VU Faculty of Mathematics and Informatics

Institute of Data Science and Digital Technologies

Annual Report 2024

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http://www.mii.lt

Director – Assoc.Prof. Dr. *Gintautas Tamulevičius*

STAFF
75 research fellows (incl. 56 holding research degree), 12 teachers (all of them holding research degree), 40 doctoral students.

SUBDIVISIONS OF THE INSTITUTE

- Blockchain and Quantum Technologies Group
- Cognitive Computing Group
- Cyber-Social Systems Engineering Group
- Education Systems Group
- Global Optimization Group
- Image and Signal Analysis Group
- Intelligent Technologies Research Group
- Interdisciplinary Statistical Research Group
- Artificial Intelligence Laboratory

RESEARCH AREAS

Integrated development of mathematics, informatics and information technologies for the knowledge society advanced products and services

DOCTORAL DISSERTATIONS MAINTAINED IN 2024

Aidas Medžiūnas – *in Informatics (N 009) defended on 26th June*
Scientific Supervisor: prof. dr. Julius Žilinskas
"Scalable Bayesian Global Optimization of Black-Box Functions"

Bernardas Čiapas – *in Informatics (N 009) defended on 30th September*
Scientific Supervisor: prof. dr.Povilas Treigys
"Barcodeless Food Products Recognition for Retail Self-checkout Service"

Karolis Noreika – *in Informatics Engineering (T 007) defended on 27th September*
Scientific Supervisor: prof. dr. Saulius Gudas
„Application Software Development Process Using an Enhanced Agile Project Management Metod“

MAIN CONFERENCES ORGANIZED IN 2024

- 15th Conference "Data Analysis Methods for Software Systems", November 28–30, 2024, Druskininkai, Lithuania
- 14th International Doctoral Consortium on Education Research, December 4–7, 2024, Druskininkai, Lithuania
- 16th International Baltic Conference on Digital Business and Intelligent Systems (Baltic DB&IS 2024), June 30 – July 3, 2024, Vilnius, Lithuania
- 5th National Conference *"Lithuanian graduate students' research in Informatics and IT"*, May 10, 2024, Vilnius.

BLOCKCHAIN AND QUANTUM TECHNOLOGIES GROUP

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www.mii.lt/en/structure/scientific-subdivisions/blockchain-technologies-group

Head – Dr. *Remigijus Paulavičius*

STAFF

Research professor: Prof. Dr. R. Paulavičius.
Senior researchers: Dr. E. Filatovas, Assoc. Prof. Dr. V. Medvedev, Dr. F. J. Orts.
Researcher: Dr. M. Juodis, Dr. M. Marcozzi, Dr. L. Stripinis.
Doctoral students: S. Ansarian Najaf Abadi, A. Budžys, J. Dautartas.

RESEARCH INTERESTS

- Blockchain technologies
- Global optimization
- Optimization software
- Multi-objective optimization
- High-performance computing
- Artificial intelligence
- Image processing
- Big Data
- Quantum computing
- Quantum technologies

RESEARCH PROJECTS CARRIED OUT IN 2024

Projects Supported by University Budget

Research and development of public, private, and consortium-type blockchain systems. Prof. Dr. R. Paulavičius, 2018–2024.
Introduction of a set of improvements for implementing a quantum blockchain protocol based on hypergraphs aiming to reduce the required resources and operations and increase noise tolerance.

Enhancing the state-of-the-art quantum circuits that underpin the quantum blockchain by optimizing the so-called T-count and T-depth. Evaluation of the effectiveness of proposed improvements on real quantum devices.
The Role of the DIRECT Algorithm in Derivative-Free Global Optimization. Development and DIRECT-Type Algorithms. Applications and Software of DIRECT-Type Algorithms.
Concentrated overview of the state-of-the-art Tourist Trip Design Problem (TTDP), including solution approaches. Model of personalized tourist trip design problem for a real-world application. A new greedy genetic algorithm to solve the designed TTDP. Evaluation of the performance of the proposed algorithm on the collected real-world dataset containing the main POIs of the City of London, using different complexity situations, and comparison it with other popular baseline algorithms. Introduction of a novel GlobeTrott Travel tourist recommendation system and access to it.

Main publications:

Stripinis, Linas; Kudela, Jakub**; Paulavičius, Remigijus.** Benchmarking derivative-free global optimization algorithms under limited dimensions and large evaluation budgets // *IEEE Transactions on Evolutionary Computation*. 2024, p. 1-19. DOI: 10.1109/TEVC.2024.3379756. [Citav. rod.: IF: 11,700; AIF: 4,650; kvartilis: Q1 (2023, Clarivate JCR SCIE)]

Budžys, Arnoldas; **Kurasova, Olga**; **Medvedev, Viktor**. Deep learning-based authentication for insider threat detection in critical infrastructure // *Artificial intelligence review*. 2024, vol. 57, iss. 10, art. no. 272, p. 1-35. DOI: 10.1007/s10462-024-10893-1. [Citav. rod.: IF: 10,700; AIF: 5,600; kvartilis: Q1 (2023, Clarivate JCR SCIE)]

Orts, Francisco; **Paulavičius, Remigijus**; **Filatovas, Ernestas**. Quantum circuit optimization of an integer divider // *Journal of systems and software*. 2024, vol. 215, art. no. 112091, p. 1-19. DOI: 10.1016/j.jss.2024.112091. [Citav. rod.: IF: 3,700; AIF: 3,500; kvartilis: Q1 (2023, Clarivate JCR SCIE)]

Juodis, Mindaugas; **Filatovas, Ernestas**; **Paulavičius, Remigijus**. Overview and empirical analysis of wealth decentralization in blockchain networks // *ICT express*. 2024, vol. 10, iss. 2, p. 380-386. DOI: 10.1016/j.icte.2024.02.002. [Citav. rod.: IF: 4,100; AIF: 3,950; kvartilis: Q1 (2023, Clarivate JCR SCIE)]

National Research Projects

Research Council of Lithuania. **Resolving research reproducibility problems in Artificial Intelligence using Blockchain Technologies** (No. P-MIP-21-196). Dr. E. Filatovas. 2021–2024.
Today, various Artificial Intelligence techniques have solved most real-world challenging decision problems (image analysis, voice and face recognition, planning, scheduling, routing, etc.). However, Artificial Intelligence research domains (as well as other research fields) face with Reproducibility Crisis. Researchers need help reproducing many key results due to the disconnection between publications and used codes, underlying data, parameter settings, etc., as they lack critical details. Solutions that improve code accessibility, data provenance tracking, research transparency, auditing of obtained results, and trust in Artificial Intelligence domains can significantly accelerate algorithm and model development, validation, and transition into real-world applications. Thanks to the features provided by Blockchain Technology, significant progress in resolving the Reproducibility Crisis and full reproducibility can be achieved.
In this context, the project's main objective is to contribute to resolving research reproducibility problems in the Artificial Intelligence field and enhance the research cycle by developing a conceptual model of a blockchain-based decentralized platform, which would be efficient, scalable, interoperable, and adaptable in various Artificial Intelligence research domains.

Ministry of Education and Science (Lithuania). **Excellence Centre "Data Centre for Machine Learning and Quantum Computing in the Life and Biomedical Sciences"** project on

"Development and validation of quantum machine learning methods using pre-built data sets". Prof. Dr. R. Paulavičius, 2023–2027.

International Projects

European Digital Innovation Hubs (DIGITAL-2021-EDIH-01) project **"EDIH VILNIUS: accelerating green and digital transformation in Vilnius region"**, Project No. 101083844. Prof. Dr. R. Paulavičius, 2023–2025.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Poznan Supercomputing and Networking Center (PSNC)
Imperial College London (UK)
Universidad de Almería (Spain)
Cardiff University (UK)
Systems Research Institute, Polish Academy of Sciences (Poland)
The Kharkiv National University of Radio Electronics, Computer Science Faculty (Ukraine)
Octeract Optimisation Intelligence (UK)

OTHER SCIENTIFIC ACTIVITIES

Dr. R. Paulavičius –

- Vilnius University representative at the Technical Committee LST TK 98 "Digital Product Passport" of Lithuanian Standards Board;
- Member of the Smart Specialization Priority "ICT Task Force" of Innovation Agency;
- Member of the Advisory Working Group (AWG) of Action Group 4 "Digital Technologies, Industry, Space" of the European Horizon (EH) programme
- Vice-president of the Lithuanian Quantum Technology Association;
- Lithuanian Expert Member of the „Quantum Technologies Coordination Group - WG1: Research" of Quantum Pact;
- member of the Young Academy of the Lithuanian Academy of Sciences;
- member of the *Artificial Intelligence and Digital Transformation* working group of the Arqus University Alliance;
- topic editor of *Mathematics*;
- affiliate member of the *European Network of Excellence on High Performance and Embedded Architecture and Compilation* (HiPEAC).

Dr. E. Filatovas –

- associated member of the Lithuanian Quantum Technology Association;
- member of the International Society on Multiple Criteria Decision Making (MCDM);
- member of the *Artificial Intelligence and Digital Transformation* working group of the Arqus University Alliance;

Dr. V. Medvedev –

- Member of the Lithuanian Artificial Intelligence Governance Forum of the Ministry of Economy and Innovation and "Kurk Lietuvai";
- Member # 97453659 of IEEE Lithuania Section (Institute of Electrical and Electronics Engineers), IEEE Computer Society, IEEE Signal Processing Society;
- member of Lithuanian Computer Society, http://www.liks.lt/;

- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/;
- member of Program/Scientific Committees:
    - organizing committee member of the Conference on Data Analysis Methods for Software Systems (DAMSS 2024), Druskininkai, Lithuania.

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

- Dr. F. José, Dr. Orts Gómez, Prof. Remigijus Paulavičius *Halving the number of qubits of quantum comparators* at 15th International Conference on Parallel Processing & Applied Mathematics (PPAM 2024), September 8-11, 2024, Ostrava, Czech Republic.
- Dr. L. Stripinis, Prof. R. Paulavičius *HotOffthePress: Benchmarking Derivative-Free Global Optimization Algorithms under Limited Dimensions and Large Evaluation Budgets* at The Genetic and Evolutionary Computation Conference (GECCO 2024), July 14-18, 2024, Melbourne, Australia.
- M. Juodis, Dr. E. Filatovas, Prof. R. Paulavičius *Examining Transactional Decentralization on the Ethereum Blockchain* at The Sixth International Conference on Blockchain Computing and Applications (BCCA 2024), Nobember 26-29, 2024, Dubai, UAE.

