

Preface

Tetiana A. Vakaliuk^{1,2,3,4}, Serhiy O. Semerikov^{3,5,1,4}

¹Zhytomyr Polytechnic State University, 103 Chudnivsyka Str., Zhytomyr, 10005, Ukraine

²Institute for Digitalisation of Education of the NAES of Ukraine, 9 M. Berlynskoho Str., Kyiv, 04060, Ukraine

³Kryvyi Rih State Pedagogical University, 54 Gagarin Ave., Kryvyi Rih, 50086, Ukraine

⁴Academy of Cognitive and Natural Sciences, 54 Gagarin Ave., Kryvyi Rih, 50086, Ukraine

⁵Kryvyi Rih National University, 11 Vitalii Matusevych Str., Kryvyi Rih, 50027, Ukraine

Abstract

This article describes the doors-2023: 3rd **Edge Computing Workshop**, which was held in Zhytomyr, Ukraine, on April 7, 2023. The proceedings of the workshop include the 9 contributed papers that were carefully peer-reviewed and selected from 12 submissions.

Keywords

algorithms and techniques for machine learning and AI at the edge, cellular infrastructure for edge computing, distributed ledger technology and blockchain at the edge, edge computing infrastructure and edge-enabled applications, edge-based data storage and databases, edge-optimized heterogeneous architectures, fault-tolerance in edge computing, fog computing models and applications, geo-distributed analytics and indexing on edge nodes, hardware architectures for edge computing and devices, innovative applications at the edge, interoperability and collaboration between edge and cloud computing, monitoring, management, and diagnosis in edge computing, processing of IoT data at network edges, programming models and toolkits for edge computing, resource management and Quality of Service for edge computing, security and privacy in edge computing

1. Introduction

1.1. doors 2023: At a glance

Peter the Great hacked through a window to Europe. We use doors.

Edge Computing Workshop (*doors*) is a peer-reviewed international Computer Science workshop focusing on research advances and applications of edge computing, a process of building a distributed system in which some applications, as well as computation and storage services, are provided and managed by

- (i) central clouds and smart devices, the edge of networks in small proximity to mobile devices, sensors and end users, and

doors-2023: 3rd Edge Computing Workshop, April 7, 2023, Zhytomyr, Ukraine


✉ tetianavakaliuk@acnsi.org (T. A. Vakaliuk); semerikov@gmail.com (S. O. Semerikov)

🌐 <https://acnsi.org/vakaliuk/> (T. A. Vakaliuk); <https://kdpu.edu.ua/semerikov> (S. O. Semerikov)

🆔 0000-0001-6825-4697 (T. A. Vakaliuk); 0000-0003-0789-0272 (S. O. Semerikov)



© 2023 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

 CEUR Workshop Proceedings (CEUR-WS.org)

- (ii) others are provided and managed by the center cloud and a set of small in-between local clouds supporting IoT at the edge.

The goal of *doors* is to bring together researchers and practitioners from academia and industry working on edge computing to share their ideas, discuss research/work in progress, and identify new/emerging trends in this important emerging area. The emergence of the Internet of Things (IoT) and the demand for responsiveness, privacy, and situation-awareness are pushing computing to the edge of the Internet. There are many challenges in the design, implementation, and deployment of different aspects of edge computing: infrastructure, systems, networking, algorithms, applications, etc. *doors* would like to open discussions in these areas.

doors topics of interest since 2021:

- algorithms and techniques for machine learning and AI at the edge
- cellular infrastructure for edge computing
- distributed ledger technology and blockchain at the edge
- edge computing infrastructure and edge-enabled applications
- edge-based data storage and databases
- edge-optimized heterogeneous architectures
- fault-tolerance in edge computing
- fog computing models and applications
- geo-distributed analytics and indexing on edge nodes
- hardware architectures for edge computing and devices
- innovative applications at the edge
- interoperability and collaboration between edge and cloud computing
- monitoring, management, and diagnosis in edge computing
- processing of IoT data at network edges
- programming models and toolkits for edge computing
- resource management and Quality of Service for edge computing
- security and privacy in edge computing

During the war in Ukraine, the *doors* 2023 was in hybrid mode (both in-person and online).

