

**RESEARCH INSTITUTE
FOR INTELLIGENT COMPUTER SYSTEMS**

**WEST UKRAINIAN NATIONAL UNIVERSITY,
MINISTRY OF EDUCATION AND SCIENCE, UKRAINE**

**V.M. GLUSHKOV INSTITUTE FOR CYBERNETICS,
NATIONAL ACADEMY OF SCIENCES, UKRAINE**

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FOREWORD

We present the next annual report of the Scientific Research Institute for Intelligent Computer Systems (RIICS) of the West Ukrainian National University and the V.M. Glushkov Institute of Cybernetics of the NAS of Ukraine. RIICS was established in 2004 based on the Branch Scientific Research Laboratory of Automated Systems and Networks, which, in turn, was the successor of the Branch Scientific Research Laboratory of Automated Information Collection and Processing Systems, founded in 1984 by the Ministry of Electronic Industry of the USSR.

Nowadays, RIICS includes 21 problem-oriented groups, and the Institute has added several new problem groups: intelligent computing for modeling complex systems under uncertainty, virtual and augmented reality, hybrid computational intelligence systems, intelligent geoinformation systems for environmental monitoring, artificial intelligence control methods for monitoring critical infrastructure facilities. These groups include domestic and foreign scientists, both leading and young scientists.

During its history, the RIICS staff has received more than 150 invention certificates of the former USSR and 85 Ukrainian patents. There were published more than 2500 papers and 499 of them in 2025 (an increase of 88% compared to 2024.). Also, 57 DSc and PhD theses were defended.

The high scientific and technical level of development is confirmed by winning 24 international projects within the framework of the INTAS, CRDF, STCU, NSF, NATO and the Seventh Framework Program FP7 of the European Union. In particular, the ERASMUS+ KA220 project “Digitalization of Sustainable Disaster and Emergency Management Processes” (SUDEM) is being implemented in 2025, and the projects “Information technology for ensuring effective electricity accumulation by a hybrid power plant” and “Project and Innovation Management for Ukraine” have also been continued.

Another 22 projects during this period were completed with funding from the Ministry of Education and Science of Ukraine. In particular, in 2023 the project “Intelligent System for Recognizing Defects in Green Energy Facilities Using UAVs” has been implemented, the project manager is Dr. of Engineering Sciences, Prof. Anatoliy Sachenko, the responsible executor is Ph.D. of Engineering Sciences, Assoc. Prof. Diana Zagorodnia, the interim results of which have been published in a number of leading journals and a number of patents have been obtained.

The staff of the RIICS, together with the Faculty of Computer Information Technologies, are the organizers of the international conferences Intelligent Data Acquisition and Advanced Computing Systems (IDAACS) www.idaacs.net, which have been held since 2001 every two years under the auspices of the International Society of Electrical and Electronics Engineers (IEEE), whose scientific works are indexed by the scientific-metric databases Web of Science, EI Compendex and Scopus. On September 4-6, 2025, IDAACS’2025 was held at the Silesian University of Technology, Gliwice, Poland. 25 articles were published in the conference proceedings. The Research Institute team, in collaboration with Professor Bardis' team, began preparations for the next IDAACS’2027, which is scheduled to be held on September 22-25, 2027 at the Hellenic Army Academy, Athens, Greece.

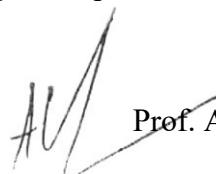
The RIICS continues the practice of good relations with IEEE within the framework of the functioning of the student branch of WUNU and the IEEE Instrumentation & Measurement/Computational Intelligence Joint Societies branch of the “Ukraine” section. Together with the “Advances & Challenges in Computing” A2C workshop (scientific secretary, associate professor Vasyl Koval), the IEEE branch held four meetings in 2025.

The RIICS in cooperation with the V.M. Glushkov Institute of Cybernetics of the NAS of Ukraine, publishes the International Journal of Computing quarterly, indexed by Scopus Elsevier, as well as Finnish publication forum, Norwegian Social Science Data Services, Google Scholar, Index Copernicus International in English. The four issues were published in 2025, in which 78 articles were published.

Finally, I would like to thank Dr. Taras Lendyuk, Maksym Palka and Dr. Oksana Chereshtnyuk for their help in preparing, editing and designing this report.

Enjoy,

March 15, 2026



Prof. Anatoliy Sachenko

1. GENERAL INFORMATION

ICS History

The mission of the Research Institute for Intelligent Computer Systems (ICS) is to develop international research projects and improve project management in the field of Computing with the participation of inter-university teams.

The institute is in building No. 11 of the West Ukrainian National University. The ICS counts the 21 Research Groups, in particular: Intelligent Distributed Systems, Intelligent Sensor Data Acquisition, Intelligent Robotic Systems, Neural Networks and Parallel Computing, Knowledge Bases and Ontologies, Information Technology and Specialized Computer Systems, Image Processing and Pattern Recognition, Wireless Systems Security, Intelligent Project and Program Management, Intelligent Computations for Modeling Complex Systems under Uncertainty, Information Security, Intelligent Cyber Security and Defense, Metrology of Information Measuring Systems, Design and Testing of FPGA Component for Safety Related Systems, Virtual Instruments for IoT, Big Data and Data Sciences, Human-Computer Interaction, Virtual and Augmented Reality, Hybrid Systems of Computational Intelligence, Intelligent Geographic Information Systems for Environmental Monitoring, AI Driving Methods for Monitoring the Critical Infrastructure Facilities.

ICS Management

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 Scientific Advisor – Prof. Volodymyr Kochan
 Scientific Secretary – Dr. Oksana Chereshnyuk

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ICS Frame

Intelligent Distributed Systems (IDS)

Principal researcher – Prof. Anatoliy Sachenko
 Group members:

- Pavlo Bykovyy
- Volodymyr Kochan
- Myroslav Komar
- Olexandr Osolinskyi
- Vasyl Yatskiv

Intelligent Sensor Data Acquisition (ISDA)

Principal researcher – Prof. Volodymyr Kochan
 Group members:

- Pavlo Bykovyy
- Mykhailo Dombrovsky
- Zbyshek Dombrovsky
- Orest Kochan
- Olexandr Osolinskyi
- Oleksiy Roshchupkin
- Radislav Smid

- Iryna Turchenko
- Nadia Vasylykiv

Intelligent Robotic Systems (IRS)

Principal researchers – Prof. Robert Hiromoto, Dr. Vasyl Koval

Group members:

- Oleh Adamiv
- Vladimir Golovko
- Anatoliy Sachenko

Neural Networks and Parallel Computing (NNPC)

Principal researchers – Prof. Vladimir Golovko, Dr. Volodymyr Turchenko

Group members:

- Vitaliy Dorosh
- Volodymyr Kochan
- Myroslav Komar
- Khrystyna Lipianina-Honcharenko
- Nazar Melnyk
- Anatoliy Sachenko

Knowledge Bases and Ontologies (KBO)

- Principal researchers – Prof. Andriy Melnyk, Prof. Sergey Rippa

Group members:

- Taras Lendyuk
- Anatoliy Sachenko
- Svitlana Sachenko
- Serhiy Voznyak

Information Technology and Specialized Computer Systems (ITSCS)

- Principal researchers – Prof. Yaroslav Nykolaychuk, Prof. Natalia Vozna

Group members:

- Orest Volynskyy
- Arthur Voronych
- Oleg Zastavnyy

Image Processing and Pattern Recognition (IPPR)

Principal researcher – Prof. Bohdan Rusyn

Group members:

- Pavlo Bykovyy
- Dmytro Lendiuk
- Sergiy Rimashevskyy
- Anatoliy Sachenko
- Diana Zahorodnia
- Denys Zolotukhin

Wireless Systems Security (WSS)

Principal researchers – Prof. Vasyl Yatskiv, Prof. Taras Maksymyuk

Group members:

- Robert Hiromoto
- Anatoliy Sachenko
- Jürgen Sieck
- Taras Tsavolyk
- Orest Volynskyy
- Natalia Yatskiv

Intelligent Project and Program Management (IPPM)

Principal researchers – Prof. Sergey Bushuyev, Prof. Carsten Wolff

Group members:

- Oksana Chereschnyuk
- Mykhailo Dombrovsky
- Zbyshek Dombrovsky
- Grygoriy Hladiy
- Taras Lendiuk
- Anatoliiy Sachenko
- Marian Senkiv
- Iryna Turchenko
- Nadiia Vasylkiv
- Victoria Vozniak
- Daria Vynohradova

Intelligent Computations for Modeling Complex Systems under Uncertainty

Principal researchers – Prof. Mykola Dyvak, Prof. Frane Urem

Group members:

- Roman Pasichnyk
- Volodymyr Manzhula
- Andriy Melnyk
- Andriy Pukas
- Yuriy Pigovskyy
- Yaroslav Tsapiv
- Oleksandr Papa
- Yuriy Maslyak
- Vasyl Tymchyshyn
- Andriy Simak
- Vitaliy Smal

Information Security (IS)

Principal researchers – Prof. Mykola Karpinsky, Prof. Sergiy Lysenko

Group members:

- Pavlo Bykovyy
- Mykhailo Kasianchuk
- Myroslav Komar
- Ihor Romanets
- Vasyl Yatskiv

Intelligent Cyber Security and Defense (ICSD)

Principal researchers – Prof. George Markowsky, Prof. Oleg Savenko

Group members:

- Pavlo Bykovyy
- Vladimir Golovko
- Stepan Ivasiev
- Volodymyr Karpinskyy
- Pavlo Radiuk
- Sergii Vladov
- Vasyl Yatskiv

Metrology of Information Measuring Systems (MIMS)

Principal researcher – Prof. Roman Kochan

Group members:

- Volodymyr Kochan
- Olexandr Osolinskyi

- Hryhorii Sapozhnyk
- Nadiia Vasylykiv

Design and Testing of FPGA Components for Safety Related Systems (DTFPGA)

Principal researchers – Prof. Vladimir Opanasenko, DSc Kostiantyn Zashcholkin

Group members:

- Viktor Antoniuk
- Miroslav Drozd
- Oleksandr Martynyuk
- Olexandr Osolinskyi

Virtual Instruments for IoT (VIIoT)

Principal researchers – Prof. Orest Kochan, Prof. Francesco Lamonaca

Group members:

- Pavlo Bykovyy
- Volodymyr Kochan
- Oleksandr Osolinskyi

Big Data and Data Sciences (BDDS)

Principal researchers – Prof. Natalya Shakhovska, Prof. Vasyl Lytvyn

Group members:

- Oksana Karpinska
- Volodymyr Kochan
- Khrystyna Lipyanina-Goncharenko
- Anatoliy Sachenko
- Oleg Savenko

Human-Computer Interaction (HCIG)

Principal researcher – Prof. Juergen Sieck

Group members:

- Pavlo Bykovyy
- Oleksandr Osolinskyi
- Anatoliy Sachenko
- Iryna Turchenko
- Natalia Yatskiv

Virtual and Augmented Reality (VAR)

Principal researcher – Prof. Juergen Sieck

Group members:

- Pavlo Bykovyy
- Khrystyna Lipianina-Honcharenko
- Anatoliy Sachenko
- Iryna Turchenko
- Diana Zahorodnia

Hybrid Systems of Computational Intelligence (HSCI)

Principal researcher – Prof. Yevgeniy Bodyanskiy

Group members:

- Olha Chala
- Serhii Kostiuk
- Nonna Kulishova
- Iryna Pliss
- Anatoliy Sachenko

Intelligent Geographic Information Systems for Environmental Monitoring

Principal researchers – Prof. Nataliia Kussul, Dr. Leonid Bytsyura, Prof. Nataliia Dzubanovska, Prof. Andriy Shelestov

Group members:

- Georgi Georgiev
- Sofia Drozd
- Dmytro Hural
- Mykhailo Machuliak
- Ruslan Savchyshyn

AI Driving Methods for Monitoring the Critical Infrastructure Facilities

Principal researchers – Dr. Lesia Dubchak, Dr. Georgi Georgiev

Group members:

- Nazar Vivchar
- Bohdan Derysh
- Andriy Kaniovskyi
- Victor Kremin
- Maksym Palka
- Anatoliy Sachenko
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2. ICS RESEARCH STAFF

Senior Staff

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Research interests: robotics, artificial intelligence, navigation methods for mobile robots.

Viktor Antoniuk



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Dmytro Bodnar



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Sergey Bushuyev

Founder and president of the Ukrainian Project Management Association, Head of Project Management Department at Kyiv National University of Construction and Architecture. Member of the Board of Directors, a member of the Certification Department, First Assessor in seven countries, International Validator of Certification Programs at International Project Management Association (IPMA), Head of PPMITK Group (2014).

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Research interests: methods and means of digital signals processing, digital filters, decision support systems, arithmetic units and real time special processors, distributed objects automated control systems.

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Research interests: parallel computing, wireless sensors security, wireless networks

Georgi Georgiev

Graduated the National High School for Economics & Trade in Plovdiv. He holds two degrees from the RWTH Aachen University in Germany – for Architecture and for Urban Planning Engineering. In 2019 he obtained a doctoral degree on SRTI-BAS/Fraunhofer on the topic Urban Air Mobility integration in Cities.

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Stepan Ivasiev



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Mykola Karpinskyy



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Volodymyr Karpinskyy



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Mykhailo Kasyanchuk

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Research interests: Physics; Residual class system; Information security; Information security management.

Orest Kochan

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Research interests: intelligent temperature measurement systems.

Roman Kochan

Specialist (1998), Informational Measurement Techniques, State University "Lviv Polytechnic", Ph. D. student (2000), Computational Technique Elements and Devices and Control Systems, Ternopil Academy of National Economy, IEEE member (2001), Ph. D. in Technical Sciences (2005), D.Sc. in Technical Sciences (2013), Head of MIMS group (2014).

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Research interests: distributed measurement systems, microprocessor systems, analog-digital converters.

Volodymyr Kochan

Specialist (1973), Informational Measurement Techniques, Lviv Polytechnic Institute, Ph. D. in Technical Sciences (1989), Devices and Methods for Measuring Thermal Values, Associate Professor of Department for Information Computer Systems and Control (1996), Associate Professor of Department of Specialized Computer Systems (2002), IEEE member (2002), Member of Specialized Academic Council K58.082.02 at TNEU (2002), Director of the Research Institute for Intelligent Computer Systems (2004), IDAACS 2001-2013 OrgCom Vice-Chair, IDS Group Member (2004), NMPC Group Member (2004), Head of ISDA Group (2009), MIMS Group member (2014).

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Research interests: intelligent measurement devices, informational-measurement systems and complexes.

Myroslav Komar



Specialist (2001), Information Systems in Management, Ternopil Academy of National Economy, Master (2002), Economic Cybernetics, Ternopil Academy of National Economy, Programmer (2002), Laboratory of Computing Systems and Networks at Department for Information Computer Systems and Control, Ph.D. Student (2008), Information Technologies, Ph.D. (2013), Information Technologies, IDS Group (2008), IS Group Member (2012), ICSD Group Member (2014).

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Research interests: artificial intelligence, systems of information security.

Vasyl Koval



Specialist (1998), Management Information Systems, Ternopil Academy of National Economy, M.S. in Economic Cybernetics (1999), Ternopil Academy of National Economy, Ph.D. Student (1999), Computing Machines, Systems and Networks, Lecturer (2001), Department for Information Computer Systems and Control, IEEE member (2000), IDAACS International Symposium Organizational Committee Member (2001-2005), Ph.D. in Artificial Intelligence Systems and Means (2004), Associate Professor of the Department for Information Computer Systems and Control (2007), Faculty of Computer Information Technologies, IDAACS 2005-2007 OrgCom Vice-Chair, Co-Head of the IRS group (2009),.

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Research interests: mobile robots signal and image processing, technical vision systems, artificial intelligence, distributed systems.

Victor Kremin



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Research interests: intelligent embedded systems, Automotive, Internet of Things, Mixed signal, Embedded Firmware, High-precision Analog, FPGA.

Nataliia Kussul



In 1987, she graduated from the Taras Shevchenko National University of Kyiv (Faculty of Mechanics and Mathematics) with a degree in Mathematics (1987), received a PhD in Systems Analysis and Automatic Control (1991), a doctoral dissertation in Systems and Control Processes (2001), the Institute for Space Research of the National Academy of Sciences and National Academy of Sciences of Ukraine (ICD of the National Academy of Sciences of Ukraine-National Academy of Sciences of Ukraine) as a senior researcher, head of the Information Technologies and Systems Department, deputy director for scientific work (1996), teaches at the Department of Information Security of the Institute of Physics and Technology of the National Technical University of Ukraine "KPI" (since 1996), associate professor of this department (2001), professor (2006), University of Maryland College Park, USA.

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Research interests: Computational intelligence, machine learning methods, satellite monitoring information technology, risk analysis, geospatial analysis.

Francesco Lamonaca



Ph.D on Computer Science and Systems, University of Calabria: Rende, Italy, Associate Professor at Department of Electric and Electronic Measurements, University of Sannio: Benevento, Italy (2015), Associate Professor of Electric and Electronic Measurements, Department of Computer Science, Modelling, Electronics and Systems, (2020).

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Research interests: measurements for medical use and health parameters monitoring, noninvasive monitoring and testing, and synchronization of networking measurement instruments and sensors.

Taras Lendyuk



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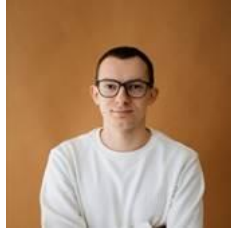


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Research interests: neural networks, renewable energy, fuzzy logic.

Serhiy Voznyak



Engineer-Economist (1996), Information Systems in Management, Ternopil National Economic University Director Deputy of Exploitation and Security (1997), Lecturer, Department of Computer Engineering (1997), KBO Group Member (2012).

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Research interests: computer networks and infrastructure, web-technologies

Viktoriya Voznyak



Bachelor (2024), Automation and Computer-Integrated Technologies, West Ukrainian National University, PPMOITZ group (2024).

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Research interests: project management.

Daria Vyhohradova



Student (2023), software engineering, West Ukrainian National University, PPMOITZ group (2024).

e-mail: -

Research interests: project management.

Denys Zolotukhin



Bachelor (2017), Computer Science, Ternopil National University of Economics, Master's (2018), Postgraduate Student, Department of Information Computing Systems and Management, IPPR Group Member (2018).

Room: 2007, phone: 47-50-50*12-324

e-mail: grakinoua@gmail.com

Research interests: Computer Graphics, 3D Modeling, VFX.

3. RESEARCH PROJECTS

Current

[Project 1] Information technology for ensuring efficient electricity storage by a hybrid power plant

Project leader and executor – Dr.Sc. (Technology), Prof. Mykola Dyvak

Responsible executor – Dr.Sc. (Technology), Prof. Volodymyr Manzhula

Deadline: 12/30/2025 – 12/31/2028.

To achieve the goal, the project provides for the following tasks:

- research and analysis of the impact of technological parameters on electricity generation for each type of plant (solar power plant, small-scale power plant) with a review of the methods of structure and parametric identification for interval dynamic and static models;
- development and verification of recommendations on optimal parameters for the effective functioning of combined power plants;
- development and verification of recommendations on the choice of methods for modeling energy generation processes at combined power plants.

Team:

- Mykola Dyvak
- Volodymyr Manzhula
- Andriy Pukas
- Andriy Melnyk
- Petro Putsenteilo
- Petro Klendiy
- Yuriy Maslyyak
- Oleksandr Kot
- Vasyl Stetsko
- Nataliia Petryshyn

[Project 2] Project and Innovation Management for Ukraine

Project leader and executor – Doctor of Technical Sciences, Prof. Anatoliy Sachenko

Responsible executor – Doctor of Technical Sciences, Associate Professor Iryna Turchenko

Deadline: 01.07.2025 – 30.06.2029.

The aim of the project is to develop partnerships between Ukrainian universities, namely WUNU, and the European academic community in the areas of project management, digitalization, innovation, and sustainable development. The UA4PIM project envisages the creation of a university alliance that will be integrated into the European EuroPIM network and will facilitate the exchange of experience, knowledge, and research results. Particular attention is paid to the modernization of English-language education and scientific activity at the master's and doctoral levels. The implementation of this project is of great importance for the reconstruction of Ukraine, its European integration, and the strengthening of international cooperation in the field of higher education.

Expected results:

- ensuring the dissemination, implementation and institutional consolidation of new approaches to project management with the support of UPMA (IPMA) and IEEE TEMS;
- increasing influence on the processes of standardization and accreditation in the higher education sector of Ukraine;
- expanding and deepening cooperation within the German-Ukrainian higher education network through the involvement of stakeholders, opening new formats of interaction and creating innovative educational approaches;
- active participation in international programs (Eastern Partnerships, KA171, Erasmus, BMBF) to ensure sustainable and long-term development of the partnership;
- developing graduates' competencies for working in interdisciplinary, international and intercultural teams;
- developing students' communication skills in English, project competence and digital literacy for using IT tools in collaboration, communication and project management;
- strengthening the orientation of universities towards modern project-oriented learning models through the development of appropriate educational formats;
- expanding cooperation between universities and industry to ensure practical orientation, innovation, and compliance of educational projects with labor market needs.

