

IDT 2021 Program Committee

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Preface

We have the pleasure to present the Program of International Conference on Information and Digital Technologies (IDT 2021). IDT 2021 provides a forum for presentation and discussion of scientific contributions covering the theories and methods in the field of information and digital technologies, and their application to a wide range of industrial, civil and social sectors and problem areas. IDT 2021 is also an opportunity for researchers, practitioners, academics and engineers to meet, exchange ideas, and gain insights from each other. IDT 2021 offers a multidisciplinary platform to address the technological, societal and financial aspects of information systems.

The conference program is divided into some workshops that cover numerous aspects of information and digital technologies.

- International Workshop on Biomedical Technologies (BT);
- International Workshop on Reliability and Safety Technologies (RaST);
- International Workshop on ACeSYRI: Modern Experience for PhD students and Young Researchers (ACeSYRI);
- Industrial Centre (IC) - Exhibition and Special Discussion Section on Information and Digital Technologies, etc.

These workshops thematically extend the conference subjects. We would like to thank colleagues who organized these Workshops. Special mention should be made of the projects and grants with the support of which these Workshops were prepared.

The Int. Workshop on Biomedical Technologies was organized under the project *“Development of methods of healthcare system risk and reliability evaluation under coronavirus outbreak”* reg. no. PP-COVID-20-0013 of Slovak Research and Development Agency and project KEGA reg. no. 009ŽU-4/2020 titled *“Creation of methodological and learning materials for Biomedical Informatics – a new engineering program at the UNIZA”*. Need to say about the ERASMUS+ project CeBMI “University-Industry Educational Centre in Advanced Biomedical and Medical Informatics” (reg. no. 600973-EPP-1-2018-1-SK-EPPKA2-KA), which activities were coordinated with the organization of the Workshop BT and Industrial Centre.

The Workshop ACeSYRI was organized as the event of the ERASMUS+ project ACeSYRI: *Advanced Centre for PhD Students and Young Researchers in Informatics*, (reg.no. 610166-EPP-1-2019-1-SK-EPPKA2-CBHE-JP).

In the framework of the project *“New methods development for reliability analysis of complex system”* of Slovak Research and Development Agency reg.no. APVV-18-0027 was prepared the conference on IDT 2021 and the Workshop on Reliability and Safety Technologies (RaST), in particular.

Initially, about a hundred papers were submitted for review. Approximately half of these submissions have been recommended by reviewers for the presentation at the Conference and publication in the proceedings. The review process was made by a

large number of reviewers, which are gratefully acknowledged for their contributions to the improvement of the quality of the accepted papers. Each paper was reviewed by at least two anonymous reviewers to ensure fair and high-quality reviews. In addition to regular sessions, IDT 2021 offers distinguished Keynote lectures.

We thank Keynote Speakers for offering their unique perspectives on information technologies at the Conference:

- Analyzing physical activity data collected with accelerometers by prof. Timo Jämsä (University of Oulu, Oulu, Finland);
- Cognitive systems for smart applications by prof. Kor Ah-Lian (Leeds Beckett University, United Kingdom);
- Novel WSN Protocols for Health Care and Critical Applications by Dr. Korhan Cengiz (Trakya University, Edirne, Turkey);
- Optimization of Convolutional Neural Networks by Dr. Martin Lukac (Nazarbayev University, Kazakhstan);
- Infinite Petri Nets for Cybersecurity of Intelligent Networks, Grid, and Clouds by prof. Dmitry A. Zaitsev (Supercomputación Castilla y León, Spain);

We gratefully acknowledge the Faculty of Management Science and Informatics of the University of Žilina, European Reliability and Safety Association (ESRA), the Czechoslovakia section of IEEE, IEEE Czechoslovakia Section Reliability Society Chapter, and IEEE Technical Committee on Computational Life Sciences.