MOST IMPORTANT AWARDS RECEIVED FOR R&D ACTIVITIES

- Dr. L. Stripinis received the VU Rector Science Award

MOST IMPORTANT PARTICIPATION CASES OF RESEARCHERS IN WORKING GROUPS OR COMMISSIONS SET UP BY STATE AUTHORITIES, STATE AND MUNICIPAL INSTITUTIONS, ORGANISATIONS, BUSINESS ENTITIES

- Prof. R. Paulavičius – member of Innovation Agency's Smart Specialisation Priority "ICT Working Group";
- Prof. R. Paulavičius – member of the Advisory Working Group (AWG) of the Lithuanian Science Council's European Horizon (EH) Programme Action Group 4 "Digital Technologies, Industry, Space";
- Prof. R. Paulavičius – Vilnius University representative at the Technical Committee LST TK 98 "Digital Product Passport" of Lithuanian Standards Board;
- Dr. V. Medvedev – Member of the Lithuanian Artificial Intelligence Governance Forum of the Ministry of Economy and Innovation and "Kurk Lietuvai".

CONSULTATIONS PROVIDED BY THE UNIT TO THE PUBLIC OR ECONOMIC ENTITIES

- Prof. Dr. R. Paulavičius conducted the expert interview *"Research on the use of blockchain technology in the management of a company's international operations"*.
- Dr. V. Medvedev has consulted and provided expert assessment & conclusions to the Innovation Agency and the Central Project Management Agency.
- Dr. A. Igumenov conducted development of programming methodologies consultations for The Youth Science (STEAM) Centre of Vilnius.

MOST IMPORTANT RESEARCH DISSEMINATION ACTIVITIES

- Presentation: "Quantum Computing – The Future is Here!" Konferencijos-programa-2024-2.pdf;

- Publication *"Quantum Computing: Who and Why?"* https://naujienos.vu.lt/kvantiniai-skaiciavimai-kam-ir-kodel/ ;
- Publication *"World Quantum Day Celebrated: What Does It Have to Do with Mathematics?"* https://mif.vu.lt/lt3/kas-vyksta-fakultete/naujienos/fakulteto-naujienos/4710-pamineta-pasauline-kvantine-diena-ka-ji-turi-bendro-su-matematika ;
- Publication *"Now is the Time for Lithuania to Jump on the Accelerating Quantum Technology Train"*: https://www.vz.lt/verslo-aplinka/2024/03/14/dabar-pats-metas-lietuvai-isokti-i-isibegejanti-kvantiniu-technologiju-traukini ;
- A publication was prepared about the important achievement of the MIF team at the International Quantum Technology Event – hackathon, which was widely communicated in the Lithuanian media: https://www.lrytas.lt/it/ismanyk/2024/04/18/news/tarptautineje-kvantiniu-technologiju-srityje-svarbus-lietuviu-laimejimas-31463524 , https://www.lrt.lt/naujienos/mokslas-ir-it/11/2256211/lietuviai-iskovojo-sidabra-tarptautiniame-kvantiniu-technologiju-hakatone , https://www.delfi.lt/login/mokslas/tarptautineje-kvantiniu-technologiju-srityje-svarbi-lietuviu-pergale-96368867 ;
- Presentation *"Towards Open and Reproducible AI Science: Implementing FAIR Principles Using Blockchain"* was presented at the Open Access Week event dedicated to the Vilnius University Open Science Competition, in which we were nominees: https://biblioteka.vu.lt/apie/naujienos/2383-pirma-karta-vilniaus-universitete-reiksmingo-indelio-i-atviraji-moksla-konkursas-nominantai-idejos-ir-pasiekimai ;
- Presentation and discussion *"Science Solutions 360°: 6G Connectivity and the Internet of Things"* at the Vilnius University Innovation Club: https://www.youtube.com/watch?v=zV-t2XSLhbs&ab_channel=VilniusUniversity%28official%29;
- Training for teachers of the Vilnius Business College *"Application of large language models in the study process as an example of AI application"*: https://www.kolegija.lt/vvk-destytojai-gilino-zinias-dirbtinio-intelekto-srities-mokymuose/;

COGNITIVE COMPUTING GROUP

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www.mii.lt/en/structure/scientific-subdivisions/cognitive-computing-group

Head – Prof. Habil. Dr. *Gintautas Dzemyda*

STAFF

Principal researchers: Prof. Habil. Dr. G. Dzemyda, Prof. Dr. O. Kurasova.
Senior researchers: Dr. G. A. Melnik-Leroy.
Researchers: Dr. R. Karbauskaitė, Dr. M. Sabaliauskas.
Junior researchers: D. Breskuvienė, R. Gipiškis, I. Juchnevičiūtė, A. Šubonienė.
Professors: Prof. Habil. Dr. G. Dzemyda, Prof. Dr. O. Kurasova.
Associate professors: Dr. M. Sabaliauskas.

Junior assistants: Ž. Vaišnoras.
Other staff: O. Klimašauskas, Dr. M. Sabaliauskas.
Doctoral students: D. Breskuvienė, V. Bulavas, R. Gipiškis, P. Gudžius, M. Motiejauskas, A. Šubonienė, Ž. Vaišnoras.

RESEARCH INTERESTS

- Artificial neural networks
- Big data
- Bioinformatics
- Cognitive science
- Data mining
- Deep learning
- Global optimization methods
- Cyber security
- Multi-objective optimization
- Image analysis, feature detection, image reconstruction, medical image processing
- Internet data mining
- Fractal dimensionality
- Local optimization methods
- Machine learning
- Medical data analysis and decision support
- Multiple criteria decision support
- Operations research
- Optimal control applications
- Parallel computing
- Simulation models in epidemiology, education, economics, and energy with uncertainty
- Statistical simulation
- Stochastic programming
- Swarm intelligence
- Visualization of multidimensional data
- Web service development

RESEARCH PROJECTS CARRIED OUT IN 2024

Research group project "*Development of Adversarial Machine Learning-Enhanced Command and Control Framework for Cybersecurity Improvement and Skill Proficiency*" (Project No. S-MIP-24-116), funded by the Research Council of Lithuania (Principal investigator Olga Kurasova), 2024-2027 .

Emerging threats in the dynamic field of cybersecurity impose significant risks to the stability of the global economy by exposing systems to vulnerabilities. To identify breaches, it is essential to analyse command and control (C2) systems, which are crucial for cybersecurity to identify vulnerabilities. An essential element in evaluating these innovative technologies is the development a C2 framework with machine learning algorithms to generate and deploy obfuscated malware to expose the vulnerabilities of the new technologies. Malware obfuscation refers to techniques that make code difficult to detect or decrypt without altering its functionality. This project aims to develop an adversarial machine learning-enhanced C2 framework that generates ethical malware to conduct offensive cybersecurity engagements, providing essential and realistic training for cybersecurity experts. During the first four months of the project, an analysis of models for malware obfuscation was conducted. The project environment has been launched and will be used throughout the project

period. Initial data collection and analysis were performed, and investigations of existing C2 frameworks are ongoing.

Dautartas, Juozas; Budžys, Arnoldas; Jomantas, Haroldas; Kurasova, Olga; Medvedev, Viktor. Red team tactics against malware detection using adversarial attacks // DAMSS: 15th conference on data analysis methods for software systems, Druskininkai, Lithuania, November 28-30, 2024. Vilnius : Vilniaus universiteto leidykla, 2024. eISBN 9786090711125. p. 21-22. (Vilnius University Proceedings, eISSN 2669-0233 ; vol. 52). DOI: 10.15388/DAMSS.15.2024.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Institute of Archaeology University of Wrocław (Poland)
State Cultural Rezerve of Kernavė (Lithuania)
University of Copenhagen (Denmark)
University of Latvia (Latvia)
University of Tartu (Estonia)

OTHER RESEARCH ACTIVITIES

Prof. Habil. Dr. G. Dzemyda –

- member of Lithuanian Academy of Science, http://lma.lt;
- recently elected as the head of Division of Technical Sciences of the Lithuanian Academy of Sciences;
- member of programme committees of the international conferences:
  - The WorldCist'21 - 9th World Conference on Information Systems and Technologies;
  - ESSE 2021, 2nd European Symposium on Software Engineering;
  - IEEE INISTA 2021, International Conference on INnovations in Intelligent SysTems and Applications (INISTA);
  - SENSORNETS 2021 : 10th International Conference on Sensor Networks;
- ❖ chairman of the 12th International Workshop *Data Analysis Methods for Software Systems*, Druskininkai, Lithuania, 2021, http://www.mii.lt/DatAMSS/;
- ❖ editor-in-Chief of *Baltic Journal of Modern Computing* http://www.lu.lv/baltic-journal-of-modern-computing/; international journal *Informatica* (IOSPress/VU), https://www.mii.lt/Informatica/;
- ❖ editorial board member of 8 international journals: *Financial Innovation; International Journal of Computers; Communications and Control; Applied Computer Systems; Informatics in Education; Journal of Civil Engineering and Management; Nonlinear Analysis: Modelling and Control; Mathematics and Informatics. Journal of the Belarusian State University;*
- ❖ member of IFIP Technical Committee 12 Artificial Intelligence; http://www.ifiptc12.org.uk/ifiptc12/members.php;
- ❖ member of Lithuanian Computer Society, http://www.liks.lt/;
- ❖ member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/;
- ❖ member of Lithuanian Operational Research Society, http://www.mii.lt/LitORS/ .

Prof. Dr. O. Kurasova –

- member of Lithuanian Academy of Science, http://lma.lt;
- member of editorial boards of international journals:
  - *Nonlinear Analysis: Modelling and Control*, http://www.mii.lt/NA/,

- *Information Technology and Control*, https://itc.ktu.lt/index.php/ITC/about/editorialTeam
- *Baltic Journal of Modern Computing*, http://www.lu.lv/baltic-journal-of-modern-computing/editorial-board/,
- *Computational Science and Techniques*, http://journals.ku.lt/index.php/CST/about/editorialTeam,
- *Informatics*, http://www.mdpi.com/journal/informatics;

- member of Association for Computing Machinery, https://www.acm.org/,
- member of IEEE, https://www.ieee.org,
- member of Association of European Operational Research Societies https://www.euro-online.org/
- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/,
- member of Lithuanian Operational Research Society, http://www.mii.lt/LitORS/.
- chairwoman of the doctoral committee of Informatics, Vilnius University.
- member of the doctoral committee of Informatics Engineering, Vilnius University.