Team:

- Anatoliy Sachenko
- Iryna Turchenko
- Lesia Dubchak
- Mykhailo Dombrovskiy
- Nataliia Dziabanovska
- Nadiia Vasylykiv
- Svitlana Sachenko
- Taras Lendiuk
- Volodymyr Kochan
- Oksana Chereschnyuk
- Leonid Bytsyura
- Oleg Zastavnyy

[Project 3] Intelligent system for recognizing defects in green energy facilities using UAVs

Project leader and executor – Dr. Sc. in Engineering, Prof. Anatoliy Sachenko

Responsible executor – Ph.D. in Engineering, Associate Professor Diana Zahorodnia

Duration: 09/30/2024 – 08/31/2026

The goal of the project is to improve the process of automated defect detection in green energy infrastructure using machine learning methods applied to video data generated using UAVs. The main innovation is to use and improve deep learning models to interpret complex visual data with high accuracy, which will make it possible to improve the maintenance and operational efficiency of green energy facilities.

To achieve the goal, the project provides for the solution of the following tasks:

- develop a method for processing video data using UAVs based on a pre-trained deep learning artificial neural network with increased accuracy.
- improve the technical and economic characteristics of the method of modeling microprocessor instructions to ensure effective data processing on UAVs.
- develop a method for detecting defects in green energy facilities using video data from UAVs based on an improved artificial neural network with increased speed.
- improve the method for localization and statistical analysis of the number of detected defects in green energy facilities.
- develop the architecture of a distributed intelligent system for recognizing defects in green energy facilities using UAVs.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Oleg Savenko
- Diana Zahorodnia
- Oleg Zastavnyy
- Lesya Dubchak

[Project 4] TruScanAI: a tool for detecting fake information based on artificial intelligence technologies to combat disinformation

Head – Doctor of Technical Sciences, Assoc. Prof. Khrystyna Lipyanina-Honcharenko

Duration: 01.01.2024 – 31.12.2025

The "TruScanAI" project is based on the key idea of creating an innovative tool capable of detecting and analyzing fake information in media content using advanced artificial intelligence algorithms. The goal is to apply artificial intelligence technology to detect disinformation in real time, which will help increase information security and reduce the impact of fake news on society.

To achieve the goal, the project provides for solving the following tasks:

- complete the creation of a working prototype of a system for automatically detecting fake information, which will include algorithms for analyzing text content using classification by emotional tone and keywords; algorithms for recognizing synthesized voice in audio recordings; video analysis modules for identifying deepfakes through facial expressions and movements analysis.
- develop a tool for identifying and combating disinformation based on artificial intelligence technologies.
- improve adaptability to the conditions of the modern information space and expand implementation capabilities.
- improve automatic detection of disinformation in video, audio and text content through the integration of advanced artificial intelligence technologies, including analysis of voice, facial expressions, movements, text structures and emotional coloring.

Team:

- Khrystyna Lipyanina-Honcharenko;
- Dmytro Lendiuk;
- Nazar Melnyk.

[Project 5] ERASMUS+ KA220 “Digitalization of Sustainable Disaster and Emergency Management Processes” (SUDEM) 2023-1-BG01-KA220-HED-000159479”

Grant holder: Institute for Space Research and Technology of the Bulgarian Academy of Sciences (Bulgaria, Sofia), SRTI-BAS

Partner universities (institutions):

- Institute for Space Research and Technology of the Bulgarian Academy of Sciences (Bulgaria), SRTI-BAS.
- Offenburg University (Germany, Offenburg), HSO.
- Composite Information Technologies B.V. (Netherlands, Enschede), CIT.
- Disaster and Emergency Management Authority (Ankara, Turkey), AFAD.
- West Ukrainian National University (Ukraine, Ternopil), WUNU.
- Lviv State University of Life Safety (Ukraine, Lviv), LULS.

Deadline: 1.11.2023 – 31.10.2025

Objective:

- Creation of a common European pool of properly trained experts for disaster management of the future;
- Implementation of the SUDEM approach – to achieve higher preparedness for disaster management at the national level by partner organizations and beyond – through digitalization;
- Creation of free access to an open source learning platform that will ensure broad impact among future and current experts in the relevant fields;
- Reduction of disaster casualties.

Implementation:

The main focus of the activity is the launch of a digital educational platform that includes relevant courses that will help achieve higher preparedness for disaster management – in HED (higher education) and LLL (lifelong learning). This includes a predictive analysis and development of a relevant curriculum, as well as a feedback system that will serve as a means for continuous improvement of the courses. In addition, communication and dissemination activities are planned so that stakeholders can track the progress and achievements of the project.

Results:

The most important result of this project is the improvement of disaster preparedness, according to the envisaged training package. The consequent result of this will be the reduction of casualties due to the improvement of many aspects and systems in the fight against natural disasters. Other results include the strengthening of the digitalization of this sector and the improvement of decision-making capabilities, as well as the creation of a larger common pool of highly qualified European experts in this field.

Team from WUNU:

- Anatoliy Sachenko
- Pavlo Bykovy
- Diana Zahorodnia
- Vasyl Yatskiv
- Taras Tsavolyk

Link to the project webpage: <https://www.wunu.edu.ua/sudem/>

Completed projects

[Project 6] "Intelligent measurement and control modules to ensure high information content, survivability and reliability of critical infrastructure monitoring systems"

Project leader and executor – Ph.D., Prof. Volodymyr Kochan

Responsible executor – Ph.D., Associate Professor Pavlo Bykovy

Duration: 01.01.2023 – 31.12.2024

The purpose of the project is to develop scientific principles and methods for creating intelligent measuring and control modules (MCM), which, due to self-diagnostics, self-calibration, artificial intelligence (self-adaptation and self-learning), as well as built-in metrological support, will have higher, compared to existing ones, accuracy of the measuring channel as a whole (including sensors), metrological reliability and autonomy, resistance to element degradation and interference of various types, and due to remote reprogramming, flexibility of adaptation to the tasks performed and saving of the necessary MCM resources will be ensured.

To achieve the goal, the project provides for the solution of the following tasks:

- development of scientific principles and methods for determining the current error of all components of the measuring channel (sensors, communication lines, analog-to-digital converters, digital-to-analog converters) during their operation, without access to the VCM, with minimal use of standards or without them, as well as correction and compensation of these errors using artificial intelligence methods and self-assessment of the non-excluded (residual) error of the measuring channels;
- development of scientific principles and methods for noise-resistant and protected data exchange between stationary and mobile means of monitoring critical infrastructure objects (OCI), especially during remote reprogramming of the VCM with the possibility of adapting noise immunity and power consumption to the level of interference in the communication channel;
- development of scientific principles and methods for noise-resistant and protected reconfiguration of the VCM structure in order to adapt to noise and the task being performed to increase the operating time without recharging the batteries;
- development of scientific principles and methods for metrological maintenance of intelligent system functions.

The project is expected to obtain the following scientific and technical results:

1. theoretical, methodological and technological principles, namely, the concept and principles, structure and elements of the methodology, mathematical models, methods and means of creating intelligent VCMs for monitoring and control systems (MCS);
2. scientific principles, methods and means of determining the current error of all components of the VCM measuring channel (sensors, communication lines, analog-to-digital converters, digital-to-analog converters, software for processing sensor data) during their operation, without access to them and their dismantling. These methods and means of determining the current error will either not use reference means at all, or use them to a minimum extent;
3. scientific principles, methods and means of correcting and compensating for the determined current errors, building individual mathematical models of the transformation functions and errors of the measuring channel using artificial intelligence methods and distributed data processing;
4. scientific principles, methods and means of automatically assessing the non-excluded error of the measuring channels to accompany each measurement result with the value of the assessment of its current error, which will significantly increase the reliability of these results and make it possible to assess the adequacy of decisions made on their basis and their possible variations. The basis for this will be artificial intelligence methods;

5. scientific principles, methods and means of metrological maintenance of VCM measuring channels, which are used to increase the accuracy of the measuring channel as a whole (including sensors), its metrological reliability and autonomy and resistance to interference, artificial intelligence methods, i.e. the metrological characteristics of which will be determined not so much by the VCM hardware, but by the perfection and flexibility of intellectual support;

6. scientific principles, methods and means of interference-resistant and protected from unauthorized access data exchange between VCM and mobile repeaters based on artificial intelligence methods, which make it possible to adapt the transmitter power to interference in the communication channel to minimize the VCM energy consumption and increase its operating time without recharging the batteries;

7. scientific principles, methods and means of testing and validation of the developed VCM (both individual and as part of the QMS), as well as methods for processing the obtained data to assess the operation of the VCM as part of the QMS;

8. experimental research model of the measuring and control module.

Team:

- Volodymyr Kochan
- Anatoliy Sachenko
- Orest Kochan
- Evgeny Bodiansky
- Roman Kochan
- Oleg Savenko
- Pavlo Bykovy
- Oleg Zastavny

[Project 7] “Virtual Master Cooperation Data Science” (ViMaCs)

Grant holder – Dortmund University of Applied Sciences (FH Dortmund)

Managers: prof. Dr. Carsten Wolf, Prof. Stefan Recker (FH Dortmund)

Partner universities:

- Kyiv National University of Construction and Architecture (KNUBA) - prof. Sergey Bushuyev.
- Ternopil National University of Economics (TNEU) - prof. Anatoly Sachenko
- National University "Zaporizka Polytechnic" (NUZP) - prof. Galina Tabunshchik

Duration: 2019 – 2024.

The goal: to build a virtual training and laboratory infrastructure for online teaching and a portfolio of modules in the field of "Data Science".

Task:

1. Building a common IT environment, including a common e-learning platform
2. Development of 4 online educational modules for 6 ECTS:
 - KNUBA "Business analysis and decision-making"
 - TNEU "Data Collection and Processing"
 - NUSP "Artificial Intelligence and Data Analysis"
 - FH Dortmund "Cloud data processing systems"
3. Pilot training in specialized schools 4 times a year
4. Pilot training of teachers for interuniversity distribution of modules
5. Creating a community of practice for continuous content evolution

TNEU team:

- Anatoliy Sachenko;
- Pavlo Bykovyy;
- Oleksandr Osolinskyi;
- Mykhailo Dombrovskiy;
- Iryna Turchenko.

Link to project web-site: <https://go-study-europe.de/vimacs/>

[Project 8] WORK4CE: Cross-domain competences for healthy and safe work in the 21st century

Grant holder: Zaporizhia Polytechnic National University

Participants from Ukraine:

- Zaporizhia Polytechnic National University
- Kyiv National University of Construction and Architecture
- Ternopil National University of Economics

Foreign partners:

- Fachhochschule Dortmund
- Katholieke Universiteit Leuven
- Universidad del Pais Vasco/ Euskal Herriko Unibertsitatea
- Azərbaycan Respublikası Dövlətqurumları Komitəsinin Akademiyası
- Azərbaycan Dövlət Neft və Sənaye Universiteti
- Azerbaijan Architecture and Construction University

Duration: 2020 – 2023 pp.

Goals and content of the project:

Development of a new form of cooperation between universities and enterprises in the era of digital technologies to improve the employability of graduates; providing the latest competencies related to the competencies required for employment to shape the workplace of the future (Competence Model for Work 4.0 and Digital Transformation Maturity Model); promotion of international and interdisciplinary development of the educational content of the competence model for work 4.0.

Tneu Team:

- Pavlo Bykovyy;
- Nadiia Vasylykiv;
- Grygoriy Hladiy;
- Zbyshek Dombrovskiy;
- Mykhailo Dombrovskiy;
- Diana Zahorodnia;
- Andriy Karachka;
- Myroslav Komar;
- Volodymyr Kochan;
- Vasyl Koval;
- Ivan Kit;
- Taras Lendyuk;
- Khrystyna Lipianina-Honcharenko;
- Oleksandr Osolinskyi;
- Anatoliy Sachenko;
- Oleg Sachenko;
- Iryna Turchenko.

Link to project web-site: <https://work4ce.eu/>

[Project 9] An intelligent system for studying the energy consumption of IoT modules

The head and executor of the project is Doctor of Technical Sciences, prof. Anatoly Sachenko
The responsible executor is Oleksandr Osolinsky, Ph.D., associate professor

Implementation period: 2022-2023.

Purpose: creation of software and hardware foundations of an intelligent system for researching energy consumption of instructions, commands and programs executed by a microcontroller as part of an IoT module or other device based on MK to ensure high accuracy and reliability of measurement results.

The main results of the project:

- A method of measuring instantaneous current values for microprocessors is proposed.
- A study of the process of measuring the average energy consumption of microcontrollers was conducted, it was shown that thanks to the appropriate simplification of mathematical expressions, it is possible to implement new methods of measuring the average energy consumption of microcontrollers, which will be characterized by a simplified scheme of the measuring channel, and an automated measurement method for this system is also proposed.
- The scheme of the measuring channel of the average energy consumption measurement system was developed, with the help of which high accuracy and immunity to interference were realized.
- The architecture of the system is proposed, which combines the methods of measuring the average and instantaneous energy consumption of the microcontroller as part of the IoT module.
- The decision-making algorithm for automatic energy consumption measurement and the latter's work algorithm are described.
- The architecture of the intelligent system for studying the energy consumption of IoT modules is proposed.
- The energy consumption of the processor core of the IoT module was evaluated and forecasted.
- A general description of the types of instructions, their internal encoding structure, the main principles of their execution, and the probable place of occurrence of additional energy consumption in the form of an inter-instruction transition are given.
- It is shown that the appropriate creation of training sets provides a highly accurate estimate of the power consumption of the microprocessor in the presence of small data sets.

Team:

- Anatoliy Sachenko;
- Oleksandr Osolinskyi;
- Yugeniy Bodyanskiy;
- Nadiia Zoriy;
- Volodymyr Kochan;
- Svitlana Sachenko.

[Project 10] DAAD program “International Study and Training Partnerships” (ISAP)

Grant holder: Berlin University of Applied Sciences (HTW Berlin), prof. Juergen Sieck.

The head of the program from TNEU is Doctor of Technical Sciences, Prof. Anatoliy Sachenko

Duration: 2019 - 2021.

Goal: strengthening partnership relations and cooperation between German universities and universities in the countries of the Middle East / Southeast and Eastern Europe, as well as in the Caucasus and Central Asia; promoting cooperation for the reconciliation of academic degrees (Bologna Process)

Main tasks:

- strengthening existing and starting new stable partnerships;
- exchange of scientists, graduates and students;
- structural improvement of research and training conditions in partner countries;
- internationalization of German and foreign universities.

TNEU team:

- Anatoliy Sachenko;
- Pavlo Bykoviy;
- Iryna Turchenko.

[Project 11] Methods and means of structural-statistical identification of hierarchical objects by characteristic points of their contours

Principal investigator of project – PhD Diana Zahorodnia;

Co-investigator – PhD Hrystyna Lipyanina-Goncharenko.

Duration: 2019 –2020

Objectives: development of methods and tools aimed at improving the efficiency of automated video surveillance systems by reducing the amount of data processed.

Main results of the project:

- An analysis of known methods of identification and classification of objects for video surveillance systems.
- A method of combined adaptive identification of objects based on a hierarchical principle has been developed.
- A method of data classification based on cluster analysis methods has been developed.
- Algorithmic solutions of the proposed method of combined adaptive identification of objects based on the hierarchical principle are developed.
- Algorithmic solutions of the proposed method of data classification based on cluster analysis methods are developed.
- Experimental researches of the offered methods and algorithms are carried out.

Team:

- Diana Zahorodnia;
- Vitaliy Dorosh;
- Hrystyna Lipyanina-Goncharenko;
- Ivan Kit;
- Andriy Kaniivskyi;
- Denys Zolotukhin;
- Andriy Sydor;
- Dmytro Lendiuk.

[Project 12] Methods for intelligent processing and analysis of Big Data based on deep neural networks

Principal investigator of project – Prof. Anatoliy Sachenko;

Co-investigator – Dr Myroslav Komar.

Duration: 2018 –2019

Objectives: to increase the efficiency and performance of Big Data intelligent processing and analysis by developing effective methods of data compression and classification, and pattern recognition using deep neural networks.

Main results of the project:

- Known methods of data protection against computer attacks were analyzed.
- Data compression method based on deep neural networks was developed, using network traffic parameters in an intrusion detection system.
- A method for data classification based on deep neural networks was developed in order to prevent attacks against information telecommunication networks.
- An image recognition method was developed based on knowledge of Big Data using deep neural networks.
- A method for parallel deep neural network training was developed to solve the problems of Big Data compression and classification.
- Algorithms of the proposed methods of intelligent processing and analysis of Big Data based on deep neural networks were proposed.
- Deep neural networks architecture was proposed to solve the problems of Big Data compression and classification.
- Experimental studies of the proposed methods and algorithms have been carried out

Team:

- Anatoliy Sachenko;
- Myroslav Komar;
- Volodymyr Kochan;
- Vasyl Koval;
- Vladimir Golovko;
- Vasyl Yatskiv;
- Nadiia Vasylyuk;
- Taras Lendyuk;
- Pavlo Bykovyy;
- Diana Zahorodnia;
- Vitaliy Dorosh;
- Oleksandr Osolinskyy;
- Grygoriy Gladiy;
- Oleksiy Roshchupkin;
- Volodymyr Turchenko

[Project 13] Erasmus+ALIOT

Grantholder – Prof. Chris Phillips, Newcastle University, Newcastle, UK

National coordinator – Prof. Vyacheslav Kharchenko, National Aerospace University KhAI, Kharkiv

Leader of ICS TNEU team – Prof. Anatoliy Sachenko, ICS, Ternopil National Economic University

Duration: 2016 – 2020

Objectives: to develop and update curricula for masters, graduate students and industrial company specialists in the field of development, research and application of Internet of Things (IoT) in accordance with the needs of modern society.

Interim project results:

- Three working meetings of all project participants were held in Chernivtsi, February, 2018; Kyiv, May, 2018, and Newcastle and Leeds, UK, July, 2018 to announce the interim results of the team and the tasks for a given period.
- Curricula were developed.
- The content of the developed courses and modules was discussed. The structure of books and manuals was developed and discussed according to the proposed courses and modules.
- Regular working meetings of the ICT-TNEU team were held (see information on the websites <http://www.tneu.edu.ua/>, www.iosu.tneu.edu.ua та www.ics.tneu.edu)

Team:

- Anatoliy Sachenko;
- Myroslav Komar;
- Volodymyr Kochan;
- Vasyl Yatskiv;
- Vasyl Koval;
- Grygoriy Gladiy;
- Iryna Strubyt'ska;
- Zbyshek Dombrovskiy;
- Mykhailo Dombrovskiy
- Oksana Dunets;
- Pavlo Bykovyy;
- Diana Zahorodnia;
- Oleksandr Osolonsky;
- Vitaliy Dorosh

[Project 14] DAAD programme “Eastern Partnerships”

Project Co-investigator: Prof. Anatoliy Sachenko

Co-investigator – Dr Iryna Turchenko

Duration: 2017 – 2019

Objectives:

- Strengthening partnerships and cooperation between German HEI and HEI in the Middle East/ South Eastern and Eastern Europe as well as Caucasus and Central Asia
- Fostering cooperation for alignment of academic degrees (Bologna process)

Main project results:

- Strengthening of existing and initiating new sustainable partnerships
- Research, graduate and student exchanges
- Sustainable structural improvement of conditions for conducting research and studying in partner-countries
- Contribution to internationalisation of German and foreign HEI

Team:

- Anatoliy Sachenko;
- Pavlo Bykovyy;
- Iryna Turchenko.

[Project 15] Theoretical Foundations and Hardware for Improving the Productivity of Wireless Sensor Networks

Principal investigator of project – Dr. Vasyl Yatskiv

Duration: 2017 – 2018

Objectives: The project is aimed at solving the scientific and applied problem of improving the productivity of Wireless Sensor Networks (WSN) by developing effective methods of noise-immune encoding and adaptive data transmission schemes, providing error-immune and asymmetric computing complexity methods of data compression. At the same time, important criteria for evaluating the developed methods are the following ones: hardware complexity, computational complexity and energy costs for the implementation of algorithms.

Main project results:

- development of methods for correction of multiple errors based on modular correction codes with low computational complexity of the decoding algorithms;
- study of computational complexity of the correction codes of the Residue Number System with a special system of modules;
- development of the method of data transmission in WSN on the basis of adaptive error control scheme and modular correction codes;
- investigation of the influence of noise on algorithms of data compression in WSN;
- development of new data compression methods resistant to noise and error propagation during decoding with asymmetric computational complexity of coding algorithms (the complexity of coding algorithms is less than the complexity of decoding algorithms);
- conducting experimental research of the transmission of compressed data under the influence of various types of noise;
- development and implementation on the FPGA of the reconfigurable special processor of noise-immune data encoding on the basis of modular correction codes;
- writing data compression algorithms in Verilog language and implementation of data processing devices in WSN on FPGA.

Team:

- Vasyl Yatskiv;
- Anatoliy Sachenko;
- Volodymyr Kochan;
- Mykhailo Kasyanchuk;
- Natalia Yatskiv;
- Ihor Yakymenko;
- Stepan Ivasiev;
- Orest Volynskyy;
- Taras Tsavolyk.

[Project 16] Methods of Protection against Computer Attacks based on Neural Networks and Artificial Immune Systems

Principal investigator of project – Prof. Anatoliy Sachenko;

Co-investigator – Dr Myroslav Komar.

Duration: 2016 – 2017

Objectives: The development of a new intelligent information technology based on the theory of artificial neural networks, fuzzy logic and artificial immune systems to increase the reliability of computer attacks detection and classification.

Main project results:

- An analysis of known methods of protection against computer attacks was carried out.
- A modified method for constructing a detector of computer attacks based on neural networks and artificial immune systems was developed.
- A method for reducing the amount of information based on neural networks of high trust with the use of multichannel neural network detectors for constructing a hierarchical classifier of computer attacks was developed.
- A generalized architecture of intelligent computer-based system to prevent computer attacks was developed.
- Experimental studies of developed methods and algorithms were conducted, which confirmed the reliability of detection and classification of computer attacks and improvement of the safety level.
- An approach was proposed to improve the security of the system designed to prevent computer attacks by implementing neural network detectors on FPGA and introducing a subsystem of decision-making based on the rules of the Mamdani fuzzy inference.