Organization team of IDT 2021

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IDT 2021. Time Schedule

Channel 1. <https://teams.microsoft.com/l/meetup-join/19%3aU3nPAYlQ9Z55epbrzQxmu9xbduCnKmAPJyqLwLb3vxM1%40thread.tacv2/1623769267248?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d>

Channel 2. <https://teams.microsoft.com/l/meetup-join/19%3aU3nPAYlQ9Z55epbrzQxmu9xbduCnKmAPJyqLwLb3vxM1%40thread.tacv2/1623770970351?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d>

UTC +2 CEST Central European Summer Time (Bratislava)

Monday, June 21, 2021		
13:00-14:00	Testing of the connection.	
Tuesday, June 22, 2021		
09:00-09:40	Registration and connection (channel 1)	
09:40-10:00	Opening of the Conference (channel 1)	
10:00-12:00	The First Plenary Section (channel 1)	
12:00-13:00	Lunch	
13:00-14:30	Section BT1 , channel 1	Section IT1 , channel 2
14:30-14:45	Coffee/tea	
14:45-16:30	Section RaST1 , channel 1	Section ACeSYRI1 , channel 2
Wednesday, June 23, 2021		
09:00-10:45	Section RaST2 , channel 1	Section ACeSYRI2 , channel 2
10:45-11:00	Coffee/tea	
11:00-12:00	The Second Plenary Section (channel 1)	
12:00-13:00	Lunch	
13:00-14:30	The Industrial Center (channel 1)	
14:30-14:45	Coffee/tea	
14:45-16:30	Section BT2 , channel 1	Section CT , channel 2
Thursday, June 24, 2021		
09:00-10:45	Section AI1 , channel 1	Section IT2 , channel 2
10:45-11:00	Coffee/tea	
11:00-12:00	The Third Plenary Section (channel 1)	
12:00-13:00	Lunch	
13:00-14:30	Section AI2 , channel 1	Section ACeSYRI3 , channel 2
14:30-15:30	The Forth Plenary Section (channel 1)	The ACeSYRI Plenary Section (channel 2)
15:45-16:00	Closing ceremony (channel 1)	

Detailed Schedule

Monday, June 21, 2021

Please, activate these URLs and check the Conference's connection to channel1 and channel2 in advance. Do not hesitate to contact the representative of the Organizing Committee (Ing. Peter Sedlacek, PhD student, peter.sedlacek@fri.uniza.sk) if you have got any technical problems.

Channel 1. [https://teams.microsoft.com/l/meetup-](https://teams.microsoft.com/l/meetup-join/19%3aU3nPavIQ9Z55epbrzOxmu9xbduCnKmAPlyqLwLb3vxM1%40thread.tacv2/1623769267248?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d)

[join/19%3aU3nPavIQ9Z55epbrzOxmu9xbduCnKmAPlyqLwLb3vxM1%40thread.tacv2/1623769267248?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d](https://teams.microsoft.com/l/meetup-join/19%3aU3nPavIQ9Z55epbrzOxmu9xbduCnKmAPlyqLwLb3vxM1%40thread.tacv2/1623769267248?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d)

Channel 2. [https://teams.microsoft.com/l/meetup-](https://teams.microsoft.com/l/meetup-join/19%3aU3nPavIQ9Z55epbrzOxmu9xbduCnKmAPlyqLwLb3vxM1%40thread.tacv2/1623770970351?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d)

[join/19%3aU3nPavIQ9Z55epbrzOxmu9xbduCnKmAPlyqLwLb3vxM1%40thread.tacv2/1623770970351?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d](https://teams.microsoft.com/l/meetup-join/19%3aU3nPavIQ9Z55epbrzOxmu9xbduCnKmAPlyqLwLb3vxM1%40thread.tacv2/1623770970351?context=%7b%22Tid%22%3a%228324ff4b-14c8-4bf5-b07e-a0713179f37e%22%2c%22Oid%22%3a%225530e086-8de0-4f1f-9499-4d5a9c323999%22%7d)

