

PROCEEDINGS OF THE 2019 INTERNATIONAL CONFERENCE ON WIRELESS NETWORKS



ICWN' 19

Editors

Hamid R. Arabnia

Leonidas Deligiannidis, Fernando G. Tinetti

Publication of the 2019 World Congress in Computer Science,
Computer Engineering, & Applied Computing (CSCE'19)
July 29 - August 01, 2019 | Las Vegas, Nevada, USA
<https://americancse.org/events/csce2019>

Copyright © 2019 CSREA Press

This volume contains papers presented at the 2019 International Conference on Wireless Networks. Their inclusion in this publication does not necessarily constitute endorsements by editors or by the publisher.

Copyright and Reprint Permission

Copying without a fee is permitted provided that the copies are not made or distributed for direct commercial advantage, and credit to source is given. Abstracting is permitted with credit to the source. Please contact the publisher for other copying, reprint, or republication permission.

American Council on Science and Education (ACSE)



Copyright © 2019 CSREA Press

ISBN: 1-60132-504-5

Printed in the United States of America

<https://americancse.org/events/csce2019/proceedings>

Foreword

It gives us great pleasure to introduce this collection of papers to be presented at the 2019 International Conference on Wireless Networks (ICWN'19), July 29 – August 1, 2019, at Luxor Hotel (a property of MGM Resorts International), Las Vegas, USA. The preliminary edition of this book (available in July 2019 for distribution on site at the conference) includes only a small subset of the accepted research articles. The final edition (available in August 2019) will include all accepted research articles. This is due to deadline extension requests received from most authors who wished to continue enhancing the write-up of their papers (by incorporating the referees' suggestions). The final edition of the proceedings will be made available at <https://americancse.org/events/csce2019/proceedings> .

An important mission of the World Congress in Computer Science, Computer Engineering, and Applied Computing, CSCE (a federated congress to which this conference is affiliated with) includes *"Providing a unique platform for a diverse community of constituents composed of scholars, researchers, developers, educators, and practitioners. The Congress makes concerted effort to reach out to participants affiliated with diverse entities (such as: universities, institutions, corporations, government agencies, and research centers/labs) from all over the world. The congress also attempts to connect participants from institutions that have **teaching** as their main mission with those who are affiliated with institutions that have **research** as their main mission. The congress uses a quota system to achieve its institution and geography diversity objectives."* By any definition of diversity, this congress is among the most diverse scientific meeting in USA. We are proud to report that this federated congress has authors and participants from 57 different nations representing variety of personal and scientific experiences that arise from differences in culture and values. As can be seen (see below), the program committee of this conference as well as the program committee of all other tracks of the federated congress are as diverse as its authors and participants.

The program committee would like to thank all those who submitted papers for consideration. About 70% of the submissions were from outside the United States. Each submitted paper was peer-reviewed by two experts in the field for originality, significance, clarity, impact, and soundness. In cases of contradictory recommendations, a member of the conference program committee was charged to make the final decision; often, this involved seeking help from additional referees. In addition, papers whose authors included a member of the conference program committee were evaluated using the double-blinded review process. One exception to the above evaluation process was for papers that were submitted directly to chairs/organizers of pre-approved sessions/workshops; in these cases, the chairs/organizers were responsible for the evaluation of such submissions. The overall paper acceptance rate for regular papers was 22%; 18% of the remaining papers were accepted as poster papers (at the time of this writing, we had not yet received the acceptance rate for a couple of individual tracks.)

We are very grateful to the many colleagues who offered their services in organizing the conference. In particular, we would like to thank the members of Program Committee of ICWN'19, members of the congress Steering Committee, and members of the committees of federated congress tracks that have topics within the scope of ICWN. Many individuals listed below, will be requested after the conference to provide their expertise and services for selecting papers for publication (extended versions) in journal special issues as well as for publication in a set of research books (to be prepared for publishers including: Springer, Elsevier, BMC journals, and others).

- *Prof. Emeritus Nizar Al-Holou (Congress Steering Committee); Professor and Chair, Electrical and Computer Engineering Department; Vice Chair, IEEE/SEM-Computer Chapter; University of Detroit Mercy, Detroit, Michigan, USA*
- *Prof. Hamid R. Arabnia (Congress Steering Committee); Graduate Program Director (PhD, MS, MAMS); The University of Georgia, USA; Editor-in-Chief, Journal of Supercomputing (Springer); Fellow, Center of Excellence in Terrorism, Resilience, Intelligence & Organized Crime Research (CENTRIC).*
- *Dr. Travis Atkison; Director, Digital Forensics and Control Systems Security Lab, Department of Computer Science, College of Engineering, The University of Alabama, Tuscaloosa, Alabama, USA*
- *Prof. Dr. Juan-Vicente Capella-Hernandez; Universitat Politècnica de Valencia (UPV), Department of Computer Engineering (DISCA), Valencia, Spain*