Dr. R. Karbauskaitė –

- managing editor of *Informatica* (IOSPress/VU), https://informatica.vu.lt/journal/INFORMATICA/information/INFORMATICA-Editorial

Dr. G. A. Melnik-Leroy

- member of the Cognitive Science Society
- member of the programme committee of the international conference: New Sounds 2021
- member of the International Speech Communication Association

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

The best presentations delivered at international conferences (no more than two in a single scientific field)

No.	Location, Country	Name, Surname (Presenter or Co-authors)	Link to Conference Website (URL) or Attached Document	Conference Name, Date	Presentation Title; Scientific Field
1	Beijing, China	Gintautas Dzemyda	http://en.sem.bjtu.edu.cn/show-881-1287.html	2024 International Symposium on Information Management Education and Teaching, September 18–23, Beijing Jiaotong University, Beijing, China	Visualization of Data: Methods, Software and Applications in Economy; Informatics Engineering; Invited Presentation
2	Xiamen, China	Modestas Motiejauskas, Gintautas Dzemyda	https://www.icairc.net/	2024 4th International Conference on Artificial Intelligence, Robotics, and Communication (ICAIRC 2024)	Evaluation of Emotions in Artworks using EfficientNet Convolutional Network Integrating the Gram Matrix Modules;

					Informatics Engineering
3	Valletta, Malta	Rokas Gipiškis	https://xaiworldconference.com/2024/	XAI-2024 - The 2nd World Conference on eXplainable Artificial Intelligence: July 17–19, 2024, Valletta, Malta	XAI-driven Model Improvements in Interpretable Image Segmentation
4	Portsmouth, UK	Dalia Breskuvienė	https://www.port.ac.uk/research/research-groups-and-centres/centre-for-cybercrime-and-economic-crime	13th Annual Counter Fraud, Cybercrime and Forensic Accounting Conference, Portsmouth, UK	Adapt or Fall Behind: A Deep Dive into Machine Learning Techniques for Detection of Evolving Fraud in the Financial Realm

MOST IMPORTANT NATIONAL AND INTERNATIONAL AWARDS RECEIVED FOR R&D ACTIVITIES

Awards Received for R&D Activities

No.	Name, Surname	Award Title	Additional Information About the Award
1	Oskaras Klimašauskas	Vytautas Statulevičius Academic Scholarship	Awarded in 2024 to Vytautas Statulevičius Academic Scholarship recipients - Institute of Data Science and Digital Technologies
2	Olga Kurasova	Vilnius University Rector's Science Award	

CONSULTATIONS PROVIDED BY THE UNIT TO THE PUBLIC OR ECONOMIC ENTITIES

List of Key Consultations Provided to the Public or Business Entities

1. **Olga Kurasova** - Expert for the Lithuanian Academy of Sciences (LMA): Evaluation of candidates for the LMA Young Scientists' Scholarship.
2. **Olga Kurasova** - Expert for the Lithuanian Science Council (LMT): Assessment of R&D projects.
3. **Gintautas Dzemyda** - Member of UAB Orthobaltic Board: Exploration of opportunities for joint research.

4. **Gintautas Dzemyda** - Meetings with business and municipal representatives (Vilnius and Panevėžys municipalities): Discussing potential partnerships and securing business support for the DAMSS-2024 conference.
5. **Gerda Ana Melnik-Leroy** - Expert for educational technology company EvidenceB: Implementation of science-based innovations.

MOST IMPORTANT RESEARCH DISSEMINATION ACTIVITIES

List of Key Science Popularization Activities

1. **Olga Kurasova** - Participated in the Lithuanian Business Forum 2024. Took part in the discussion *"Future Leadership: When Will AI Algorithms Replace Managers?"* (2024-10-17).
   https://www.versloforumas.org/

2. **Olga Kurasova** - Delivered a public lecture titled *"Artificial Intelligence and Its Impact on Science and Everyday Life: Opportunities and Challenges"* in the scientific lecture series "Café Scientifique" (2024-11-20).
   https://openreadings.eu/cafe-scientifique-2025/

3. **Olga Kurasova** - Appeared on the LRT news program *"Panorama"* to comment on the impact of artificial intelligence on layoffs (2024-09-04).
   https://www.lrt.lt/mediateka/irasas/2000358050/panorama

4. **Gintautas Dzemyda** - Presented opportunities for AI applications in liver transplantation at the conference *"Organ Transplantation and Artificial Intelligence."*
   https://www.lma.lt/news/2292/38/Kaip-dirbtinio-intelekto-algoritmai-padeda-medikams

5. **Gerda Ana Melnik-Leroy** - Participated in the project *"A Lesson with a University Lecturer"* and conducted lectures at five schools, including Vilnius Žygimantas Augustas Gymnasium (2024-10-25) and Šiauliai Simonas Daukantas Engineering Gymnasium (2024-11-07).
   http://mif.vu.lt/lt3/dokumentai/dokumentai/Naujienos/2024/2024.04.17-pataisyta.pdf

CYBER-SOCIAL SYSTEMS ENGINEERING GROUP

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Head – Assoc. Prof. Dr. *Audronė Lupeikienė*

STAFF

Research fellows: Dr. Romas Alonderis, Dr. Saulius Maskeliūnas, Dr. Jolanta Miliauskaitė, Dr. Asta Slotkienė.
Associate professors: Assoc. Prof. Dr. Audronė Lupeikienė, Dr. Jolanta Miliauskaitė, Dr. Asta Slotkienė.
Specialist: Laima Paliulionienė.
Affiliated researchers: Prof. Dr. (HP) Saulius Gudas, Prof. Habil. Dr. Stasys Jukna, Assoc. Prof. Dr. Aida Pliuškevičienė.
Doctoral student: Darius Sabaliauskas.

RESEARCH INTERESTS

Cyber-social systems engineering:

- models, methods, and tools for cyber-social systems;
- intelligent systems for digital business;

- AI-augmented systems specification and testing;
- causal modelling of enterprise management activities and business processes;
- model-based engineering for different systems types (e.g. enterprise systems, Internet of Things, smart systems) and integration with other methods/models (e.g. digital twins).

Mathematical logic:

- proof theory.

RESEARCH PROJECTS CARRIED OUT IN 2024

Projects Supported by University Budget

Research of cyber-social systems and development of engineering methods at the intersection of cyber-physical and cyber-social systems. Assoc. Prof. Dr. Audronė Lupeikienė.

Main results in 2024:

1. A multi-succedent sequent calculus for intuitionistic epistemic logic has been introduced. It has been proved that the structural rules of weakening and contraction and the rule of cut are admissible in the calculus. It has also been proved that any sequent with at most one formula in succedent is derivable in the calculus, iff it is derivable in the standard non-multi-succedent sequent calculus of the considered logic.
2. Through an in-depth case study of the Comprehensive Post-Myocardial Infarction Care Program (KOS-Zawał), it is demonstrated how a BPM approach supported by telemedicine can enhance treatment quality and reduce mortality rates for post-heart attack patients. A paradigm shift from traditional healthcare models is presented, emphasising the importance of collaboration among healthcare professionals, patients, and caregivers.
3. As a result of the bibliometric analysis, it was found that a) publications on the concept of ontology and fuzzy IS consistently increase in the last ten years, indicating its growing interest and relevance in both science and application; b) there is limited cooperation among authors and countries is limited, indicating the need for its further development in the future.

Main publications:

1. **Alonderis, Romas**. *Multi-succedent sequent calculus for intuitionistic epistemic logic*, Lietuvos matematikos rinkinys, 2024, 65(A), p. 9-17. doi:10.15388/LMD.2024.37367.

2. Szelągowski, Marek; Berniak-Woźny, Justyna; **Lupeikienė, Audronė**; Szewczyk, Jerzy. *Telemedicine and BPM in cardiac rehabilitation: a comprehensive post-myocardial infarction care program case study* // Business process management: blockchain, robotic process automation, Central and Eastern European, educators and industry forum, Krakow, Poland, September 1-6, 2024 : proceedings. Cham : Springer Nature, 2024. ISBN 9783031704444. eISBN 9783031704451. p. 205-219. (Lecture notes in business information processing, ISSN 1865-1348, eISSN 1865-1356 ; vol. 527).

3. Kalibatienė, Diana; **Miliauskaitė, Jolanta; Slotkienė, Asta**. *Ontology and fuzzy theory application in information systems: A bibliometric analysis* // Informatica. Vilnius : Vilnius University Press. ISSN 0868-4952. eISSN 1822-8844. 2024, vol. 35, iss. 3, p. 557-576. DOI: 10.15388/24-INFOR557.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Riga Technical University (Latvia)

University of Tartu (Estonia)
Systems Research Institute Polish Academy of Sciences
University of Geneva (Switzerland)
University of Frankfurt (Germany)
University of the Azores (Portugal)

OTHER SCIENTIFIC ACTIVITIES

Prof. Dr. (HP) Saulius Gudas

- IFIP TC8 Information Systems member;
- representative of the National Digital Coalition from LIKS;
- reviewer of the journal *Informatica*, https://www.mii.lt/informatica/;
- reviewer of the journal *Information systems and e-business management*, https://link.springer.com/journal/10257 ;
- reviewer of the *Baltic Journal of Modern Computing*, https://www.bjmc.lu.lv/ ;
- reviewer of the journal *Complex Systems Informatics and Modeling Quarterly*, https://csimq-journals.rtu.lv/index ;
- reviewer of the MDPI journal *Information*, http://www.mdpi.com/journal/information/ ;
- program committee member of the 25th International Conference on Computer Systems and technologies (CompSysTech'24), https://www.compsystech.org/index.php?cmd=dPage&pid=pc.

Prof. Habil. Dr. Stasys Jukna

- scientific board member of the *Electronic Colloquium on Computational Complexity* (ECCC), http://eccc.hpi-web.de/colloquium/scientific_board/;
- editorial board member of the *Lithuanian Mathematical Journal*, https://www.mii.lt/en/lithuanian-mathematical-journal#editorial-board.

Assoc. Prof. Dr. Audronė Lupeikienė

- editorial board member of the *Scientific Journal of Riga Technical University: Applied Computer Systems*, https://acs-journals.rtu.lv/;
- steering committee member of the International Baltic Conference on Digital Business and Intelligent Systems (Baltic DB&IS), https://dbis2024.vu.lt/;
- program committee member of the 17th International Conference on Agents and Artificial Intelligence (ICAART 2025), https://icaart.scitevents.org/ProgramCommittee.aspx , of the Practice of Enterprise Modeling Forum (PoEM 2024 Forum), https://ceur-ws.org/Vol-3855/preface.pdf, of the 28th European Conference on Advances in Databases and Information Systems (ADBIS 2024), https://conferences.sigappfr.org/adbis2024/program-committee/ ; of the 40th ACM/SIGAPP Symposium on Applied Computing, Intelligent Systems for Digital Era (ISDE) track, https://ati.ttu.ee/sac-isde/; of the 9th Workshop on Managed Complexity (ManComp 2024), https://wwwswt.informatik.uni-rostock.de/ManComp2024/comm .

Dr. Saulius Maskeliūnas

- Chairman of the Council & President of the *Lithuanian Computer Society* https://www.liks.lt/en/contacts/ ;
- Head of the *Technical Committee TK4 "Information Technology" of the Lithuanian Standards Board LST* https://eshop.lsd.lt/public#!/committee/info/6040 ;

- Member of the *State Commission of the Lithuanian Language Sub-Commission of Language Technologies* https://vlkk.lt/struktura-ir-kontaktai/komisija/pakomises ;
- *"Encyclopedia for Lithuania and the World"* (www.Lietuvai.lt) Board of Editors member https://lietuvai.lt/wiki/Enciklopedija:Bendruomen%C4%97 ;
- Lithuania representative at the *International Federation for Information Processing (IFIP)* https://ifip.org/index.php?option=com_content&task=view&id=125&Itemid=441&ref=25;
- *International AIQT Foundation* Advisory Board member (in Artificial Intelligence) https://www.inaiqt.com/about/foundation-advisory-board/ ;
- Individual expert supporter of the *Confederation of Laboratories for Artificial Intelligence Research in Europe (CAIRNE) https://cairne.eu/expert-supporters/ , https://cairne.eu/individual-supporters/ ;*
- Member of the Lithuanian Artificial Intelligence Governance Forum of the Ministry of Economy and Innovation and "Kurk Lietuvai";
- program committee member of the *16th International Baltic Conference on Digital Business and Intelligent Systems (Baltic DB&IS 2024)* https://dbis2024.vu.lt/organisation/programme-committee ;
- PC head and OC member of the *Biennial National Conference "Computer Days 2025"* https://www.liks.lt/kodi-2025/ .
- reviewer of the *Applied Computer Systems*, https://sciendo.com/journal/ACSS .

