

# **2021 11th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2021)**

**Virtual Conference  
22-25 September 2021**

**Volume 1  
Pages 1-600**



**IEEE Catalog Number: CFP21803-POD  
ISBN: 978-1-6654-2606-0**

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

|                         |                   |
|-------------------------|-------------------|
| IEEE Catalog Number:    | CFP21803-POD      |
| ISBN (Print-On-Demand): | 978-1-6654-2606-0 |
| ISBN (Online):          | 978-1-6654-2605-3 |
| ISSN:                   | 2770-4262         |

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# Table of Contents

## Volume 1

|  |    |
|--|----|
| Multilevel Flow Model of an Espresso Machine. <i>Miki Sirola, Harald P.-J. Thunem.</i> .....   | 1  |
| Implementation of Effective Evidence-based Monitoring of the Object State by Means of Wireless Network Object Systems. <i>Bohdan Shevchuk, Orest Ivakhiv, Mykhaylo Geraimchuk.</i> .....   | 7  |
| Application of the Computer System Component with Adjustment Elements for Processing Sensor Signals. <i>Hanna Ukhina, Valerii Sytnikov, Oleg Streltsov, Pavel Stupen, Volodymyr Kudria.</i> .....                                | 12 |
| Research on Face Detection and Face Attribute Recognition based on Deep Learning. <i>Wendong Zhang, Sha Guan, Chunzhi Wang, Yucheng Zhang, Xianjing Zhou.</i> .....  | 18 |
| Multi-objective Optimization Algorithm based on PTN Network Index System. <i>Xing Li, Chunzhi Wang, Zaoning Wang, Aijun Liu, Yucheng Zhang, Yunfei Xiong.</i> .....  | 23 |
| A Method to Optimize the PTN Ring Formation Rate by Calculating the Accounting Income of Network Elements. <i>Sha Guan, Wendong Zhang, Chunzhi Wang, Yucheng Zhang, Xianjing Zhou.</i> .....                                     | 28 |
| Voxel Approach to the Shadow Formation Process in Image Analysis. <i>Volodymyr Hnatushenko, Viktoria Hnatushenko, Vita Kashtan, Oleksandr Reuta, Iryna Udovyk.</i> .....   | 33 |
| 7-GHz Measurement System for in-situ Space/Material Channel Characterisation. <i>Tanbir Bakth Nabil, Per Ångskog, José Chilo.</i> .....  | 37 |
| IoT Aroma Sensor Module to Determine Beverage Alcohol Grade. <i>Jorge Javier Mendoza Montoya, Germán Torregrosa Penalva, Ernesto Àvila Navarro, Kevin Huanca Zea, Javier Alvaro Rivera Suaña, José Chilo.</i> .....              | 43 |
| Neurocompressor-based Analysis of the Combined Action of Occupational Hazards on Human Health. <i>Iryna Perova, Olena Litovchenko, Oleksandra Yeremenko, Igor Zavgorodnii, Nelia Miroschnychenko, Oleksandr Novytskyi.</i> ..... | 49 |
| Data Mining to Achieve Quality of Life for Home Automation Users. <i>Myroslav Zadoian, Yulii Horichenko, Artem Tulenkov, Anzhelika Parkhomenko.</i> .....  | 55 |

|   |     |
|---|-----|
| The Methods and Means of Efficiency Increasing the Linear Optimization Problems Solving in Project Management. <i>Sergii K. Chernov, Sergey D. Titov, Ludmila S. Chernova, Lubava S. Chernova, Diana Zahorodnia, Taras Lendiuk.</i> ..... | 60  |
| Detection DNS Tunneling Botnets. <i>Bohdan Savenko, Sergii Lysenko, Kira Bobrovnikova, Oleg Savenko, and George Markowsky.</i> .....  | 64  |
| Concept of Active Wireless Sensor Network in Checkability Aspect. <i>Oleksandr Drozd, Anatoliy Sachenko, Volodymyr Kochan, Myroslav Drozd, Maciej Dobrowolski, Jun Su.</i> .....  | 70  |
| Equipment Monitoring System with use of Digital Twins and Internet of Things: Algorithms, Architecting and Experiments. <i>Yaroslav Abarnikov, Vyacheslav Kharchenko, Olga Morozova.</i> .....  | 75  |
| Application of Deep Neural Networks for EEG Signal Processing in Brain-controlled Wheeled Robotic Platform. <i>Serhii Artemuk, Vitalii Brydinskyi, Ihor Mykytyn, Yuriy Khoma.</i> .....   | 81  |
| Method of Selecting and Determining the Free Parameters of Swarm Intelligent Algorithms for Optimizing Solutions in GIS. <i>Dmytro Uhryn, Vasyl Lytvyn, Taras Lendiuk.</i> .....  | 86  |
| Visual Question and Answering System for NLP and Computer Vision Problems. <i>Dmytro Koziy, Nataliya Shakhovska.</i> .....  | 94  |
| Improved Seagull Optimization Algorithm to Optimize Neural Networks with Gated Recurrent Units for Network Intrusion Detection. <i>Sen Ma, Chunzhi Wang, Aijun Liu, Yucheng Zhang, Junfang Wang, Yuguang Chang, Jie Yang.</i> .....       | 100 |
| Object-oriented Models of High-speed Electronic Devices. <i>Volodymyr Kudrya, Volodymyr Slyusarenko, Maxim Shulgin.</i> .....   | N/A |
| A Workflow for Designing Video Processing Pipelines with PYNQ. <i>John Kalomiros, John Vourvoulakis, Stavros Vologiannidis.</i> .....   | 109 |
| Aerosol in the Upper Atmosphere of the Earth Study. <i>Petro Nevodovskyi, Anatoliy Vid'machenko, Orest Ivakhiv, Oleksandr Zbrutskyi, Mykhaylo Geraimchuk, Yurii Hirniak.</i> .....  | 115 |
| A Modified Grasshopper Optimization Algorithm. <i>Man Gao, Hui Xu, Jun Su, Lingyu Yan.</i> .....  | 120 |
| The Robin Soft-Core: A Paradigm for Studying VHDL and Computer Architecture. <i>John Kalomiros, John Vourvoulakis.</i> .....  | 124 |
| Car Engines Diagnostics based on the Evaluation of the Mutual Wavelet Dependency. <i>Adrian Nakonechnyi, Dmytro Horoshko, Rostyslav Nakonechnyi.</i> .....  | 130 |

