19th Conference on Computer Science and Intelligence Systems (FedCSIS 2024)

CONFERENCE REPORT

The 19th edition of the Conference on Computer Science and Intelligence Systems (FedCSIS 2024; www.fedcsis.org) took place in took place on September 8-11, 2024, in Belgrade, Serbia. The conference took place on-site, in the facilities of The Faculty of Management of the University of Belgrade.

FedCSIS 2024 was chaired by Ivan Lukovic, while Dragana Makajić-Nikolić was the Chair of the Organizing Committee. This year, FedCSIS was organized by the Polish Information Processing Society (Mazovia Chapter), IEEE Poland Section Computer Society Chapter, Systems Research Institute of Polish Academy of Sciences, The Faculty of Mathematics and Information Science Warsaw University of Technology, The Faculty of Electrical and Computer Engineering of the Rzeszów University of Technology, and The Faculty of Management of the University of Belgrade.

FedCSIS 2024 was technically co-sponsored by IEEE Poland Section, IEEE Serbia and Montenegro Section, Poland Section of IEEE Computer Society Chapter, Czechoslovakia Section of IEEE Computer Society Chapter, Serbia and Montenegro Section of IEEE Computer Society Chapter, Poland Section of IEEE Systems, Man, and Cybernetics Society Chapter, Poland Section of IEEE Computational Intelligence Society Chapter, Serbia and Montenegro Section of IEEE Computational Intelligence Society Chapter, Serbia and Montenegro Section of IEEE Education Society Chapter, Serbia and Montenegro Section of IEEE Young Professionals Affinity Group, Committee of Computer Science of Polish Academy of Sciences, Informatics Association of Serbia, and Mazovia Cluster ICT.

FedCSIS 2024 was organized in collaboration with the Strategic Partner: QED Software, and sponsored by the Ministry of Science, Technological Development and Innovation, Republic of Serbia, Banca Intesa, Nelt Group, Netconomy, Elsevier, Journal of Computer Languages, ONLYOFFICE Ascensio Systems d.o.o., Beograd, MDPI and Yettel Bank.

This year, we continued the process of modifying the structure of the conference. Starting from 2024, FedCSIS conferences have a single Main Track with 5 Topical Areas, Thematic Sessions and, possibly, Competitions. The slightly adjusted structure emphasizes the integrity of the conference and its closeness to the issues that are crucial for the world today. Here, we recognize the fact that, over the last few years, rapid progress of various forms of computational intelligence could have been observed. As the result, broadly understood, intelligence which was a separate research area became part of other areas that, previously, were explored independently. As a matter of fact, today (in 2024) it is difficult to envision research (and its applications) without an intelligence component. Reflecting this, all five Topical Areas, established within the FedCSIS Main Track, while being situated within a general domain of Computer Science, represent various aspects of Intelligence Systems. Moreover, the Thematic Sessions provide focal insights into selected areas Intelligence Systems, approached from different perspectives. Even the Data Mining Competition, having strong roots in artificial intelligence, data science and machine learning, can be seen as a path toward introducing more intelligence into real-world anchored computer systems. This vision has been depicted in Figure 1.

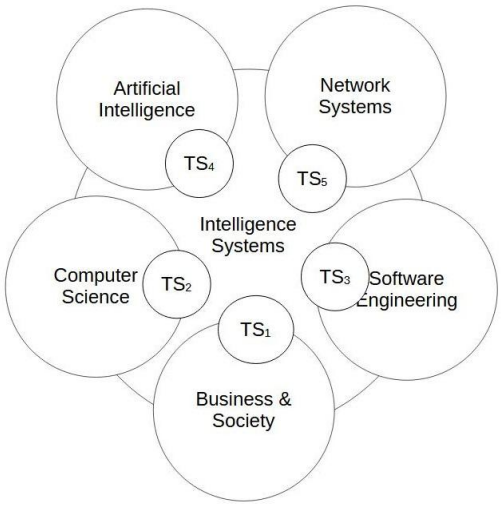

Figure 1. *FedCSIS Conference structure; birds-eye view; TSn denotes Technical Session.*

During FedCSIS 2024 the following Keynote and Invited presentations have been delivered:

- Frank, Ulrich, University of Duisburg-Essen, Germany, *keynote title*: Multi-Level Language Architectures: Fostering Reuse, Integration and User Empowerment by Allowing for Additional Abstraction
- Jovanović, Jelena, University of Belgrade, Serbia, *keynote title*: Learning analytics: Challenges and opportunities opened by AI
- Kutyniok, Gitta, Ludwig-Maximilians-Universität München, Germany, *keynote title*: Reliable AI: Successes, Challenges, and Limitations
- Tolvanen, Juha-Pekka, Metacase, Finland, *keynote title*: Languages for non-developers: what, how, where?
- Dujmović, Jozo, San Francisco State University, USA, invited presentation title: Graded Logic and Professional Decision Making

As noted above, FedCSIS 2024 consisted of a single Main Track (comprising five Topical Areas), Thematic Sessions and Competitions. Here, the designated Topical Areas were:

- Topical Area 1: Advanced Artificial Intelligence in Applications
- Topical Area 2: Computer Science & Systems
- Topical Area 3: Network Systems and Applications
- Topical Area 4: Information Technology for Business and Society
- Topical Area 5: Software, System and Service Engineering

Moreover, the following Thematic Sessions enriched the program of FedCSIS 2024:

- Advances in Programming Languages (APL)
- AI in Agriculture (AgriAI)
- AI in Digital Humanities, Computational Social Sciences and Economics Research (AI-HuSo)

- Application of Disruptive Technologies for Society 5.0 (ADTS)
- Challenges for Natural Language Processing (CNLPS)
- Complex Networks – Theory and Application (CN-TA)
- Computational Optimization (CO)
- Computer Aspects of Numerical Algorithms (CANA)
- Data Science in Health, Ecology and Commerce (DSH)
- Industrial Cyber-Physical Systems and Software Agents (ICPS-SA)
- Information Systems Management (ISM)
- Internet of Things – Enablers, Challenges and Applications (IoT-ECAW)
- Model Driven Approaches in System Development (MDASD)
- Multimedia Applications and Processing (MMAP)
- Resilience in Critical Infrastructures and Systems (RCIS)
- Rough Sets: Theory and Applications (RSTA)
- Self Learning and Self Adaptive Systems (SL-SAS)
- Scalable Computing (SC)

The above-described five Topical Areas of the FedCSIS Main Track reflect the five fundamental aspects of understanding, developing, and applying Intelligence Systems. This topical integrity is emphasized by the Professor Zdzisław Pawlak award, considered in four categories: Best Paper, Young Researcher, Industry Cooperation, and International Cooperation. Although Professor Zdzisław Pawlak has been often recognized as "the father of Polish AI", his research achievements have gone far beyond AI itself, in particular toward AI applications and Intelligence Systems as we mean them. Accordingly, for this award contributions from the Main Track and from all Thematic Sessions are considered. This year, the following contributions have been awarded:

- In the category **Best Paper:** Rytis Maskeliunas and Robertas Damasevicius, "d'Alembert Convolution for Enhanced Spatio-Temporal Analysis of Forest Ecosystems"
- In the category **Young Researcher:** Alexander Kammeyer, Florian Burger, Daniel Lübbert and Katinka Wolter, "HPC operation with time-dependent cluster-wide power capping"
- In the category **Industry Cooperation:** Guillaume Hutzler, Hanna Klaudel, Witold Klaudel, Franck Pommereau and Artur Rataj, "An autonomous vehicle in a connected environment: case study of cyber-resilience"
- In the category **International Cooperation Award:** Alexander Fischer, Juha-Pekka Tolvanen and Ramin Tavakoli Kolagari, "Automotive Cybersecurity Engineering with Modeling Support"

Young Researcher Award and International Cooperation Award were sponsored by MDPI, while the remaining awards were sponsored by Mazovia Branch of Polish Information Processing Society.

FedCSIS 2024 Data Mining Competition was devoted to: *Predicting Stock Trends* and was the 10^{th} data science challenge, organized within the scope of the FedCSIS conference series. In this anniversary edition, the task was related to financial data. Specifically, participants were asked to predict the performance of investments in selected stocks, from several industry sectors. The competition was sponsored by Yettel. Bank and by the FedCSIS conference. The 2024 competition was organized and managed by:

- Aleksandar M. Rakićević, University of Belgrade
- Pavle D. Milošević, University of Belgrade
- Ivana T. Dragović, University of Belgrade
- Ana M. Poledica, University of Belgrade
- Milica M. Zukanović, University of Belgrade
- Ivan S. Luković, University of Belgrade
- Andrzej Janusz, Queensland University of Technology and QED Software
- Dominik Ślęzak, QED Software and University of Warsaw