Tuesday, June 22, 2021

Opening of the Conference

09:40-10:00 (channel 1)

The Conference Opening

Prof. Elena Zaitseva

Welcome words of the Conference Chair

Prof. Paolo Soda

Welcome words from the University of Žilina

Prof. Karol Matiaszko

Welcome words of the Dean of the Faculty

Dr. Emil Kršák

Welcome words of the chair ESRA

Prof. Marko Cepin

The First Plenary Section

10:00-12:00 (channel 1)

Moderators: Prof. Paolo Soda, Italy

Assistant: Ing. Peter Sedláček, Slovakia

Prof. Timo Jämsä (University of Oulu, Oulu, Finland)

Analyzing physical activity data collected with accelerometers

Dr. Martin Lukac (Nazarbayev University, Nursultan, Kazakhstan)

Optimization of Convolutional Neural Networks

Section BT1. Biomedical technologies

13:00-14:30 (channel 1)

Moderators: Dr. Jaroslav Majernik, Slovakia

Assistant: Ing. Peter Sedláček, Slovakia

Luisa Francini, Paolo Soda and Rosa Sicilia.

Describing rumours: a comparative evaluation of two handcrafted representations for rumour detection

Jaroslav Majernik, Martin Komenda, Andrzej Kononowicz, Inga Hege and Adrian Ciureanu.

Software based support of curriculum mapping in education at medical faculties

Kristína Kovalčíková, Hynek Bachraty, Katarína Bachratá and Katarína Buzáková.

Numerical Experiment Characteristics Dependence on Red Blood Cell Parameters

Kirill Yakunin, Ravil Mukhamediev, Marina Yelis, Adilkhan Symagulov, Yan Kuchin, Elena Muhamedijeva, Jan Rabcan and Aubakirov Margulan.

Reflection of the COVID-19 pandemic in mass media

Maike Krips, Nenad Kostanjsek, Sebastian Decker and Thomas M. Deserno.

Terminology to classify events in the early rescue chain

Natalia Aralova, Valery Mashkin and Iryna Mashkina.

Information technologies for decision-making support in case of viral infectious

Section I1. Information Technologies

13:00-14:30 (channel 2)

Chair: Dr. Michal Kvet, Slovakia

Assistant: Dr. Patrik Rusnák, Slovakia

Roman Čerešňák, Michal Kvet, Karol Matiaško and Adam Dudáš.

Mapping rules for schema transformation SQL to NoSQL and back

Stanislava Simonova.

Requirements Gathering for Specialized Information Systems in Public Administration

Oksana Nass, Gaukhar Kamalova, Rauan Shotkin and Jan Rabcan.

Analysis of methods for planning data processing tasks in distributed system for the remote access to information resources

Matej Meško, Patrik Hrkút, Štefan Toth, Michal Ďuračík and Dominik Kornhauser.

Checking the writing of commas in Slovak

Roman Čerešňák, Michal Kvet and Karol Matiaško.

Improved method of selecting data in a nonrelational database

Vasyl Gorbachuk, Serge Gavrilenko, Gennady Golotsukov and Dmytro Nikolenko.

On the Corporate Digital System for Organization and Management of Pools for Intellectual Property Rights in Ukraine

Section RaST1: Reliability and Safety Technologies

14:45-16:30 (channel 1)

Chair: Prof. Nicolae Brînzei, France

Assistant: Ing. Peter Sedláček, Slovakia

Attila Kuki, Tamás Bérczes, János Sztrik and Ádám Tóth.

Reliability analysis of a retrieval queueing systems with collisions, non-patient customers, and catastrophic breakdowns

Ádám Tóth, Janos Sztrik, Ákos Pintér and Zoltán Bács.

Reliability Analysis of Finite-Source Retrieval Queueing System with Collisions and Impatient Customers in the Orbit Using Simulation

Gaël Hequet, Nicolae Brînzei and Jean-François Pétrin.