|  |     |
|--|-----|
| A SIEM Architecture for Multidimensional Anomaly Detection. <i>Tim Laue, Carsten Kleiner, Kai-Oliver Detken, Timo Klecker</i> .....  | 136 |
| Categories of Responsible Investment: Bibliometric Landscape. <i>Anna Vorontsova, Inna Makarenko, Yuriy Petrushenko, Tetiana Ostapchuk, Olena Boiko</i> .....  | 143 |
| Computer-aided Selection of the Optimal Gamma Correction Parameter for Image Enhancement in Video Analytics Systems. <i>Oleksandr Golovin</i> .....  | 148 |
| Automated Measuring System for Studying the Temperature Dependence of Dielectric Spectra of Ferroelectrics. <i>Henrietta Bán, David Gal, Vitaly Gerasimov, Andriy Haysak, Alexander Molnar</i> ..... | 156 |
| Information Technology for Adaptive Semantic Testing of Knowledge Level of Educational Materials. <i>Olexander Mazurets, Olexander Barmak, Iurii Krak, Maryna Molchanova, Olena Sobko</i> .....      | 160 |
| Multidimensional Neuro-fuzzy System and Fuzzy Coding for a Constant Length Facial Landmark Set Formation. <i>Yevgeniy Bodyanskiy, Nonna Kulishova</i> .....  | 166 |
| The Optimization of the Critical Resource Protection System of a Mineral Fertilizers Manufacturing Facility. <i>Bogdan Korniyenko, Vladyslav Zabolotnyi, Liliya Galata</i> .....                     | 172 |
| A Toolkit for Modeling and Simulation of Dynamic Virtual Machine Consolidation Approach. <i>Eduard Zharikov, Sergii Telenyk, Yevhenii Serdiuk</i> .....  | 179 |
| Customer Intent Prediction Using Sentiment Analysis Techniques. <i>Say Hong Lye, Phoey Lee Teh</i> .....   | 185 |
| Predicting the Mental State of the Social Network Users based on the Latent Dirichlet Allocation and fastText. <i>Igor Kotenko, Yash Sharma, Alexander Branitskiy</i> .....                          | 191 |
| A Static and Dynamic Co-attention Network for Social Recommendation. <i>Fan Bian, Lingyu Yan, Rong Gao, Kumpeng Zheng, Yucheng Zhang, Jie Yang</i> .....   | 196 |
| An IoT-based Context-Aware Recommender System to Improve the Quality of Life of Elderly People. <i>Komal Shinde, Areej Aldaghamin, Iyad Tumar, Abdalkarim Awad, Carsten Wolff</i> .....              | 202 |
| Comparative Analysis of the Efficiency of Modern Fake Detection Algorithms in Scope of Information Warfare. <i>Yevhenii Shtefaniuk, Ivan Opirskyy</i> .....  | 207 |
| Path Selection Strategy for Network-Coded Cooperation with Decode-and-Forward Relay. <i>Mokhtar Bouteggui, Fatiha Merazka</i> .....  | N/A |
| Analyzing the Busy Period of the M/M/1 Queue via Order Statistics and Record Values. <i>Pierre M. Fiorini</i> .....  | 217 |

|  |     |
|--|-----|
| Decision Support System for Efficient Energy Management of MicroGrid with Renewable Energy Sources. <i>Sergii Shendryk, Vira Shendryk, Yuliia Parfenenko, Oleksii Drozdenko, Sergii Tymchuk.</i> .....                               | 225 |
| Improvement of Measurement Systems for Relative Quality Indicator by Immitance Parameters. <i>Vasyl Yatsuk, Tetiana Bubela, Yevhen Pokhodylo, Volodymyr Zdeb.</i> .....  | 231 |
| OrchestraBox: RFID Music Box for Musical Education at Schools. <i>Andrey Borisov, Jurgen Sieck, Elisabeth Thielen.</i> .....   | 236 |
| Resource Tradeoff Analysis of Plant Physiological Status Sensor with Cloud Connectivity. <i>Linas Svilainis, Zilvinas Nakutis, Paulius Tervydis, Andrius Chaziachmetovas, Arturas Aleksandrovas.</i> .....                           | 241 |
| A Hybrid Method for Managing Agile Team in a Distributed Environment. <i>Valentyn Domanskyi, Carsten Wolff, Anatoliy Sachenko, Anna Badasian.</i> .....  | 247 |
| Augmentation of Printed Content with Web-based Technologies. <i>Sophie Schauer, Julien Letellier, Jurgen Sieck.</i> .....  | 252 |
| Lattice-Based Technique to Visualize and Compare Regional Terrorism Using the Global Terrorism Database. <i>Linda Markowsky, George Markowsky.</i> .....   | 257 |
| DMQC Project: Design Technologies, Implementation, and Research of the Properties of a Digital Multi-Qubit Coprocessor. <i>Anatoliy Melnyk, Valerii Hlukhov.</i> .....   | 267 |
| Visualization of Data Cubes for Anomaly Detection in Network Traffic Data Streams. <i>Volker Ahlers, Tim Laue, Nils Wellermann, Felix Heine.</i> .....   | 272 |
| Automation of Scheduling Training Sessions in Educational Institutions using Genetic Algorithms. <i>Evgenii Fedkin, Natalya Denissova, Iurii Krak, Irina Dyomina.</i> .....  | 278 |
| Ransomware Prevention System Design based on File Symbolic Linking Honeypots. <i>Danyil Zhuravchak, Taras Ustyianovych, Valery Dudykevych, Bogdan Vennyk, Khrystyna Ruda.</i> .....  | 284 |
| Validation of the Global Human Settlement Layer and NASA Population Data for Ukraine. <i>Nataliia Kussul, Hanna Yailymova, Sophia Drozd, Andrii Shelestov.</i> .....   | 288 |
| Pixel-level Road Pavement Defects Segmentation Based on Various Loss Functions. <i>Rytis Augustauskas, Arūnas Lipnickas.</i> .....   | 292 |
| Protection of Biometric Data Transmission and Storage in the Human State Remote Monitoring Tools. <i>Anatoliy Melnyk, Yurii Morozov, Bohdan Havano, and Petro Hupalo.</i> .....  | 301 |
| OMEx-DriveTrain: An Open, Modular Experimental Platform for the Electric Powertrain. <i>Daniel Fruhner, Robert Kleinert, Carsten Wolff, Friedbert Pautzke, Heinrich Zöllner, Shubhangi Sisodiya, Vipul Shrikant Deshpande.</i> ..... | 307 |