This volume represents the proceedings of the 3rd Edge Computing Workshop (*doors* 2023), held in Zhytomyr, Ukraine, on April 7, 2023. It comprises 9 contributed papers that were carefully peer-reviewed and selected from 12 submissions (<https://notso.easyscience.education/doors/2023/>). Each submission was reviewed by at least 3, and on the average 3.2, program committee members. The accepted papers present the state-of-the-art overview of successful cases and provides guidelines for future research.

2. *doors* 2023 committees

2.1. Program committee

- *Mehdi Ammi*, University of Paris 8, France

- *Abhineet Anand*, Chitkara University, India
- *Josef Cernohorsky*, Technical university of Liberec, Czech Republic
- *Lubomir Vankov Dimitrov*, Technical University-Sofia, Bulgaria
- *Olena Glazunova*, National University of Life and Environmental Sciences of Ukraine, Ukraine
- *Mahmud Hossain*, Visa Inc., United States
- *Attila Kertesz*, University of Szeged, Hungary
- *Valerii Kontsedailo*, Inner Circle, Netherlands
- *Vyacheslav Kryzhanivskyy*, R&D Seco Tools AB, Sweden
- *Nagender Kumar Suryadevara*, University of Hyderabad, India
- *Gyu Myoung Lee*, Liverpool John Moores University, United Kingdom
- *Nadiia Lobanchykova*, Zhytomyr Polytechnic State University, Ukraine
- *Taras Maksymyuk*, Lviv Polytechnic National University, Ukraine
- *Mykhailo Medvediev*, ADA University, Azerbaijan
- *Franco Milano*, University of Florence, Italy
- *BongKyo Moon*, Dongguk University, Korea
- *Leonardo Mostarda*, University of Camerino, Italy
- *Tetiana Nikitchuk*, Zhytomyr Polytechnic State University, Ukraine
- *Shadi A. Noghabi*, Microsoft Research, United States
- *Igor Puleko*, Zhytomyr Polytechnic State University, Ukraine
- *Djamel Eddine Saidouni*, MISC Laboratory, University Constantine 2 – Abdelhamid Mehri, Algeria
- *Gwen Salaun*, University Grenoble Alpes, France
- *Serhiy Semerikov*, Kryvyi Rih State Pedagogical University, Ukraine
- *Etibar Seyidzade*, Baku Engineering University, Azerbaijan
- *Andrii Striuk*, Kryvyi Rih National University, Ukraine
- *Inna Suhoniak*, Zhytomyr Polytechnic State University, Ukraine
- *Tetiana Vakaliuk*, Zhytomyr Polytechnic State University, Ukraine
- *Pedro Valderas*, Universitat Politècnica de València, Spain
- *Tetiana Voloshyna*, National University of Life and Environmental Sciences of Ukraine, Ukraine
- *Volodymyr Voytenko*, Athabasca University, Canada
- *Xianzhi Wang*, University of Technology Sydney, Australia
- *Michael Wei*, VMware Research, USA
- *Eiko Yoneki*, University of Cambridge, United Kingdom
- *Pamela Zave*, Princeton University, USA

2.2. Organizing committee

- *Tetiana Nikitchuk*, Zhytomyr Polytechnic State University, Ukraine
- *Andrii Morozov*, Zhytomyr Polytechnic State University, Ukraine
- *Serhiy Semerikov*, Kryvyi Rih State Pedagogical University, Ukraine
- *Andrii Striuk*, Kryvyi Rih National University, Ukraine
- *Tetiana Vakaliuk*, Zhytomyr Polytechnic State University, Ukraine

2.3. Workshop chairs

Dr. **Tetiana Vakaliuk**, Professor of Software Engineering and Educational Technology, Zhytomyr Polytechnic State University, Ukraine.