Usage profile in physical systems modeled with stochastic hybrid automata

Ihor Kliushnikov, Vyacheslav Kharchenko, Herman Fesenko and Elena Zaitseva.

Multi-UAV Routing for Critical Infrastructure Monitoring Considering Failures of UAVs: Reliability Models, Rerouting Algorithms, Industrial Case

Peter Sedlacek and Elena Zaitseva.

Software reliability model based on syntax tree

Alexander Kolchin, Stepan Potiyenko and Thomas Weigert.

Extending data flow coverage with redefinition analysis

Michal Mrena and Miroslav Kvassay.

Comparison of Left Fold and Tree Fold Strategies in Creation of Binary Decision Diagrams

Workshop on ACeSYRI-1 (under separate program)

14:45-16:30 (channel 2)

Chair: Prof. Martin Lukac, Kazakhstan

Assistant: Dr. Patrik Rusnák, Slovakia

This workshop is intended for PhD students, young researchers, and their scientific advisors from different countries. The main goal of the workshop is to approbate presentation skills of young researchers, to establish and to expand international contacts and co-operation of potential foreign co-advisors and young researchers from Partner Countries.

Wednesday, June 23, 2021

Section RaST2: Reliability and Safety Technologies

09:00-10:45 (channel 1)

Chair: Prof. Frank Coolen, United Kingdom

Assistant: Ing. Peter Sedláček, Slovakia

Dmitry Zaitsev, Tatiana Shmeleva and Peyman Ghaffari.

Modeling Multidimensional Communication Lattices with Moore Neighborhood by Infinite Petri Nets

Mikhail Tatur, Aleksander Ivanitski, Viachaslau Prorovski and Miroslav Kvassay.

Exploratory analysis of the fire statistics using automatic time series decomposition

Mohamed Hedi Zaghouani, Hamza Nemouchi and János Sztrik.

Reliability analysis of Cognitive Radio Networks with balking and reneging

Patrik Rusnak.

Algorithms for calculation of logical derivatives for survival signature and their analysis

Galina Zverkina.

On polynomial convergence rate for extended reliability standby system

Stanislaw Czapp.

Time-Current Tripping Characteristics of RCDs for Sinusoidal Testing Current

Workshop on ACeSYRI-2 (under separate program)

09:00-10:45 (channel 2)

Chair: Dr. Krzysztof Podlaski, Poland / Dr. Miroslav Kvassay, Slovakia

Assistant: Dr. Patrik Rusnák, Slovakia

This workshop is intended for PhD students, young researchers, and their scientific advisors from different countries. The main goal of the workshop is to approbate presentation skills of young researchers, to establish and to expand international contacts and co-operation of potential foreign co-advisors and young researchers from Partner Countries.

The Second Plenary Section

11:00-12:00 (channel 1)

Moderators: Prof. Daria Filatova, France

Assistant: Ing. Peter Sedláček, Slovakia

**Prof. Dmitry A. Zaitsev (Odessa State Environmental University, Ukraine;
Supercomputación Castilla y León, Spain)**

*Infinite Petri Nets for Cybersecurity of Intelligent Networks,
Grid, and Clouds*

The Industrial Centre

13:00-14:30 (channel 1)

Moderators: Prof. Janos Sztrik, Hungary

Assistant: Ing. Peter Sedláček, Slovakia

Miroslav Kvassay and Elena Zaitseva (University of Žilina)
*University-Industry Educational Centre in Advanced Biomedical and Medical
Informatics*

Adrian Petrik (StaPro)
Early warning score – from paper to a digital solution

Nika Kvaššayová, Marek Mansell and Martin Cápay
The BBC micro:bit in Slovakia

Section BT2: Biomedical Technologies

14:45-16:30 (channel 1)

Chair: Dr. Tomaz Amon, Slovenia

Assistant: Ing. Peter Sedláček, Slovakia

Marek Kvet.
*Impact of Fairness Constraints on Average Service Accessibility in Emergency
Medical System*

Mariana Ondrušová and Ivan Cimrák.
*Computational study of red blood cell behaviour in shear flow for different bending
stiffness of the membrane*

Sara Mollà-Casanova, Núria Sempere-Rubio, Marta Aguilar-Rodríguez, Marta Inglés
and Pilar Serra-Añó.
*Effectiveness of Bodily Illusion Therapy on gait and pain in patients with
incomplete spinal cord injury*

Michal Kvet and Karol Matiaszko.