|   |     |
|---|-----|
| A Comparison of Kubernetes and Kubernetes-compatible Platforms. <i>Sergii Telenyk, Oleksii Sopov, Eduard Zharikov, Grzegorz Nowakowski</i> .....  | 313 |
| Digital Qubits for FPGA-based Homogenous Quantum Coprocessor. <i>Valerii Hlukhov</i> .....  | 318 |
| Agile Systems Engineering in Complex Scenarios. <i>Carsten Wolff, Philipp Tendyra, Carsten Wiecher</i> .....  | 323 |
| A Hybrid Approach for the Mixed-Model Assembly Line Balancing Problem Type-II. <i>Lakhdar Belkharroubi, Khadidja Yahyaoui</i> .....   | 329 |
| 3D Adaptive SMCM Filtering of CT Images. <i>Ivo Draganov, Rumien Mironov</i> .....  | 333 |
| Automatic Deforestation Detection based on the Deep Learning in Ukraine. <i>Leonid Shumilo, Mykola Lavreniuk, Nataliia Kussul, Bella Shevchuk</i> .....   | 337 |
| Towards a Formal Verification of Seamless Cryptographic Rekeying in Real-Time Communication Systems. <i>Heiko Buhler, Andrzej Zbrzezny, Agnieszka M. Zbrzezny, Andreas Walz, Axel Sikora</i> .....                                      | 343 |
| Efficient ECG Analysis with High F1 Score and Low Computation Complexity. <i>Andrii Yavorskyi, Bohdan Tyshchenko, Taras Panchenko</i> .....   | 348 |
| CPE and CVE based Technique for Software Security Risk Assessment. <i>Roman Ushakov, Elena Doynikova, Evgenia Novikova, Igor Kotenko</i> .....  | 353 |
| Sewage Influent Estimation in BSM1 Model of Płaszów WWTP. <i>Paweł Król, Alberto Gallina, Tadeusz Uhl</i> .....   | 357 |
| Manipulator's Control System with Application of the Machine Learning. <i>Yuriy Kondratenko, Stanislav Sichevskyi, Galyna Kondratenko, Ievgen Sidenko</i> .....   | 363 |
| Models and Methods of Project Administration in 4P-environment. <i>Nataliia Yehorchenkova, Oleksii Yehorchenkov, Yevheniia Kataieva, Serhii Mitsenko, Oleksandr Mohylnyi, Svitlana Odokienko, Nataliya Babina, Olena Verenysh</i> ..... | 369 |
| The Wetland Map Validation for Ukraine. <i>Andrii Shelestov, Hanna Yailymova, Bohdan Yailymov, Artem Chyrkov</i> .....  | 373 |
| Automated Control Method for Charging Supercapacitors based on Relaxation Characteristics. <i>Oleg Savenko, Valeriy Martynyuk, Mykola Fedula, Liudmyla Koretska, Denys Makaryshkin</i> .....  | 377 |
| FPGA Implementation of CORDIC Algorithms for Sine and Cosine Floating-Point Calculations. <i>Anatolii Sergiyenko, Leonid Moroz, Lesya Mychuda, Volodymir Samotyj</i> .....  | 383 |

|  |     |
|--|-----|
| Generating and Numbering Permutations with the Use of Chaotic Maps. <i>Marcin Lawnik, Arkadiusz Banasik</i> .....  | 387 |
| Fundamentals of Implementation of Safety Movement of Trains under Integration of Control Systems with Hardware for Railway Infrastructure Facilities Monitoring. <i>Dmitry Efanov, German Osadchy, Igor Aganov</i> ..... | 391 |
| A Natural Language Processing Tool to Support the Electronic Invoicing Process in Italy. <i>Luigi Di Puglia Pugliese, Francesca Guerriero, Giusy Macrina, Enza Messina</i> .....   | 397 |
| Extraction of Nonredundant Information from Sensor Networks. <i>Zbigniew Kokosiński</i> .....  | 403 |
| Brain-based Classification of Landmarks using Audible Sonar Echo Sequences. <i>Roman Kuc</i> .....   | 408 |
| Hiding Messages in Audio Files Using Direct Spread Spectrum. <i>Alexandr Kuznetsov, Oleksii Smirnov, Victor Zhora, Alexander Onikiychuk, Olha Pieshkova</i> .....  | 414 |
| Quality Assurance and Control of Steel Blade Production Using Full Non-Contact Frequency Response Analysis and 3D Laser Doppler Scanning Vibrometry System. <i>Lukasz Scislo</i> .....                                   | 419 |
| Special Aspects of Errors Definition via Sum Codes within Embedded Control Schemas being Realized by Means of Boolean Complement Method. <i>Dmitry Efanov, German Osadchy, Marina Zueva</i> .....                        | 424 |
| Cost Efficient Audio Spectrum Analyzer: Design and Study. <i>Yevheniia Zhyvaha, Halyna Klym, Roman Dunets</i> .....  | 432 |
| Architecture of a Universal Monitoring System for Transport Infrastructure Facilities. <i>Valery Myachin, Dmitry Efanov, German Osadchy, Igor Aganov, Valerii Khoroshev</i> .....  | 438 |
| Agile-Transformation Organizational Development based on Portfolio Management. <i>Sergiy Bushuyev, Victoria Bushuieva, Svitlana Onyshchenko, Natalia Pavlova</i> .....   | 444 |
| Measuring Amplifier based on Hamon Resistors and Dynamic Element Matching Technology. <i>Mykhaylo Dorozhovets</i> .....  | 452 |
| Research and Development of QoS Methods based on SDN in 5G/IMT-2020. <i>Behrooz Daneshmand</i> .....   | 458 |
| Message Concealing in Vector Images. <i>Alexandr Kuznetsov, Anna Kononchenko</i> .....   | 465 |
| Fault Tolerance Computer System Structures Functioning in Residue Classes. <i>Victor Krasnobaev, Alexandr Kuznetsov, Anastasiia Kiian, Kateryna Kuznetsova</i> .....   | 471 |