Team:

- Anatoliy Sachenko;
- Myrolav Komar;
- Volodymyr Kochan;
- Vladimir Golovko;
- Vasyl Yatskiv;
- Lesya Dubchak;
- Pavlo Bykovyy;
- Diana Zahorodnia;
- Vitaliy Dorosh;
- Taras Tsavolyk;
- Stepan Ivasiev;
- Grygoriy Sapozhnyk;
- Andriy Karachka.

[Project 17] Distributed Sensor Networks with Computing Nodes Reconfiguration

Principal investigator: Prof. Anatoliy Sachenko

Co-investigator: Dr. Igor Maykiv

Foreign partner: Technical University of Moldova, Moldova

Duration: 2014 – 2015

Objectives: Development of methods for structural synthesis of universal modules with the reconfiguration possibility.

Main project results:

- Method for structural synthesis of universal modules comprising functional analysis, structural synthesis and the search for a set of optimal solutions was developed on the basis of morphological analysis and synthesis. The proposed method combines lexicographical criterion advantages (L-criterion) for the selection of electronic components during functional analysis and absolute criterion of preference (optimality Pareto, π -criterion) during the search for a set of optimal solutions that are considered in scientific literature as alternative methods for finding optimal solutions. The combination of L- and π -criteria allows us to reduce the number of alternatives synthesized during structural synthesis. A formalized discrete optimization solution is versatile for a wide range of problems of optimal structural synthesis of computing systems.
- A new universal module structure with improved functional properties was designed due to separate data processing and sharing as well as reconfiguration of hardware and software using Field Programmable Gate Arrays (FPGAs).
- A 4-level model that graphically shows information relationships between different processes of receiving and transmitting messages in the controller serial interfaces, which is an effective tool of their implementation both during functional analysis and structural synthesis, was developed.
- An experimental model of network application processor with the capability of reconfiguring was created and the methodology of its testing was developed.

Team:

- Anatoliy Sachenko;
- Igor Maykiv;
- Volodymyr Kochan;
- Nadia Vasylykiv;
- Oleksiy Roshchupkin;
- Diana Zahorodnia;
- Yuriy Ivanyshak;
- Olexandr Osolinsky;
- Taras Lendyuk;
- Oksana Dunets.

[Project 18] Wireless Multimedia Sensor Networks on the Base of Modular Arithmetics and Galois Codes for Videomonitoring Systems

Principal investigator: Prof. Anatoliy Sachenko

Co-investigator: Dr. Vasyl Yatskiv

Foreign partner: Pedagogical University Huazhong, China.

Duration: 2013 – 2014

Objectives: developing of improved methods for training artificial neural networks on heterogeneous parallel computing systems referring to Grid, which provide high efficiency of parallelization and development of grid-based library functions for parallel training of artificial neural networks.

Main project results:

- New methods of data coding and transmitting based on modular arithmetic were developed, which enable increased efficiency of wireless multimedia sensor networks (WMSN). Methods were designed for devices with limited hardware resources and autonomous power supply.
- Method of network coding is based on data of Residue Number System. The overall bandwidth of wireless sensor networks was investigated as well as the scope of data transmission schemes for different residues.
- Method of coding and redundancy reducing of multimedia data without the loss in Residue Number System, which allows us to reduce image processing in 2-3 times by splitting the image into the modules of Residue Number System and parallel encoding of the obtained residues, was developed. Application of Huffman codes for residues compressing provides lossless compression ratio depending on the class of images: 1,6 – 4 – for photo-realistic images; 4 – 8 – for images with large areas of the same color.
- Method of improving data reliability based on modified correcting code of Residue Number System, which is characterized by a lower computational complexity and allows us to increase the efficiency of encoding about 5 times comparing with R – source code RNS and Reed – Solomon RS (127, 87), was developed.

Team:

- Anatoliy Sachenko
- Yaroslav Nykolaychuk
- Natalia Yatskiv
- Vasyl Yatskiv
- Orest Volynskyy
- Petro Humenyi

[Project 19] Neural network method for improving the accuracy of information-measurement systems of ultraviolet radiation

Principal investigator: Prof. Anatoliy Sachenko

Project was completed within inter-university network Erasmus Mundus together with partners from Alaxender Ioan Kuza University, Iassi, Romania.

Duration: 2013 – 2014

Objectives: development of new neural network method for improving the accuracy of information measuring systems for measurement of ultraviolet radiation.

Research methods: structural and functional analysis (error analysis in measuring systems for measuring UV radiation level and UV sensors); methods of neural networks theory, the method of gradient ascent in the space of weight coefficients and neurons thresholds (for NN training); simulation methods (for experimental research of developed methods); technique for primary transformer investigation.

Project results:

- The methods of signal processing of multiparameter sensors were proposed. Simulations were conducted in MathLab.
- The software for modeling of the real multiparameter sensors behavior was developed. The software allows us to enter the model random and systematic errors and identify the limits of the proposed methods.
- Ukrainian Patent application for invention and useful model was received.

Team:

- Anatoliy Sachenko
- Oleksiy Roshchupkin
- Volodymyr Kochan

[Project 20] Methods and Tools of Building Wireless Multimedia Sensor Networks Based on Modular Arithmetic

Principal investigator – Prof. Yaroslav Nykolaychuk

Duration: 01.01.2013 – 31.12.2014

Objectives: development of methods and tools for data encoding and transmitting in wireless multimedia sensor networks aimed at improving the reliability of their operation and functionality.

Abstract: New methods and algorithms for data encoding and transmitting using mathematical tools of modular arithmetic were developed, aimed at improving the performance of wireless multimedia sensor networks (WMSM). A Verilog – encoder model for noise-immune data encryption using modified correcting codes was designed.

Main results:

- The method of adaptive coding and transmission of multimedia data based on modular arithmetic and multipath routing using adaptive distribution packages and their transfer from multipath routing, is developed, which provides the efficiency of the total bandwidth of wireless sensor networks.
- The method of network data coding based on the Residue Number System (RNS), which provides reduction of data amount by 50%, including the retransmission of packages that are necessary for message recovery, was developed. The proposed method allows us to select relatively simple modules of various bit-widths, though the bit-width of residues transmitted through the common route is approximately equal to the bit-width of residues on specific routes. The developed method of network coding improves overall network bandwidth by about 60%.
- A modified correcting code of Residue Number System was developed, which is characterized by the simplified procedure of check symbols formation, providing increased efficiency of encoding approximately in 5 times as compared with other correcting codes. Using modified correcting codes of RNS in wireless sensor networks allows us to improve the reliability and overall network bandwidth by reducing the number of retransmissions.

Team:

- Yaroslav Nykolaychuk
- Anatoliy Sachenko
- Vasyl Yatskiv
- Natalia Yatskiv
- Natalia Vozna
- Petro Humenny
- Orest Volynsky

[Project 21] Efficient Parallel Batch and Single Pattern Neural Network Training Algorithms Using Open MPI and GPU-computing

Principal investigator: Dr. Volodymyr Turchenko

Partners: Prof. Jack Dongarra, Innovative Computing Lab, University of Tennessee, Knoxville, TN, USA.

Grant: Fulbright Scholar Program 2012/13

Duration: 09/2012 – 06/2013

Objectives: test enhanced batch pattern parallel algorithm for NN training by changing the parameters of the internal algorithms of MPI collective functions on different parallel architectures; develop GPU-based versions of the parallel batch and single pattern algorithms for NN training; test experimentally the efficiency of the improved GPU-based version of the algorithms in comparison with their Open MPI implementations.

Main results:

1. The parallelization efficiency of the neural network training algorithm on the example of the recirculation neural network model has been researched. The Open MPI, OpenMP and CUDA-based versions of the parallel batch pattern training algorithm for recirculation of neural network were implemented using C language. The parallelization efficiency of the developed algorithms has been researched on many-core parallel machine with 48 AMD Opteron 6180 SE processors, on computational cluster with 48 Intel Xeon E5520 processors, on 60-core Intel GPU Xeon Phi Coprocessor 5110P card and Nvidia Tesla C2050 GPU card using its 64 cores only (total is 1024). The experimental research of the developed algorithm using Open MPI technology showed the parallelization efficiency of 75% on 48 processors of the many-core system, 60% on 48 processors of the cluster, 70% on 60 processors of the Intel GPU Xeon Phi card. The experimental research of the developed algorithm using OpenMP technology showed lower figures, 40% of parallelization efficiency on 48 processors of the many-core system. The experimental research of the developed algorithm using CUDA technology showed 14-times speedup on one Nvidia Tesla GPU card. The developed algorithms are included to the developing library PaGaLiNNeT capable to speed-up scientific computations based on neural networks on general-purpose and hybrid (CPU+GPU) high performance computing systems.
2. The research project entitled “An Adaptive End-to-End Approach for Terabit Data Movement Optimization” was investigated. The goal of this project is to develop a novel architecture and related approaches to the end-to-end optimization of terabyte size data movement on next-generation networking and storage system technologies. The moving scientific data sets at terabits per second transfer rates over wide-area networks between geographically dispersed data centers were modeled. The set of events which describe a drop of the bandwidth in the communication network was obtained. A predictive model based on artificial neural networks to predict the duration of the event and the value of the maximum bandwidth drop was developed. I have used the developed library for parallel neural network training PaGaLiNNeT (developed by me within my previous project) and the model of a multi-layer perceptron. The experimental researches showed that the modeled events have stochastic nature and therefore it is necessary to tune the neural network model to provide desirable prediction results. This scientific collaboration with the host institution will be continued in the future.

Published results:

1. Turchenko V., Bosilca G., Bouteiller A. and Dongarra J. “Efficient Parallelization of Batch Pattern Training Algorithm on Many-core and Cluster Architectures”, Proceedings of the 7th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems, Sep 12-14, 2013, Berlin, Germany, pp. 692-698.

[Project 22] Neural Network Methods for Evaluation of Microprocessor Power Consumption While Performing Instructions

Principal investigator: Dr. Zbyshek Dombrovsky

Duration: 2010 – 2012

Objectives: development of hardware-software complex, which allows to built mathematical models of processor cores power consumption.

Main tasks:

- development of appropriate specialized hardware, which allows to evaluate power consumption of instruction execution in normal microprocessor operation mode;
- development of testing methods (calibration) of created hardware;
- using artificial neural networks to predict power consumption of the instruction execution modes (addressing, conditions, etc.) which were not completely tested experimentally;
- using the experiment planning methods for additional decreasing of experiments volume.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Andrii Borovyi
- Oleh Havryshok
- Ihor Maykiv
- Orest Volynskyy

Published results:

2. A. Borovyi, V. Kochan, Th. Laopoulos, Sachenko A. Improved Sorting Methodology of Data-processing Instructions, International Journal of Computing, vol. 10, issue 1, 2011, pp. 50-55.
3. A. Borovyi, I. Maykiv, R. Kochan, Z. Dombrovskyy, V. Kochan. The Unit of Measurement of Consumers Pulse Energy, Patent of Ukraine 90922 UA, MPK (2009) G05F 5/00 G01K 17/00, no. A2008 06325 ; applied 13. 05. 2008; published 10. 06. 2010, Bulletin no. 11.
4. Time-domain analysis of ARM7TDMI core instructions [Text] / A. Borovyi, V. Kochan, Th. Laopoulos, A. Sachenko // Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS'2011). – Vol. 2. – [S. L. : s. N.], 2011. – September 15-17. – P. 785 –790.

[Project 23] Human Biometric Identification in Video Surveillance Systems

Foreign partner: Technical University of Sofia, Bulgaria

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Bulgaria: Dr. Ognian Bumbarov

Duration: 2009 – 2010

Objectives: design of intelligent biometrical sub-system for detection and recognition of human faces in the video surveillance systems for monitoring of public places, database support of staff or factory's visitors etc.

Main tasks:

- development of methods and algorithms for movement detection on the captured videoframes;
- development of methods and algorithms of videoframes preliminary processing by skin color;
- improvement of methods and algorithms for detection and tracing of human face;
- development of methods and algorithms for face recognition.

Team:

- Anatoliy Sachenko
- Ihor Paliy
- Yuriy Kurylyak
- Taras Leshko

Published results:

1. Ihor Paliy, Anatoliy Sachenko, Yuriy Kurylyak, Ognian Boumbarov, Strahil Sokolov. Combined Approach to Face Detection for Biometric Identification Systems // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, 21-23 September 2009, Rende (Cosenza), Italy, pp. 425-429.
2. Ognian Boumbarov, Strahil Sokolov, Plamen Petrov, Anatoliy Sachenko, Yuriy Kurylyak. Kernel-based Face Detection and Tracking with Adaptive Control by Kalman Filtering // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, 21-23 September 2009, Rende (Cosenza), Italy, pp.434-439.
3. Y. Kurylyak, I. Paliy, A. Sachenko, A. Chohra, K. Madani. Face Detection on Grayscale and Color Images using Combined Cascade of Classifiers // International Journal of Computing. – Ternopil (Ukraine). – 2009. – Vol. 8, Issue 1. – pp. 61-71.
4. Y. Kurylyak A Real-Time Motion Detection for Video Surveillance System // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS2009). – Rende (Cosenza), Italy, 2009. – pp.386-389.
5. Paliy I.O. Methods of Face Detection in Systems of Computer Recognizing on the Base of Combined Cascade of Neural Network Classifiers. – PhD Thesis, Ternopil National Economic University. – Ternopil. – 2009.

[Project 24] Parallel Grid-aware Library for Neural Networks Training – PaGaLiNNeT

Principal investigator: Dr. Volodymyr Turchenko

Scientific advisor: Prof. Anatoliy Sachenko

Partners: Prof. Lucio Grandinetti, Center of Excellence on High Performance Computing, Department of Electronics, Computer Science and Systems, University of Calabria, Italy.

Grant No FP7 MC IIF 221524 – 908524 according to the 7th EU Frame Programme, Grant of Marie Curie for researches from the third countries (International Incoming Fellowships – IIF), return phase

Duration: 2011 – 2012

Objectives: development of the enhanced training methods for artificial neural networks in heterogeneous parallel computing systems within the Grid; providing the high efficiency of parallelization and development of the Grid-based library for parallel neural networks training.

Main results:

- As a part of the project design three levels of grid-based library are created: (i) at the level of a single supercomputer / cluster homogeneous computing nodes, (ii) at the heterogeneous computing nodes within a cluster, (iii) at the grid of computing system with heterogeneous hosts and heterogeneous communication channels between them. A parallel version of the library for the level (i) was installed on parallel machines with ccNuma architecture. A strategy for resource brokering based on Pareto optimization [1] is implemented in C programming language and included in the library. The developed library for the level (i) which includes the routines for parallel training of multilayer perceptron [2] and recurrent neural network was used for the prediction of the stock price for financial markets. The results are published in [6]. A parallel version of the library for the level (ii) was developed and installed on the computing cluster of heterogeneous architectures. The resource brokering sub-routine based on Pareto optimization [1] is called from the code of resource broker separately before executing the main task. The performance analysis of computing nodes of the cluster is based on a modified BSP-based model with improved computational complexity of parallel training algorithm for multilayer perceptron [2]. The results are published in [5];
- Within the application of parallel algorithms for neural network training to speed up the execution of practical tasks, an application task of convolution neural network for the detection of the number of micronucleus in the human lymphocytes is considered. The accurate detection of the number of micronucleus in the human lymphocytes can be used as biological dosimeter in order to relieve the presence and the action of carcinogenic factors and could enhance the correctness of the final medical response. It was proven the application of convolution NN for the development of this task because this NN model provides good detection properties and showed good detection results of the more complicated task of human face detection. The human lymphocyte images were acquired by the image flow cytometer which causes the different types of noise that influence on the acquired image. We have tested the CNN for the images altered by a zoom factor. The CNN provides no false alarms for each zoom factor. The number of false negative detections is much lower in comparison with the pattern matching method, implemented as a LABVIEW routine (IMAQ Match Pattern method) inside the flow cytometer. The detection rate of 87.5% provided by the CNN is much higher than 25% of detection rate by the IMAQ Match Pattern method on the considered example images. The results are published in [3, 4].

Published results:

1. Turchenko V.O. Brokering methodology of Grid-resources using Pareto-optimality // Measuring and Computing Technologies Equipment in Technological Processes. – 2011. # 1. – pp. 312-318.
2. Turchenko V.O. Efficiency Comparison of Multilayer Perceptron Group Training on Parallel Computer and Computation Cluster // Transactions KPI. Informatics, management and computing technology: Proceedings – Kyiv: Vek+. – 2011. – No. 54. – pp. 130-138.
3. Paliy I., Lamonaca F., Turchenko V., Grimaldi D., Sachenko A. Detection of Micro Nucleus in Human Lymphocytes Altered by Gaussian Noise Using Convolution Neural Network, Proceedings of 2011 IEEE International Instrumentation and Measurement Technology Conference (I2MTC 2011), 2011, Binjiang, Hangzhou, China, pp. 1097-1102.
4. Lamonaca F., Turchenko V., Grimaldi D. Aspetti innovativi della progettazione hardware e software di citofluorimetro ad immagini, Atti del XXVIII Congresso Nazionale Gruppo Misure Elettriche ed Elettroniche, 2011, Genova, Italy, pp. 289-290.
5. Turchenko V., Puhol T., Sachenko A., Grandinetti L. Cluster-Based Implementation of Resource Brokering Strategy for Parallel Training of Neural Networks, Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems IDAACS2011, Sep 15-17, 2011, Prague, Czech Republic, pp. 212-217.
6. Turchenko V., Beraldi P., De Simone F., Grandinetti L. Short-term Stock Price Prediction Using MLP in Moving Simulation Mode, Proceedings of the 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems IDAACS2011, Sep 15-17, 2011, Prague, Czech Republic, pp. 666-671.
7. Turchenko V. Efficiency Comparison of Batch Pattern Training Algorithm of Multilayer Perceptron on Parallel Computer and Computational Cluster, Scientific Journal of National Technical University of Ukraine “Kyiv Polytechnic Institute”, Kyiv, 2011, No 54, pp. 130-138 (in Ukrainian).
8. Sachenko A., Kulakov Yu., Kochan V., Turchenko V., Bykovvy P., Borovyy A. Computer Networks: A Tutorial, Ternopil, Ekonomichna dumka, 2012, 476 p. // Chapter 15. Grid-computations based on network technologies, pp. 416-439 (in Ukrainian).
9. Turchenko V., Grandinetti L., Sachenko A. Parallel Batch Pattern Training of Neural Networks on Computational Clusters, Proceedings of the 2012 International Conference on High Performance Computing & Simulation (HPCS 2012), July 2 – 6, 2012, Madrid, Spain, pp. 202-208.
10. Turchenko V., Golovko V., Sachenko A. Parallel Batch Pattern Training of Recirculation Neural Network, Proceedings of the 9th International Conference on Informatics in Control, Automation and Robotics (ICINCO 2012), July 28 – 31, 2012, Rome, Italy, pp. 644-650.
11. Turchenko V., Golovko V., Sachenko A. Parallel Training Algorithm for Radial Basis Function Neural Network, 7th International Conference on Neural Networks and Artificial Intelligence (ICNNAI'2012), October 10-12, 2012, Minsk, Belarus, pp. 47-51.

[Project 25] Development of Intelligent Video Surveillance Systems

Principal investigator: Dr. Volodymyr Kochan

Project executed together with the Glushkov Institute for Cybernetics, Prof. Vitaliy Boyun.

Duration: 2009 – 2010

Objectives: development of highspeed and relevant video surveillance system on the basis of intelligent videocamera, which allows us to decrease information streams between camera and worksatation central processor, as well as to read and process large images with high frame rate.

Main tasks:

- increasing efficiency of communication channels between intelligent videocamera and personal computer;
- development of methods and algorithms for videoframes preliminary processing by skin color and movement;
- development of methods and algorithms for human face recognition on the basis of the combined cascades classifiers, classifier training paralleling, and improvement of neural network training method in the frame of combined cascade;
- development of algorithms for faces tracing;
- development of software and highlevel programe interface for interaction with intelligent camera; coding of developed algorithms in processor computer code for digital processing of intelligent videocamera images.

Team:

- Anatoliy Sachenko
- Ihor Paliy
- Yuriy Kurylyak

Published results:

1. Kurylyak Y.O., Sachenko A.O. Method of background image renewal for movement segmentation // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 44.
2. Paliy I.O. Training of neural network classifiers with combined cascade for face detection // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 42.
3. Paliy I. Face detection on grayscale and color images using combined cascade of classifiers // International Journal of Computing. – 2009. – Vol. 8. – Issue 1. – pp.61-71.

[Project 26] Development of 3D Localization Methods for Navigation of Mobile robot**Foreign partner:** Kaunas Technical University, Lithuania

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Lithuania: Prof. Rimvydas Simutis

Duration: 2009 – 2010

Objectives: developing the unified structure for autonomous mobile robot control and providing 3D localization and navigation in non-structured environment with dynamical objects by using new methods and means which allow us to improve the navigation characteristics of mobile robots and use already known methods for new applications.

Main tasks:

- 1) Analysis of already known methods for designing the structure of control system for mobile robots (MR) and development of unified structure for autonomous MR control.
- 2) Development of Dataflow Diagram (DFD) for robot control system and analysis of time characteristics of DFD main modules. Setting of requirements for main MR modules.
- 3) Development of improved methods and means of MR control system:
 - a) Development of new method of acquisition and processing of sensor data;
 - b) Development of MR 3D localization methods.
- 4) Development of hardware and software for autonomous MR.
- 5) MR composing according to the requirements set in point 2, taking into account the applied problems and MR hardware/software means developed in points 3-4.
- 6) Verification and testing of MR prototype functioning.