Tetiana Vakaliuk, born in 1983, received a Candidate of Pedagogical Sciences degree from the National Pedagogical Dragomanov University, Ukraine, in 2013, and a Doctor of Pedagogical Sciences degree from the Institute of Information Technologies and Learning Tools of the National Academy of Sciences of Ukraine, in 2019. Since 2019, she has been working in the field of information technologies at the Zhytomyr Polytechnic State University. Her research interests include Information Systems and Technology (e.g., Edge Computing), and Educational Technology. She has published a number of papers in international journals. She is a member of editorial boards of the Information Technologies and Learning Tools, Educational Technology Quarterly, Educational Dimension, and editor-in-chief of the Journal of Edge Computing.

WWW: <https://acnsi.org/vakaliuk/>

ResearchGate: <https://www.researchgate.net/profile/Tetiana-Vakaliuk>

Google Scholar: <https://scholar.google.com.ua/citations?hl=en&user=Ka98KhMAAAAJ>

ORCID: <https://orcid.org/0000-0001-6825-4697>

Scopus: <https://www.scopus.com/authid/detail.uri?authorId=57211133927>

dblp: <https://dblp.org/pid/277/6092.html>

Web of Science: <https://www.webofscience.com/wos/author/record/C-3650-2016>

Email: tetianavakaliuk@acnsi.org

Serhiy Semerikov is a Professor of the Department of Computer Science and Applied Mathematics at Kryvyi Rih State Pedagogical University. He is an expert in the field of education, particularly in the area of informatics. Dr. Semerikov has over 25 years of experience in academia and has made significant contributions to the field of education through his research, teaching, and service.

Dr. Semerikov earned his PhD in Education (Informatics) from the National Pedagogical Dragomanov University in 2001. He went on to earn his Doctor of Science (DSc) in Education (Informatics) from the same institution in 2009. His doctoral research focused on the development of methods for the effective use of computer technologies in the education process.

As a leading expert in his field, Dr. Semerikov's research has focused on the development and implementation of innovative teaching methods and educational technology. He has published numerous articles and papers on topics such as the use of virtual and augmented reality in education, the design of effective e-learning environments, and the development of adaptive learning systems. He is also the author of several textbooks on informatics and educational technology. He has also received several research grants from the Ukrainian government and other funding organizations to support his research projects.

Dr. Semerikov has been actively involved in the academic community throughout his career. He has served as a reviewer for several academic journals and has presented his research at numerous conferences and workshops. He is a member of several professional organizations, including the Association for Computing Machinery (ACM) and the Academy of Cognitive and Natural Sciences (ACNS).

WWW: <https://kdpu.edu.ua/semerikov/>

ResearchGate: <https://www.researchgate.net/profile/Serhiy-Semerikov>

Google Scholar: <https://scholar.google.com/citations?user=o6srl8sAAAAJ>
ORCID: <https://orcid.org/0000-0003-0789-0272>
Scopus: <https://www.scopus.com/authid/detail.uri?authorId=56375008500>
dblp: <https://dblp.org/pers/hd/s/Semerikov:Serhiy>
Web of Science: <https://www.webofscience.com/wos/author/record/H-3067-2013>
Email: semerikov@gmail.com

3. Workshop overview

The proliferation of web applications in various aspects of our lives has increased the possibility of application security issues. With the rise of attacks on web applications, it is imperative to understand the typical weaknesses in web applications and the methods to minimize them. The study “Common vulnerabilities in real world web applications” examines the major security threats that can affect web applications, including request forgery attacks, injection attacks, cryptographic failures, and broken access control mechanisms, in the context of modern web frameworks widely used for developing web applications. The study is based on the OWASP Top Ten, a list of the most common and serious security threats to web applications. Authors also present best security practices recommended by professionals for each attack category that can prevent or mitigate attacks. This study aims to provide web developers with a better understanding of how to secure web applications.