Dr. Jolanta Miliauskaitė

- Organising Committee member of *Baltic DB&IS'2024* (International Baltic Conference on Digital Business and Intelligent Systems) https://dbis2024.vu.lt/;
- Scientific committee member of ICMarkTech'24 (International Conference on Marketing and Technologies), https://icmarktech.org/;
- Program committee member of SAC 2025 (Intelligent Systems for Digital Era (ISDE) https://ati.ttu.ee/sac-isde/ ;
- reviewer of the journal *Informatica*, https://www.mii.lt/informatica/;
- reviewer of the *Baltic Journal of Modern Computing*, https://www.bjmc.lu.lv/ .

Laima Paliulionienė

- organizing committee member and webmaster of the 16th International Baltic Conference on Digital Business and Intelligent Systems (Baltic DB&IS 2024), https://dbis2024.vu.lt/ .

Dr. Asta Slotkienė

- reviewer of the *Baltic Journal of Modern Computing*, https://www.bjmc.lu.lv/ .

EDUCATION SYSTEMS GROUP

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Head – Dr. *Tatjana Jevsikova*

STAFF

Chief research fellow: Prof. Dr. V. Dagienė

Senior research fellow: Dr. V. Dolgopolovas, Dr. T. Jevsikova, Dr. A. Juškevičienė

Research fellows: Dr. D. Gudeika, Dr. D. Stumbrienė, Dr. G. Stupurienė

Doctoral students: S. Bagočienė, V. Masiulionytė-Dagienė

Affiliated senior research fellows: Assoc. Prof. Dr. G. Grigas, Dr. L. Markauskaitė.

RESEARCH INTERESTS

- Application of intelligent technologies in education
- Computer science (Informatics) education research
- Computing engineering education research
- Cultural aspects of human-computer interaction
- Technology enhanced learning

RESEARCH PROJECTS CARRIED OUT IN 2024

Research on automated systems for design thinking and computational thinking development and assessment. Dr. T. Jevsikova, 2024–2026.

Main objective of the theme: To explore the design and integration of automated assessment systems for general education.

Main publications:

Dolgopolovas, Vladimiras; Dagienė, Valentina. Competency-based TPACK approaches to computational thinking and integrated STEM: A conceptual exploration // Computer applications in engineering education. Hoboken : Wiley. ISSN 1061-3773. eISSN 1099-0542. 2024, vol. 32, iss. 6, art. no. e22788, p. [1-28]. [Science Citation Index Expanded (Web of Science); Scopus] [Indėlis: 1,000] [Citav. rod.: IF: 2,000; AIF: 3,333; kvartilis: Q2 (2023, Clarivate JCR SCIE)] [Citav. rod.: CiteScore: 7,20; SNIP: 1,371; SJR: 0,715; kvartilis: Q1 (2023, Scopus Sources)] [M.kr.: T 007]

Stumbrienė, Dovilė; Jevsikova, Tatjana; Kontvainė, Vita. Key factors influencing teachers' motivation to transfer technology-enabled educational innovation // Education and information technologies: Special Issue on: What will be the new normal? Digital competence and 21st century skills: critical and emergent issues in the K-12 education. New York : Springer Nature. eISSN 1573-7608. 2024, vol. 29, iss. 2, p. 1697-1731. DOI: 10.1007/s10639-023-11891-6. [Social Sciences Citation Index (Web of Science); Scopus; ACM Digital Library; Current Contents / Social & Behavioral Sciences; DBLP; Dimensions; ERIC; ERIH Plus; INSPEC; Journal Citation Reports/Social Sciences Edition (Thomson Reuters)] [Indėlis: 0,667] [Citav. rod.: IF: 4,800; AIF: 1,900; kvartilis: Q1 (2023, Clarivate JCR SSCI)] [M.kr.: T 007,S 007,N 009]

Stupurienė, Gabrielė; Jevsikova, Tatjana; Gülbahar, Yasemin; Juškevičienė, Anita; Gindulytė, Austėja; Juodagalvytė, Agnė. To plug or not to plug: exploring pedagogical differences for teaching informatics in primary schools // Education and information technologies. New York : Springer. ISSN 1360-2357. eISSN 1573-7608. 2024, Early Access, p. [1-38]. DOI: 10.1007/s10639-024-13000-7. [Social Sciences Citation Index (Web of Science); Scopus] [Indėlis: 0,483] [Citav. rod.: IF: 4,800; AIF: 1,900; kvartilis: Q1 (2023, Clarivate JCR SSCI)] [Citav. rod.: CiteScore: 10,00; SNIP: 2,308; SJR: 1,301; kvartilis: Q1 (2023, Scopus Sources)] [M.kr.: N 009,S 007]

International Research Projects

2020–2024 m. **COST: EUGAIN - CA19122** European Network for Gender Balance in Informatics**. (Prof. Dr. V. Dagienė, Dr. Anita Juškevičienė)**

2021–2024 m. **Erasmus+ KA220-HED**. Future IT Professionals Education in Artificial Intelligence. **(Prof. dr. V. Dagienė, Dr. V. Dolgopolovas)**

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Ankara University (Turkey)
ETH Zurich (Switzerland)
KTH Royal Institute (Sweden)
Lancaster University (UK)
Radboud University Nijmegen (The Netherlands)
Tallinn University (Estonia)
Turku University (Finland)

OTHER RESEARCH ACTIVITIES

Prof. Dr. V. Dagienė –

- editor-in-Chief of the journal *Informatics in Education*, https://infedu.vu.lt/journal/INFEDU (Clarivate Analytics Web of Science Core Collection; Scopus; etc.);
- editor-in-Chief of the journal *Olympiads in Informatics* (Scopus, etc.), https://ioinformatics.org/page/ioi-journal-editorial-board/2;
- area editor (Computing Didactics) of the *Baltic Journal of Modern Computing*, https://www.bjmc.lu.lv (Clarivate Analytics Web of Science Core Collection; Scopus; etc.);
- editorial board member of the journals: *International Journal of Digital Literacy and Digital Competence; International Journal of Instruction*; *Acta Paedagogica Vilnensia*;
- coordinator of the Nordplus Network on Innovative Computing Engineering Education Research;
- representative of Lithuania in Education Committee TC3 under the International Federation for Information Processing (IFIP);
- President of the Bebras International Association (International Challenge on Informatics and Computational Thinking): https://www.bebras.org/structure-of-the-bebras-community.

Dr. V. Dolgopolovas –

- member of European AI Alliance https://futurium.ec.europa.eu/en/european-ai-alliance
- member of USERN: Universal Scientific Education and Research Network: https://usern.tums.ac.ir/

Dr. T. Jevsikova –

- member of International Federation for Information Processing (IFIP) TC3 WG 3.1 (Informatics for Secondary Education).

Dr. G. Stupurienė –

- member of Lithuanian Computer Society, http://www.liks.lt;
- member of Lithuanian Young Scientists Union, https://www.ljms.lt/;
- country representative at European Commission Joint Research Center network of experts for the use cases of the tool SELFIE for TEACHERS.
- Managing Editor of the journal *Informatics in Education*, https://infedu.vu.lt/journal/INFEDU (Clarivate Analytics Web of Science Core Collection; Scopus; etc.).

Dr. D. Gudeika –

- member of Lithuanian Society of Young Researchers, https://www.ljms.lt/;

- emeritus member of the Young Academy of the Lithuanian Academy of Sciences;
- associate editor of the journal Frontiers in Coatings, Dyes and Interface Engineering, https://www.frontiersin.org/journals/coatings-dyes-and-interface-engineering/sections/dyes-and-pigments/editors.

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

Dagienė, Valentina. Solving Bebras-like Tasks: Approaches for Concept Building (Keynote speaker). CMSC - Creative Mathematical Sciences Communication, 2024-10-7–10, https://www.uni-trier.de/en/universitaet/fachbereiche-faecher/fachbereich-iv/faecher/informatikwissenschaften/professuren/theoretische-informatik/research/conferences-and-workshops/cmsc

Dagienė, Valentina. Computational Thinking in "Mind-Size Bites" (Keynote presentation). CTE-STEM 24: The Eighth APSEC International Conference on Computational Thinking and STEM Education, Beijing, China, May 28–30, 2024, https://www.apsce.net/events/cte-stem-2024

Stupurienė, Gabrielė; Perednytė, Gintarė. Fostering AI literacy in primary education // Informatics in Schools: 17th international conference on informatics in schools: situation, evolution and perspective, ISSEP 2024 local proceedings, Budapest, Hungary, October 28–30, 2024. Budapest : ELTE Informatikai Kar, 2024. ISBN 9789634897460. p. 162-165. Prieiga per internetą: <https://drive.google.com/file/d/1oibYbA0sqqKqzByDcXkM9cTIK2v4VtTq/view>.

Bilbao, J.; Bravo, E.; Garcia, O.; Rebollar, C.; **Dagienė, Valentina**; **Masiulionytė-Dagienė, Vaida**; Jankauskienė, A.; Laakso, M.J.; Kaarto, H.; Lehtonen, D.; Parviainen, M.; Güven, I.; Gulbahar, Y.; Öztürk, T.; Özdemir Öncül, F.; Tan Yenigün, N.; Pluhár, Z.; Sarmasági, P.; Pears, A. Computational thinking and problem solving in PISA era // INTED2024: 18th international technology, education and development conference, 4-6 March, 2024, Valencia, Spain : conference proceedings / edited by L. Gómez Chova, C. González Martínez, J. Lees. València : IATED Academy, 2024. ISBN 9788409592159. p. 7335-7342. (INTED Proceedings, ISSN 2340-1079). DOI: 10.21125/inted.2024.1922.

Feklistova, Lidia; **Jevsikova, Tatjana**; Gaál, Bence; Pluhár, Zsuzsa. Teachers' motivation to engage with students in a computer science and computational thinking challenge: does motivation conform to a 'One-Size-Fits-All' model? // Informatics in schools. Innovative approaches to computer science teaching and learning: 17th international conference on informatics in schools: situation, evolution, and perspectives, ISSEP 2024, Budapest, Hungary, October 28–30, 2024 : proceedings. Cham : Springer, 2025. ISBN 9783031734731. eISBN 9783031734748. p. 152-166. (Lecture Notes in Computer Science, ISSN 0302-9743, eISSN 1611-3349; vol. 15228). DOI: 10.1007/978-3-031-73474-8_12.