- *Prof. Emeritus Kevin Daimi (Congress Steering Committee); Director, Computer Science and Software Engineering Programs, Department of Mathematics, Computer Science and Software Engineering, University of Detroit Mercy, Detroit, Michigan, USA*
- *Prof. Leonidas Deligiannidis (Congress Steering Committee); Department of Computer Information Systems, Wentworth Institute of Technology, Boston, Massachusetts, USA; Visiting Professor, MIT, USA*
- *Prof. Mary Mehrnoosh Eshaghian-Wilner (Congress Steering Committee); Professor of Engineering Practice, University of Southern California, California, USA; Adjunct Professor, Electrical Engineering, University of California Los Angeles, Los Angeles (UCLA), California, USA*
- *Prof. Tai-hoon Kim; School of Information and Computing Science, University of Tasmania, Australia*
- *Prof. Louie Lolong Lacatan; Chairperson, Computer Engineering Department, College of Engineering, Adamson University, Manila, Philippines; Senior Member, International Association of Computer Science and Information Technology (IACSIT), Singapore; Member, International Association of Online Engineering (IAOE), Austria*
- *Prof. Dr. Guoming Lai; Computer Science and Technology, Sun Yat-Sen University, Guangzhou, P. R. China*
- *Dr. Andrew Marsh (Congress Steering Committee); CEO, HoIP Telecom Ltd (Healthcare over Internet Protocol), UK; Secretary General of World Academy of BioMedical Sciences and Technologies (WABT) a UNESCO NGO, The United Nations*
- *Prof. Salahuddin Mohammad Masum; Computer Engineering Technology, Southwest Tennessee Community College, Memphis, Tennessee, USA*
- *Prof. Dr., Eng. Robert Ehimen Okonigene (Congress Steering Committee); Department of Electrical & Electronics Engineering, Faculty of Engineering and Technology, Ambrose Alli University, Nigeria*
- *Prof. James J. (Jong Hyuk) Park (Congress Steering Committee); Department of Computer Science and Engineering (DCSE), SeoulTech, Korea; President, FTRA, EiC, HCIS Springer, JoC, IJITCC; Head of DCSE, SeoulTech, Korea*
- *Dr. Akash Singh (Congress Steering Committee); IBM Corporation, Sacramento, California, USA; Chartered Scientist, Science Council, UK; Fellow, British Computer Society; Member, Senior IEEE, AACR, AAAS, and AAI; IBM Corporation, USA*
- *Ashu M. G. Solo (Publicity), Fellow of British Computer Society, Principal/R&D Engineer, Maverick Technologies America Inc.*
- *Prof. Fernando G. Tinetti (Congress Steering Committee); School of Computer Science, Universidad Nacional de La Plata, La Plata, Argentina; also at Comision Investigaciones Cientificas de la Prov. de Bs. As., Argentina*
- *Prof. Hahanov Vladimir (Congress Steering Committee); Vice Rector, and Dean of the Computer Engineering Faculty, Kharkov National University of Radio Electronics, Ukraine and Professor of Design Automation Department, Computer Engineering Faculty, Kharkov; IEEE Computer Society Golden Core Member; National University of Radio Electronics, Ukraine*
- *Prof. Shiuh-Jeng Wang (Congress Steering Committee); Director of Information Cryptology and Construction Laboratory (ICCL) and Director of Chinese Cryptology and Information Security Association (CCISA); Department of Information Management, Central Police University, Taoyuan, Taiwan; Guest Ed., IEEE Journal on Selected Areas in Communications.*
- *Dr. Yunlong Wang; Advanced Analytics at QuintilesIMS, Pennsylvania, USA*
- *Prof. Layne T. Watson (Congress Steering Committee); Fellow of IEEE; Fellow of The National Institute of Aerospace; Professor of Computer Science, Mathematics, and Aerospace and Ocean Engineering, Virginia Polytechnic Institute & State University, Blacksburg, Virginia, USA*
- *Prof. Hyun Yoe; Director of Agrofood IT Research Center and Vice President of Korea Association of ICT Convergence in the Agriculture and Food Business (KAICAF); Director of Agriculture IT Convergence Support Center (AITCSC); Department of Information and Communication Engineering, Suncheon National University, Suncheon, Republic of Korea (South Korea)*
- *Prof. Jane You (Congress Steering Committee); Associate Head, Department of Computing, The Hong Kong Polytechnic University, Kowloon, Hong Kong*

We would like to extend our appreciation to the referees, the members of the program committees of individual sessions, tracks, and workshops; their names do not appear in this document; they are listed on the web sites of individual tracks.

As Sponsors-at-large, partners, and/or organizers each of the followings (separated by semicolons) provided help for at least one track of the Congress: Computer Science Research, Education, and Applications Press (CSREA); US Chapter of World Academy of Science; American Council on Science & Education & Federated Research Council (<http://www.americancse.org/>). In addition, a number of university faculty members and their staff (names appear on the cover of the set of proceedings), several

publishers of computer science and computer engineering books and journals, chapters and/or task forces of computer science associations/organizations from 3 regions, and developers of high-performance machines and systems provided significant help in organizing the conference as well as providing some resources. We are grateful to them all.

We express our gratitude to keynote, invited, and individual conference/tracks and tutorial speakers - the list of speakers appears on the conference web site. We would also like to thank the followings: UCMSS (Universal Conference Management Systems & Support, California, USA) for managing all aspects of the conference; Dr. Tim Field of APC for coordinating and managing the printing of the proceedings; and the staff of Luxor Hotel (Convention department) at Las Vegas for the professional service they provided. Last but not least, we would like to thank the Co-Editors of ICWN'19: Prof. Hamid R. Arabnia, Prof. Leonidas Deligiannidis, and Prof. Fernando G. Tinetti.

We present the proceedings of ICWN'19.

Steering Committee, 2019
<http://americancse.org/>