|  |     |
|--|-----|
| Building Occupancy Classification from Indirect Sensing with Heterogeneous Datasets. <i>Georgiana Cretu, Iulia Stamatescu, Grigore Stamatescu</i> .....  | 475 |
| A Discrete Missing Data Imputation Method based on Improved Multi-layer Perceptron. <i>Chunyan Yan, Jianyu Yuan, Zhiwei Ye, Zhiyong Yang</i> .....   | 480 |
| Comment on “Particle Swarm Optimization Based Highly Nonlinear Substitution-Boxes Generation for Security Applications”. <i>Alexandr Kuznetsov, Kateryna Kuznetsova</i> .....  | 485 |
| An Approach to Scene Change Detection. <i>Igor Bieda, Anton Kisil, Taras Panchenko</i> .....   | 489 |
| Efficient Near-Optimal t-Closeness with Low Information Loss. <i>Vikas Thammanna Gowda, Rajiv Bagai, Gerald Spilinek, Spandana Vitalapura</i> .....  | 494 |
| A Load Factor and its Impact on the Performance of a Multicore System with Shared Memory. <i>Dmytro Nedzelky, Maryna Derkach, Inna Skarga-Bandurova, Larisa Shumova, Svitlana Safonova, Volodymyr Kardashuk</i> .....                          | 499 |
| Agglomerative Clustering of Data Collected by Honeypots. <i>Antonina Kashtalian, Oleg Savenko, Anatoliy Sachenko</i> .....   | 504 |
| Investigation of the Correlation Properties of Spreading Sequences for Asynchronous CDMA. <i>Alexandr Kuznetsov, Victor Krasnobaev, Mykhaylo Bagmut and Yelyzaveta Kuznetsova</i> .....  | 510 |
| Vessels Detection Based on Neural Network with Application in Wood Recognition. <i>Pavel Todorov, Nicole Christoff</i> .....   | 516 |
| Simulated Test Laboratory for 5G Test Patterns. <i>Giorgi Iashvili, Maksim Iavich, Sergiy Gnatyuk, Roman Odarchenko, Sergei Simonov</i> .....  | 521 |
| Development of Recommendation System in E-commerce using Emotional Analysis and Machine Learning Methods. <i>Taras Mykhalchuk, Tetiana Zatonatska, Oleksandr Dluhopolskyi, Alina Zhukovska, Tetiana Dluhopolska, Larysa Liakhovych</i> .....   | 527 |
| Variational Model for the Restoration of Clouds Corrupted Multispectral Satellite Optical Images. <i>Pavel Khanenko, Peter Kogut, Mykola Uvarov</i> .....  | 536 |
| An Intrusion Detection Model Based on Improved Whale Optimization Algorithm and XGBoost. <i>Xinlu Zong, Ruicheng Li, Zhiwei Ye</i> .....   | 542 |
| Intelligent Multi-Agent System for Improving the Quality of Software by Taking into Account the Information of the Subject Area at all Stages of its Development. <i>Ivan Lopatto, Tetiana Hovorushchenko, Peter Popov, Olga Pavlova</i> ..... | 548 |
| Efficient Floating-Point Square Root and Reciprocal Square Root Algorithms. <i>Leonid Moroz, Volodymyr Samotyy, Mariusz Węgrzyn, Ulyana Dzelendzyak</i> .....  | 552 |

|   |     |
|---|-----|
| 7 Level New Modified Cascade H Bridge Multilevel Inverter with Modified PWM Controlled Technique. <i>Shivinder Mehta, Vinod Puri</i> .....  | 560 |
| Optimization of Linguistic Terms' Shapes and Parameters: Fuzzy Control System of a Quadrotor Drone. <i>Oleksandr Skakodub, Oleksiy Kozlov, Yuriy Kondratenko</i> .....  | 566 |
| Development of an Intelligent Robotic System for Plasma Processing of Industrial Products with Complex Shape. <i>Assel Kussaiyn-Murat, Alexander Krasavin, Darya Alontseva, Albina Kadyroldina, Alexandr Khozhanov, Iurii Krak, Patricia Muñoz de Escalona, Irina Dyomina</i> ..... | 572 |
| WSN for Food Product Quality Control. <i>Volodymyr Romanov, Igor Galelyuka, Oleksandr Voronenko</i> .....   | 580 |
| Knowledge and Trust Nexus Support the Link Among Six-sigma and Project Success: A Case of Developing Country. <i>Asadullah, Wajid Shakeel Ahmad, Rao Aamir Khan</i> .....   | 584 |
| The Testing Mechanism for Software and Services Based on Mike Cohn's Testing Pyramid Modification. <i>Vadym Mukhin, Yaroslav Kornaga, Yurii Bazaka, Ievgen Krylov, Andrii Barabash, Alla Yakovleva, Oleg Mukhin</i> .....   | 589 |
| A Band Selection Method for Hyperspectral Image Based on Binary Coded Hybrid Rice Optimization Algorithm. <i>Zhiwei Ye, Shiqin Liu, Xinlu Zong, Zhe Shu, Xiaoyu Xia</i> .....   | 596 |