The efficiency of the Temporal Medical Data Retrieval

Mikuláš Klimo, Nika Kvaščayová, Miroslav Kvaščay, Marek Mansell, Bibiána Kleinová.

3D Printed Face Shield as a Help for Nursing Homes During COVID-19 Pandemic

Kim Gandy, Myra Schmaderer, Anthony Szema, Chris March, Mary Topping, Anna Song, Marcos Garcia-Ojeda, Arthur Durazo, Jos Domen and Paul Barach.

Remote Patient Monitoring: A Promising Digital Health Frontier

Tomaz Amon.

Experience with the usage of virtual reality worlds about natural history in Slovenia

Vasyl Martsenyuk, Nazar Milian and Roksolana Milian.

The U-Net model application for retinal vessels segmentation using minimax approach

Alexander Fedorov, Sergei Koryagin, Pavel Klachek and Irina Liberman.

Development of neurodynamic methods based on hybrid computational intelligence

Section CT: Communication Technologies

14:45-16:30 (channel 2)

Chair: Prof. Andriy Luntovskyy, Germany

Assistant: Dr. Patrik Rusnák, Slovakia

Andriy Kovalenko, Nina Kuchuk, Heorhii Kuchuk and Jozef Kostolny.

Horizontal scaling method for a hyperconverged network

Andriy Luntovskyy and Tim Zobjack.

Secured and Blockchain IoT

Hanan Tariq and Stanislaw Czapp.

Tripping of F-type RCDs for High-Frequency Residual Currents

Andrii Astrakhantsev, Larysa Globa, Rina Novogrudskaya, Mariia Skulysh and Olexandr Stryzhak.

Improving Service Delivery Efficiency in a Hybrid Communication Environment Networks

Sofya Chikarenko, Kseniya Ivanova, Alexandra Skornyakova and Sergey Tyurin.

Self-Timed FPGA Design Perspectives

Ekaterina Danilova, Dmitry Kovylyaev and Alexey Gorodilov.

Advanced genetic algorithm for the embedded FPGA logic diagnostic

Ibrahim Alameri, Stepan Hubalovsky and Jitka Komarkova.

Evaluation of impact of mobility, network size and time on performance of adaptive routing protocols

Ibrahim Alameri, Jitka Komarkova and Mustafa Ramadhan.

Conceptual analysis of single and multiple path routing in MANET network

Section AI1: Artificial Intelligence

09:00-10:45 (channel 1)

Chair: Prof. Ravil Mukhamediev, Kazakhstan

Assistant: Ing. Peter Sedláček, Slovakia

Rajesh Venkatachalapathy, Kai Brooks, Mikhail Mayers, Roman Minko, Tyler Hull, Bliss Brass, Martin Zwick, Adam Slowik and Marek Perkowski.

Universal Biological Motions for Educational Robot Theatre and Games

Alexei Belotserkovsky, Pavel Lukashevich, Mert Doganli and Jan Rabcan.

A Concept of a Multi-robotic System for Warehouse Automation

Ravil Mukhamediev, Marina Yelis, Ilyas Assanov, Yan Kuchin, Adilkhan Symagulov, Kirill Yakunin and Peter Sedlacek.

Rapid bibliometric analysis in deep learning domain

Meseret Yihun Amare and Stanislava Simonova.