Team:

- Anatoliy Sachenko
- Vasyl Koval
- Oleh Adamiv
- Viktor Kapura

Published results:

1. Roth H., Sachenko A., Koval V., Chanim J., Adamiv O., Kapura V. The 3D Mapping Preparation using 2D/3D Cameras for Mobile Robot Control // Artificial Intelligence journal, Donetsk, Ukraine. – 2008. – Vol. 4. – pp. 512-521.
2. Adamiv O., Sachenko A., Kapura V. Gradient Method for Autonomous Robot Navigation // Proceedings of the Ninth International Conference “Modern Problems of Radio Engineering, Telecommunications and Computer Science” (TCSET’2008). – Lviv-Slavsko (Ukraine), 2008. – pp. 640-642.
3. O. Adamiv, V. Koval, V. Dorosh, G. Sapozhnyk, V. Kapura Mobile Robot Navigation Method for Environment with Dynamical Obstacles // Proceedings of the 5-th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS’2009). – Rende (Cosenza), Italy, 2009. – pp.515-518.
4. O. Adamiv, A. Lipnickas, A. Knyš. A stereovision system for autonomous robot navigation in 3-D // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 28.

[Project 27] Development of Stereovision Methods and Devices for Autonomous Navigation of Mobile Robots

Foreign partner: University of Sigen, Germany

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Germany: Prof. Hubert Roth

Duration: 2008 – 2009

Objectives: Development of stereovision methods for autonomous navigation of mobile robots.

Main tasks:

- Development of stereo camera preliminary data processing methods for future integration with a mobile robot;
- Methods of generation of stereo images;
- Image filtering and analysis methods.
- Development of stereo image fusion and mobile robot 3D environment map generation techniques:
- Image description methods;
- Stereo image corresponding points search and 3D environment map generation methods.
- Development and implementation of sensor data fusion algorithms.
- Verification and testing of the developed methods using a mobile robot.

Team:

- Anatoliy Sachenko
- Vasyl Koval
- Oleh Adamiv
- Viktor Kapura

Published results:

1. Roth H., Sachenko A., Koval V., Chanim J., Adamiv O., Kapura V. The 3D Mapping Preparation using 2D/3D Cameras for Mobile Robot Control // Artificial Intelligence journal, Donetsk, Ukraine. – 2008. – Vol. 4. – pp. 512-521.
2. Adamiv O., Sachenko A., Kapura V. Gradient Method for Autonomous Robot Navigation // Proceedings of the Ninth International Conference “Modern Problems of Radio Engineering, Telecommunications and Computer Science” (TCSET’2008). – Lviv-Slavsko (Ukraine), 2008. – pp. 640-642.
3. H. Roth, A. Sachenko, V. Koval, O. Adamiv, V. Kapura Evaluation of Camera Calibration Methods for Computer Vision System of Autonomous Mobile Robot // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 29.

[Project 28] Development of Design and Optimization Methods for Breach Detection Systems

Foreign partner: Institute of Technology, Gebze, Turkey

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Turkey: Dr Serkan Aksoy

Duration: 2008 – 2009

Objectives: development of a Computer Aided Design (CAD) system for development of perimeter security systems optimized for quality-price, reliability-price criteria and further testing of the CAD system on real security systems.

Main tasks:

- Analysis of existing solutions and formation of a set of criteria and limitations for functional and cost analysis of security systems. Development of improved components and database for security systems.
- Development of methods and algorithms for structural synthesis and multi-criteria optimization of security systems. Development of a CAD system for security systems design based on the developed methods and algorithms.
- Development of a pilot security system with the use of the developed CAD. Testing of the pilot system.
- Carrying out a comparative analysis of the developed pilot system against existing systems. Introduction of necessary changes to the CAD system based on the conducted analysis.
- Carrying out the pilot security system testing to measure risks of undetected intrusions and risks of false alarms. Introduction of necessary changes to the pilot security system based on the conducted tests.
- Testing of the CAD system.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Volodymyr Turchenko
- Pavlo Bykovyy

Published results:

1. Bykovyy P. Design optimization of distributed technical security systems using a genetic algorithm // Visnyk of Vinnitsa Polytechnic Institute. – 2008, Issue #6, pp 28-34.
2. Bykovyy P., Pigovsky Yu., Kochan V., Sachenko A., Markowsky G., Aksoy S. Genetic Algorithm Implementation for Distributed Security Systems Optimization // Proceedings of the IEEE International Conference on Computational Intelligence for Measurement Systems and Applications (CIMSAS 2008), 14-16 July 2008. – Istanbul, Turkey. – pp. 120-124.
3. Bykovyy P.Ye., Kochan V.V. Cryptographically secure protocol for networks of security sensors // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET’2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 189.
4. Bykovyy P.Ye. Distributed sensor network for security systems // International journal of Computing. – Ternopil (Ukraine). – 2009. Vol. 8, Issue 2. – pp. 157-164.
5. P. Bykovyy, V. Kochan, Y. Kinakh, A. Sachenko, O. Roshchupkin, S. Aksoy, G. Markowsky. Data Communication Crypto Protocol for Security Systems Sensor Networks // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS’2009). – Rende (Cosenza), Italy, 2009. – pp. 375-379.
6. P. Bykovyy, Y. Pigovsky, A. Sachenko, A. Banasik. Fuzzy Inference System for Vulnerability Risk Estimation of Perimeter Security // Proceedings of 5th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS’2009). – Rende (Cosenza), Italy, 2009. – pp. 380-384.

[Project 29] Computer Telecommunication System Based on Noise Signals

Principal investigator: Prof. Yaroslav Nykolaychuk

Project is executed together with JSC Ternopil Radio Plant 'Orion', chief designer Volodymyr Kordyak.

Duration: 2007 – 2009

Objectives: to increase noise-immunity and active range of radio stations, produced by the Orion plant; introduce a mode of code based on division of transmission channels; develop a computerized system of data acquisition based on autonomous sensors.

Project tasks:

- Design of a noise-signal based radio station with a low range of operation for construction companies;
- Analysis of possible application areas for 2D noise signals;
- Analysis of possible application areas and prospective customers of computer systems based on autonomous sensors.
- Preparation of project solutions related to radio system serving and construction areas.

Team:

- Yaroslav Nykolaychuk
- Oleh Zastavnyy
- Nazar Krutskevych

Published results:

1. Nykolaychuk Y., Krutskevych N., Zastavniy O. Multibases Processors of Two-dimensional Correlation for Noise Immunity of Transfer Information // Proc. Of the IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 315-317.

[Project 30] Dynamically Reprogrammable Network Capable Application Processor with Internet Capability

Foreign partner: Esensors Inc., USA

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from USA: Dr Darold Wobschall, PhD

Grant #UE2-2534-TE-07.

Duration: 2007 – 2009

Objectives: to enter the US smart sensors market with the Network Capable Application Processor (NCAP) developed within the project CRDF #UE2-2534-TE-03 – device oriented on software data processing in smart distributed measurement and control systems which uses adaptive software reconfiguration for intelligent functions execution (self-adapting and self-training). The developed NCAP will have the following features:

- ability to work in distributed measurement control systems utilizing the Internet;
- online remote reprogramming of user application software;
- support of a wide set of network interfaces;

Main tasks:

- the minimal set of the design documentation sufficient for production of a prototype NCAP was developed;
- two prototype NCAP devices have been developed and undergo testing;
- testing of certain NCAP modules was performed, the NCAP software was developed as well.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Roman Kochan
- Andrew Stepanenko
- Ihor Maykiv
- Iryna Turchenko
- Natalia Vozna

Published results:

1. Maykiv I., Stepanenko A., Wobschall D., Kochan R., Kochan V., Sachenko A., Vasylyuk N. Remote Reprogrammable NCAPs: Issues and Approaches // Proc. Of the IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 109-113.
2. Maykiv I.M., Kochan V.V., Bilousov I.A. Project analysis of methods of serial interfaces controllers realization // Transactions of Ternopil State technical University. – 2009. – No. 1. – pp. 110-115.
3. Maykiv I.M. Investigation of I2C interface controllers realizations method on the programmed logical matrix // Proceedings of 5-th International Youth Conference “Modern Problems of Radiotechnics and Telecommunication”. – Sevastopol (Ukraine), 2009. – pp. 284.
4. Maykiv I.M., Kochan V.V. Software-hardware controller of consecutive interfaces in network nodes of data acquisition // Proceedings of 10-th International Conference “Modern Information and Electronic Technologies” (SIET'2009). – Odessa (Ukraine), 2009. – Vol. 1. – pp. 138.
5. Maykiv I.M. Methodology of structural synthesis of network capable application processors // Proceedings of National Conference in Ternopil Ivan Pul'uj State Technical University. – Ternopil (Ukraine), 2009. – pp. 176.

6. Maykiv I.M. Software-hardware method of sequential interfaces controllers realization // Proceedings of 11-th International Conference “System Analysis and Information Technologies” (SAIT-2009). – Kyiv (Ukraine), 2009. – pp. 437.
7. Maykiv I.M. Network capable application processor for distributed measuring-control systems // Transaction “Problems of Informatization and Control”, Kyiv (Ukraine). – 2009. – No. 2 (28). – pp. 187-191.
8. Maykiv I.M. Universal controller of serial interfaces // Transactions of Chernivtsi University. Series: Physics. Electronics, Chernivtsi (Ukraine). – 2009. – No. 3 (186). – pp. 130-135.
9. Maykiv I.M., Stepanenko A.V., Wobschall D. A method for structural synthesis of network capable application processors. // International Journal of Computing – Ternopil (Ukraine). – 2009. – Vol. 8. – Issue 2. – pp.126-138.
10. I. Maykiv, D. Wobschall, A. Stepanenko, R. Kochan, A. Sachenko, V. Kochan. Multi-port Serial NCAP using IEEE1451 Smart Transducer Standard // Proceedings of IEEE Sensor Application Symposium (SAS-2009). – New Orleans, LA, (USA), 2009. – pp. 293-297.
11. I. Maykiv, A. Stepanenko, D. Wobschall, R. Kochan, V. Kochan, A. Sachenko. Universal Controller of Serial Interfaces // Proceedings of the 5-th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS'2009). – Rende (Cosenza), Italy, 2009. – pp. 121-125.
12. Iryna Turchenko. Methods for Improving Efficiency of Data Processing Obtained from Multi-parameter Sensors in Distributed Computer Systems. Ph. D. Thesis on speciality 05.13.05 – Computer Systems and Components.- Ternopil National Economic University.- Ternopil.- 2008.- 200 p. (in Ukrainian)
13. Natalia Vozna. Forming and Organizing of Structured Data Movement in Multilevel Distributed Computer Systems. Ph. D. Thesis on speciality 05.13.05 – Computer Systems and Components.- Ternopil National Economic University. – Ternopil. – 2009. (in Ukrainian)

[Project 31] Ternopil Education Communication Center**Foreign partner:** University of Maine, USA

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from USA: Prof. George Markowsky

Project is granted by NATO Program of Security through Science Network Infrastructure Grant, and performed together with the University of Maine, USA.

Duration: 2006 – 2009

Objectives: create common communication center for universities of Ternopil, integrate educational networks of Ternopil Universities, introduce high-speed network for training and research.

Main tasks:

- Connect educative institutions of Ternopil to Internet through Ternopil Education Communication Center;
- Make a basis for cooperation of all universities of Ternopil;
- Make a basis for educative and research cooperation between universities of Ternopil and University of Maine and other researchers;
- Provide high-speed access to UARNET and GEANT networks;
- Provide abilities for holding video-conferences between Ternopil and other cities;
- Develop a prototype of a system, that can be implemented in other areas of Ukraine;
- Implement 16 processor clusters for GRID-processing that will be used in universities – project members;
- Introduce on-line library;
- Provide Wi-Fi service for universities of Ternopil.

Team:

- Anatoliy Sachenko
- Serhiy Voznyak
- Ihor Romanets'
- Roman Romanyak

Published results:

1. Sachenko A. Ternopil Education Communication Center // Innovation and Communication Security (ICS) Panel Meeting. – 2006. – Kyiv (Ukraine).
2. G. Markowsky, A. Sachenko, S. Voznyak, V. Spilchuk, R. Romanyak, V. Turchenko, I. Romanets. The Ternopil Educational Communication Center – A NATO Project to Integrate Regional Information Technology Resources. Computing, 2008, Vol. 7, Issue 1.
3. Palagin O., Alishov N., Markowsky G., Sachenko A., Turchenko V. Security Tools for GRID-systems // Proceedings of the 2007 International Conference on Security and Management. -2007. Las Vegas, NV (USA).

[Project 32] Instruction Parameters Analysis for Power Modeling of Embedded Microprocessors

Foreign partner: Aristotle University of Thessaloniki, Thessaloniki, Greece

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Greece: Prof. Theodore Laopoulos

Project is granted by Ministry of Education and Science of Ukraine and Greek Government (agreement #M/85-2006), and performed together with the Aristotle University of Thessaloniki, Greece.

Duration: 2006 – 03.2008

Objectives: to determine power consumption of each parameter while executing the following instructions by the processor: determining number and value of registers, immediate values, values and addresses of operands, address of command call, pipeline panel and substitution, examination and analysis of correlation of instruction parameters in power consumption of instructions; examination and analysis of each parameter in power consumption of instructions; developing accurate power models for execution level of ARM7TDMI processor instructions.

Main tasks:

Additional investigating of instruction parameters power consumption and developing of measurement methodology using existing measurement setup; developing new approach in measurement methodology that can determine processor configuration. Due to this approach it is possible to measure and analyze correlation of instruction power consumptions according to instruction parameters; determine power consumption; analyze and process power consumption values; develop power models for instructions; experimentally prove achieved theoretical results.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Volodymyr Turchenko
- Andrii Borovyi

Published results:

1. Borovyi A., Kostandakos V., Kochan V., Sachenko A., Yaskilka V. Analysis of CPU's Instructions Energy Consumption Device Circuits // Proceedings of Fourth IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 42-46.
2. Borovyi A., Kochan V. Analysis of Microcontroller Instructions Power Consumption Measurement Circuits. Visnyk of Khmelnytsky National University. – 2007. – Vol. 1. – #2. – pp. 105-109.
3. Borovyi A.M., Kochan V.V., Turchenko V.O. Stand for investigation of current moment value consumed by microprocessor // Transaction of Ternopil State Technical University. – 2009. – No. 1. – pp. 131-137.
4. Borovyi A.M. Analysis of power consumption by ARM7TDMI processor kernel // Proceedings of National Conference in Ternopil Ivan Pul'uj State Technical University. – Ternopil (Ukraine), 2009. – pp. 101.
5. A. Borovyi, V. Kochan, Z. Dombrovskyy, V. Turchenko, A. Sachenko Device for Measuring Instant Current Values of CPU's Energy Consumption // Proceedings of the 5-th IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS'2009). – Rende (Cosenza), Italy, 2009. – pp.126-130.

[Project 33] Financial Analytics Method with Applications of Knowledge Bases

Principal investigator from RIICS: Prof. Anatoliy Sachenko

This is a joint project between National University of the State Taxation Department of Ukraine, Irpin, Ukraine and Research Institute for Intelligent Computer Systems, Ternopil, Ukraine.

Duration: 09.2008 – 11.2008

Objectives: evaluation of the present state and selection of priority directions for implementation of intelligent information technologies of financial analytics and knowledge bases in governmental resource management processes.

Main tasks:

- evaluation of the present state and investigation of theoretical research in information technologies for financial analytics with application of knowledge bases in management of governmental institutions;
- investigation of possible intelligent computer technologies application in the domain of financial analytics ontologies in governmental management;
- evaluation of the state and perspectives of ontology intelligent tools using methods of financial analytics;
- development of technologies in area of intellectulazation of information-analytical processes and creation of financial analytics knowledge bases in governmental management;
- the conducted activity enabled to provide functional completeness of solutions to the defined research tasks and creation of documentation as per the Requirements Specification;
- research and creation of the output documentation were performed on the basis of a systematic approach, conceptual completeness of results and consistency;
- the conducted work follows the principal of minimal implementation costs for the proposed solutions.

Team:

- Anatoliy Sachenko
- Taras Lendyuk

Published results:

1. Palagin A., Rippa S. and Sachenko A. Conceptualization and problems of ontologies // Journal of Artificial Intelligence, 2008 Vol. 3, pp 374-379.

[Project 34] Development of Effective GRID-technologies for Ecology Monitoring Using Satellite Data

Principal investigator from ICS: Prof. Anatoliy Sachenko

Principal investigator NSAU: Prof. Nataliya Kussul

Collaborative project of Scientific-Technologic Centre in Ukraine and National Sciences Academy of Ukraine has been performed together with the Space Research Institute of National Sciences Academy of Ukraine and National Aerospace Agency of Ukraine, Kyiv.

Grant STCU #3872

Duration: 12.2005 – 12.2007

Objectives: Development of an effective distributed computations techniques that provide simple and transparent solutions to the computationally-complicated tasks in different areas, especially associated with space data processing.

Main tasks:

- developing methodology for constructing temporal interpolation earth atmosphere photographs;
- developing methodology for predicting solar activity and corresponding algorithms for holding parallel computations;
- developing parallel implementation modeling methods algorithms for dynamics of main processes in multi-component ground environments with the corresponding cluster.
- developing GRID-service for monitoring and control solutions process in systems;
- developing GRID-service for balancing system loading;
- developing GRID-service for visualization of computational results;
- developing GRID-service for granting users' access to system;
- developing service for system security purposes;
- combining some clusters or computational networks into one complex for searching solution to the same task.

Team:

- Anatoliy Sachenko
- Volodymyr Turchenko
- Viktor Demchuk

Published results:

1. Turchenko V., Demchuk V., Sachenko A. Interplanetary Shock Arrival Time Prediction Using Multi-Layer Perceptron // Proceedings of the 4th IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS'2007. – 2007. – Dortmund (Germany). – pp. 185-190.
2. Turchenko V. An Approach to IP Shock Arrival Time Prediction Using Approximating Neural Network // International Journal of Information Technology and Intelligent Computing. – 2007. – No. 4. – Vol. 1.
3. V. Turchenko, V. Demchuk, A. Sachenko, Y. Veremeyenko. An Approach to Interplanetary Shocks Prediction Using Single ACE/EPAM Channel Data // Proceedings of the Fourth International Conference on Neural Networks and Artificial Intelligence ICNNAI'2006. – 2006. – Brest (Belarus). – pp. 140-144.

[Project 35] Development of Web Ontologies as Data Exchange and Decision Support Tools to Facilitate Economic Cooperation between Ukraine and USA

Foreign partner: New Jersey Institute of Technology, USA

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from USA: Dr. Yefim Kats

Project had been performed according to Research program of the US National Science Foundation.

Grant # NSF-04-12

Duration: 2004 – 2007

Objectives: develop Web-ontologies as data exchange and decision making instrument for promotion of economic partnership between Ukraine and USA.

Main tasks:

- Standard ontology dictionary used in economic interchange, including dictionaries for typical e-commerce models, identification.
- Identifying objects as classes or relations with adequate limiting interpretation.
- Identifying specific ontology relations for (intelligence) agents based on automated processing.
- Developing Windows object library compatible apparatus for measuring possible ontology errors.

Team:

- Anatoliy Sachenko
- Roman Pasichnyk
- Yuriy Pihovsky
- Andrii Melnyk

Published results:

1. Pasichnyk R., Sachenko A. Semantic WEB-Search Developing by Problem-Oriented Ontology Means // Proceedings of the IEEE International Workshop IDAACS'2007. – 2007. – Dortmund (Germany). – pp. 445-448.
2. Hrusha V. Specifics of Ontologies Design and Application in proceedings of the 11th scientific conference of Ternopil State Technical University. – 2007. – Ternopil: TSTU. – pp. 78.
3. R. Pasichnyk, A. Sachenko, A. Melnyk “Formalization of ontology creation process using base classes” in proceedings of the 13th national conference “Modern problems of applied mathematics and informatics”, Lviv, October 3-5 2006, P.162-163.
4. Master thesis by Andrii Melnyk was defended in 2006.
5. Course thesis by Andrii Melnyk was defended in 2005.
6. Master thesis by Vitaliy Kharchuk was defended in 2004.

[Project 36] Dynamically Reprogrammable Network Capable Application Processor with Internet Capability

Principal investigator: Prof. Anatoliy Sachenko

The project is funded under the Ministry of Education and Science of Ukraine

Grant #0107U005985.

Duration: 08.2007 – 12.2007

Objectives: to enter the US smart sensors market with the Network Capable Application Processor (NCAP) developed within the project CRDF #UE2-2534-TE-03 – device aimed at software data processing in smart distributed measurement and control systems which uses adaptive software reconfiguration for intelligent functions execution (self-adapting and self-training). The developed NCAP will have the following features:

- ability to work in distributed measurement control systems utilizing the Internet;
- online remote reprogramming of user application software;
- support of a wide set of network interfaces.