## Volume 2

|   |     |
|---|-----|
| Optimal Decomposition of Control of Distributed Cyber-physical System. <i>Volodymyr Dubovoi, Demian Sembrat, Mariia Yukhymchuk</i> .....                                    | 601 |
| Data Augmentation using GAN for Sound based COVID 19 Diagnosis. <i>Nishant Yella, Bina Rajan</i> .....  | 606 |
| Indoor Positioning Model Based on Support Vector Regression Optimized by the Sparrow Search Algorithm. <i>Hua Li, Jun Su, Wufei Liu, Yucheng Zhang, Xianjing Zhou</i> ..... | 610 |
| CNN-based Tree Model Extraction. <i>Karim Ben Alaya, Laszlo Czuni</i> .....   | 616 |
| A Feature Selection Method Based on Hybrid Natural Inspired Algorithms. <i>Xiaoyu Xia, Zhiwei Ye, Shuang Sun</i> .....  | 621 |

|   |     |
|---|-----|
| Modeling an Intelligent Solar Power Plant Control System Using Colored Petri Nets.<br><i>Aleksandr Gozhyj, Irina Kalinina, Vladyslav Nechakhin, Victor Gozhyj, Victoria Vysotska</i> .....  | 626 |
| Critical IT Infrastructure Resource Distribution Algorithm. <i>Yaroslav Dorogy, Vasyl Tsurkan, Volodymyr Mokhor, Olena Doroha-Ivaniuk</i> .....   | 632 |
| Modeling of Multi-Core CPU Power Consumption during Online Video Conference.<br><i>Iryna Zhuravska, Kateryna Obukhova</i> .....   | 640 |
| Soil Moisture Estimation based on the RSSI of RFID Modules. <i>Roberta Avanzato, Francesco Beritelli, Giacomo Capizzi, Christian Napoli, Corrado Rametta</i> .....  | 647 |
| Mathematical Model of the Basic Measuring Neuron in a Self-routing Analog-to-digital Converter. <i>Anton Posyagin</i> .....   | N/A |
| Smart Care in Smart Cities - Scenario Analysis for an Innovative Care Platform.<br><i>Jelena Bleja, Lars Engelmann, Dominik Wiewelhove, Uwe Grossmann</i> .....   | 657 |
| Modeling Datasets in Distributed Monitoring Systems. <i>Yana Bekeneva</i> .....   | 663 |
| Online Identification of Magnetic Flux in MR Actuators. <i>Janusz Gołdasz</i> .....   | 668 |
| Melanoma Detection using Two Neural Networks. A Comparison Study. <i>Hakan Meva, Dan Popescu, Loretta Ichim</i> .....   | 673 |
| Online Pattern Recognition of Time-series Gas Sensor Data with Adaptive 2D-CNN Ensemble. <i>Vishakha Pareek, Santanu Chaudhury, Sanjay Singh</i> .....  | 679 |
| Gas Discrimination & Quantification using Sensor Array with 3D Convolution Regression Dual Network. <i>Vishakha Pareek Santanu Chaudhury, Sanjay Singh</i> .....  | 684 |
| Extending the Multiphysics Modelling of Electric Machines in a Digital Twin Concept. <i>Gabriel Mendes, Ângela Ferreira</i> .....   | 689 |
| A Low-complexity, FPGA-based Maximum Power Point Tracking Circuit, for Wide Range Light-energy Harvesting. <i>Konstantinos Kozalakis, Vasiliki Gogolou, Vasileios Konstantakos, Kostas Siozios, Stylianos Siskos and Theodore Laopoulos</i> ..... | 694 |
| A Hybrid Rice Optimization Algorithm with Ant System for Feature Selection.<br><i>Zhiwei Ye, Zhe Shu, Shiqin Liu, Xiaoyu Xia</i> .....  | 700 |
| Implementation of Language Processing Tools for the University Quality System.<br><i>Yevhenii Shendrikov, Daria Tabunshchyk, Sergey Subbotin, Peter Arras, Galyna Tabunshchyk</i> .....   | 705 |
| Investigation of the Use of Protective Characteristics of Single-layer Reflective Coating Films of Hafnium Dioxide to Counter Special Cyber Espionage Devices.  |     |

|   |     |
|---|-----|
| <i>Valerii Dudykevych, Nazarii Dzianyi, Ivan Opirskyy, Larysa Rakobovchuk, Petro Haraniuk</i> .....   | 709 |
| Development of Sound Identification System for Domestic Actions Recognition. <i>Artem Sazonov, Arūnas Lipnickas, Rytis Augustauskas, Anatolii Zhuchenko, Dmytro Kovaliuk, Anton Korotynskyy</i> .....   | 714 |
| Search of the Deviation from the Natural Process Using Stepanets Approach for Classification of Functions. <i>Oleg Chertov, Ivan Zhuk, Anatolii Serdyuk</i> . ....  | 720 |
| Deep Neural Network Models for the Recognition of Traffic Signs Defects. <i>Amr M. Nagy, Laszlo Czuni</i> .....   | 725 |
| RGB-D Sensors Extrinsic Calibration In Controlled Environment. <i>Krasimir Tonchev, Agata Manolova, Nikolay Neshov, Vladimir Poulkov</i> .....  | 730 |
| Semantic Segmentation of 3D Facial Models Using 2D Annotations. <i>Krasimir Tonchev, Radostina Petkova, Nikolay Neshov, Agata Manolova</i> . ....   | 736 |
| Computational Intelligence Application to Reproduce a Map of Surface Deviations based on the Results of Remote Measurements. <i>Mykhaylo Palamar, Myroslava Yavorska, Igor Zelinskyy, Mykhaylo Strembitskyi</i> . ....                              | 741 |
| Application of a Laser Total Station to Control the Shape of the Mirror Antenna Reflector. <i>Igor Zelinskyy, Mykhaylo Palamar, Myroslava Yavorska</i> . ....   | 745 |
| Modeling the Stabilization Factors of Monetary Unions in Turbulent Economics. <i>Aikaterini-Sotiria Argyriou, Mariia Lyzun, Ihor Lishchynskyy, Yevhen Savelyev, Vitalina Kuryliak, Iryna Ivashkiv, Svitlana Sachenko</i> .....                      | 749 |
| Performance Evaluation of the Classic McEliece Key Encapsulation Algorithm. <i>Alexandr Kuznetsov, Maria Lutsenko, Mykhaylo Bagmut, Victor Zhora</i> . ....   | 755 |
| Correction of Uncertain Access Points Positions in Underground Mines Using SLAM Approach. <i>Dmitry Larionov, Oleg Lukashenko, Alex Moschevikin, Roman Voronov, Axel Sikora</i> .....   | 761 |
| Optimization Methods on the Wavelet Transformation Base for Technical Diagnostic Information Systems. <i>Galina Shcherbakova, Viktor Krylov, Wan Qianqi, Bohdan Rusyn, Anatolii Sachenko, Pavlo Bykovyy, Diana Zahorodnia, Lukasz Kopania</i> ..... | 767 |
| Generalized Approach to Modelling Architecture of Transaction Processing Information Systems. <i>Kateryna Yalova, Kseniia Yashyna</i> .....   | 774 |
| The Approach for IoT Malware Detection Based on Opcodes Sequences Pattern Mining. <i>Dmytro Denysiuk, Kira Bobrovnikova, Sergii Lysenko, Oleg Savenko, Piotr Gaj, Roman Havryliuk, Yaroslav Boichuk</i> . ....                                      | 779 |

