science, University of Missouri, St. Louis, USA. His primary areas of research include evolutionary algorithms, optimization techniques and design, and analysis of algorithms. He has also authored more than 50 publications in international journals and the proceedings of

leading international conferences. He currently serves as a program committee member of several conferences and an editor for various Scopus and SCI-indexed journals.

Munesh C. Trivedi is currently an Associate Professor at the Department of Information Technology, Rajkiya Engineering College, Azamgarh, India and also Associate Dean-UG Programs, Dr. APJ Abdul Kalam Technical University, Lucknow. He has published 20 textbooks and 95 research papers in various international journals and in the proceedings of leading international conferences. He has received young scientist and numerous other awards from different national and international forums. He currently serves on the review panel of the IEEE Computer Society, International Journal of Network Security, and Computer & Education (Elsevier). He is a member of the executive committee of the IEEE UP Section, IEEE India Council and also the IEEE Asia Pacific Region 10.