Big-Data Based Prediction Model for Learning Analytics-Identification of suitable prediction methods

Jozef Kostolny, Patrik Rusnak and Rudolf Simo.

Development of Knowledge Games in an Interactive Educational Portal

Marek Baláž and Peter Tarábek. *AlphaZero with Real-Time Opponent Skill Adaptation*

Daria Shaptala. *Decision-making at evolutionary search during limited number of fuzzy experiments with multiple criteria*

Section IT2. Information Technologies

09:00-10:45 (channel 2)

Chair: Prof. Charles El-Nouty, France

Assistant: Dr. Patrik Rusnák, Slovakia

Terézia Sliacka, Michal Varga and Norbert Adamko. *Application of the A* algorithm for navigation of workers in simulation models of railway yards*

Jaroslav Janacek and Marek Kvet.

Customization of Uniformly Deployed Set Kit for Path-relinking Method

Darya Filatova, Charles El-Nouty and Roman Fedorenko.

Some theoretical backgrounds for reinforcement learning model of supply chain management under stochastic demand

Adam Dudáš, Jarmila Škrinárová and Adam Kiss.

On Graph Coloring Analysis Through Visualization

Dobroslav Grygar and Michal Koháni. *Simulated annealing metaheuristic with greedy improvement for road segments selection problem*

Baptiste Jacquet, Frank Jamet and Jean Baratgin.

On the Pragmatics of the Turing Test

Ján Kučera, Norbert Adamko and Michal Varga.

Securing constrained edges in a triangulation

The Third Plenary Section

11:00-12:00 (channel 1)

Moderators: Dr. Miroslav Kvassay, Slovakia

Assistant: Ing. Peter Sedláček, Slovakia

Prof. Kor Ah-Lian (Leeds Beckett University, United Kingdom)

Cognitive systems for smart applications

Section AI2: Artificial Intelligence

13:00-14:30 (channel 1)

Chair: Dr. Marek Kvet, Slovakia

Assistant: Ing. Peter Sedláček, Slovakia

Katerina Prihodova and Jakub Jech.

Gender recognition using thermal images from UAV

Jan Bohacik.

Phishing Detection for Secure Operations of UAVs

Sergey Stankevich, Nick Lubskyi and Artur Lysenko.

Longwave infrared remote sensing data spatial resolution enhancement using modulation transfer function fusion approach

Milan Ondrašovič, Peter Tarábek and Ondrej Šuch.

Object Position Estimation from a Single Moving Camera

Irena Drofova and Milan Adamek.

Analysis of counterfeits using color models

Leonardo Pinheiro de Queiroz, Helder Oliveira and Svetlana Yanushkevich.

Thermal-Mask -- A Dataset for Facial Mask Detection and Breathing Rate Measurement in Infrared Spectrum

Workshop on ACeSYRI-3 (under separate program)

13:00-14:30 (channel 2)

Chair: Prof. Nicolae Brînzei, France

Assistant: Dr. Patrik Rusnák, Slovakia

This workshop is intended for PhD students, young researchers, and their scientific advisors from different countries. The main goal of the workshop is to approbate presentation skills of young researchers, to establish and to expand international contacts and co-operation of potential foreign co-advisors and young researchers from Partner Countries.

The Fourth Plenary Section

14:30-15:30 (channel 1)

Moderators: Dr. Jan Rabčan, Slovakia

Assistant: Ing. Peter Sedláček, Slovakia

Dr. Korhan Cengiz (Trakya University, Edirne, Turkey)

Novel WSN Protocols for Health Care and Critical Applications

The ACeSYRI Plenary Section

14:30-15:30 (channel 2)

Moderators: Prof. Vitaly Levashenko, Slovakia

Assistant: Ing. Michal Mrena, Slovakia

Dr. Patrik Rusnák (University of Žilina, Slovakia)

Reliability analysis based on the logic differential calculus

Peter Sedláček (University of Žilina, Slovakia)

Reliability analysis of non-coherent system