|   |     |
|---|-----|
| Optimization of UAV-Femtocell Systems Positioning via Game Theory to Geolocate Mobile Terminals in a Post-Earthquake Scenario. <i>Roberta Avanzato, Francesco Beritelli, Fabio Raciti, Enrica Spataro</i> .....   | 785 |
| An Object-oriented Architecture of the Information System for Solving the Protein Folding Problem. <i>Iryna Fefelova, Andrey A. Fefelov, Oleksii K. Tyshchenko, Volodymyr I. Lytvynenko</i> .....                 | 791 |
| Fault Diagnosis of Communication Equipment Gear based on Deep Learning. <i>Peng Yongjun, Guo Rui, Dai Zheng, Yang Xuehui, WAN Anping, Hu Zhengbing</i> .....  | 797 |
| Identifying the Behaviors of an Industrial Plant: Application to Industry 4.0. <i>Dylan Molinie, Kurosh Madani, Corentin Amarger</i> .....  | 802 |
| Exploiting VPN Bonding for Time Critical Video Transmission on Board Drone. <i>Roberta Avanzato, Francesco Beritelli, Corrado Rametta, Michele Russo</i> .....  | 808 |
| Real-time Multi Pose Trajectory Tracking based on OpenPose keypoints. <i>Adam Surówka</i> .....   | 813 |
| The Detection of Inter-turn Shorting in Induction Motor by Means of Using Algorithm of Decision Tree. <i>Maciej Sułowicz, Ryszard Mielnik, Marcin Tomczyk</i> .....   | 818 |
| A Simple Reinforcement Learning Algorithm for Stock Trading. <i>Pierre Fiorini, Pierce-Gabriel Fiorini</i> .....  | 824 |
| Ontological-based ABAC and Blockchain Organizational Cooperation Framework for Security Management in AmI environment. <i>Manal Lamri, Lyazid Sabri, Abdelhak Boubetra</i> .....                                  | 831 |
| Machine Learning Methods in Energy Consumption Optimization Assessment in Food Processing Industry. <i>Piotr Milczarski, Zofia Stawska, Artur Hłobaż, Bartosz Zieliński, Paweł Maślanka, Piotr Kosiński</i> ..... | 835 |
| Abnormality Detection and Segmentation in Breast Digital Mammography Images Using Neural Network. <i>Nixon Dutta, Basabi Chakraborty</i> .....  | 841 |
| Finite Element Analysis of a Magnetocell for MR Elastomers. <i>Zuzanna Mielnik, Denys Gutenko</i> .....   | 847 |
| Multi-Agent Decision Making System based on Membrane Computing. <i>Silvia Munteanu, Viorica Sudacevschi, Victor Ababii, Olesea Borozan, Constantin Ababii, Victor Laşco</i> .....                                 | 851 |
| Markov Clustering Algorithms and Their Application in Analysis of PPI Network of Malaria Genes. <i>Mamata Das, PJA Alphonse, Selvakumar Kamalanathan</i> .....  | 855 |
| Intrusion Detection System for 5G with a focus on DOS/DDOS attacks. <i>Giorgi Iashvili, Maksim Iavich, Razvan Bocu, Roman Odarchenko, Sergiy Gnatyuk</i> .....  | 861 |

|  |     |
|--|-----|
| Applying an Improved DBSCAN Clustering Algorithm to Network Intrusion Detection. <i>Shunyu Yao, Hui Xu, Lingyu Yan, Jun Su</i> .....   | 865 |
| A Personnel Rating Optimization Algorithm. <i>Jianyu Yuan, Chunyan Yan, Zhiwei Ye</i> .....  | 869 |
| Construction and Performance Analysis of a Groomed Polarity Lexicon Derived from Product Review Source Datasets. <i>Derek Colley, Md Asaduzzaman</i> .....   | 875 |
| PER-COVID (PEople pRoximity based on Certified and coOperative VIDEo-intelligence): A Software Tool for Physical Distancing and PPE Monitoring. <i>Michele Russo, Roberta Avanzato, Francesco Beritelli</i> .....                            | 881 |
| Optimizing Occupant Actions to Enhance his Comfort while Reducing Energy Demand in Buildings. <i>Fateh Boulmaiz, Amr Alzouhri Alyafi, Stephane Ploix Patrick Reignier</i> .....  | 886 |
| FPGA Implementation of Interleaved Modular Multiplier with Improved Area-time Efficiency. <i>Radu-Mihai Coliban</i> .....  | 895 |
| IoT-enabled Smart Energy Metering Solution with Soft-UPS for Developing Countries. <i>Mahnoor Aftab, Aamna Nasir Hameed, Ali Samiq, Muhammad Bilal Shah, Muhammad Adeel Pasha, Nauman Ahmad Zaffar, Amrut Ganesh Dant, Axel Sikora</i> ..... | 899 |
| A Super-resolution Method of Remote Sensing Image Using Transformers. <i>Chongjun Ye, Lingyu Yan, Yucheng Zhang, Jun Zhan, Jie Yang, Junfang Wang</i> .....  | 905 |
| A CNN-based Audio Sensor for Rainfall Estimation: Implementation on Embedded Board. <i>Michele Russo, Valerio Francesco Puglisi, Roberta Avanzato, Francesco Beritelli</i> .....   | 911 |
| Artificial Neural Networks in Export and Import Forecasting: An Analysis of Opportunities. <i>Mykhailo R. Luchko, Nataliia Dziubanovska, Oksana Arzamasova</i> .....   | 916 |
| Car Social Network: Contact a Driver Through the License Plate. <i>Michele Russo, Giovanni Mirulla, Roberta Avanzato, Francesco Beritelli</i> .....  | 924 |
| Investigation of the Broken Authentication Vulnerability in Web Applications. <i>Yuriy Lakh, Elena Nyemkova, Andrian Piskozub, Viktor Yanishevskiy</i> .....   | 928 |
| Air Quality Sensor Data Collection and Analytics with IoT for an Apartment with Mechanical Ventilation. <i>Lukasz Scislo, Nina Szczepanik-Scislo</i> .....   | 932 |
| The Reduction of Fully Connected Neural Network Parameters Using the Pre-training Technique. <i>Aliaksandr Kroshchanka, Vladimir Golovko</i> .....   | 937 |
| The Estimate of Informative Parameters Based on the Neural Network Approach During Monitoring of the Geotechnical System. <i>Nikolay V. Dorofeev, Ekaterina S. Pankina, Maxim S. Goryachev</i> .....   | 942 |