MOST IMPORTANT RESEARCH DISSEMINATION ACTIVITIES

In cooperation with the Institute of Educational Sciences, the Education System Group has organized the International Doctoral Consortium – International Doctoral School of Educational Sciences in Druskininkai, Lithuania, December 4–7, 2024.

International conference "Informatics with Bebras. International Challenge on Informatics and Computational Thinking 20-th anniversary". Vilnius, Lithuania, September 26–27, 2024

International journal "Informatics in Education" Scopus citation index 6.1 (2023). WoS Journal Impact Factor – 2.1 (2023).

GLOBAL OPTIMIZATION GROUP

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www.mii.lt/en/structure/scientific-subdivisions/global-optimization-group

Head – Prof. Dr. *Julius Žilinskas*

STAFF

Principal research fellows: Prof. Dr. J. Žilinskas
Senior research fellows: Assoc. Prof. Dr. A. Lančinskas
Doctoral students: S. Tautvaišas, M. Kepalas, A. Petrėtis, S. P. Sellapperuma.
Professor emeritus: Prof. Habil. Dr. A. Žilinskas

RESEARCH INTERESTS

- Optimization and high-performance computing

RESEARCH PROJECTS CARRIED OUT IN 2024

- **Projects Supported by University Budget**

Global Optimization. Prof. Dr. J. Žilinskas.
The aim is development of global optimization algorithms and application of them to optimization problems.
The main results were: global optimization algorithms with constraints; heuristic algorithms for facility location problems; Bayesian global optimization.

Main publications:

- Lančinskas, Algirdas; Žilinskas, Julius; Fernández, Pascual; Pelegrín, Blas. Population-based algorithm for discrete facility location with ranking of candidate locations // Journal of computational and applied mathematics. Amsterdam : Elsevier B.V. ISSN 0377-0427. eISSN 1879-1778. 2025, vol. 457, art. no. 116304, p. [1-8]. DOI: 10.1016/j.cam.2024.116304.
- Kepalas, Mindaugas; Žilinskas, Julius. Solving net-constrained clustering problem // Journal of nonlinear and variational analysis. Edmonton : Biemdas Academic Publishers. ISSN 2560-6921. eISSN 2560-6778. 2024, vol. 8, iss. 6, p. 987-1012. DOI: 10.23952/jnva.8.2024.6.09.
- Tautvaišas, Saulius; Žilinskas, Julius. Scalable Bayesian optimization with generalized product of experts // Journal of global optimization. Dordrecht : Springer. ISSN 0925-5001. eISSN 1573-2916. 2024, vol. 88, iss. 3, p. 777-802. DOI: 10.1007/s10898-022-01236-x.

International Research Projects

2023–2024 COST Action CA22137 ROAR-NET – Randomised Optimisation Algorithms Research Network. (A. Lančinskas, J. Žilinskas)

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Universidad de Almería (Spain)
Universidad de Murcia (Spain)
Universidad de La Laguna (Spain)
Universidad de Malaga (Spain)
Universidade de Coimbra (Portugal)
Università della Calabria (Italy)

Università degli Studi di Cassino e del Lazio Meridionale (Italy)
Cardiff University (UK)
New Jersey Institute of Technology (USA)

OTHER RESEARCH ACTIVITIES

Prof. Dr. J. Žilinskas –

- member of editorial boards of international journals:
  - Computational Management Science (Springer, https://link.springer.com/journal/10287/editorial-board),
  - Computer Science (AGH, https://journals.agh.edu.pl/csci/about/editorialTeam),
  - Informatica (VU, https://informatica.vu.lt/journal/INFORMATICA/information/INFORMATICA-Editorial),
  - Information Technology and Control (KTU, https://itc.ktu.lt/index.php/ITC/about/editorialTeam),
  - Journal of Global Optimization (Springer, https://www.springer.com/journal/10898/editorial-board),
  - Mathematical Methods of Operations Research (Springer, https://www.springer.com/journal/186/editorial-board),
  - Mathematical Modelling and Analysis (VGTU, https://journals.vilniustech.lt/index.php/MMA/editorialboard),
  - Open Computer Science (De Gruyter, https://www.degruyter.com/journal/key/comp/html#editorial),
  - Optimization Letters (Springer, https://www.springer.com/journal/11590/editorial-board),
  - Operations Research Forum (Springer Nature, https://www.springer.com/journal/43069/editorial-board),
- member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), http://www.hipeac.net

Prof. Habil. Dr. A. Žilinskas –

- member of IFIP working group WG 7.6 Optimization-Based Computer Aided Modeling and Design, http://www.ifip.org/bulletin/bulltcs/memtc07.htm;
- member of American Mathematical Society, http://www.ams.org/cml;
- member of programme committees of International conferences;
- member of editorial boards of international journals:
  - *Journal of Global Optimization* (Springer), http://www.springer.com/business+%26+management/operations+research/journal/10898?detailsPage=editorialBoard,
  - *Informatica* (IOSPress/VU), http://www.mii.lt/Informatica/editors.htm,
  - Control and Cybernetics, control.ibspan.waw.pl:3000/mainpage,
  - *Statistics, Optimization and Information Computing, www.iapress.org/index.php/soic*
  - *Journal of Intelligent Learning Systems and Applications*, http://www.scirp.org/journal/jilsa/,
  - *International Journal of Grid and High Performance Computing*, http://www.igi-global.com/Bookstore/TitleDetails.aspx?TitleId=1105&DetailsType=ReviewBoard
  - *The Open Cybernetics and Systemics Journal*, http://www.bentham.org/open/tocsj/EBM.htm,

- *Baltic Journal of Modern Computing;* http://www.bjmc.lu.lv/editorial-board/ .
- member of the Lithuanian Academy of Sciences, http://lma.lt http://lma.lt/index.php?option=com_k2&view=item&layout=item&id=235&Itemid=243&lang=lt.

Dr. A. Lančinskas –

- affiliate member of European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC), http://www.hipeac.net
- reviewer of journals:
  - Optimization Letters
  - Baltic Journal of Modern Computing
  - Journal of Global Optimization
  - Nonlinear Analysis: Modelling and Control
  - Informatica

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

A. Lančinskas, **J. Žilinskas**, P. Fernandez, B. Pelegrin, Robust Optimization Strategy for Facility Location, *Optimization, Analytics, and Decisions in the Big Data Era*, June 16-21, 2024, Halkidiki, Greece

MOST IMPORTANT NATIONAL AND INTERNATIONAL AWARDS RECEIVED FOR R&D ACTIVITIES

On the 6th February 2024 Prof. Habil. Dr. Antanas Žilinskas has been named the 2023 laureate of the Lithuanian Science Prize in the field of Technological Sciences –
for the series of works **"Innovative algorithms for complex global optimization problems"**

IMAGE AND SIGNAL ANALYSIS GROUP

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Head – Assoc. Prof. Dr. *Povilas Treigys*

STAFF

Principal researchers: Prof., Dr. Povilas Treigys, Dr. G. Korvel
Senior research fellows: Assoc. Prof. Dr. G. Korvel, Assoc. Prof., Dr. G. Tamulevičius, Dr. Jolita Bernatavičienė
Affiliated research fellows: Prof. Habil. Dr. K. Kazlauskas
Projects specialist: G. Navickas; **Technician**: S. Tolomanovas
Doctoral students: M. Danilovaitė, S. Dastgeer, K. Karlauskas, J. Ramonaitė, R. Surkant, A. Vaitulevičius, D. Zakševski
Study staff: A. Rasmusson, J. Globienė, M. Liutvinavičius, G. Navickas, J. Jucevičius.

RESEARCH INTERESTS

Audio and image signal processing; pattern recognition; robotics; machine learning; artificial inteligence; natural language processing.

RESEARCH PROJECTS CARRIED OUT IN 2024

National Research Projects

The project "*Development and validation of machine learning methods using prepared datasets" of the Center of Excellence* "Data Center for Machine Learning and Quantum Computing in Natural and Biomedical Sciences" of the Lithuanian Ministry of Education and Science's "University Excellence Initiatives" program. Head: Prof. P. Treigys, 2023-2027.

The project "Development of a de-personalised fundus image database" of the Ministry of Health. Head: Prof. P. Treigys, 2018-2030.

International Research Projects

COST action CA21167 *"Universality, diversity and idiosyncrasy in language technology (UniDive)"*, Member of Managing Committee Dr. G. Korvel, 2022-2026

- Efficient access to the constantly growing quantities of data, especially of language data, largely relies on advances in data science. This domain includes natural language processing (NLP), which is currently booming, to the benefit of many end users. However, this optimization-based technological progress poses an important challenge: accounting for and fostering language diversity. The UniDive Action takes two original stands on this challenge. Firstly, it aims at embracing both inter- and intra-language diversity, i.e. a diversity understood both in terms of the differences among the existing languages and of the variety of linguistic phenomena exhibited within a language. Secondly, UniDive does not assume that linguistic diversity is to be protected against technological progress but strives for both of these aims jointly, to their mutual benefit. Its approach is to: (i) pursue NLP-applicable universality of terminologies and methodologies, (ii) quantify inter- and intra-linguistic diversity, (iii) boost and coordinate universality- and diversity-driven development of language resources and tools. UniDive builds upon previous experience of European networks and projects which provided a proof of concept for language modelling and processing, unified across many languages but preserving their diversity. The main benefits of the Action will include, on the theoretical side, a better understanding of language universals, and on the practical side, language resources and tools covering, in a unified framework, a bigger variety of language phenomena in a large number of languages, including low-resourced and endangered ones.

COST action CA22111 *"A European consortium to determine how complex, real-world environments influence brain development (ENVIRO-DEV)"*. Member of Management Committee Dr. J. Bernatavičienė, 2023-2027

- The early years of brain development are critically influential for life-long outcomes. During early childhood, neurodevelopmental conditions emerge and vulnerabilities for longer-term problems are sown. Homes, schools and neighbourhoods shape children's life chances, interacting with individual differences in cognition and behaviour to determine access to resources and quality of life. However, because almost all current research measures behaviour and brain function by taking children away from these natural environments into controlled lab settings, our knowledge of how early life settings shape development is surprisingly limited. We understand very little about the mechanisms through which specific environmental features impact development (e.g. the effects of variation in noise, clutter, social interaction etc); how these vary across European nations; and how they interact with neurodiverse learning styles. This limits us from designing personalised practical interventions to tailor early environments for different individuals. Under this COST Action we shall create the infrastructure and networks to allow for transformative new approaches to quantifying variability in the early life physical and social environments experienced by children across the EU. We will bring together currently siloed areas of expertise across Europe in new methods for studying children in their natural habitats; new perspectives on cultural and neurodiversity; and new ethical and legal frameworks to support large-scale collaborative developmental science. Our network will be a partnership across European nations and with neurodiverse communities to enable our work to be underpinned by co-creation, ensuring we are harnessing state-of-the-art research efforts to generate meaningful and impactful real- world outcomes.