Main tasks:

- a minimal set of the design documentation sufficient for production of a prototype NCAP had been developed, which allowed to choose its elemental basis and embodiment;
- there was developed a package of structural documentation;
- there was developed software for interface microcontroller providing software support of hardware drivers for supported interfaces – data link layer, IP protocol (Internet Protocol) – network layer, TCP protocol (Transport Control Protocol) – transport layer, HTTP protocol (Hypertext Transfer Protocol) – session layer, dynamical HTML-page, where the data is presented and received by all supported interfaces and can be read – presentation layer;
- two prototype NCAP devices had been developed and underwent testing that allows to debug application software of its microcontrollers and their interaction between each other, as well as with the server and measuring-control modules in real time.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Roman Kochan
- Andrew Stepanenko
- Ihor Maykiv
- Pavlo Bykovyy

Published results:

1. Maykiv I., Stepanenko A., Wobschall D., Kochan R., Kochan V., Sachenko A., Vasylykiv N. Remote Reprogrammable NCAPs: Issues and Approaches // Proc. Of the IEEE International Workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2007). – 2007. – Dortmund (Germany). – pp. 109-113.
2. Stepanenko A., Maykiv I., Wobschall D., Kochan R., Kochan V., Sachenko A. Multi-port Serial NCAP Using IEEE1451 Smart Transducer Standard // Proceedings of the IEEE Sensor Application Symposium SAS'2009, 17-19 February, 2009, New Orleans, USA, pp. 293-297.

[Project 37] Investigation of the Intelligent Properties of Re-Configurable Network Capable Application Processor in Adaptive Distributed Instrumentation and Control Systems

Foreign partner: Sensors Development and Applications Group, National Institute Standards and Technologies, USA

Principal investigator from Ukraine: Dr. Volodymyr Kochan

Principal investigator from USA: Kang Lee

This project has been performed within US Civilian Research and Development Foundation (Cooperative Grant Program).

Grant # CRDF.CGP. UE2-2534-TE-03

Duration: 2005 – 2006

Objectives: Development of the IEEE-1451 standard compatible Network Capable Application Processor (NCAP) with dynamic software and hardware reconfiguration and investigation of its self-adaptive and intelligent properties in information-measurement systems.

Main tasks:

- Investigation of the NCAP intelligent properties to be used with smart sensors, deployed in distributed information measurement systems with different architectures and functional requirements.
- Extension of the NCAP's functional features compatible with the IEEE1451 standard to support dynamic online reprogramming of software and a set of network interfaces.
- Development and investigation of the prototype NCAP and its programming methodology.

Team:

- Volodymyr Kochan
- Anatoliy Sachenko
- Roman Kochan
- Oleh Adamiv
- Iryna Turchenko
- Andriy Stepanenko

Published results:

1. Kochan V., Lee K., Kochan R., Sachenko A. Approach to Improving Network Capable Application Processor Based on IEEE 1451 Standard // Computer Standards & Interfaces. – 2005. – Vol. 28. – Issue2. – pp. 141-149.
2. Stepanenko A., Lee K., Kochan R., Kochan V., Sachenko A. Development of a Minimal IEEE1451.1 Model for 8051-Compatible Microcontrollers // Proc. Of the 2006 IEEE Sensors Applications Symposium. – 2006. – Houston, Texas (USA). – pp. 88-93.
3. Kochan R., Kochan V., Sachenko A., Maykiv I., Turchenko V., Markowsky G. Interface and Reprogramming Controller for Dynamically Reprogrammable Network Capable Application Processor (NCAP). // Proc. Of 3-th IEEE International workshop on Intelligent Data Acquisition and Advancing Computing Systems (IDAACS'2005). – 2005. – Sofia (Bulgaria). – pp. 639-642.
4. Kochan R., Kochan V., Sachenko A., Maykiv I. NCAP Based on FPGA // Proc. Of the IEEE Instrumentation and Measurement Technology Conference IMTC/2005. – 2005. – Ottawa, Ontario (Canada). – pp. 813-817.
5. Kochan R., Lee K., Kochan V., Sachenko A. Development of a Dynamically Reprogrammable NCAP // Proc. Of the IEEE Instrumentation and Measurement Technology Conference IMTC/2004. – 2004. – Como (Italy). – pp. 1188-1193.
6. Roman Kochan. Improvement of components of precision distributed information control systems: Ph.D. Theses on speciality 05.11.16 / Ternopil Academy of National economy. – Ternopil, 2005. – 193 p.

[Project 38] Methods and Algorithms for Face Detection and Recognition for Real Time Video Surveillance Systems

Foreign partner: Belarus State University of Informatics and Radio Electronics, Belarus

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Belarus: Prof. Rauf Sadykov

This project has been performed in frames of State fund of fundamental research programs, Ministry of Education and Science of Ukraine order #356 dated to 14.06.05.

Duration: 2005 – 2006

Objectives: Development of algorithms for preliminary processing of images based on segmentations and development of algorithms and software for face detection in static vision conditions.

Main tasks:

- Development of effective algorithms and software for capturing face images in video stream;
- Development of approximate 3-dimension face models;
- Development of algorithms for selection of informative features and classification of images according to modified syntactical discriminator functions;
- conducting experimental diagnosis and configuration of proposed algorithms for achieving maximum results of program model;
- development of a software system which implements the designed recognition scheme.

Team:

- Anatoliy Sachenko
- Vasyl Koval
- Ihor Paliy
- Yuriy Kurylyak
- Victor Kapura

Published results:

1. Y. Kurylyak. System of Face Detection at Static Images. – 2006. – 83p.
2. Y. Kurylyak, Ihor Paliy, Vasyl Koval, Anatoliy Sachenko. Improved Method of ace Detection Using Color Images // Proceedings of the International Conference “Modern Problems of Radio Engineering, Telecommunications and Computer Science” TCSET’2006. – Feb’28 – Mar’4, 2006. – Lviv-Slavske, Ukraine. – pp. 186-188.
3. A. Sachenko, V. Koval, I. Paliy, Y. Kurylyak. Approach to Face Recognition Using Neural Networks // Proceedings of the IEEE Second International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS’2005, Sofia, Bulgaria, September 5-7, 2005, pp. 112-115.

[Project 39] Development of Methods and Tools for Improvement of Robot Navigation in a non-Structured Environment

Foreign partner: Kaunas Technical University, Lithuania

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Lithuania: Dr Arunas Raudis

This project has been performed in frames of State Fund for Fundamental Research Programs, Ministry of Education and Science of Ukraine order #174 dated by 23.03.05.

Duration: 2005 – 2006

Objectives: Development of methods and tools for improvement of mobile robot navigation in non-structured environment.

Main tasks:

- Development of methodology for creation of a mobile robot management system, which reflects schemes for conforming mobile robot subsystems for ensuring unobstructed navigation in non-structured environment.
- Development and implementation of main concepts for processing sensor data and creating environmental local map to improve robot navigation in non-structured environment with the help of artificial neural networks.
- Development and implementation of effective and self-adaptive methods for robot navigation and pathway planning.
- Research of experimental methods (with the use of imitation modeling and neural network resources).

Team:

- Anatoliy Sachenko
- Vasyl Koval
- Oleh Adamiv
- Yuriy Kurylyak
- Maxym Lunochkin
- Serhiy Maystrenko

Published results:

1. Koval V., Adamiv O. The Software Structure Development for Mobile Robot Control // Proceedings of the IEEE Second International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS'2005. – 2005. – Sofia (Bulgaria). – pp. 120-124.
2. Oleh Adamiv. Models and Intelligent Means of Autonomous Mobile Robot Adaptive Control: Ph.D. Theses on speciality: 05.13.23 / Ternopil National Economic University. – Ternopil, 2007. – 166 p.

[Project 40] Development of Parallel Neural Networks Training Algorithms on Advanced High Performance Systems

Foreign partner: Parallel Computing Laboratory, Department of Electronics, Computer Science and Systems, University of Calabria, Italy

Principal investigator from Ukraine: Dr. Volodymyr Turchenko

Principal investigator from Italy: Prof. Lucio Grandinetti

Grant # INTAS YSF 03-55-2493

Duration: 2004 – 2006

Main tasks:

- Develop a parallel algorithm of enhanced data integration method using C programming language and MPI parallelization technology.
- Design and implement in C programming language and MPI parallelization technology two new methods of coarse-grain neural network parallelization which provides high efficiency of parallelization at the certain training parameters of neural networks and dynamic mapping method, which is more universal than static and shows better efficiency at different initial parameters of neural networks and provides parallelization. A series of on-line computational experiments of the above mentioned algorithms of the parallel machines SGI Origin 300, NEC TX-7 is performed and the computational grid consists of the cluster of double-processor Compaq personal computers under Linux operation system and Globus middleware package.
- Develop and implement in C programming language using MPI and MPE libraries the fine-grain parallel training algorithm of multilayer perceptron with parallelization of the outputs of hidden layer neurons at the initial stage of information processing inside neural network module.
- Compare the advantages and disadvantages of middleware technologies, in particular Globus, in a case of coarse-grain parallelization algorithm of Integration Historical Data Neural Networks with dynamic mapping on the parallel computer Origin 300 without using middleware package and on the computational grid operated by Globus middleware package.

Published results:

1. V. Turchenko. Parallel Algorithm of Dynamic Mapping of Integrating Historical Data Neural Networks, Information Technologies and Systems, 2004, Vol. 7, No. 1, pp. 45-52, ISSN: 0135-5465, <http://www.tanet.edu.te.ua/iics/vtu/B7.pdf>.
2. V. Turchenko, V. Demchuk. Efficiency Analysis of Parallel Routine Using Processor Time Visualization, International Scientific Journal of Computing, 2005, Vol. 4, Issue 1, pp. 12-18, ISSN: 1727-6209, <http://www.tanet.edu.te.ua/computing/Computing2005Vol4Issue1-12-18.pdf>.
3. V. Turchenko. Computational Grid vs. Parallel Computer for Coarse-Grain Parallelization of Neural Networks Training, Lecture Notes in Computing Science LNCS 3762, Edited by Robert Meersman, Zahir Tari, Pilar Herrero, Berlin, Heidelberg, New York, Springer-Verlag, 2005, pp. 357-366, ISSN: 0302-9743, http://dx.doi.org/10.1007/11575863_55.
4. V. Turchenko, C. Triki, L. Grandinetti, A. Sachenko. Efficiency Estimation of Parallel Algorithm of Enhanced Historical Data Integration on Computational Grid, International Scientific Journal of Computing, 2005, Vol. 4, Issue 3, pp. 9-19, ISSN: 1727-6209, <http://www.tanet.edu.te.ua/computing/Computing2005Vol4Issue3-9-19.pdf>.
5. V. Turchenko. Fine-Grain Approach to Development of Parallel Training Algorithm of Multi-Layer Perceptron, Artificial Intelligence, 2006, Vol. 1, pp. 94-102, ISSN 1561-5359, <http://www.tanet.edu.te.ua/iics/vtu/B1.pdf>.

[Project 41] Development of a Web-based Measurement System with Distributed Intelligence

Foreign partner: Laboratory of Signal Processing and Information Measurement University of Sannio, Benevento, Italy

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Italy: Prof. Pasquale Daponte

Project was performed under the Ministry of Education and Science of Ukraine order #M/79-2004, state registration #0104U006975.

Duration: 2004 – 2006

Objectives: to create a distributed measurement system (based on Intranet and Internet technologies), that can provide high accuracy sensor data processing by the use of artificial neural networks. The system's feature is remote units working in real time mode during long delays in data link layer, and costs decrease is achieved by shifting of some intelligent functions to a main server.

Main tasks:

- Development of distributed measurement system architecture with either Internet- or Intranet-technologies.
- Research and design of networked software structures. Development of software for distributed system using Web-technologies.
- Testing and verification of the developed software for distributed measurement system.

Team:

- Anatoliy Sachenko
- Volodymyr Turchenko
- Volodymyr Kochan
- Roman Kochan
- Iryna Turchenko
- Volodymyr Hrusha
- Olexandr Osolinskiy

Published results:

1. V. Hrusha, O. Osolinskiy, P. Daponte, D. Grimaldi, R. Kochan, A. Sachenko, I. Turchenko. Distributed Web-based Measurement System // IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications. 5-7 September 2005, Sofia, Bulgaria – pp. 355 -358.
2. V. Hrusha, O. Osolinskiy, R. Kochan, G. Sapojnyk Development of Web-based instrumentation, Proc. Of the International Conference “Modern Problems of Radio-Engineering, Telecommunications and Computer Science” TCSET’2006, February 28 – March 4, 2006, Lviv-Slavsko, Ukraine – pp. 199-201.
3. V. Hrusha, O. Osolinskiy, P. Daponte, D. Grimaldi, R. Kochan, A. Sachenko, I. Turchenko. Distributed Web-based Measurement System // IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications. 5-7 September 2005, Sofia, Bulgaria – pp. 355 -358.
4. I. Turchenko, V. Kochan, A. Sachenko, R. Kochan, A. Stepanenko, P.Daponte D. Grimaldi “Simulation Modeling of Neural-Based Method of Multi-Sensor Output Signal Recognition” in Proceedings of 2006 IEEE Instrumentation and Measurement Technology Conference IMTC/06. – April 24-27, 2006. – Sorrento (Italy). – pp. 1530-1535.

[Project 42] Design of Distributed Sensor Network for Ayers Island Security Using Value Analysis Technology

Foreign partner: Department of Computer Science, University of Maine, USA

Projects investigator from Ukraine: Prof. Anatoliy Sachenko

Projects investigator from USA: Prof. George Markowsky

Project had been performed within the frames of the First Steps to Market program of the US Civilian Research and Development Foundation.

Grant # CRDF FSTM UM2-5012-TE-03

Duration: 2003 – 2005

Objectives: investigating possibilities for developing distributed sensor network with defined features for providing security Ayers Island, Orono, ME, USA.

Main tasks:

- Analyze component and perimeter security systems vendors, examine well-known perimeter security systems.
- Propose algorithm for defining key functional indicators for perimeter security distributed systems components that can optimize preparing procedure for CAD, intended for design and optimization according to functional-price characteristics security system. This algorithm usage filled DB with functional-price characteristics for perimeter area security systems components that are unified and eligible for creating CAD.
- Morphological matrix method was proposed for optimization according to functional-price characteristics of designed security systems and selecting variants of DSN that create Paret boundaries for all alternative variants according to two key functional characteristics.
- CAD software module was developed, functions for all modules were described, and major requirements to perimeter area security systems CAD were established. Proposed CAD allows us to design projects perimeter area security systems, using perimeter area security systems components database.
- Demonstrate CAD version that was used for developing perimeter area security systems for Ayers island in Orono, ME according to quality, reliability and price characteristics.

Team:

- Anatoliy Sachenko
- Volodymyr Turchenko
- Volodymyr Kochan
- Pavlo Bykovyy

Published results:

1. Bykovyy P. Choosing of Technical & Economic Indices for Knowledge Base of Perimeter Security Systems // Proceedings of the 2004 IEEE International Conference on Intelligent Systems 3. – 2004. Bulgaria. – pp. 54-57.
2. I. Turchenko, V. Turchenko, V. Kochan, P. Bykovyy, A. Sachenko and G. Markowsky. “Database Design for CAD System Optimizing Distributed Sensor Networks for Perimeter Security.” Proceedings of the 8th IASTED International Conference on Software Engineering and Applications SEA’2004 (2004): 59-64. (USA)
3. R. Kochan, V. Kochan, A. Sachenko, I. Maykiv, I. Turchenko and G. Markowsky. “Network Capable Application Processor based on FPGA.” Proceedings of the 22nd IEEE Instrumentation and Measurement Technology Conference IMTC 2005 II (2005): 813-817. (Canada)
4. P. Bykovyy, I. Maykiv, I. Turchenko, O. Kochan, V. Yatskiv and G. Markowsky. “A Low-Cost Network Controller for Security Systems.” Proceedings of the 3rd IEEE International Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS’05 (2005): 388-391. (Bulgaria)

[Project 43] Development of Intelligent Precision System for Thermal Objects Control

Foreign partner: Department of Automatics, the University of Mons, Belgium

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Belgium: Prof. Marcel Remy

The project had been performed under the NATO (Cooperative Science & Technology Sub-Program).

Grant NATO PST.CLG.977647

Duration: 2002 – 2004

Objectives: development of precision and self-adaptive temperature control system for temperature objects with multi-zone linked control.

Main tasks:

- Analysis of precision thermal objects and their control systems;
- Analysis of error control system components and ways for reducing their influence on general system error.
- Development of constructive-technological and structural-algorithmic methods for improving accuracy of measuring channels and control channels for multi-zone thermal objects.
- Development of result processing methods for defining thermal objects parameters.
- Adaptation of random small perturbation method for thermal objects with multi-zone linked control.

Team:

- Anatoliy Sachenko
- Roman Pasichnyk
- Volodymyr Kochan
- Volodymyr Turchenko
- Roman Kochan
- Nadia Vasylykiv
- Yuriy Pihovsky
- Mykola Derlytsya

Published results:

1. Derlytsya M., Pigovsky Y., Pasichnyk R., Kochan V. Improved Control System of Multi-Zone Thermal Object // Scientific Journal of Khmelnytsky Podillya Technical University. – 2004. – No. 2. – Vol. 1. – pp. 30-33.
2. Kochan V., Vasylykiv N., Chyrka M. The Error Evaluation of Temperature Measurement in Diffusion Furnace // Proceedings of the VIII International Conference Temperature. – 2003. – Lviv (Ukraine). – pp. 33.
3. Sachenko A., Kochan V., Pasichnyk R. Development of the Simulation Model of Thermocouples // Proceedings of the IEEE Instrumentation and Measurement Technology Conference IMTC/2003. – 2003. – Vail, CO. – pp. 1673-1677.
4. Derlytsya M. Improvement of the PC Based System of Optimal Control of Multi-Zone Thermal Object // Master Thesis, Ternopil Academy of National Economy. – 2004.
5. Pigovsky Y. Simulation Model for Effectivity Control of the Chip Manufacturing Process // Master Thesis, Ternopil Academy of National Economy. – 2004.

[Project 44] Using Multisensor Fusion and Neural Networks Techniques for Robot Control

Foreign partner: Laboratory of Robotics Systems, University of La Coruña, Spain

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Ukraine: Prof. Richard Duro

The project had been performed under the NATO (Cooperative Science & Technology Sub-Program).

Grant NATO PST.CLG.978744

Duration: 2002 – 2004

Objectives: development and implementation of main concepts of merging sensor data, using neural networks for controlling mobile robot. It is assumed that robot moves in unknown (dangerous for human) environment. Main purpose is the endpoint reached through obstructions.

Main tasks:

- Development of new methods for merging sensor data, using neural networks.
- Development of algorithms and software for merging sensor data subsystem.
- Hardware implementation of merging methods for sensor data on mobile robot.
- Verification and testing procedures of developed engines for merging sensor data on mobile robot.
-

Team:

- Anatoliy Sachenko
- Volodymyr Turchenko
- Vasyl Koval
- Oleh Adamiv

Published results:

1. Koval V. The Fusion of Structured Light and Video Image for Mobile Robot Control // Scientific and Technical Journal Artificial Intelligence. – 2004. – Donetsk (Ukraine). – No1.
2. Koval V. The Method of Obstacle Detection Using Fusion Technique of Heterogeneous Sensors // ASU and Automatic Devices. – 2004. – Kharkiv (Ukraine). – pp. 128-135.
3. Koval V., Turchenko V., Kochan V., Sachenko A., Markowsky G. Smart License Plate Recognition System Based on Image Processing Using Neural Network // Computing. – 2003. – Vol. 2. – Issue 2. – pp. 40-46.
4. Adamiv O., Koval V., Turchenko I. Predetermined Movement of Mobile Robot Using Neural Networks // International Scientific Journal Computing. – 2003. – Ternopil (Ukraine). – Vol. 2. – Issue 2. – pp. 64-68.
5. Koval V., Turchenko V., Sachenko A., Becerra J., Duro R., Golovko V. Infrared Sensor Data Correction for Local Area Map Construction by a Mobile Robot // The Lecture Notes in Artificial Intelligence, LNAI2718. – 2003. – pp. 306-315.
6. Koval V. The Method of Local Area Map Construction for Mobile Robot // Scientific Journal of Ternopil State Technical University I.Pulyuj. – 2002. – Ternopil (Ukraine). – Vol. 8. – No2. – pp. 80-88.
7. V. Koval, “Adversary merging sensor data algorithm on ultisensory systems”, // Sensors and systems, #7 (38) Sep. 2002. Pp.39-41.
8. Vasyl Koval. Methods and Algorithms of Map Development of Mobile Robot Environment Using Sensor Data Fusion: Ph.D. Theses on speciality 05.13.23 / Ternopil Academy of National Economy; NAS of Ukraine; State Research Institute of Information Infrastructure. – Ternopil, 2004. – 208 p.

[Project 45] Development of an Intelligent Sensing Instrumentation Structure

Foreign partners: Electronic Laboratory, Aristotle University, Thessaloniki, Greece, Parallel Computations Laboratory, University of Calabria, Italy, Department of Electronics at Brest Polytechnic Institute, Belarus.

Principal investigator from Ukraine: Prof. Anatoliy Sachenko

Principal investigator from Greece: Prof. Theodore Laopoulos

Principal investigator from Italy: Prof. Lucio Grandinetti

Principal investigator from Belarus: Prof. Volodymyr Golovko

The project had been performed under the “INTAS Open Call” program, grant # INTAS OPEN 97-0606.

Duration: 1999 – 2001

Objective: development of information measurement system for increasing measurement accuracy using automated correction of instrumental compound measurement error.

Research tasks:

- Target area analysis and requirements definition for intelligent sensor measurement system;
- Development of distributed structure for intelligent sensor measurement system;
- Development of methods for evaluating the results of processing with the target objective to increase the system operational characteristics;
- Development and testing of the prototype intelligent sensor measurement system.