|  |      |
|--|------|
| Assessment of Key Bifurcation Zones in the Information and Analytical System of Geotechnical Monitoring. <i>Nikolay V. Dorofeev, Ekaterina S. Pankina, Maxim S. Goryachev.</i> .....   | 947  |
| Analysis of Secure Routing Processes Using Traffic Engineering Model. <i>Oleksandr Lemeshko, Oleksandra Yeremenko, Maryna Yevdokymenko, Anastasiia Shapovalova, Valentyn Lemeshko, Mykhailo Persikov.</i> .....                    | 951  |
| Lanchester's Equations and Cyberwarfare. <i>George Markowsky, Linda Markowsky.</i> .....   | 956  |
| On Geometric Properties of Adversarial Examples. <i>Andrii Ivaniuk, Galyna Kriukova.</i> .....   | 964  |
| Hybrid Classic-Quantum Neural Networks for Image Classification. <i>Yevhenii Trochun, Sergii Stirenko, Oleksandr Rokovyi, Oleg Alienin, Evgen Pavlov, Yuri Gordienko.</i> .....  | 968  |
| Convolutional and Recurrent Neural Networks for Physical Action Forecasting by Brain-Computer Interface. <i>Kostiantyn Kostiukevych, Sergii Stirenko, Nikita Gordienko, Oleksandr Rokovyi, Oleg Alienin, Yuri Gordienko.</i> ..... | 973  |
| Particularities of Sync Monitoring in FPGA Components of Safety-Related Systems. <i>Oleksandr Drozd, Anatoliy Sachenko, Robert Hiromoto, Kostiantyn Zashcholkin, Myroslav Drozd.</i> .....   | 979  |
| Verification Model for Agent Coordination of Distributed Information Systems. <i>Oleksandr Martynyuk, Oleksandr Drozd, Anatoliy Sachenko, Hanna Stepova, Dmitry Martynyuk, Lyudmila Sugak, Iryna Turchenko.</i> .....              | 984  |
| The Hybrid Research Stand based on LabVIEW within IoT. <i>Oleksandr Osolinskyi, Volodymyr Kochan, Liubomyr Kolodiichuk, Grygoriy Sapozhnyk, Agnieszka Molga.</i> .....   | 990  |
| Biometric Identification via Oculomotor System Based on the Volterra Model. <i>Vitaliy Pavlenko, Tetyana Shamanina, Vladislav Chori.</i> .....   | 997  |
| An Implantable Bipolar Active Charge Balancing Circuit with Six Adjustment Current levels for Facial Paralysis Patients. <i>Ganesh Lakshmana Kumar Moganti, V N Siva Praneeth, Siva Rama Krishna Vanjari.</i> .....                | 1004 |
| Blockchain Model Testing and Implementation Based on Improved PBFT Consensus. <i>Qianyu Zhang, Jun Su, Zhaohui Ma, Yucheng Zhang, Jie Yang, Jun Zhan.</i> .....  | 1010 |
| Real-Time Patient Ailment Monitoring Framework Collaborating Enhanced CNN Architectures. <i>Yeaminur Rahman, Rezwana Mahfuza, Md. Abdul Hai, Rafsan Shartaj Uddin, Muhammad Iqbal Hossain.</i> .....                               | 1016 |
| NILM Application for Real Time Monitoring of Appliances Energy Consumption. <i>Krzysztof Dowalla, Piotr Bilski, Robert Łukaszewski, Augustyn Wójcik, Ryszard Kowalik.</i> .....  | 1022 |