Main results:

- Feature space analysis for machine-based recognition.
- Machine learning algorithms for multiscale data analysis.
- Machine learning methods for language generation.
- Efficient deployment of fractal theory to industry applications.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

- Hospital Kauno klinikos of Lithuanian University of Health Sciences (Lithuania)
- MB Sauliaus Vaitkaus ausų, nosies, gerklės ligų klinika (Lithuania)
- Forensic Science Centre of Lithuania (Lithuania)
- Vilnius University Hospital Santaros klinikos (Lithuania)
- National Cancer Institute (Lithuania)
- Gdansk University of Technology, Faculty of Electronics, Telecommunications and Informatics, Audio Acoustics Laboratory
- Aveiro University, Portugal
- Konstantinos Diamantaras, Department of Information and Electronic Engineering, International Hellenic University, Greece
- Elena Lloret, Department of Software and Computing Systems, University of Alicante, Alicante, Spain
- Justino Laurenco, Porto, ISPGAYA Portugal

OTHER RESEARCH ACTIVITIES

Prof. Dr. P. Treigys –

- member of EuroHPC Joint Undertaking GB board;
- reviewer of the journals:
  - *Informatica*, http://www.mii.lt/informatica,
  - *Modelling and Control Journal*, http://www.mii.lt/NA,
  - Nonlinear Analysis,
  - Baltic Journal of Modern Computing,
  - MDPI Senesors,
  - MDPI Electronics.

Prof. Habil. Dr. K. Kazlauskas –

- member of Lithuanian Computer Society, http://www.liks.lt;
- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/;
- reviewer of international journals:
  - *IEEE Trans. On Signal Processing*,
  - *IEEE Trans. On Circuits and Systems,*
  - *Informatica*,
  - *Information Technology and Control.*

Assoc. Prof. Dr. G. Tamulevičius –

- reviewer for the international journals:
  - *Informatica*, http://www.mii.lt/Informatica/,
  - *Baltic Journal of Modern Computing*, www.lu.lv/baltic-journal-of-modern-computing,
  - *Nonlinear Analysis: Modelling and Control Journal*, http://www.mii.lt/NA,
  - *IEEE Access*,

    - *Neurocomputing https://www.journals.elsevier.com/neurocomputing,*
    - *IEEE Journal of Biomedical and Health Informatics https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6221020,*
    - *International Journal of Applied Mathematics and Computer Sciences https://www.amcs.uz.zgora.pl/;*
- Senior member of IEEE Computer Society, Signal Processing Society, and Computational Intelligence Society sections. Chairman of the IEEE Lithuania Section Computer Society section;
- Member of European Association For Signal Processing (EURASIP).

Dr. G. Korvel –

- Member of Lithuanian Computer Society, http://www.liks.lt;
- Member of the Young Academy of the Lithuanian Academy of Sciences https://www.lma.lt/jaunoji-akademija;
- Member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/;
- Member of INSTICC (the Institute for Systems and Technologies of Information, Control and Communication), https://portal.insticc.org/;
- Member of IEEE Computer Society https://www.ieee.org/.
- A member of editorial board of The Journal of Intelligent Information Systems
- Reviewer of international journals:
    - *Journal of the Audio Engineering Society* www.aes.org/journal,
    - *Archives of Acoustics* acoustics.ippt.gov.pl,
    - *Metrology and Measurement Systems* http://www.metrology.pg.gda.pl,
    - *Journal of Intelligent Information Systems* https://link.springer.com/journal/10844,
    - *Information Technology and Control* http://itc.ktu.lt,
    - *Informatica* www.mii.lt/informatica,
    - *Pattern Recognition Letters* www.journals.elsevier.com/speech-communicat,
    - *Speech Communication* www.journals.elsevier.com/speech-communication,
    - *Symmetry https://www.mdpi.com/journal/symmetry,*
    - *Applied Sciences https://www.mdpi.com/journal/applsci,*
    - Electronics https://www.mdpi.com/journal/electronics.

Dr. J. Bernatavičienė –

- Managing Co-editor of Baltic Journal of Modern Computing, http://www.bjmc.lu.lv/editorial-board/;
- member of IEEE http://www.ieee.org;
- Member of Lithuanian Computer Society (Artificial Intelligence Section), http://www.liks.lt/;
- Member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/;
- Member of Lithuanian Operational Research Society, http://www.mii.lt/LitORS/;
- reviewer of international journals:
    - *Informatica (IOSPress/VU),*
    - *Baltic Journal of Modern Computing,*
    - *Sensors,*
    - *Applied Sciences,*
    - *Journal of Marine Science and Engineering.*

G. Navickas –

- member of Lithuanian Computer Society, http://www.liks.lt;

- member of IEEE Computer Society http://www.ieee.org.

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

- J. Malūkaitė. J. Bernatavičienė, P. Treigys "*Enhancing Arrhythmia Detection Using an Ensemble of Transformer Models for Heartbeat Classification*" // 10th International Conference, LOD 2024 "Machine Learning, Optimization, and Data Science", Castiglione della Pescaia, Italy, September 22-25, 2024;
- A. Vaitulevičius, J. Bernatavičienė, P. Treigys "*nnU-Net: Investigation of Attention Mechanism for Prostate Zone Segmentation Task*" // EHB 2024, Iasi, Romania, November 14-15, 2024.

MOST IMPORTANT PARTICIPATION CASES OF RESEARCHERS IN WORKING GROUPS OR COMMISSIONS SET UP BY STATE AUTHORITIES, STATE AND MUNICIPAL INSTITUTIONS, ORGANISATIONS, BUSINESS ENTITIES

- Povilas Treigys is a:
  - Member of Board of the Lithuanian Quantum Technology Association,
  - Member of the Council of Visoriai Information Technology Park,
  - VU Faculty of Mathematics and Informatics representative at the Infobalt Education Committee,
  - VU Faculty of Mathematics and Informatics representative at the Telecommunications, Computer Programming, Consulting and Related Activities Sectoral Professional Committee,
  - VU Faculty of Mathematics and Informatics representative at the Commission for Coordination of Products and Service Accessibility Issues.

CONSULTATIONS PROVIDED BY THE UNIT TO THE PUBLIC OR ECONOMIC ENTITIES

- Consultation by dr. J. Bernatavičienė and prof. P. Treigys: *"Aspects of application of machine learning methods in ECG signal analysis"* under the cooperation agreement with JSC "Zive" (there were initiated and ongoing corresponding topics of master's and bachelor's theses);
- Consultation by dr. J. Bernatavičienė and prof. P. Treigys: "*Aspects of application of machine learning methods in MRI signal analysis"* under the cooperation agreement with National Cancer Institute (there were initiated and ongoing corresponding topics of master's and bachelor's theses).

INTELLIGENT TECHNOLOGIES RESEARCH GROUP

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www.mii.lt/en/structure/scientific-subdivisions/intelligent-technologies-research-group

Head – Prof. Dr. *Virginijus Marcinkevičius*

STAFF

Principal researchers: Prof. Dr. Darius Plikynas.
Senior researchers: Prof. Dr. Virginijus Marcinkevičius, Prof. Dr. Darius Plikynas, Prof. Dr. Igoris Belovas.
Affiliated researchers: Prof. Habil. Dr. Leonidas Sakalauskas**,** Dr. Stasys Steišūnas.
Junior assistants: Lukas Kuzma, Rolandas Gricius.
Profesors: Prof. Dr. Virginijus Marcinkevičius , Prof. Dr. Igoris Belovas, Prof. Dr. Darius Plikynas.
Doctoral students: Aivaras Bielskis, Chaževskas Andrius, Dulskis Vytautas, Gricius Rolandas, Saulius Grigaitis, Lukas Kuzma, Ieva Rizgelienė, Brendonas Stakauskas, Urbonaitė Neringa, Vaitkevičius Paulius.
Other staff and researchers in projects: Doc. Dr. Vilma Zubaitienė, Dr. Gaubienė Neringa, Dr. SkIaistė Volungevičienė, Jelena Vasilionokienė, Paulius Zaranka, Ieva Rizgelienė, Dr. Nerijus Maliukevičius

RESEARCH INTERESTS

- Machine learning and its application.
- Artificial intelligence and its application.
- Natural language processing.
- Cyber security.
- Mathematical modeling.
- Image analysis.
- Data mining and visualization.
- Application of modeling, classification and clustering methods in medicine (e.g. in genetics) and economics.
- Optimization. Application of stochastic optimization methods in engineering.
- Multi-agent systems: simulation and application in social research.
- Propaganda and disinformation recognition, classification and societal impact modeling
- Experimental mathematics
- Analytic number theory

RESEARCH PROJECTS CARRIED OUT IN 2024

- **Projects Supported by University Budget**

Research theme "Advanced applications of machine learning, mathematical modeling, and large language models (2024–2028)"
The main goal is to develop solutions based on machine learning, mathematical modeling, and large-scale language models for cybersecurity, natural language processing, propaganda and disinformation detection, and image analysis.

Main results:

- Proposed end-to-end method with pre-training based on the visual place recognition method, in order to mitigate the effect of variation in data. As there always are situations where the

trained agents encounter unseen conditions (e.g. wheather conditions), which results in a shift in the data distribution in wheather condition.

- Results were obtained about the region of the complex plane that does not contain zeros of the prime zeta function; hypotheses were put forward and tested about the distribution of zeros of the prime zeta function.
-

Main publications:

- Juneja, Shubham; Daniušis, Povilas; Marcinkevičius, Virginijus. Visual place recognition pre-training for end-to-end trained autonomous driving agent // IEEE access. Piscataway : Institute of Electrical and Electronics Engineers Inc. eISSN 2169-3536. 2023, vol. 11, p. 128421-128428. DOI: 10.1109/ACCESS.2023.3331678 (Impact Factor 2022: 3,9).
- Belovas, I., Sabaliauskas M., Čepaitytė M. On the zero-free region and the distribution of zeros of the prime zeta function. Analele Stiintifice Ale Universitatii Ovidius Constanta-Seria Matematica (in review).
- Sakalauskas, Leonidas; Dulskis, Vytautas; Plikynas, Darius. A technique for efficient estimation of dynamic structural equation models: a case study // Structural equation modeling. Abingdon : Routledge. ISSN 1070-5511. eISSN 1532-8007. 2024, vol. 31, iss. 4, p. 635-650. DOI: 10.1080/10705511.2023.2282378 (Impact Factor, 2,5 (2023)).