Ensuring high reliability, fault tolerance, and continuity of computing processes in computer systems is achieved through the use of failover clusters, which combine computing resources for virtualization and enable the movement of virtual resources, services, or applications between physical servers while supporting continuity. The study “Cluster fault tolerance model with migration of virtual machines” focuses on failover clusters, consisting of two physical servers connected through a switch and a distributed storage system with synchronous data replication. A Markov model of the reliability of a failover cluster is proposed, taking into account the costs of migrating virtual machines and mechanisms that ensure continuity in the event of a failure. A simplified model is also presented, neglecting migration costs and providing an upper-reliability estimate. The reliability of the failover cluster is measured using the coefficient of non-stationary readiness, and the impact of virtual machine migration on the reliability is demonstrated. The results obtained can aid in selecting technologies for ensuring the failure stability and continuity of computing processes in computer systems with cluster architecture.

This article “Object detection method based on aerial image instance segmentation received by unmanned aerial vehicles in the conditions rough for visualization” explores the potential of unmanned aerial complexes for aiding in decision making during crisis situations that require object detection through aerial images obtained by unmanned aerial vehicles under conditions of atmospheric fog and smoke. The authors employ the Pansharpening method for image sharpening, which involves injecting dimensional details from a panchromatic image to a multispectral image. To improve the operational efficiency and accuracy of automotive vehicle detection in aerial images received by unmanned aerial vehicles, the authors implement the Hybrid Task Cascade for Instance Segmentation model. This model is particularly suitable for tasks involving small-sized object multiclass classification and detection in aerial images using

indirect signs. The findings of this study can contribute to the development of effective decision support systems for crisis management.

In the context of Russia's war against Ukraine, the article "An analysis of approach to the fake news assessment based on the graph neural networks" explores the challenges posed by disinformation campaigns and propaganda efforts, particularly their negative psychological impact on populations. The authors focus on the problem of identifying and monitoring online media content that contains such negative influence. To address this issue, they propose a novel approach based on graph neural networks for automating the process of detecting fake news. The article presents a thorough analysis of existing techniques for automated content analysis, highlighting the advantages of machine learning methods and graph neural networks in particular. The authors then describe their proposed approach and demonstrate its effectiveness through simulated detection of fake news. The results of the study indicate that the proposed approach using graph neural networks can successfully detect and respond to the threat of fake news spread by Russia, thus providing a valuable tool for maintaining information security in Ukraine.

The past few years have witnessed the swift growth of information systems, Internet of Things (IoT) technologies, and edge devices, resulting in the development of new sensors for constructing such systems, which have been increasingly integrated into people's lives, including their domestic and social environments. The microclimate of living spaces, workplaces, and educational institutions plays a critical role in maintaining people's well-being. Deviations from the norm in the environmental microclimate can negatively impact human physiological conditions, reduce concentration, and decrease work or study efficiency. To address this challenge, Oksana L. Korenivska, Tetiana M. Nikitchuk, Tetiana A. Vakaliuk, Vasyl B. Benedytskyi and Oleksandr V. Andreiev develop an autonomous IoT system based on edge devices to monitor the microclimate of classrooms around the clock. This system measures climatic parameters, such as temperature, relative humidity, carbon dioxide levels, and light air ion concentrations, records data on a smartphone, and stores it on a remote server. The system is a part of a larger project aimed at studying the impact of microclimate parameters on the physiological state of students. The findings of "IoT monitoring system for microclimate parameters in educational institutions using edge devices"

With the growth of cyber attacks targeting critical infrastructure and industrial IoT networks in Ukraine, effective solutions for detection and response are needed. These attacks have made Ukrainian networks a testing ground for new tactics and methods employed by Russian hackers. The study "Honeypot and cyber deception as a tool for detecting cyber attacks on critical infrastructure" focuses on the use of honeypot/honeynet networks and cyber deception platforms as sources of information for better understanding these attacks. While there is no universal solution for such systems, highly interactive honeypot systems and deception platforms can be used to build believable systems that collect information on the attack and actions of the attackers. The analysis of this information can improve network security and serve as evidence for prosecution. This article provides an overview of the use of honeypot/honeynet solutions and cyber deception for both general-purpose networks and industrial IoT networks.