|  |      |
|--|------|
| Accurate Modelling of Temperature Sensors using the Polynomial Method. <i>Krzysztof Tomczyk, Grzegorz Nowakowski and Bartłomiej Ligeza</i> .....   | 1026 |
| Path Planning Based on Improved Ant Colony Optimization in Congestion. <i>Ying Ma</i> .....  | 1030 |
| WiFi Indoor Location Method Based on RSSI. <i>Xin Li, Zhongliang Deng, Fuxing Yang, Xinyu Zheng, Likai Zhang, Zheng Zhou</i> .....   | 1036 |
| Vector Simulation of Logic Faults Based on XOR-Relations. <i>Vladimir Hahanov, Svetlana Chumachenko, Eugenia Litviniva, Hanna Khakhanova</i> .....   | 1041 |
| An Artificial Intelligence Hearing Aid Based on Two-level Neural Network. <i>Chaoyang Zhao, Chun Liu</i> .....   | 1045 |
| Sentiment Analysis of Movie Reviews based on Pretraining and Dual Branch Coding. <i>Feihong Wang, Gang Liu, Zhiwen Wang, Xinyun Wu</i> .....   | 1051 |
| Bloom Filter Based Graph Database CRUD Optimization for Stream Data. <i>Alisettar Hüseyinli, M. Ali Akcayol</i> .....  | 1056 |
| COVID-19 Lungs Assessment in Chest X-ray Images using Convolutional Neural Networks. <i>Piotr Milczarski, Michał Beczkowski, Norbert Borowski</i> .....  | 1062 |
| Passive Eavesdropping Attack of Several Intruders on Deterministic Protocol with Pairs of Entangled Qubits. <i>Yevhen Vasiliu, Tetiana Okhrimenko, Andriy Fesenko, Sergiy Dorozhynskyy</i> ..... | 1068 |
| Permutation-Based Frame Synchronisation Method for Short Packet Communication Systems. <i>Emil Faure, Anatoly Shcherba, Bohdan Stupka</i> .....  | 1073 |
| Application of Machine Learning Methods in Carbon Footprint Optimization. <i>Piotr Milczarski</i> .....  | 1078 |
| Forecasting Day-Ahead Electricity Price with Artificial Neural Networks: A Comparison of Architectures. <i>Milutin Pavićević, Tomo Popović</i> .....   | 1083 |
| Modeling an Enhancement of Optical Effect of Nano sphere on Organic Light Emitting Diode. <i>Megha Munikumar, Namratha Shetty T. Gopalkrishna, Divya Venkatesh, Chaya B Muniraju</i> .....       | 1089 |
| Method of Finding Cover Signal for Audio Steganalysis Calibrated Methods. <i>Hanna Martyniuk, Valeriy Kozlovskiy, Tetiana Meleshko, Anton Sorokun</i> .....                                      | 1095 |
| Neural Network Based Intelligent Traffic System. <i>Saathvik B. M., Vinayak Gupta, Ayush Kedia, Lov Asawa and Karpagavalli Subramanian</i> .....   | 1101 |
| Analysis of Anomaly Detection and Identification Methods in 5G Traffic. <i>Tamara Radivilova, Lyudmyla Kirichenko, Oleksandr Lemeshko, Dmytro Ageyev, Oksana Mulesa, Andrii Ilkov</i> .....      | 1108 |



|   |      |
|---|------|
| Development of CCTV-camera-based System for Detection of Anomalous Behaviors in Penitentiary Institutions. <i>Piotr Bilski, Andrzej Buchowicz, Brunon Hołyst, Konrad Jędrzejewski, Marcin Lewandowski, Paweł Mazurek, Jacek Olejnik</i> ..... | 1114 |
| Linear Fold and Tree Fold in Creation of Binary Decision Diagrams of Standard Benchmarks. <i>Michal Mrena, Peter Sedlacek, Miroslav Kvassay</i> .....   | 1120 |
| General Considerations about Simulating Energy Communities. <i>Mircea Stefan Simoiu, Ioana Fagarasan, Stephane Ploix, Vasile Calofir, Sergiu Stelian Iliescu</i> .....  | 1126 |
| Intelligent Method of Predicting the Discount Rate Trend. <i>Viktor Koziuk, Hrystyna Lipyaniina-Goncharenko</i> .....   | 1132 |
| Formal Methods of FPGA Project Verification Flow. <i>Serhii Naumenko, Viktoriia Moskalets, Oleg Odarushchenko, Elena Odarushchenko, Volodymyr Peschanenko, Larysa Degtyareva, Oleksandr Letychevskiy</i> .....                                | 1141 |
| Features of Information Support for Safe Maneuvering in Different Road Conditions in an Unmanned Semi-trailer Road Train with a Traffic Control System. <i>Oleksandr Piskachov, Maryna Kolisnyk</i> .....                                     | 1147 |
| Optimal Feature Selection for Deep Learning-Based Anomaly Detection in 5G. <i>Taras Maksymyuk, Nazarii Lutsiv, Bohdan Shubyn, Mykola Beshley, Longzhe Han and Juraj Gazda</i> .....   | N/A  |
| Availability Assessment of a Cloud Server System: Comparing Markov and Semi-Markov Models. <i>Oleg Ivanchenko, Vyacheslav Kharchenko, Boris Moroz, Yuri Ponochovnyi, Larysa Degtyareva</i> .....  | 1157 |
| The Fault Tolerant Černý Finite State Machine: a Concept and VHDL Models. <i>Vyacheslav Kharchenko, Sergey Tyurin, Herman Fesenko, Oleg Goncharovskij</i> .....   | 1163 |
| Rehabilitation According to the Biological Feedback. <i>Aleksandr Kurgaev, Oleksandr Palagin</i> .....  | 1170 |
| Distributed Diagnostics System for Pump Maintenance. <i>Paweł Orkisz, Krzysztof Polak</i> .....   | 1176 |
| Evolution of Models and Methods in the Field of Resilient Computing. <i>Oleksandr Drozd, Adam Ustynowicz, Andrzej Rucinski, Anatoliy Sachenko, Julia Drozd</i> .....  | 1180 |
| On Visualization of Regulatory and Evolutionary Processes Towards Climate Changes. <i>Yury Kolokolov, Anna Monovskaya, Kondo Adjallah, Anatoly Sachenko</i> .....   | 1186 |
| Competences Management for the Digital Transformation: Development of an Assessment Method. <i>Nargiza Mikhridinova, Carsten Wolff, Bassam Hussein</i> .....  | 1190 |

Adaptive Management of Digitalization Projects for Efficiency Increasing. *Michael Dombrowski, Zbyszek Dombrowski, Jacek Woloszyn, Anatoliy Sachenko, Oleg Sachenko, Inna Melnychuk*..... 1195

Issues of Intelligent Data Acquisition and Quality for Manufacturing Decision-support in an Industry 4.0 Context. *Tangxiao Yuan, Kondo Hloindo Adjallah, Alexandre Sava, Huifen Wang, Linyan Liu*..... 1200