Team:

- Anatoliy Sachenko
- Volodymyr Kochan
- Volodymyr Turchenko
- Roman Kochan

Published results:

1. Sachenko A., Kochan V., Turchenko V., Tymchyshyn V., Vasylykiv N. Intelligent Nodes for Distributed Sensor Network // Proceedings of the 16th IEEE Instrumentation and Measurement Technology Conference IMTC/99. – 1999. – Venice (Italy). – Vol. 3. – pp. 1479-1484.
2. Golovko V., Grandinetti L., Kochan V., Laopoulos T., Sachenko A., Turchenko V. Tymchyshyn V. Approach of an Intelligent sensing Instrumentation Structure Development // Proceedings of the IEEE International Workshop on Intelligent Signal Processing WISP'99? Budapest, Hungary, 4-6 September, 1999. – pp. 336-341.
3. Sachenko A., Kochan V., Turchenko V., Laopoulos T., Golovko V., Grandinetti L. Features of Intelligent Distributed Sensor Network Higher Level Development // Proceedings of the 17th IEEE Instrumentation and Measurement Technology Conference IMTC/2000. – 2000. – Baltimore (USA). – pp. 335-340.
4. Sachenko A., Kochan V., Turchenko V., Golovko V., Savitsky Y., Dunets A., Laopoulos T. Sensor Errors Prediction Using Neural Networks // Proceedings of the IEEE-INNS-ENNS International Joint Conference on Neural Networks IJCNN'2000. – 2000. – Como (Italy). – Vol. IV. – pp. 441-446.
5. Sachenko A., Kochan V., Kochan R., Turchenko V., Tsahouridis K., Laopoulos Th. Error Compensation in an Intelligent Sensing Instrumentation System, 18th IEEE Instrumentation and Measurement Technology Conference IMTC/2001. – 2001. – Budapest (Hungary). – pp. 869-874.
6. Turchenko V., Kochan V., Sachenko A., Laopoulos Th. The New Method of Historical Data Integration Using Neural Networks // Proceedings of the International Workshop on Intelligent

- Data Acquisition and Advanced Computing Systems IDAACS'2001. – 2001. – Foros (Ukraine). – pp. 21-24.
7. Turchenko V., Kochan V., Sachenko A. Estimation of Computational Complexity of Sensor Accuracy Improvement Algorithm Based on Neural Networks // Lecture Notes in Computing Science, No 2130, Ed. By G.Gooss, J.Hartmanis and J. van Leeuwen, Springer-Verlag, Berlin, Heidelberg, New York. – 2001. – pp. 743-748.
 8. Volodymyr Turchenko. Neural Network Methods and Means of Efficiency Improvement of Distributive Networks of Sensor Data Acquisition and Processing: Ph.D. Theses on speciality 05.13.13 / Lviv National Polytechnical University. – Lviv, 2001. – 188 p.
 9. Volodymyr Tymchychyn. Efficiency Increasing of Specialized Computer System Design on the Base of Typical Microprocessor Platforms: Ph.D. Theses on speciality 05.13.13 / Lviv National Polytechnical University. – Lviv, 1999. – 200 p.
 10. Patent of Ukraine 25609A, MKI G06F 15/00. Two-Wired Local Area Network, Signal Repeater and Invertor for Using in it / V. Kochan, V. Tymchyshyn (Ukraine); Applied 30.10.97 # 97105295; Issued 30.10.98.
 11. Patent of Ukraine 25498A, MKI G06F 11/00. Method of Communication Channel Bandwidth Increasing on the Base of Serial Interface and Device for it Realisation / V. Kochan, V. Tymchyshyn (Ukraine); Applied 27.01.98 # 98010432; Issued 30.10.98.

4. RESEARCH ACTIVITIES

IDAACS Conferences and Symposia

A – IDAACS Conferences

Prof. Lucio Grandinetti (Italy), Prof. Theodore Laopoulos (Greece) and Prof. Anatoliy Sachenko (Ukraine) proposed the idea of IDAACS Workshop during the working meeting in Cetraro, Italy, in June 2000. One of the main strategic goals of IDAACS is promotion of the close scientific cooperation between the research teams and scientists from the countries of Western and Eastern Europe. Therefore, the Workshop's motto is "IDAACS – the crossing point of Intelligent Data Acquisition & Advanced Computing Systems and East & West Scientists". In 2011 the name 'IDAACS Workshop' has transformed in 'IDAACS Conference'. Since 2001 the following IDAACS Workshops and Conferences have been organized:

XIII IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS'2025)



The 13th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS'2025) was held in Gliwice, Poland, from 4 to 6 September 2025, and was organized in a hybrid format at the Silesian University of Technology. The conference was co-chaired by Professor Anatoliy Sachenko (Ukraine) and Professor Wojciech Kempa (Poland). The Honorary Chair was Professor Vincenzo Piuri (Italy), and the Chair of the International Advisory Board (IAB) was Professor George Markowsky (USA).

Technical co-sponsors were:

- West Ukrainian National University;
- IEEE SPS Polish Branch;
- IEEE SMC Polish Branch.

Financial sponsors were:

- Silesian University of Technology;
- IEEE Polish Section;
- IEEE Region 8;
- IDAACS Charity Found.

Supporters and sponsors included:

- MagneticOne;
- Yaware – effective employee monitoring software;
- Infineon Technologies;
- Sensors. An open access journal published by MDPI.

Participants presented their 240 papers in 42 oral and poster sessions. Among them, there were 75 presentations in 16 oral sessions in person, 24 presentations in 2 poster sessions in person, 72 presentations in 18 oral sessions online, and 69 presentations in 6 poster sessions online.

On Thursday, September 4, the first day of the conference, a key invited scientist, Professor Oleksandr Letychevsky (Heriot-Watt University, United Kingdom), participated in the plenary session with the topic "Digital Twins Based on Neuroinsertion."

The following sessions were held: Pattern Recognition, Digital Image and Signal Processing; Advanced Mathematical Methods and Big Data; Internet of Things and Industrial Internet; Special Stream on Cybersecurity; Special Stream on Advanced Project Management; Virtual Labs and Virtual Toolkits in STEM.

The following sessions were held online: Stream on Intelligent Software Systems and Tools; Special Stream on Cybersecurity; Special Stream on Advanced Project Management; Special Stream on Virtual Labs and Virtual Toolkits in STEM; Pattern Recognition, Digital Image and Signal Processing; Advanced Mathematical Methods and Big Data.

In the evening, conference participants visited an underground mine and an old coal mine.

On Friday, September 5, the second day of the conference, key invited scientists participated in the plenary sessions: Dr. Angelo Genovese (University of Milan, Italy) with a report "Detecting Industrial Anomalies at the Edge" and Professor Natalia Kussul (University of Maryland, USA) with a report "Artificial and Earth-based Intelligence for Monitoring Our Changing Planet."

The following sessions were held: Pattern Recognition, Digital Image and Signal Processing; Advanced Mathematical Methods and Big Data; Internet of Things and Industrial Internet; Special Stream on Cybersecurity; Special Stream on Advanced Project Management; Special Stream on Virtual Labs and Virtual Hardware in STEM; Special Stream on Design and Testing of Advanced Computing Systems; Seminar on 5G and 6G Network Technologies and Security; Stream on Intelligent Software Systems and Tools; Special Stream on Advanced Machine Learning and Intelligent Information Systems; Computer Systems for Healthcare, Medicine and Bioinformatics; Data Analysis and Modeling / Special Stream on Data-Driven Computational Diagnostic Methods.

The following sessions were held online: Special Stream on Economics in the Era of Digital Transformation; Intelligent Information Systems, Data Analytics and Ontology; Special Stream on Design and Testing of Advanced Computing Systems; Seminar Beyond 5G and 6G Network Technologies and Security; Data Analysis and Modeling; Special Stream on Data-Driven Computational Diagnostic Methods; Computer Systems for Healthcare, Medicine and Bioinformatics; Special Stream on Digital Law and Computational Legal Research.

In the evening, conference participants attended a dinner at the Lancuszkowa Spa in Zabrze.

On Saturday, September 6, on the third day of the conference, Dr. Victor Kremin (sponsoring company Infineon) delivered a presentation at the plenary session entitled "Infineon Trends and the Evolution of Automotive Human-Machine Interfaces."

The following sessions were held: Special Stream on Advanced Automatic Control and IT; Cybernetic Internet of Things 2025 Seminar; Special Stream on Digital Law and Computational Legal Research.

The following sessions were held online: Special Stream on Advanced Automatic Control and IT; Special Stream on Advanced Machine Learning; Special Stream on Economics in the Era of Digital Transformation; Cybernetic Internet of Things 2025 Seminar.

At the closing round table on Saturday, September 6, Professor Sachenko summarized the main results of the conference and announced statistical data. 438 papers from 35 countries were submitted to the conference, of which 271 papers were accepted after peer review. In total, 252 participants took part in the conference: 96 in person in Gliwice and 156 online.

Professor George Markowsky announced the results of two meetings of the International Advisory Board (IAB). It was decided to introduce 3 new members to the IAB, including Associate Professor Lesya Dubch WUNU ak, WUNU. In addition, applications from candidate countries for participation in the XIV IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS'2027) were considered, and according to the results of the vote, Athens (Greece) was chosen as the venue for IDAACS'2027.

Professor Nikos Bardis, host of the upcoming IDAACS'2027 conference, gave a welcoming speech and invited everyone to Athens in September 2027.

A selection committee was established by the IAB and determined the winners in two main categories. In the general category, the paper "Respiratory Waveform Measurement System Using

Non-Contact Devices” by Japanese authors Yuto Kojima, Toru Higaki, and Hirotaka Inoe was awarded a prize of 400 Swiss francs, provided by MDPI Sensors.

In the category of the best youth work, the work "Positioning a drone in a specific location using visual data in the absence of GPS" by Ukrainian researchers Dmytro Kagitin, Volodymyr Kazymyr, Mykola Suslo, Yevheniy Yatchenko, and Petro Oleksienko was awarded a prize of 400 Swiss francs provided by Infineon Technologies.

All accepted and presented papers were included in IEEE Xplore and indexed by the Scopus database.

The IDAACS'2025 conference once again confirmed the high level of international cooperation in this field.

Photo report

First day



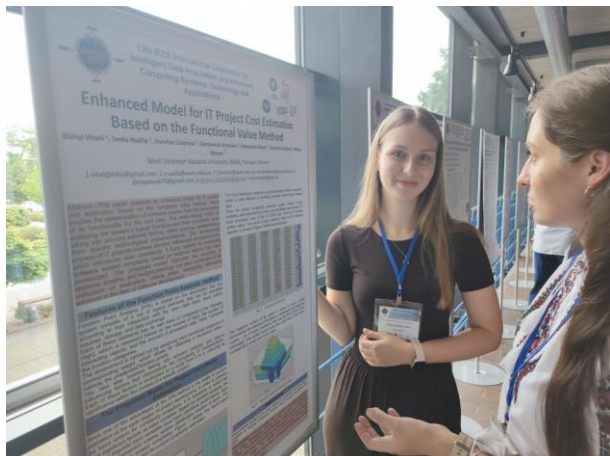
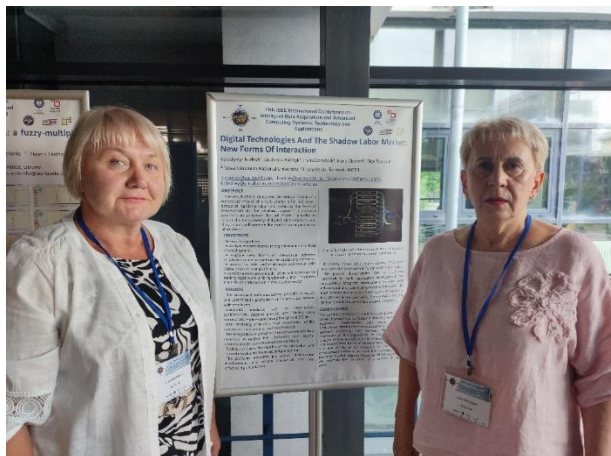




Second day









Third day





- IDAACS'2023. 7-9 September 2023, Dortmund University of Applied Sciences and Arts (Fachhochschule Dortmund), Dortmund, Germany.
 - Co-Chairs: Anatoliy Sachenko, Ukraine; Carsten Wolff, Uwe Grossmann and Christof Roehrig, Germany.
 - IPC Co-Chairs: Jürgen Sieck, Germany, Yuriy Kondratenko, Ukraine, Agata Manolova, Bulgaria, Andrea Kienle, Germany and Masami Iwase, Japan.
 - Statistics: 266 participants, 55 countries, 223 papers, two volumes (Volume 1, 1–626 pages, Volume 2, 627–1255 pages).
 - Special issues: MDPI Sensors.
 - Sponsors: Dortmund University of Applied Sciences and Arts, Dortmund, Germany; Faculty of Computer Information Technologies, West Ukrainian National University; IEEE Germany Section I&M Society Chapter; IEEE Ukraine Section I&M / CI Joint Societies Chapter; ruhrvalley Cluster e.V. The DeepTech Innovation Network; EuroPIM – European Partnership for Project and Innovation Management; Research Institute for Intelligent Computer Systems, West Ukrainian National University and V.M. Glushkov Institute of Cybernetics, National Academy for Sciences of Ukraine, Ukraine; MagneticOne; Yaware – Effective Employee Monitoring Software; MDPI Sensors; River Publishers.

- IDAACS'2021. 22-25 September 2021, Tadeusz Kosciuszko Cracow Technology University, Cracow, Poland.
 - Conference Co-Chairmen: Anatoliy Sachenko, Ukraine; Zbigniew Kokosiński, Volodymyr Samotyy, Poland.
 - IPC Co-Chairmen: Theodore Laopoulos, Greece; Piotr Bilski, Poland.
 - Statistics: 175 participants, 42 countries, 219 papers, two volumes (Volume 1, 1–600 pages, Volume 2, 601–1205 pages).
 - Special Issues: MDPI Sensors.
 - Sponsors: IEEE Ukraine Section I&M / CI Joint Societies Chapter; Research Institute for Intelligent Computer Systems, West Ukrainian National University and V.M. Glushkov Institute of Cybernetics, National Academy for Sciences of Ukraine, Ukraine; West Ukrainian National University; Faculty of Electrical and Computer Engineering; Cracow University of Technology; IEEE Ukraine Section; IEEE Poland Section; MDPI Sensors; River Publishers, EFENTO - Producer of a full range of wireless, low power IoT sensors working with any cloud platform, Dortmund University of Applied Sciences and Arts.

- IDAACS'2019. 18-21 September 2019 p., Technical Institute Ecole Nationale d'Ingénieur de Metz (ENIM) University of Lorraine, Metz, France.
 - Conference Co-Chairmen: Anatoliy Sachenko, Ukraine; Kondo Hloindo Adjallah, France.
 - IPC Co-Chairmen: Francesca Guerriero, Italy; Carsten Wolff, Germany
 - Statistics: 178 participants, 42 countries, 213 papers, two volumes (Volume 1, 1–578 pages, Volume 2, 579–1147 pages).
 - Special Issues: River Publishers
 - Sponsors: IEEE Ukraine Section I&M / CI Joint Societies Chapter; Research Institute for Intelligent Computer Systems; Ternopil National Economic University; ENIM (Ecole Nationale d'Ingénieur de Metz); LCOMS (Laboratory of Conception, Optimisation and Modelling of Systems); University of Lorraine; IEEE Ukraine Section; IEEE France Section; MDPI Sensors; River Publishers.

- IDAACS'2017. September 21-23, 2017, Faculty of Automatic Control and Computer Science, University "Politehnica" of Bucharest (UPB), Romania.
 - Conference Co-Chairmen: Anatoliy Sachenko, Ukraine, Grigore Stamatescu, Romania.
 - IPC Co-Chairmen: Dora Blanco Heras, Spain, John Kalomiros, Greece.
 - Statistic: 194 participants, 35 countries, 213 papers, 24 oral and 3 poster sessions, 1143 pages, 2 volumes.
 - Special Issues: River Publishers, International Journal of Computing.
 - Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, TNEU, Faculty of Automatic Control and Computers, University "Politehnica" of Bucharest (UPB), Asti Automation, IEEE Ukraine Section, IEEE Romania Section, Romanian Society of Automation and Technical Informatics (SRAIT), TÜV AUSTRIA ROMANIA, Festo, River Publishers.

- IDAACS'2015. September 24-26, 2015, Faculty of Electronics and Information Technology and Faculty of Mathematics and Information Science, Warsaw University of Technology, Warsaw, Poland.
 - Conference Co-Chairmen: Anatoliy Sachenko, Ukraine, Wiesław Winiecki, Poland
 - IPC Co-Chairmen: Robert Hiromoto, USA, Linas Svilainis, Lithuania
 - Statistic: 180 participants, 29 countries, 185 papers, 24 oral and 3 poster sessions, 991 pages, 2 volumes.
 - Special Issues: River Publishers, Journal of Cyber Security and Mobility, International Journal of Computing, Elsevier Engineering Applications of Artificial Intelligence.
 - Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, TNEU, University of Applied Sciences in Berlin, IEEE Instrumentation & Measurement Society, Office of Naval Research, the University of Maine, IEEE Region 8, River Publishers, IEEE Ukraine Section.

- IDAACS'2013. September 12-14, 2013, Hochschule für Technik und Wirtschaft, University of Applied Sciences Berlin (HTW Berlin), Berlin, Germany.
 - Conference Co-Chairmen: Anatoliy Sachenko, Ukraine, Jürgen Sieck, Germany
 - IPC Co-Chairmen: Vladimir Haasz, Czech Republic, Kurosh Madani, France
 - Statistics: 185 participants, 28 countries, 185 papers, 120 oral and 60 poster presentations, 940 pages, 2 volumes.
 - Special Issues: River Publishers, Journal of Cyber Security and Mobility, International Journal of Computing, Elsevier Engineering Applications of Artificial Intelligence, Sensors & Transducers Journal.
 - Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, TNEU, University of Applied Sciences in Berlin, IEEE Instrumentation & Measurement Society, Office of Naval Research, The University of Maine, IEEE Region 8, River Publishers, IEEE Ukraine Section.

- IDAACS'2011. September 15-17 2011, Czech Technical University in Prague, Prague, Czech Republic.
 - Conference Co-Chairmen: Anatoliy Sachenko, Ukraine, Domenico Grimaldi, Italy

- IPC Co-Chairmen: Dana Petcu, Romania, Axel Sikora, Germany
 - Statistics: 197 participants, 32 countries, 197 papers, 96 oral and 51 poster presentations, 738 P., 1 Vol.
 - Special Issues: International Journal of Computing, Sensors & Transducers Journal, Computer Standards & Interfaces.
 - Sponsors: IEEE Ukraine I&M / CI Joint Societies Chapter, TNEU, Czech Technical University in Prague, Faculty of Electrical Engineering at Czech Technical University, Office of Naval Research, Honeywell spol. S r.o., H TEST a.s., authorized distributor of Agilent Technologies Agilent Technologies H TEST a.s., IEEE Ukraine Section, IEEE Czechoslovakia Section, IEEE Instrumentation & Measurement Society, IEEE Region 8, River Publishers.
- IDAACS'2009. September 21-23 2009, Department of Electronics, Informatics and Systems, University of Calabria, Rende, Italy.
 - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Domenico Grimaldi, Italy
 - IPC Co-Chairmen: Vladimir Oleschuk, Norway, Dominique Dallet, France
 - Statistics: 122 participants, 25 countries, 142 papers, 86 oral and 56 poster presentations, 722 P., 1 Vol.
 - Special Issues: River Publishers, International Journal of Computing
 - Sponsors: Ukraine I&M / CI Joint Societies Chapter, University of the Calabria, Department of Electronics at University of the Calabria, IEEE Ukraine Section, IEEE Instrumentation & Measurement Society, IEEE Italy Section, IEEE Region 8. Workshop participants approved the IPS proposal to change the status from "Workshop" to "Conference"
- IDAACS'2007. September 6-8 2007, University of Applied Sciences Fachhochschule Dortmund, Dortmund, Germany.
 - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Peter J. A. Reusch, Germany
 - IPC Co-Chairmen: Richard Duro, Spain, Wieslaw Winiecki, Poland
 - Statistics: 105 participants, 35 countries, 180 papers, 95 oral and 52 poster presentations, 720 P., 1 Vol.
 - Special Issues: IEEE Transactions on Instrumentation and Measurement, Journal of Computing, Sensors & Systems
 - Sponsors: TNEU, University of Applied Sciences Fachhochschule Dortmund, IEEE Instrumentation & Measurement Society, RWE Systems AG, DSW21, Anna and Hermann Reusch Foundation, the Deutsche Forschungsgemeinschaft (German Research Foundation).
- IDAACS'2005. September 5-7 2005, Technical University of Sophia, Sophia, Bulgaria.
 - Workshop Co-Chairmen: Anatoliy Sachenko, Ukraine, Plamenka Borovska, Bulgaria
 - IPC Co-Chairmen: Domenico Grimaldi, Italy, Peter A. J. Reusch, Germany
 - Statistics: 99 participants, 27 countries, 147 papers, 96 oral and 51 poster presentations, 738 P., 1 Vol.
 - Special Issues: International Journal of Computer Standards & Interfaces, IEEE Transactions on Instrumentation and Measurement, Journal of Computing, Sensors & Systems
 - Sponsors: TANE, Technical University of Sophia, STCU, IEEE Bulgaria Section, IEEE Computer Chapter of Bulgaria Section.
- IDAACS'2003. August 8-10 2003, National University "Lviv's Polytechnic", Lviv, Ukraine.
 - Workshop Co-Chairmen: Anatoly Sachenko, Bohdan Stadnyk, Ukraine
 - IPC Co-Chairmen: Lucio Grandinetti, Italy, Fernando Lopes Pena, Spain
 - Statistics: 85 participants, 21 countries, 112 papers, 60 oral and 52 poster presentations, 529 P., 1 Vol.
 - Special Issues: International Journal of Computer Standards & Interfaces, IEEE Transactions on Instrumentation and Measurement, International Journal of Computing, Sensors & Systems

- Sponsors: Ternopil Academy of National Economy (TANE) of IEEE Instrumentation & Measurement Society, STCU at MES of Ukraine, Aval bank.
- IDAACS'2001. July1-4 2001, Foros, Crimea, Ukraine.
- Workshop Chairman: Anatoliy Sachenko
- Co-Chairmen of International Program Committee (IPC): Theodore Laopoulos, Greece, Robert E. Hiromoto, USA
- Statistics: 70 participants, 18 countries, 112 papers, 30 oral and 35 poster presentations, 280 P., 1 Vol.
- Special Issues: International Journal of Computing
- Sponsors: INTAS, NEC, HP invent, Science & Technology Center in Ukraine (STCU), Aval bank, Institute of Computer Information Technologies, IEEE Instrumentation & Measurement Society, IEEE Region 8.