- **National Research Projects**

National government commissioned studies: Priority Research Programme 2023-2026 "Building Societal Resilience and Crisis Management in the Context of Contemporary Geopolitical Developments". Implementation via Lithuanian Research Council. Project title: 'Propaganda and disinformation research: machine learning-based automatic recognition, impact and societal resilience'.
Funding agreement: 30 June 2023, No. S-VIS-23-8.
Implementation period: 01.09.2023 - 30.06.2026.
Financing amount: 195607 EUR.
Partners: University of Arkansas, UAB Delfi, University of Cyprus, Strategic Communication Department of the Lithuanian Armed Forces, VŠĮ Lietuvos nacionalinis radijas ir televizija.
The aim of the project is to develop a recommendation decision support tool for automatic detection of propaganda and disinformation in media news portals and social network messages using machine learning methods.
Join project with VDU "Abstract libraries for artificial intelligence." Funding programme: Economic Recovery and Resilience Plan "New Generation Lithuania"
Project code: Nr.02-101-K-0001
Implementation period: 12.08.2024 - 30.04.2026.
The project aims to develop and validate mixed corpora of Lithuanian language text summaries/abstracts for training deep learning-based automatic compilation systems.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

SAP (Germany)
Neurotechnology (Lithuania)
University of Tartu (Estonia)
University of Latvia (Latvia)
FERMI research consorcium (flagship research and innovation programme Horizon Europe).
Pan-European multidiscplinary network (SoBigData++ programme under the European Union's Horizon 2020 research and innovation programme, grant agreements No. 871042).
Vilnius Gediminas Technical University (Lithuania)

Strategic Communications Department of the Lithuanian Armed Forces (Lithuania)
Lithuanian National Radio and Television (Lithuania)
UAB Delfi (Lithuania)
University of Arkansas (US)
University of Cyprus (Cyprus)

OTHER RESEARCH ACTIVITIES

Prof. L. Sakalauskas –

- Editorial board member of Journal Technological and Economic Development of Economy http://www.tandf.co.uk/journals/journal.asp?issn=2029-4913&linktype=145
- Elected member of International Statistical Institute (2001) http://isi-web.org;
- Member of European Working Group on Continuous Optimization http://www.iam.metu.edu.tr/EUROPT
- Member of European Working Group on Stochastic Optimisation http://www.mii.lt/EWGSO
- Member of European Working Group on Civil Engineering and Sustainable Development http://http://www.orsdce.vgtu.lt
- President of Lithuanian Operational Research Society, http://www.mii.lt/LitORS
- Chair of Lithuanian Conference on Operations Research and Application in Business and Technics http://www.mii.lt/OT-2016.
- Reviewer of international journals:
    - Annals of Operation Research (Springer)
    - European Journal of Operational Research (Elsevier)
    - Informatica (IOSPress/VU)
    - Central European Journal of Operational Research (Springer),
    - Information Technology and Control (KTU),
    - International Transactions on Operational Research (Wiley&Sons)
    - Methodology and Computing in Applied Probability (Springer)
    - Technological and Economic Development of Economy (Francis&Taylor)

Prof. D. Plikynas -

- Reviewer in
    - Computational and Mathematical Organization Theory (Springer)
    - Entropy (MDPI)
    - PeerJ
    - Economics (VU)
    - Information Technology and Control (KTU)
- Member of
    - Artificial Intelligence section of Lithuanian Computer Society (LIKS-AIS)
    - ESSA (European Social Simulation Association)
    - ECCAI (European Coordinating Committee for Artificial Intelligence)

Prof. Dr. I. Belovas –

- Member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/
- Member of editorial board of "Lietuvos matematikos rinkinys" journal
- Reviewer of international journal "Informatica"
- Reviewer of international journal "Mathematical Modeling and Analysis"
- Reviewer of international journal "Nonlinear Analysis: Modelling and Control"

Prof. Dr. V. Marcinkevičius –

- Member of Lithuanian Computer Society, http://www.liks.lt/en/modules/tinycontent/index.php?id=3
- Member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/

- Member of Lithuanian Operational Research Society, http://www.mii.lt/LitORS/
- Member of European Working Group on Stochastic Optimisation http://www.mii.lt/EWGSO
- Reviewer of international journal Informatica (IOSPress/VU)
- Member of editorial board of journal Applied Computer Systems
- Member of IST-141-RTG on Exploratory Visual Analytics group
- Substitute in COST action Statistical and machine learning techniques in human microbiome studies.
- Member of Artificial Intelligence Doctoral Academy (AIDA), https://www.i-aida.org/
- Reviewer of international journals:
    - Informatica (IOSPress/VU)
    - IEEE Access
    - Digital Signal Processing
    - Informatics in Education
    - Baltic Journal of Modern Computing

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

R. Gricius, I Belovas. Using Large Language Models in Anti-Money Laundering Automation. 13th Counter Fraud, Cybercrime and Forensic Accounting Conference. Portsmouth, 2024-06-12-13

D. Plikynas. Systematic Overview of Machine Learning Applied for Propaganda Social Impact Research. *5th International Conference on NLP & Artificial Intelligence Techniques (NLAI 2024)*, Zurich, Switzerland. Proceedings: Volume 14 : Number 22 : Computer Science & Information Technology (CS & IT)

MOST IMPORTANT RESEARCH DISSEMINATION ACTIVITIES

- Ongoing research was presented on internet program hosted by Rolandas Maskoliūnas on the topic "Neural network training, lying artificial intelligence and the Lithuaniasn version of ChatGPT" https://www.lrt.lt/mediateka/irasas/2000320024/neuronu-tinklu-treniravimas-meluojantis-dirbtinis-intelektas-ir-lietuviska-chatgpt-versija
- Participated in the discussion at the "Agribusiness Forum" on the topic "Artificial intelligence in agriculture. What will inevitably change?" https://konferencijos.vz.lt/agroverslas/
- Consulting and collaboration established with the EU Horizon project FERMI. FERMI consortium develops a framework to detect and monitor the way that D&FN spread, both in terms of locations and within different segments of the society, and to put in place relevant security countermeasures. FERMI Project - Fake News Risk Mitigator (fighting-fake-news.eu)
- Our research team became Meta research partner via Harvard Social Science One program.
- Video program at the Lithuanian public broadcaster (Lithuanian Radio and Television - LRT): Neuronų tinklų treniravimas, meluojantis dirbtinis intelektas ir lietuviška „ChatGPT“ versija - 2024.03.02 - LRT
- Establishment of collaborating international research team consisting of researchers from Vilnius University, University of Tartu and University of Latvia. Lithuanian, Latvian and Estonian researchers have jointly created databases of propaganda and disinformation articles from each country in LabelStudio, where the articles are analyzed by noting the propaganda techniques, narratives and other features used. Mutual agreement has been reached on a comparative study of propaganda and disinformation specifics in the Baltic region, with a view to a joint publication of a WoS Q1-2 paper, conference presentations, and potentially a joint application for a European project.
- Science popularization article (#1) published in LRT Science and Technology News:

https://www.lrt.lt/naujienos/mokslas-ir-it/11/2402008/vu-mokslininkai-kuria-inovatyvu-dirbtinio-intelekto-iranki-propagandai-aptikti

- Science popularization article (#2) published in LRT Science and Technology News: https://www.lrt.lt/naujienos/lietuvoje/2/2402027/socialiniai-tinklai-ir-propaganda-ar-tikrai-gebame-atskirti-tiesa-nuo-melo
- Presentation given at the seminar in the University of Tartu (Institute of Computer Science), following SoBigData++ programme under the European Union's Horizon 2020 research and innovation programme.
- Collaboration with Google Cyber Security and Baltic regional representatives to use data from the Baltic region for propaganda and disinformation research.

INTERDISCIPLINARY STATISTICAL RESEARCH GROUP

Akademijos str 4., LT-08663 Vilnius
Tel. +370 5 2109303
E-mail: audrone.jakaitiene@mf.vu.lt
www.mii.lt/en/structure/scientific-subdivisions/interdisciplinary-statistical-research-group

Head – Prof. Dr. *Audronė Jakaitienė*

STAFF

Principal Researcher: Prof. Dr. Jakaitienė Audronė, Assoc. Prof. Dr. (HP) Norvidas Saulius
Senior Researchers: Dr. Čiginas Andrius, Dr. Otera Daniele Ettore
Researcher: Dr. Novickij Jurij, Dr. Vaičiulis Marijus, Dr. Žvirblis Tadas
Professor: Prof. Habil. Dr. Kubilius Kęstutis (affiliated), Prof. Habil. Dr. Sapagovas Mifodijus (emeritus)
Assistant: Dr. Ringienė Laura
Phd Students: Burakauskaitė Ieva, Juškys Raimondas, Puronaitė Roma, Šablauskas Karolis, Vaišnorė Ramunė, Vitkauskaitė Akvilė

RESEARCH INTERESTS

- Biostatistical analysis in biomedical research.
- Statistical analysis and modelling of International Large-Scale Assessment data.
- Application of statistical methods in mechatronic systems processes.
- Non-probability and probability sample integration.
- Parameter estimation in small population areas.
- Algebraic geometry.
- Geometry, Topology, Group theory

MAIN SCIENTIFIC ACHIEVEMENTS IN 2024

1. **Žvirblis, Tadas**; Pikšrys, Armantas; Bzinkowski, Damian; Rucki, Mirosław; Kilikevičius, Artūras; Kurasova, Olga. Data augmentation for classification of multi-domain tension signals // Informatica. Vilnius : Vilniaus universiteto leidykla. ISSN 0868-4952. eISSN 1822-8844. 2024, Early Access, p. [1-26]. DOI: 10.15388/24-INFOR578.
2. **Otera, Daniele Ettore**. An outreach note on the Poincaré Conjecture for non-specialists // European journal of pure and applied mathematics. Maryland : New York Business Global. ISSN 1307-5543. 2024, vol. 17, no. 3, p. 2361-2369. DOI: 10.29020/nybg.ejpam.v17i3.5351.
3. **Sapagovas, Mifodijus**; Būda, Vytautas; Maskeliūnas, Saulius; Štikonienė, Olga; Štikonas, Artūras. Minimal surfaces and the Plateau problem: numerical methods and applications // Informatica.

Vilnius : Vilnius University Press. ISSN 0868-4952. eISSN 1822-8844. 2024, vol. 35, iss. 2, p. 401-420. DOI: 10.15388/24-INFOR552.

4. **Kubilius, Kęstutis**. The implicit Euler scheme for FSDEs with stochastic forcing: Existence and uniqueness of the solution // Mathematics. Basel : MDPI. eISSN 2227-7390. 2024, vol. 12, iss. 16, art. no. 2436, p. [1-18]. DOI: 10.3390/math12162436.
5. Jucevičienė, Agnė; **Puronaitė, Roma**; Badarienė, Jolita; Ryliškytė, Ligita. Aortic pulse wave velocity predicts cardiovascular mortality among middle-aged metabolic syndrome subjects without overt cardiovascular disease // Nutrition & metabolism. London : BMC. ISSN 1743-7075. 2024, vol. 21, art. no. 98, p. [1-10]. DOI: 10.1186/s12986-024-00875-z.

