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(Eds.)



# ICT in Education, Research and Industrial Applications

Proceedings of the 15th International Conference,  
ICTERI 2019. Volume I: Main Conference


Kherson, Ukraine  
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This volume represents the proceedings of the Main Conference, with Posters track, of the 15th International Conference on ICT in Education, Research, and Industrial Applications, held in Kherson, Ukraine, in June 2019. It comprises 52 contributed papers that were carefully peer-reviewed and selected from 171 submissions. The volume is organized in five parts. Parts I to IV contain the contributions to the Main ICTERI Conference tracks, structured in four topical sections: (I) Advances in ICT Research; (II) Information Systems: Technology and Applications; (III) ICT in Education; and (IV) ICT Cooperation in Academia and Industry. Part V contains the short papers presenting the contributions to the Posters track.

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## Preface

It is our pleasure to present you the proceedings of the Main Conference of ICTERI 2019, the fifteenth edition of the International Conference on Information and Communication Technologies in Education, Research, and Industrial Applications, held in Kherson (Ukraine) on June 12-15, 2019. This year's edition focused on research advances, information systems technologies and applications, business/academic applications of Information and Communication Technologies. Emphasis was also placed on the role of ICT in Education. These aspects of ICT research, development, technology transfer, and use in real world cases are vibrant for both the academic and industrial communities.

The ICTERI 2019 Main Conference was structured into four thematic tracks reflecting these research fields. In addition, the final part of the proceedings volume contains the short papers which constituted the program of our Posters track.

The conference program was complemented by a tutorial, PhD Symposium, Posters track, industrial IT Talks sub-event, and five co-located workshops. The proceedings of the PhD Symposium and co-located workshops were published as separate volumes.

The tutorial has been given by Prof. Vadim Ermolayev, the head of the Intelligent Systems group at Zaporizhzhia National University. It was focused on a systematic review of the good practices and required ingredients that help produce a conference paper in Computer Science with high chances to be accepted.

The rationale behind the Ph.D. Symposium sub-event is to offer an expert environment for the presentation of the tractable ideas and early results of PhD projects or other research aiming at receiving a PhD. Young researchers joined the Symposium to take part in discussions and/or present their papers. They were offered an opportunity to exchange and discuss their research ideas with their peers, supervisors, and senior scientists working in the fields within the scope of ICTERI 2019.

Posters track at ICTERI 2019 called for solution presentations and novel technology applications at an early stage of development. The 20 selected posters, whose descriptions were included in this volume as short papers, have been presented in two poster sessions.

Overall ICTERI 2019 Main Conference, including Posters and Demonstrations track, attracted 171 paper submissions. Out of these submissions, we have accepted: 32 high quality and most interesting papers for the Main Conference program, with the acceptance rate of 19 percent; and 20 best poster papers and presentations.

The conference would not have been possible without the support of many people. First of all, we would like to thank all the authors who submitted papers to ICTERI 2019 and thus demonstrated their interest in the research problems within our scope. We are very grateful to the members of our Program Committee for providing timely and thorough reviews and, also, for being cooperative in doing additional review work. We would like to thank the local organizers of the conference whose devotion and efficiency made this instance of ICTERI a very interesting and effective scientific forum.

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