B – IDAACS Symposia

The first IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2012) was held in 2012.

Due to the full-scale Russian invasion of Ukraine, IDAACS-SWS was not held in 2022 and 2024.

The fifth IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2020) was held in 2020.

- IDAACS-SWS'2020. 17-18 September 2020., online at the Dortmund University of Applied Sciences and Arts (Fachhochschule Dortmund), Dortmund, Germany
- Symposium Honorary Chairman: Anatoliy Sachenko, Ukraine;
- Co-Chairmen of IPC: Uwe Grossmann, Christof Roehrig, Axel Sikora, Carsten Wolff, Germany, Orest Ivakhiv, Ukraine
- Co-Chairmen of IPC: Vladimir Oleshchuk, Norway, Jürgen Sieck, Germany
- Statistics: participants from 23 countries, 58 papers, 318 pages, 1 volume.
- Sponsors: Dortmund University of Applied Sciences and Arts (Fachhochschule Dortmund); Research Institute for Intelligent Computer Systems; IEEE Ukraine Section I&M / CI Joint Societies Chapter; IEEE Ukraine Section; IEEE Germany Section IM Chapter; IEEE Germany Section; EuroPIM; River Publishers.

The fourth IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2018) was held in 2018.

- IDAACS-SWS'2018. September 20-21'2018, National University "Lviv Polytechnics" (NULP) Lviv, Ukraine
- Symposium Honorary Chairman: Anatoliy Sachenko, Ukraine;
- Symposium Co-Chairmen: Ivan Prudyus, Orest Ivakhiv, Ukraine, Axel Sikora, Germany
- Co-Chairmen of IPC: Mykhaylo Klymash, Ukraine, Uwe Grossmann, Germany
- Statistics: participants from 12 countries, 51 papers, 146 pages, 1 Volume
- Sponsors: Lviv Polytechnic National University; Faculty of Electrical Engineering and Information Technology, Offenburg University of Applied Sciences; Research Institute for Intelligent Computer Systems, Ternopil National Economic University and V.M. Glushkov Institute of Cybernetics, National Academy for Sciences of Ukraine; IEEE Ukraine Section I&M / CI Joint Societies Chapter; IEEE Ukraine Section; Ministry of Education and Science of Ukraine; Cypress.

The third IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2016) was held in 2016.

- IDAACS-SWS'2016. September 26-27'2016, University of Applied Sciences in Offenburg, Offenburg, Germany.
- Symposium Honorary Chairman: Anatoliy Sachenko, Ukraine;
- Symposium Co-Chairmen: Volodymyr Brovko, Ukraine, Evren Eren, Uwe Grossmann, Axel Sikora, Germany
- Statistics: participants from 9 countries, 24 papers, 24 oral presentations, 146 pages, 1 Volume
- Sponsors: Faculty of Electrical Engineering and Information Technology at Offenburg University of Applied Sciences, IEEE Ukraine Section IM/CIS Joint Chapter, IEEE Instrumentation & Measurement Society.

The second IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2014) was held in 2014.

- IDAACS-SWS'2014. September 11-12'2012, University of Applied Sciences in Offenburg, Offenburg, Germany.
- Symposium Honorary Chairman: Anatoliy Sachenko, Ukraine;
- Symposium Co-Chairmen: Svitlana Antoshchuk, Volodymyr Brovko, Ukraine, Evren Eren, Uwe Grossmann, Juergen Sieck, Axel Sikora, Germany
- Statistics: participants from 7 countries, 15 papers, 15 oral presentations, 127 P., 1 Vol.
- Sponsors: Faculty of Electrical Engineering and Information Technology at Offenburg University of Applied Sciences, IEEE Ukraine Section IM/CIS Joint Chapter, IEEE Instrumentation & Measurement Society.

The first IEEE International Symposium on Wireless Systems within the Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS'2012) was held in 2012.

- IDAACS-SWS'2012. September 20-21'2012, University of Applied Sciences in Offenburg, Offenburg, Germany.
- Symposium Honorary Chairman: Anatoliy Sachenko, Ukraine;
- Workshop Co-Chairmen: Evren Eren, Uwe Grossmann, Juergen Sieck, Axel Sikora, Germany
- Statistics: participants from 12 countries, 39 papers, 27 oral presentations, 127 P., 1 Vol.
- Special Issues: International Journal of Computing, Sensors & Transducers Journal, Computer Standards & Interfaces.
- Sponsors: Faculty of Electrical Engineering and Information Technology at Offenburg University of Applied Sciences, IEEE Ukraine Section IM/CIS Joint Chapter, IEEE Instrumentation & Measurement Society.

International Workshop Advances & Challenges in Computing (A2C)

The international workshop “Advances & Challenges in Computing” has been running since 2007. It covers a scope of the international standard [Computing Curricula](#) (Computer Science, Computer Engineering, Software Engineering, Information Technologies, Information Systems, Cyber Security and Data Science) and is related to topics of the International [IEEE IDAACS Conference](#), [IEEE IDAACS-SWS](#) as well as the [International Journal of Computing](#).

The A2C Workshop is running quarterly (March, June, September, December).

Working languages: Ukrainian, English

Workshop Co-Chairs:

– [Aleksander Palagin](#), Academician, Doctor of technical sciences, professor, Vice-Director of the V.M. Glushkov Institute of Cybernetics, NAS of Ukraine

– [Anatoliy Sachenko](#), Honorable inventor of Ukraine, IEEE Senior Member, doctor of technical sciences, professor, scientific advisor of Research Institute for Intelligent Computer Systems

Workshop scientific secretary:

– [Vasyl Koval](#), PhD, Associated Professor, Co-chair of Intelligent Robotic Systems Group, Research Institute of Intelligent Computer Systems

Workshop technical secretary:

– [Taras Lendiuk](#), PhD, Associated Professor

Google Meet administrators

– [Maksym Palka](#), PhD Student, Data Scientists, Engineer at Research Institute for Intelligent Computer Systems

Email: a2c.workshop@gmail.com

Workshops 2025

Date: 17 December 2025 (Wednesday)

AGENDA:

1. **Speaker:** Oleksiy Lutsyk
2. **Speaker:** Andrii Topalov

1. **Speaker:** Oleksiy Lutsyk



Ph.D., Research Scientist in department of Methods and Systems for Processing, Analysis, and Identification of Images at the Physic and Mechanical Institute of the National Academy of Sciences of Ukraine.

E-mail: olutsyk@yahoo.com

Topic: Optimization of training datasets in neural network learning tasks.

Presentation in Ukrainian

Abstract: This work explores approaches for feature extraction, dataset optimization, and efficient model training in image recognition and classification tasks. The proposed methods focus

on transforming raw image data into compact and informative representations that can be effectively utilized by machine learning and deep learning algorithms. Techniques for reducing the size of training datasets while maintaining their informativeness are discussed, along with strategies for improving the balance, coverage, and quality of data samples. By applying statistical and stochastic modeling frameworks, the approaches allow more efficient analysis, enhance model generalization, and reduce computational requirements. The results demonstrate the potential of these methods to improve training efficiency, support real time processing, and provide for the development of more robust and adaptive recognition systems. The work also highlights opportunities for further research in dataset preparation, adaptive feature representation, and machine learning techniques for complex image analysis problems.

Resume: In 2005, Oleksiy Lutsyk graduated with honour from Lviv Franko National University, Specialization: Radio physics. In 2014, he defended his Ph.D. thesis in Information Technology at the Ternopil National Economic University. From 2005 to present – Researcher in the Department of Methods and Systems for Processing, Analysis, and Identification of Images, Karpenko Physico-Mechanical Institute, National Academy of Sciences of Ukraine. His research interests encompass advanced signal and image processing, 3D image reconstruction, pattern recognition, neural networks, machine learning, big data analytics, and the development of high-performance algorithms for real-time processing. He is particularly focused on creating efficient computational methods and intelligent systems capable of operating under resource-constrained conditions and in environments with high levels of noise and uncertainty. He is the author of 68 scientific publications, including conference papers, journal articles, and research results indexed in leading international databases. His work has been presented at national and international research forums. In addition to articles, he is also a co-author of two academic books.

2. **Speaker:** Andrii Topalov



Associate professor, Ph.D. in computer systems and components,
Admiral Makarov National University of Shipbuilding

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Topic: Methods for information flows creation and digital twins models of port infrastructure
Presentation in Ukrainian

Abstract: The study examines modern technologies, including artificial intelligence, the Internet of Things, automation and robotics, big data, and digital twins. For each of these technologies, the areas of practical application in ports, the expected benefits of implementation, and the levels of integration into management systems—ERP, MES, SCADA, and SSB—are defined. It is summarized that artificial intelligence plays a key role in forecasting demand for logistics services, enabling more accurate planning of cargo flows, estimating vessel arrival times, and optimizing port service schedules based on historical and real-time data analysis. Internet of Things technologies provide round-the-clock monitoring of the technical condition of port equipment, containers, handling machinery, as well as environmental parameters. Blockchain technologies enable the creation of a secure and transparent document management system that ensures reliable recording of all transactions within the supply chain, including cargo movements, customs clearance, and insurance. Automation and robotics significantly reduce dependence on the human factor, especially in high-load operations such as container sorting, crane control, and autonomous transportation within

the port area. Big data allows for in-depth analysis of port activities, including processing information from various sources. The digital twin technology, which reflects a virtual copy of a real object or process, enables simulation modeling of port operations, scenario testing, optimization of logistics schemes, and efficient management of infrastructure resources. The proposed table visualizes the relationship between the technologies and management levels, taking into account the specifics of port operations.

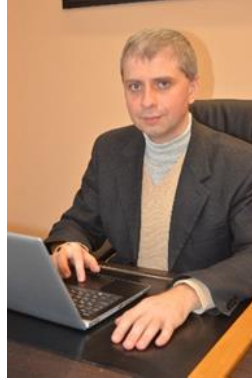
Resume: In 2014, Andrii Topalov graduated with excellence from the Admiral Makarov National University of Shipbuilding, obtaining his M.Sc. in Automation at the Institute of Automation and Electrical Engineering, and in 2020 he defended his Ph.D. thesis in Computerized Control Systems at Odessa National Polytechnic University. Since 2016, he has been a lecturer at the Department of Computerized Control Systems of the Admiral Makarov National University of Shipbuilding, and from 2024 he has served as a lecturer at the Drones Department of the Kyiv School of Economics. Since 2020, he has also worked as a research assistant at the Institute of Environment and Energy Conservation Problems, contributing to state-funded research projects in intelligent monitoring and control systems, mobile robotics, automation of complex technical objects, and innovative technologies for shipbuilding. His research interests include automated control systems, sensor and IoT systems, intelligent robotic platforms, fuzzy logic, stabilization of floating structures, and the development of advanced monitoring and control algorithms. Since 2024, he has been Editor-in-Chief of the scientific journal *Methods and Devices of Quality Control*. Dr. Topalov is the author of numerous scientific papers indexed in Scopus and Web of Science (h-index Scopus: 11; WoS: 5), as well as several monograph chapters, and holds multiple Ukrainian patents in robotics, ship systems automation, and intelligent measurement technologies. His scientific achievements have been recognized by national awards, including the Prize of the President of Ukraine for young scientists (2024) and the Prize of the Verkhovna Rada of Ukraine (2021), along with multiple institutional distinctions for contributions to research, education, and technological innovation.

Date: 24 Sep 2025 (Wednesday)

AGENDA:

- 1. Speaker:** Vitaliy Kobets
- 2. Speaker:** Vladyslav Iatsiuta

- 1. Speaker:** Vitaliy Kobets



(Prof., Dr. Sc. (Economics))
 Professor of Computer Science and Software Engineering Department,
 Kherson State University)

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Topic: Application of RFM-D Analysis for Customer Segmentation Using
 Machine Learning
Presentation in Ukrainian

Abstract: The research uses modern machine learning methods to apply RFM-D (Recency, Frequency, Monetary, Diversity) analysis for customer segmentation. The authors focus on integrating three main approaches: reinforcement learning methods, unsupervised, and supervised ML methods. The first approach, based on reinforcement learning, allows for adaptive adjustment of segmentation strategies based on variable customer characteristics and preferences and can continuously improve the process of selecting optimal strategies to achieve the objective function, which is important for businesses operating in a dynamic market environment. For unsupervised learning, the K-means method helps identify more homogeneous customer groups based on their characteristics, allowing businesses to customize their unique customer offers. At the same time, machine learning methods, such as classification algorithms, can predict customer behavior based on training data, ensuring high prediction accuracy and improving the quality of management decisions for each customer segment. The study results show that combining these approaches allows for effective customer segmentation and optimized customer interaction, critical for increasing loyalty and overall efficiency of business strategies.

Resume: In 2002, Vitaliy Kobets graduated with honors from Kherson State University. In 2008, he defended his PhD thesis specializing in mathematical methods and information technologies in supply chains. In 2019, he defended his Doctoral Thesis, which focused on the evolutionary and experimental modeling of microeconomic systems. In 2021, he was awarded the academic title of Professor of Informatics, Software Engineering, and Economic Cybernetics Department. His major research fields are evolutionary microeconomics, robo-advisors, business analytics, machine learning, and financial technology. Since 2002, he has been working at Kherson State University and has risen from Assistant Professor to Professor. In 2011-2020, he was a Deputy Head of Informatics, Software Engineering, and Economic Cybernetics Department; in 2019-2020, he was a Head of

Education Quality Assurance Department; in 2020–2021, he was a Vice Rector for Academic Affairs. Since 2019, he has been a Professor of Computer Science and Software Engineering Department at KSU.

He has published over 80 peer-reviewed publications in international journals and conferences, indexed by Scopus and WoS.

Research interests include robo-advisors and investor portfolio optimization, factors influencing ICT adoption in SMEs, household food security and insecurity dynamics, and innovative data processing and analysis systems.

He is a member of the International Association for Technological Development and Innovations IATDI, a permanent specialized academic council member (Kyiv), a member of 3 editorial boards, a program committee member of international conferences, and a reviewer for international journals.

2. Speaker: Vladyslav Iatsiuta



(Postgraduate student, Kherson State University)

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Topic: Multimodal NLP Techniques for Processing Unstructured Financial Information
Presentation in Ukrainian

Abstract: The research investigates the application of Natural Language Processing (NLP) tools for processing unstructured business data and automating the analysis of financial video content. A system architecture is proposed to transform different data types into a unified text format. An experimental study using ChatGPT-4o demonstrates that NLP models can accurately extract stock-related forecasts and risk assessments from YouTube videos, significantly improving investment decision-making speed and quality. The results confirm the potential of AI-based technologies for enhancing financial analytics and business data processing.

Resume: Vlad Iatsiuta received his Master's degree in Informatics from Kherson State University in 2010 and his Master's degree with honors in Information Systems and Technologies in 2023. From 2008 to 2010, he worked as a developer at the Laboratory of Integration of Pedagogical Software. Since 2010, he has been working at DataArt, where he has advanced to the positions of Senior Software Developer, Team Lead, and Architect. He has over 15 years of professional experience in software development across various business domains, including travel, finance, and healthcare.

He is a postgraduate student in software engineering at Kherson State University, conducting research in artificial intelligence, financial report generation, and business request processing. He has authored four publications in peer-reviewed journals indexed by Scopus and Web of Science.

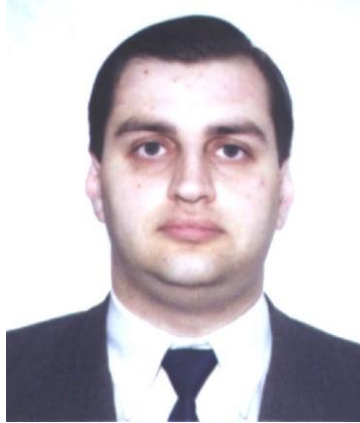
His research interests include artificial intelligence applications in business analytics, financial technologies, and intelligent systems for data processing and decision support.

Date: 25 June 2025 (Wednesday)

AGENDA:

1. **Speaker:** Sergey Subbotin
2. **Speaker:** Serhii Leoshchenko
3. **Information about research projects and conferences:** Anatoliy Sachenko

1. **Speaker:** Sergey Subbotin



(Prof., Dr. Sc. (Dr.-Ing. habil.)
Head of Department of Software Tools,
National University “Zaporizhzhia Polytechnic”

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Topic: Data-driven diagnosis: problems and methods

Presentation in Ukrainian

Abstract:

Diagnostics in engineering is a mean of ensuring high quality and durability of products, and in biomedical applications is a mean of determining the patient’s condition. Traditionally at practice the diagnostic methods are based on analytical models, and require a depth knowledge of the physics (biology) of the object of diagnosis, which is not always available in practice. Therefore, the data-driven diagnostics is of particular relevance, which allows building diagnostic models based on point observations with insufficient knowledge of the nature of the diagnosed object. The presentation provides an overview of the main stages of tasks and methods of computational diagnostics, their comparative characteristics and recommendations for choosing a specific method taking into account the specifics of the task.

Resume: In 2000, Sergey Subbotin graduated with honour from Zaporizhzhia State Technical University.. In 2005, he defended the PhD Thesis. In 2007, he was awarded the academic title of Associate Professor. In 2014, he was awarded Dr. Sc. (Dr. habil.sc. ing. Degree). In 2014, he was awarded the academic title of Professor. Since 2000, he has been working at National University “Zaporizhzhia Polytechnic” (former Zaporizhzhia National Technical University). In 2000-2003, he was an Assistant; in 2004-2005, he was a Senior Lecturer; in 2005–2013, he was an Associate Professor; in 2014-2016, he was a Professor. Since 2016, he has been a Head of the Department of Software Tools.. His major fields of research are computational diagnosis, machine learning, neuro-fuzzy systems, intelligent optimization.

2. **Speaker:** Serhii Leoshchenko



(PhD)

Associate professor of the Department of Software Tools,
National University “Zaporizhzhia Polytechnic”

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Topic: Mechanisms of fine tuning of neuroevolutionary synthesis of diagnostic models

Presentation in Ukrainian

Abstract: During performing complex synthesis (structural and parametric) of artificial neural networks (ANN) of complex topologies (for example, recurrent neural networks: RNN and deep neural networks: DNN), neuroevolution is a promising approach. After all, methods of neuroevolution synthesis allow to obtain the appropriate topology and parameters of the neuromodel with less involvement of an external expert, by gradually increasing, increasing the complexity and changing the network parameters. However, neuroevolution synthesis has a significant execution time. There are also sometimes problems with local extremes. That's why the urgent task is to develop modifications that can be introduced point-by-point during the synthesis process in order to overcome disadvantages that were listed and improve results of using such methods.

Resume: During 2013-2017, studied for a bachelor's degree at Zaporizhia National Technical University (now: National University “Zaporizhzhia Polytechnic”), in 121 Software Engineering specialty. Received a diploma with honors. In 2017-2019, he continued his master's degree at Zaporizhia National Technical University. In 2019, he entered the postgraduate course of the National University “Zaporizhzhia Polytechnic”, in 122 Computer Sciences, under the scientific supervision of Dr. Sc., Professor Sergey Subbotin and Dr. Sc., Professor Andrii Oliinyk. On July 27, 2023, he defended his PhD thesis. Since 2019, he worked as an assistant and, later, a senior lecturer at the Department of software tools. Since September 2024, the academic title of associate professor was awarded by the decision of the attestation Board of the Ministry of education and science of Ukraine dated 10.12.2024.

Date: 26 May 2025 (Wednesday)

AGENDA:

1. **Speaker:** Viacheslav Moskalenko
2. **Speaker:** Ihor Yakymenko

1. **Speaker:** Viacheslav Moskalenko



(Associate Professor., Ph.D.)

Associate Professor of Computer Science Department,
Sumy State University;
CTO at Molfar.AI sp. z o.o.

E-mail: v.moskalenko@cs.sumdu.edu.ua

Topic: Methodological Foundations and Information Technologies for Creating Resilient Intelligent Data Analysis Systems
Presentation in Ukrainian

Abstract: The vulnerabilities of Intelligent Data Analysis Systems (IDAS) and the approaches to ensuring various aspects of their resilience are analyzed and systematized. The methodological foundations and information technologies for evaluating and enhancing the resilience of IDAS under diverse disturbances and resource-constrained conditions are proposed. A novel concept is introduced, accompanied by models and methods for assessing and ensuring the resilience of IDAS against different types of disturbances under limited resources. A distinct feature of the proposed approach is the development of models that incorporate parallel module correction and dynamic structural adaptation, thereby ensuring enhanced system resilience. Furthermore, the integration of advanced meta-learning techniques with a structured framework for machine learning operations enhances resilience by improving both robustness and adaptation speed, while employing a model-agnostic approach that makes the method universally applicable. Experimental validation using an image recognition task confirms the effectiveness of the proposed models and methods.