RESEARCH PROJECTS CARRIED OUT IN 2024

International Research Projects

1. European Joint Programme on Rare Diseases (EJP RD) Joint Transnational Call 2022 funded Project "Resolve 15q" No. EJPRD22-134; Nr. S-EJP RD-23-1. Coordinator: University of Heidelberg. https://www.ejprarediseases.org/funded-projects-jtc22/
2. 2. R&D project "Education Systems Benchmarking with Frontier Techniques (eduBEST)". Application No. 2022.08686.PTDC. Coordinator: University of Porto. Funding source: Portugal budget. https://edubest.inesctec.pt
3. Postdoctoral fellowship project "Development of artificial intelligence methods for prediction and classification of mechatronic systems parameters", No. P-PD-22-036.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

Institute of Human Genetics, Heidelberg university [GERMANY]
Krembil Research Institute [CANADA]
Karolinska Institutet [SWEDEN]
Radboud institute for molecular life sciences [THE NETHERLANDS]
University of Porto [PORTUGAL]
Nacionalinis vėžio institutas [LITHUANIA]

OTHER RESEARCH ACTIVITIES

Prof. A. Jakaitienė, PhD –

- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/index.html;
- board member of Lithuanian Statistics Society, http://www.statistikusajunga.lt/;
- member of International Biometric Association, https://www.biometricsociety.org;
- country representative of International Biometric Association in Nord Baltic Region, http://ibsnbr.org;
- country representative at European Statistical Advisory Committee, https://ec.europa.eu/eurostat/web/european-statistical-advisory-committee-esac;
- member of the International Society for Clinical Biostatistics, https://www.iscb.info/.

Andrius Čiginas, PhD –

- member of Lithuanian Statistics Society, http://www.statistikusajunga.lt/;
- steering committee member of Baltic-Nordic-Ukrainian Network on Survey Statistics https://wiki-emerita.it.helsinki.fi/display/BNU/Organisation
- member, country representative of International Association of Survey Statisticians (IASS)

Prof. Kęstutis Kubilius, PhD –

- co-editor-in-Chief of the Modern Stochastics: Theory and Applications, https://www.vmsta.org/journal/VMSTA/information/editorial-board;

- editorial board member of the Lithuanian Mathematical Journal, https://link.springer.com/journal/10986/editors;
- editorial board member of the Mathematical Modelling and Analysis, https://journals.vilniustech.lt/index.php/MMA/editorialboard.

Prof. Saulius Norvidas, PhD –

- editorial board member of the Lithuanian Mathematical Journal, https://link.springer.com/journal/10986/editors.

Prof. Emeritus Mifodijus Sapagovas, PhD –

- editorial board member of the Lithuanian Mathematical Journal, https://link.springer.com/journal/10986/editors;
- editorial board member of the journal Nonlinear Analysis: Modelling and Control, https://www.journals.vu.lt/nonlinear-analysis/about/editorialTeam;
- editorial board member of the journal Informatica, https://informatica.vu.lt/journal/INFORMATICA/information/INFORMATICA-Editorial;
- editorial board member of the Mathematical Modelling and Analysis, https://journals.vilniustech.lt/index.php/MMA/editorialboard.

Tadas Žvirblis, PhD –

- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/index.html;
- member of Lithuanian Statistics Society, http://www.statistikusajunga.lt/.
- member of Artificial Intelligence Association of Lithuania, https://lithuania.ai/
- member of Institute of Electrical and Electronics Engineers (IEEE), https://www.ieee.org/
- member of Association of Lithuanian Young Scientists
- member of Association of Hematology, Oncology and Transfusion LTU

Daniele Ettore Otera, PhD –

- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/index.html;
- Ph.D. committee member in mathematics MIF, http://mif.vu.lt/lt3/studijos/doktorantams#matematikos-studijų-komitetas

Marijus Vaičiulis, PhD –

- member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/index.html;
- Asociate editor in Research in Statistics, https://www.tandfonline.com/journals/urst20/about-this-journal#editorial-board

PhD student Akvilė Vitkauskaitė –

- secretary of Lithuanian Statistics Society, https://www.statistikusajunga.lt/;

PhD student Ieva Burakauskaitė –

- member of International Statistical Institute, https://isi-web.org/;

PhD student Roma Puronaitė

- member of the International Society for Clinical Biostatistics, https://www.iscb.info/

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

19th annual conference "BBCC2024 Bioinformatics and Computational Biology", Naples, Italy, November 27-29, 2024; https://www.bbcc-meetings.it/wp-content/uploads/2024/11/BBCC2024-Program.pdf
INVITED LECTURE: Predictive Analytics in Medicine and Biology

XVIII European workshop on efficiency and productivity analysis, Faro, June 18-21, 2024, Portugal, https://www.ewepa.org/;
TITLE: Does achievement gap correlate with average performance? Case of PIRLS

32nd International Biometric Conference (IBC2024) 8-13 December 2024, Atlanta, Georgia, USA, https://www.ibc2024.org/ibc2024/home
TITLE: How to Model Genetic Changes in 15Q13.3? (4099324)

Baltic-Nordic-Ukrainian (BNU) Workshop on Survey Statistics 2024, 2024-08-26 – 2024-08-30; Poznan, Poland;
https://wiki.helsinki.fi/xwiki/bin/view/BNU/Events/Workshop%20on%20Survey%20Statistics%202024/;
TITLE: Small area estimation of tourism indicators using online booking platform data
TITLE: Nowcasting Consumer Confidence Indicators Using Social Media and Google Trends Data

Joint Statistical Meetings (JSM 2024), 2024-08-03 – 2024-08-08, Portland, Oregon, USA, https://ww2.amstat.org/meetings/jsm/2024/;
TITLE: Estimation of job vacancies in small population domains using web-scraped data
TITLE: ntegrating a non-probability sample and its complementary probability sample

11th European Conference on Quality in Official Statistics (Q2024), 2024-06-04 – 2024-06-07; Estorili, Portugal; https://www.q2024.pt/
TITLE: Integrating Social Media and Administrative Data for the Real-Time Prediction of the Consumer Confidence Indicator
TITLE: Combining Online Job Advertisements with Probability Sample Data for Enhanced Small Area Estimation of Job Vacancies

IEEE 11th workshop on Advances in Information, Electronic and Electrical Engineering (AIEEE), 31 May - 01 June 2024, Valmiera, Latvia, https://ieee.lv/aieee/
TITLE: Deep autoencoder model for hypoid gear fault diagnosis with dynamic torque and rotation speed

IEEE 11th workshop on Advances in Information, Electronic and Electrical Engineering (AIEEE), 31 May - 01 June 2024, Valmiera, Latvia, https://ieee.lv/aieee/
TITLE: Investigation of time series data augmentation methods for improving deep learning models in conveyor belt load classification

ARTIFICIAL INTELLIGENCE LABORATORY

Akademijos 4, LT-08663 Vilnius.
Tel. (+370 5) 210 9311
E-mail: virginijus.marcinkevicius@mif.vu.lt
www.mii.lt/en/structure/scientific-subdivisions/artificial-intelligence-laboratory

Head – Prof. Dr. *Virginijus Marcinkevičius*

STAFF

Senior researchers: Dr. Virginijus Marcinkevičius.
Junior researcher: Linas Aidokas
Other staff: Neringa Urbonaitė
Doctoral students: Shubham Juneja, Vytautas Paura, Mantas Briliauskas.

RESEARCH INTERESTS

- Advance machine learning in process automatization.
- Natural language processing.
- Image processing and analysis with deep neural networks.
- Visual odometry and localization.

RESEARCH PROJECTS CARRIED OUT IN 2024

- **Projects Supported by University Budget**

The main goal is to investigate machine and imitational learning usage for robot navigation and localization in real environments. Research of natural language processing applications in human-machine interface

Main results:

1. Juneja, Shubham; Daniušis, Povilas; Marcinkevičius, Virginijus. Visual place recognition pre-training for end-to-end trained autonomous driving agent // IEEE access. Piscataway : Institute of Electrical and Electronics Engineers Inc. eISSN 2169-3536. 2023, vol. 11, p. 128421-128428. DOI: 10.1109/ACCESS.2023.3331678 (Impact Factor 2022: 3,9).
2. Briliauskas, Mantas. Learning stabilization control of quadrotor in near-ground setting using reinforcement learning // Informacinės technologijos ir valdymas = Information technology and control. Kaunas : Technologija. ISSN 1392-124X. eISSN 2335-884X. 2024, vol. 53, no. 1, p. 237-242. DOI: 10.5755/j01.itc.53.1.35135 (Impact Factor 2023, 2.0).
3. Paura, Vytautas; Marcinkevičius, Virginijus. Crop hyperspectral dataset unmixing using modified U-Net model // Digital Business and Intelligent Systems. 16th International Baltic Conference, Baltic DB&IS 2024, Vilnius, Lithuania, June 30 – July 3, 2024 : proceedings / editors: Audronė Lupeikienė, Jolita Ralytė, Gintautas Dzemyda. Cham : Springer Science and Business Media Deutschland GmbH, 2024. ISBN 9783031635427. eISBN 9783031635434. p. 195-210. (Communications in computer and information science, ISSN 1865-0929, eISSN 1865-0937 ; vol. 2157). DOI: 10.1007/978-3-031-63543-4_13.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INNOVATION) PARTNERS

SAP (Germany)
Neurotechnology (Lithuania)

OTHER RESEARCH ACTIVITIES

Dr. V. Marcinkevičius –

- Member of Lithuanian Computer Society, http://www.liks.lt/en/modules/tinycontent/index.php?id=3
- Member of Lithuanian Mathematical Society, http://www.mif.vu.lt/lmd/
- Member of Lithuanian Operational Research Society, http://www.mii.lt/LitORS/
- Member of European Working Group on Stochastic Optimisation http://www.mii.lt/EWGSO
- Reviewer of international journal Informatica (IOSPress/VU)
- Member of editorial board of journal Applied Computer Systems
- Member of IST-141-RTG on Exploratory Visual Analytics group
- Substitute in COST action Statistical and machine learning techniques in human microbiome studies.
- Member of Artificial Intelligence Doctoral Academy (AIDA), https://www.i-aida.org/
- Reviewer of international journals:
    - Informatica (IOSPress/VU)
    - IEEE Access
    - Digital Signal Processing
    - Informatics in Education
    - Baltic Journal of Modern Computing

Linas Aidokas -

- Member of Institute of Electrical and Electronics Engineers https://www.ieee.org
- Member of Institute of Electrical and Electronics Engineers Young Professionals https://yp.ieee.org

BEST REPORTS DELIVERED AT CONFERENCES ABROAD

Shubham, Juneja; Povilas, Daniušis, Virginijus, Visual Place Recognition Pre-Training for End-to-End Trained Autonomous Driving Agent, The First International Conference on AI-based Systems and Services“ (AISyS 2024) 2024, https://ieeexplore.ieee.org/abstract/document/10313277/

MOST IMPORTANT RESEARCH DISSEMINATION ACTIVITIES

- Ongoing research was presented on internet program hosted by Rolandas Maskoliūnas on the topic "Neural network training, lying artificial intelligence and the Lithuanian version of ChatGPT" https://www.lrt.lt/mediateka/irasas/2000320024/neuronu-tinklu-treniravimas-meluojantis-dirbtinis-intelektas-ir-lietuviska-chatgpt-versija
- Participated in the discussion at the "Agribusiness Forum" on the topic "Artificial intelligence in agriculture. What will inevitably change?" https://konferencijos.vz.lt/agroverslas/