Digital signal processing has become ubiquitous in modern science and technology, and the demand for improving the digital proportional-integral-derivative (PID) controller model remains high. The paper "Algorithm for optimizing a PID controller model based on a digital

filter using a genetic algorithm” addresses the challenge of constructing a model of a digital PID controller suitable for use in robotic systems with microcontrollers and programmable logic integrated circuits. Authors propose a novel approach that employs digital filtering methods as the foundation for the regulator and calculates digital filter coefficients with a genetic algorithm. This technique enhances model accuracy while using classical methods to calculate PID controller coefficients for an analog PID controller. The software implementation of the proposed method uses Python programming language, and the modeling results demonstrate the efficacy of the developed model. Authors’ findings suggest that their genetic algorithm-based digital filtering approach can help to optimize PID controllers in robotic systems.

PHP is a widely used programming language for web development, with numerous website engines and frameworks written in it. The paper “The system for testing different versions of the PHP” presents an in-depth analysis of various versions of PHP, including the recently released PHP 8. Authors describe the new and useful features of PHP 8, such as the JIT compiler and error correction, and their impact on both users and developers. To evaluate the performance of different PHP versions, authors have developed a testing system that can be extended with additional modules. Their results indicate that PHP 8 offers significant performance improvements over earlier versions, with the JIT compiler playing a crucial role. Authors also discuss the implications of their findings for web developers and suggest future research directions, including investigating the impact of PHP 8 on web application security and analyzing its use in large-scale web development projects.

In the paper “An academic events sub-system of the URIS and its ontology representation to improve scientific usability and motivation of scientists in terms of European integration” Viktor B. Shapovalov, Alla G. Zharinova, Sergiy S. Zharinov, Iryna O. Tsybenko and Oleksiy S. Krasovskiy propose an edge-based approach for collecting and processing academic event data in Ukraine. Authors first provide an overview of edge computing and its benefits, particularly in the context of data collection and processing. Authors then review existing systems in Europe, such as NARCIS, SICRIS, and Research.fi, and highlight the need for a similar system in Ukraine. Authors present a case diagram and list of relevant data for the proposed academic events system, as well as the essential EU legislation that must be considered. Authors investigate and describe systems proposed for interoperability with the proposed system, and present models for receiving data, URIs as the main component of the decentralized approach in science, and data exchange and interaction with their proposed database. The proposed system offers a novel solution for efficient and effective academic event data collection and processing in Ukraine, with potential applications for knowledge discovery from data.

4. Conclusion

The doors 2023 workshop was a resounding success, bringing together experts and professionals from various institutions and organizations to share their knowledge and ideas on edge computing. We express our gratitude to the [Academy of Cognitive and Natural Sciences](#) and Zhytomyr Polytechnic State University for their collaboration and support in the publishing of the *Journal of Edge Computing*.

We are immensely grateful to the authors and delegates who contributed to the success of

the workshop by submitting their papers and participating actively in the discussions. We appreciate the efforts of the program committee members and the peer reviewers who provided their guidance, feedback, and support in improving the quality of the papers. Their valuable contributions and constructive critical comments helped to shape the content of the conference and made it a memorable experience for all participants.

We would like to acknowledge the developers and professional staff of the *Academy of Cognitive and Natural Sciences* (<https://acnsci.org>) and the *Not So Easy Science Education* platform (<https://notso.easyscience.education>) for providing us with the excellent and comprehensive conference management system that facilitated the smooth running of the workshop.

Since 2021, our workshop is **sponsored** by the CEUR Workshop Proceedings (CEUR-WS.org), the world best Diamond Open-Access proceedings publisher for Computer Science workshops. Long live CEUR-WS.org!

We believe that the presentations and discussions at the workshop have broadened our professional horizons and will serve as a catalyst for further research and innovation in the field of digital transformation in education. We look forward to meeting again in doors 2024 with renewed energy, enthusiasm, and a commitment to advancing the cause of edge computing.