This year, 194 teams comprising of 259 individuals registered for the competition, making it one of the most popular competitions in the history of the FedCSIS conference series. By the end of the competition, 77 enrolled teams were deemed active. Their members represented 28 different countries from around the world, with the highest representation from Germany (58), Poland (50), Italy (41), Turkey (24), and Serbia (18). There were 3,000 submitted solutions in total. Out of these, on the final day of the competition, over 250 solutions have been submitted. After evaluation, the following contributions, found in these proceedings, discuss the winning contributions:

First place: Carlos Huertas, Gradient Boosting Trees and Large Language Models for Tabular Data Few-Shot Learning

Second place: Quang Hieu Vu, Dymitr Ruta, Ling Cen and Ming Liu, FedCSIS 2024 Data Science Challenge: Predicting Stock Trends by a Multi-Dimensional Approach

Third place: Chang Lin, Key Financial Indicators Analysis and Stock Trend Forecasting Based on a Wrapper Feature Selection Method

Special award for the most practically applicable solution: Marcin Traskowski and Eyad Kannout, Forecasting Stock Trends with Feedforward Neural Networks

English was the exclusive conference language. In 2024, the FedCSIS conference attracted 184 submissions. Out of submitted contributions, after obtaining at least two reviews for each paper, 37 articles were accepted as regular full papers (acceptance rate of 20,1%), 46 articles were accepted as regular short papers. The long-term trend (captured since the first event that was the predecessor of the current conferences) of the acceptance rate, of full regular papers, is illustrated in Figure 2.

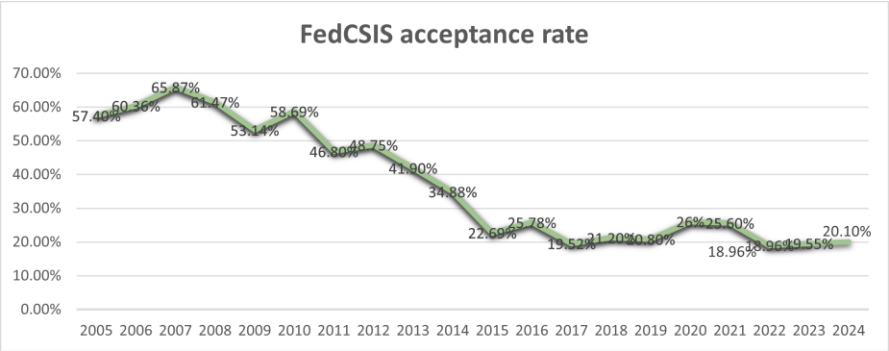

Figure 2. *Acceptance rate for the regular full papers for the FedCSIS conference series since 2005 (when FedCSIS' predecessor was organized for the first time).*

Conference Proceedings also include two invited contributions from past FedCSIS keynote speakers. Two more volumes of post-conference publications have been completed. Here, one of them consists of 12 position papers, while the other presents 24 communication papers. Accepted contributions represented 48 countries.

Conference materials were initially published on the conference WWW site (as Preprints). After the conference, final versions of full and short papers have been indexed in the IEEE Digital Library (ART: ISBN 978-83-969601-8-4, IEEE Catalog Number CFP2485N-ART, USB: ISBN 978-83-969601-7-7, IEEE Catalog Number CFP2485N-USB, Web: ISBN 978-83-969601-6-0, ISSN 2300-5963, DOI 10.15439/978-83-969601-6-0); furthermore, they will be sent to the Scopus and the Clarivate Web of Science for indexing. Position Papers and Communication Papers were published as a separate volumes (ISSN 2300-5963; ISBN 978-83-969601-9-1 (Web), 978-83-969601-0-8 (USB), DOI: 10.15439/978-83-969601-9-1, for the Position Papers volume, and ISBN 978-83-973291-0-2 (Web), 978-83-973291-1-9 (USB), DOI: 10.15439/978-83-973291-0-2 for the Communication Papers volume).

Moreover, Proceedings, Position Papers and Communication Papers of the FedCSIS 2024 Conference (in their final version) were posted at the conference WWW site – available through the Archive section of the www.fedcsis.org web-site (alongside publications from all past conferences). It should be stressed that only papers presented in the conference were published in either form (the FedCSIS conference series strictly adheres to the "IEEE No-show Policy").

Respectfully submitted by the Chairs of the FedCSIS Conference Series,

Marek Bolanowski

Maria Ganzha

Leszek Maciaszek

Marcin Paprzycki

Dominik Ślęzak