



INTELLECTUAL SYSTEMS AND INFORMATION TECHNOLOGIES



ISIT 2021

PROCEEDINGS
OF THE II INTERNATIONAL CONFERENCE

September 13 – 19, 2021
Odesa, Ukraine

ISIT 2021

Proceedings
of the

II International Scientific and Practical Conference

INTELLECTUAL SYSTEMS AND INFORMATION TECHNOLOGIES

13-19 September 2021

Odesa, Ukraine

Editors:

- | | |
|-------------------------------|--|
| Mikolaj Karpinski, | Dr. of Tech.Sc., Professor, University of Bielsko-Biala, Department of Computer Science and Automatics, Poland |
| Piotr Milczarski, | PhD, Professor, University of Lodz, Faculty of Physics and Applied Informatics, Poland |
| Nadiia Kazakova, | Dr. of Tech.Sc., Professor, Odessa State Environmental University, Department of Information Technologies, Ukraine |
| Yurii Gunchenko, | Dr. of Tech.Sc., Professor, Odessa I.I.Mechnikov National University, Department of Computer Systems and Technologies, Ukraine |
| Svitlana Kuznichenko, | PhD, associated Professor, Odessa State Environmental University, Department of Information Technologies, Ukraine |
| Serhii Yevseiev, | Dr. of Tech.Sc., Professor, Simon Kuznets Kharkiv National University of Economics, Department of Cyber Security and Information Technology, Ukraine |
| Oleksii Frazе-Frazenko | PhD, associated prof., Odessa State Environmental University, Department of Information Technologies, Ukraine |
| Artem Sokolov, | PhD, associated prof., Odessa National Polytechnic University, Department of Cybersecurity and Software, Ukraine |

Preface

The II International Scientific and Practical Conference Intelligent Systems and Information Technologies (ISIT2021) was held on September 13-19, 2021 in Odessa (Ukraine) as part of the Digital Reality Forum in hybrid format (was held as a hybrid in-person and virtual event). The conference presented papers on research in the areas of Information technology, Artificial intelligence systems and tools, Computers, systems, networks and their components, Automate systems and management processes, Cybersecurity and information security, Computer Science and Cybernetics, Project Management, Electrical and Telecommunications, Smart devices and systems, digitalization of society and IT technologies. The conference also aimed to share experiences and announce the participants of modern advanced research in the field of computer science, information technology and prospects for digital transformation in the world. The main goal of the DR forum and the ISIT2021 conference is to provide participants with a free platform for communication, exchange of views and ideas, presentation of new research and development for discussion, finding partners for cooperation and research. In addition, the conference included invited presentations, specialized round tables on professional topics and keynote speeches. This year, we received 65 papers submitted for peer review; out of these, 56 were accepted for this volume, 3 as regular papers, and 53 as short papers.

We thank the Program Committee members, the authors, and the organizers for their work and contribution. We look forward to further cooperation at future conferences and publications.

Odessa

February 2022

The editors.

PROGRAM COMMITTEE

- **Bezkorovainyi V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Bychkov O.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Golub S.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Grishchuk R.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Ivanchenko S.** Dr. of Tech.Sc., prof. (Ukraine)
- **Karpinski M.**, Dr. of Tech.Sc., prof. (Poland)
- **Khoroshko V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Kobzev V.**, Ph.D., Associate Professor (Ukraine)
- **Koval V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Luzhetskyi V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Malakhov E.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Masliy N.**, Dr. of Econ.Sc., prof. (Ukraine)
- **Maślanka P.**, Dr. of Tech.Sc., prof. (Poland)
- **Mescheryakov V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Mezhuyev V.**, Dr. of Tech.Sc., prof. (Austria)
- **Milczarski P.**, PhD, associated prof. (Poland)
- **Milković M.** PhD, prof. (Croatia)
- **Mirzoakhmedov F.**, Dr. of Tech.Sc., prof. (Tajikistan)
- **Parkhuts L.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Petryshyn L.**, Dr. of Tech.Sc., prof. (Poland)
- **Pezeril M.**, prof. (France)
- **Polozhaienko S.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Ramazanov S.**, Dr. of Tech&Econ.Sc., prof. (Ukraine)
- **Rybalskyi O.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Rychlik A.**, PhD, associated prof. (Poland)
- **Sabyrova M.**, PhD, prof. (Kazakhstan)
- **Semenets V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Sharonova N.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Shelest M.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Shevchenko A.**, Dr. of Tech.Sc., prof., Corresponding member of NSAU (Ukraine)
- **Shumeiko O.**, Dr. of Tech.Sc., prof. (Ukraine)

- **Shvorov S.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Shyshmanov K.**, Dr. of Econ.Sc., prof. (Bulgaria)
- **Smirnov O.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Smityukh A.**, Doctor of Law, prof. (Ukraine)
- **Sobczuk H.**, prof. (Poland)
- **Svjatnyj V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Syniehlazov V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Toliupa S.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Volkov V.**, Dr. of Tech.Sc., prof. (Ukraine)
- **Weyrich M.**, Prof. Dr.-Ing. Dr. h. c. (Germany)
- **Yevseiev S.** Dr. of Tech.Sc., prof. (Ukraine)

ORGANIZING COMMITTEE

Deputies

- **Gunchenko Y.**, Dr. of Tech.Sc., prof., ONU
- **Kazakova N.**, Dr. of Tech.Sc., prof., OSENU
- **Kuznichenko S.**, PhD, associated prof., OSENU
- **Yevseiev S.**, Dr. of Tech.Sc., prof., KhNEU

Responsible secretary

- **Buchynska I.**, PhD, OSENU

Working group

- **Fraze-Frazenko O.**, PhD, associated prof., OSENU
- **Popov V.**, department of information and public relations of the Odesa city council
- **Kopychenko I.**, EGAP Regional Coordinator

Technical group

- **Klepatska V.**, Postgraduate Student OSENU
- **Zabozhan O.**, Head of the laboratory, OSENU
- **Yakovenko G.**, first class technician, OSENU
- **Zui O.**, senior laboratory assistant, ONU