Resume: Viacheslav Moskalenko graduated with honours from Sumy State University in 2011 with a degree in Control Systems and Automation. He later completed his second degree in Computer Science at Sumy State University in 2021, graduating with honours. On 16 May 2014, he defended his Candidate of Technical Sciences dissertation on the automation of control processes at the National Technical University “Kharkiv Polytechnic Institute. Since 1 May 2017, he has been serving as an Associate Professor at the Computer Science Department of Sumy State University. From 2021 to 2022, he completed his doctoral studies at the Department of Computer Systems, Networks, and Cybersecurity of the Faculty of Radioelectronics, Computer Systems, and Infocommunications at the National Aerospace University “Kharkiv Aviation Institute,” focusing on the research topic “Methodological Foundations and Information Technologies for Creating Resilient Intelligent Data Analysis Systems.” He is scheduled to present his dissertation for defence later this year.

His research interests encompass machine vision, artificial intelligence, resilient systems, and unmanned systems. He is a leading researcher at the Laboratory of Intelligent Systems at Sumy State University and has led numerous research projects, including “Information Technology for Providing Resilience of Artificial Intelligence Systems to Protect Cyber-Physical Systems” and “Intelligent Autonomous On-Board System of an Unmanned Aerial Vehicle for Identifying Objects on the Ground,” among others. Under his supervision, two doctoral dissertations have been successfully defended, focusing on autonomous navigation technologies for small unmanned aerial vehicles and the automatic generation of inspection reports for underground infrastructure based on video inspection data.

Since 2016, he has been the Chief Technology Officer (CTO) at Molfar Technologies Limited (London, United Kingdom), a company specializing in outsourced development of artificial intelligence systems for edge and cloud computing. In 2019, he also assumed the role of CTO at Molfar.AI s.p. z.o.o. (Gdańsk, Poland), which focuses on cloud-based AI technologies for video data analysis in infrastructure inspection and autonomous navigation technologies for UAVs.

2. **Speaker:** Ihor Yakymenko



Ph.D., Associate Professor of the Department of Computer Engineering

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Topic: Methods and means of cryptographic information protection based on the residual number system

Presentation in Ukrainian

Abstract: The work is devoted to the development and research of new encryption methods and techniques in the Residue Number System (RNS). The proposed cryptographic algorithms are based on the use of integer, polynomial, and hierarchical residue number systems and their modified forms, which significantly enhance efficiency, performance, and resistance to cryptanalytic attacks.

For the first time, a symmetric cryptographic algorithm in the Residue Number System has been developed, in which the ciphertext is represented as a set of residues modulo (keys). Analytical security assessments have made it possible to determine the required bit lengths and the number of moduli to ensure a protection level equivalent to the modern AES-256 symmetric encryption algorithm.

High-performance symmetric and asymmetric cryptographic algorithms have been proposed based on arbitrary replacement of basis numbers in the Residue Number System, which enhances security and resistance to cryptanalytic attacks. Single-key and dual-key symmetric encryption methods have been developed, the cryptanalysis of which requires solving NP-complete problems, ensuring high cryptographic strength.

New methods of encrypting and decrypting information flows in the hierarchical integer and polynomial residue number systems have been proposed. The use of parallelized computations and representation of the encrypted text as residues increases the encryption algorithm's performance and security.

A methodology for cryptographic information protection in the Residue Number System has been developed. By utilizing vector-modular methods of modular multiplication and exponentiation, as well as integer, modified perfect form, polynomial, and hierarchical residue number systems, this methodology enhances security, reduces computational complexity, improves algorithm performance, and supports the development of a unified strategy for securing information flows.

Further development has been made in polynomial, two- and three-modulus asymmetric Rabin encryption algorithms, which exhibit reduced time and hardware complexity by replacing multiplication operations with addition operations. Additionally, methods for finding the inverse polynomial and methods for reconstructing a polynomial from its residues in the ring $\mathbb{Z}[x]/\mathbb{Z}[x] \times \mathbb{Z}[x]/\mathbb{Z}[x]$ have been improved, allowing for parallelized computations and reduced computational complexity.

The research results can be applied in the development of advanced cryptographic systems designed to protect confidential information under conditions of high computational workloads and cryptanalytic threats.

Resume: In 1998 graduated from the Taras Shevchenko National University of Kyiv on specialty Mathematics. In 2012 defended his dissertation for the Candidate degree (Ph.D.) of Technical Sciences. In 2018 received the title of Associate Professor of the Department of Computer Engineering. Currently, is the Dean of the Faculty of Computer Information Technologies of the West Ukrainian National University and works as an Associate Professor of the Department of Computer Engineering. Scientific interests: remainder class system, research of mathematical operations in cryptographic methods of information protection, asymmetric systems.

International Journal of Computing

The International journal of Computing was founded on the basis of Branch Research Laboratory of Automated Systems and Networks in 2002. Its main goal is to present results in the field of Computer Science, Computer Engineering and Information Technology. The official language of the Journal is English. Journal is issued 4 times per year.

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Specialized Scientific Council D58.082.02

Specialized scientific council in the three specialties:

- 01.05.02 – Mathematical modeling and computational methods;
- 05.13.05 – Computer Systems and Components;
- 05.13.06 – Information Technologies;

In 2025, the two dissertations were defended. Lychak O. V. defended his doctoral dissertation on the topic: “Mathematical modeling of non-stationary random signals for detecting defects in mechanisms at the initial stages of development” in the specialty 01.05.02 – mathematical modeling and computational methods in March 11, 2025.

Abstract. In this dissertation an important scientific and applied problem, which consists in developing methods for statistical analysis of vibration signals of damaged mechanisms was resolved, based on mathematical models of multicomponent non-stationary random processes with stochastic amplitude-phase modulation of carrier harmonics and, using the Hilbert transform, their correlation-spectral structure is investigated, which makes it possible to establish the types of defects in mechanisms, their localization and assess the degree of development. The problem was solved by means of developing and implementing approach, based on methods of stochastic process theory, signal theory, methods of Fourier analysis, the small parameter method, and methods of computational mathematics. For the first time, the definition of the early stage of defect development as a periodically nonstationary random process is formulated. It is accompanied by the appearance of hidden oscillations in the system response, which are periodically nonstationary random signals (PNRS). It is established that second-order periodic nonstationarities (hidden periodicities) are result of higher-orders joint correlations between the modulating processes of PNRS. A comparative analysis of coherent and component methods for detecting hidden periodicities is carried out. Theoretical basics for using of the Hilbert transform for the analysis of diagnostic PNRSs, with wideband and narrowband high-frequency and amplitude-phase modulations of carriers, are developed. It is shown that the analytical signal of PNRS is also PNRS. It is established that the use of known methods of “envelope” for the analysis of multicomponent PNRS is inappropriate, since the square of the modulus of the analytical signal, which is called the “square of the envelope”, is a random process, its moment functions change periodically with time. It is shown that stochastically amplitude-phase modulated oscillations of PNRS can be represented by a superposition of high-frequency components, which are stationary and jointly periodically non-stationary joined random processes. Such a representation reduces the study of signal properties to the analysis of the correlation components of higher orders of quadratures of high-frequency carriers. Theoretical studies have been performed, showing the validity of estimates by PNRS methods of the functions of mathematical expectation, correlation function and their Fourier coefficients. It has been established, that the frequency range in which the instantaneous spectral density of PNRS signal changes over time is determined by cosine transformations from cosine and sine correlation components. It has been shown that filtering of the PNVS signal should be based on estimates of joint correlations of high-frequency components of higher orders, which increase the efficiency of diagnostics. It is shown that the use of bandpass filtering and the Hilbert transform for the extraction and analysis of correlations of quadratures of high-frequency harmonics allows building a correlation map that has characteristic features for various defects. Diagnostic signal processing procedures have been substantiated, which make it possible to detect and describe within the framework of the moment functions of the first and second orders of the PNVP their structure, including the structure of high-frequency, broadband and amplitude-phase modulations. The developed approach is applied to the analysis of signals from the distributed and local defects in mechanisms. Within the framework of the moment functions of the first and second orders, the main patterns and differences between the signals of such defects are described. Real signals were processed. Their correlation structure is described based on the constructed correlation maps. It is established that the high-frequency modulation of the carrier harmonics of the PNRS model of bearing vibrations is narrow-band and can be described using to Rice’s equations. It is shown that the correlations of the quadratures of modulations are slowly

decaying oscillatory functions of the lag, which causes a similar shape of the correlation components and decay interval of the correlation components is much larger than the period of non-stationarity. The main results of the dissertation were implemented at the Institute of Physics and Mechanics of the NAS of Ukraine when performing research on the development of methods for extraction and processing signals for defects detection, at LLC FIRM “DIALAB” LTD for technical diagnostics of mechanism drives, at LLC “PORTTECHEXPERT” for detecting and assessing the degree of development of defects in the bearing units of electrical motors of container loaders mechanisms, at LLC “DP WORLD TIS PIVDENNYI” for the analysis of diagnostic signals during port crane mechanisms diagnosing , at LLC “KIPER-PLAST” for assessing the degree of development of defects in rotating mechanisms.

Romanets I. Ye. defended his candidate’s dissertation on the topic: “Intellectualized computer system for detecting malicious IP telephony messages in a corporate network” in the specialty 05.13.05 – computer systems and components in August 28, 2025.

Abstract. The dissertation is devoted to the pressing scientific and technical challenge of enhancing the security level of corporate networks by developing and researching an intellectualized computer system designed to detect malicious messages in IP telephony. The work analyzes modern threats and vulnerabilities in IP telephony systems within corporate environments, such as spam over internet telephony (SPIT), call payment fraud, and denial-of-service (DoS) attacks. The insufficient effectiveness of existing protection methods and tools against new and adaptive attacks has been identified, necessitating the application of intelligent approaches. An architecture for an intellectualized computer system is proposed, utilizing machine learning methods to analyze traffic (e.g., SIP messages) and metadata of media streams (RTP/RTCP) in VoIP. Models and algorithms have been developed to extract informative features of malicious messages, classify traffic, and detect anomalies in real time. Special attention is given to the system's ability to self-learn and adapt to new, previously unknown types of threats. The effectiveness of various machine learning algorithms for solving the tasks of classification and anomaly detection in VoIP has been investigated. Experimental testing of the developed system on real and simulated datasets confirmed its ability to detect malicious messages with high accuracy and a low false-positive rate. The scientific novelty of the work lies in the development of a comprehensive approach to detecting malicious messages in VoIP based on intelligent analysis of multi-dimensional data, considering the specifics of corporate networks, as well as in the improvement of adaptive threat detection methods using ontological approaches and fuzzy logic. The practical significance of the obtained results is reflected in the developed software prototype of the system, recommendations for its implementation, and configuration in corporate networks to enhance IP-telephony security, prevent financial losses, and protect confidential information. Keywords: IP-telephony, VoIP, malicious messages, vishing, corporate network, intellectualized system, machine learning, anomaly detection, cybersecurity, information protection.

IEEE Instrumentation & Measurement/Computational Intelligence Joint Societies Chapter

The Instrumentation & Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section were established on June 7, 2005. A current Chairman of the Chapter is Prof. Volodymyr Kochan, and a current Vice-Chairman is Prof. Anatoliy Sachenko. The Chapter consists of 18 members from Lviv, Ternopil, Khmelnytsky, Kyiv, Zaporizhzhya, Odessa and Kherson, in particular:

Prof. S. Antoshchuk, Odessa National Polytechnic University
 Dr P. Bykovyy, Ternopil National Economic University
 Prof. M. Dorozhovets, Lviv National Technical University
 Prof. O. Ivakhiv, Lviv National Technical University
 Prof. R. Kochan, Lviv National Technical University
 Dr O. Kochan, Ternopil National Economic University
 Prof. V. Kochan, Ternopil National Economic University
 Prof. V. Krylov, Odessa National Polytechnic University
 Dr S. Lysenko, Khmelnytsky National University

Prof. V. Lytvynenko, Kherson National Technical University
Dr V. Mukhin, National Technical University of Ukraine “Kyiv Polytechnic Institute”
Dr O. Osolinskyi, Ternopil National Economic University
Prof. S. Rippa, National University of the State Taxation Department of Ukraine
Prof. A. Sachenko, Ternopil National Economic University
Dr V. Turchenko, Ternopil National Economic University
Dr G. Shilo, Zaporizhzhya National Technical University
Dr V. Yatskiv, Ternopil National Economic University

The six of technical meetings were held by I&M/CI Chapter:

- I. On March 26, 2025, as part of a joint meeting of the IEEE I&M/CI branch and the international workshop “Advances & Challenges in Computing” online. The agenda included two reports: 1) “Methodological foundations and information technologies for creating stable intelligent data analysis systems”, Ph.D., Associate Professor Vyacheslav Moskalenko, Associate Professor of the Department of Computer Science, Sumy State University. 2) “Methods and means of cryptographic information protection based on the remainder number system”, Ph.D., Associate Professor, Ihor Yakymenko, Associate Professor of the Department of Cybersecurity, Dean of the Faculty of Computer Information Technologies, West Ukrainian National University. Both reports aroused keen interest among the participants, including members of the IEEE I&M/CI branch, as well as a number of Ukrainian and foreign scientists, as well as master's and postgraduate students of Ukrainian universities. As a result of the discussion, both reports were recommended for publication in the International Journal of Computing. At the end of the meeting, Prof. Anatoliy Sachenko, a senior IEEE member, vice-head of the IEEE I&M/CI branch, informed the audience about current competitions for national and international research projects, as well as international IEEE conferences. The event was attended by 30 participants, including 11 IEEE members.
- II. On June 25, 2025, as part of a joint meeting of the IEEE I&M/CI branch and the international workshop “Advances & Challenges in Computing” online. The agenda included two reports: 1) “Data-based diagnostics: problems and methods”, Dr. Sc., Professor Serhiy Subbotin, Head of the Department of Software Tools of the National University “Zaporizhzhia Polytechnic”. 2) “Mechanisms of fine-tuning neuroevolutionary synthesis of diagnostic models”, Ph.D., Associate Professor, Serhiy Leoshchenko, Associate Professor of the Department of Software Tools of the National University “Zaporizhzhia Polytechnic”. Both reports aroused keen interest among the participants, among whom were members of the IEEE I&M/CI branch, as well as a number of Ukrainian and foreign scientists, as well as masters and postgraduate students of Ukrainian universities. As a result of the discussion, both reports were recommended for publication in the International Journal of Computing. At the end of the meeting, Prof. Anatoliy Sachenko, a leading member of IEEE, vice-head of the IEEE I&M/CI department, informed the attendees about current competitions for national and international research projects, as well as international IEEE conferences. The event was attended by 35 participants, including 12 IEEE members.
- III. On August 28, 2025, within the framework of a joint meeting of the IEEE I&M/CI branch and the specialized academic council D 58.082.02 of the West Ukrainian National University, Ihor Romanets defended his PhD thesis on the topic "Intellectualized computer system for detecting malicious IP telephony messages in a corporate network" in the specialty 05.13.05 - computer systems and components. The event was attended by 19 participants, including 7 IEEE members.
- IV. On September 4–6, 2025, the 13th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS'2025) was held in Gliwice,

Poland, which was organized in a hybrid format at the Silesian University of Technology. The conference was co-chaired by Professor Anatoliy Sachenko (Ukraine) and Professor Wojciech Kempa (Poland). The honorary chairman was Professor Vincenzo Piuri (Italy), the chairman of the International Advisory Board (IAB) was Professor George Markovsky (USA). The event was attended by 252 participants, including 47 IEEE members.

- V. On September 24, 2025, as part of a joint meeting of the IEEE I&M/CI section and the international workshop “Advances & Challenges in Computing” in online mode. There were two reports on the agenda: 1) “Application of RFM-D analysis for customer segmentation using machine learning”, Doctor of Technical Sciences, Professor Vitaliy Kobets, Professor of the Department of Computer Science and Software Engineering, Kherson State University. 2) “Multimodal methods of natural language processing for processing unstructured financial information”, Vladyslav Yatsyuta, postgraduate student of Kherson State University. After discussion, both reports were recommended for publication in the International Journal of Computing. At the end, Prof. Anatoliy Sachenko, Director of the Research Institute of Intelligent Computer Systems of the West Ukrainian National University and the V. M. Glushkov Institute of Cybernetics of the NAS of Ukraine, presented a report on the topic “Current Status and Future Research Projects and Conferences”. Both reports aroused keen interest among the participants, among whom were members of the IEEE I&M/CI branch, as well as a number of Ukrainian and foreign scientists, as well as master’s and postgraduate students of Ukrainian universities. As a result of the discussion, both reports were recommended for publication in the International Journal of Computing. At the end of the meeting, Prof. Anatoliy Sachenko, leading IEEE member, vice-head of the IEEE I&M/CI branch, informed the attendees about current competitions for national and international research projects, as well as international IEEE conferences. The event was attended by 33 participants, including 11 IEEE members.
- VI. On December 17, 2025, as part of a joint meeting of the IEEE I&M/CI branch and the international workshop “Advances & Challenges in Computing” in online mode. There were two reports on the agenda: 1) “Optimization of training data sets in neural network training tasks”, Ph.D. Oleksiy Lutsyk, research associate of the Department of Methods and Systems for Processing, Analysis and Identification of Images of the Institute of Physics and Mechanics of the National Academy of Sciences of Ukraine. 2) “Methods for Creating Information Flows and Models of Digital Twins of Port Infrastructure”, Ph.D., Associate Professor Andriy Topalov, Associate Professor of the Department of Computer Systems and Components of the Admiral Makarov National Shipbuilding University. Both reports aroused keen interest among the participants, including members of the IEEE I&M/CI branch, as well as a number of Ukrainian and foreign scientists, as well as master's and postgraduate students of Ukrainian universities. As a result of the discussion, both reports were recommended for publication in the International Journal of Computing. The event was attended by 39 participants, including 14 IEEE members.

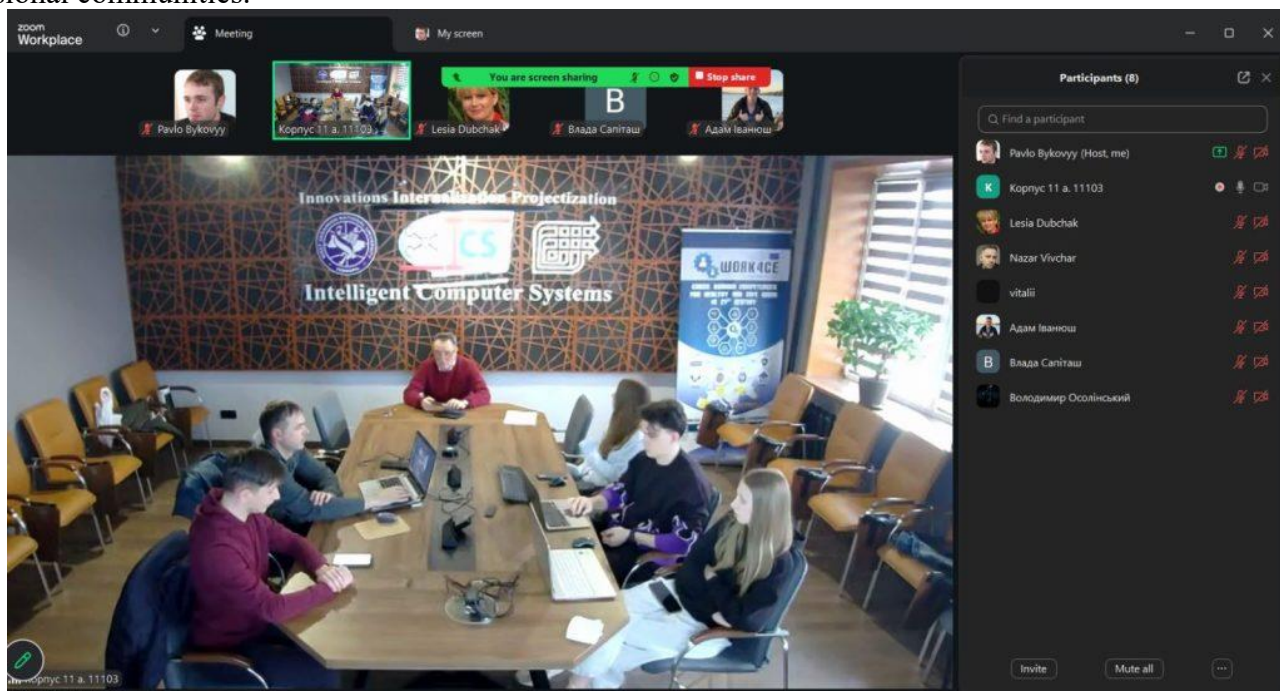
IEEE WUNU Student Branch

The IEEE WUNU Student Branch has been founded at the Ternopil Academy of National Economy (it's renamed into WUNU) was founded in 1998. In past, members of the IEEE WUNU Student Branch participated in international conferences and projects. In particular, they took a part in organizing the IEEE International conferences "Intelligent Data Acquisition and Advanced Computing Systems: Development and Application" (IDAACS): IDAACS'2001, IDAACS'2003, IDAACS'2005, IDAACS'2007, IDAACS'2009, IDAACS'2011, IDAACS'2013, IDAACS'2015, IDAACS'2017, IDAACS'2019, IDAACS'2021, IDAACS'2023 in different countries of Europe.

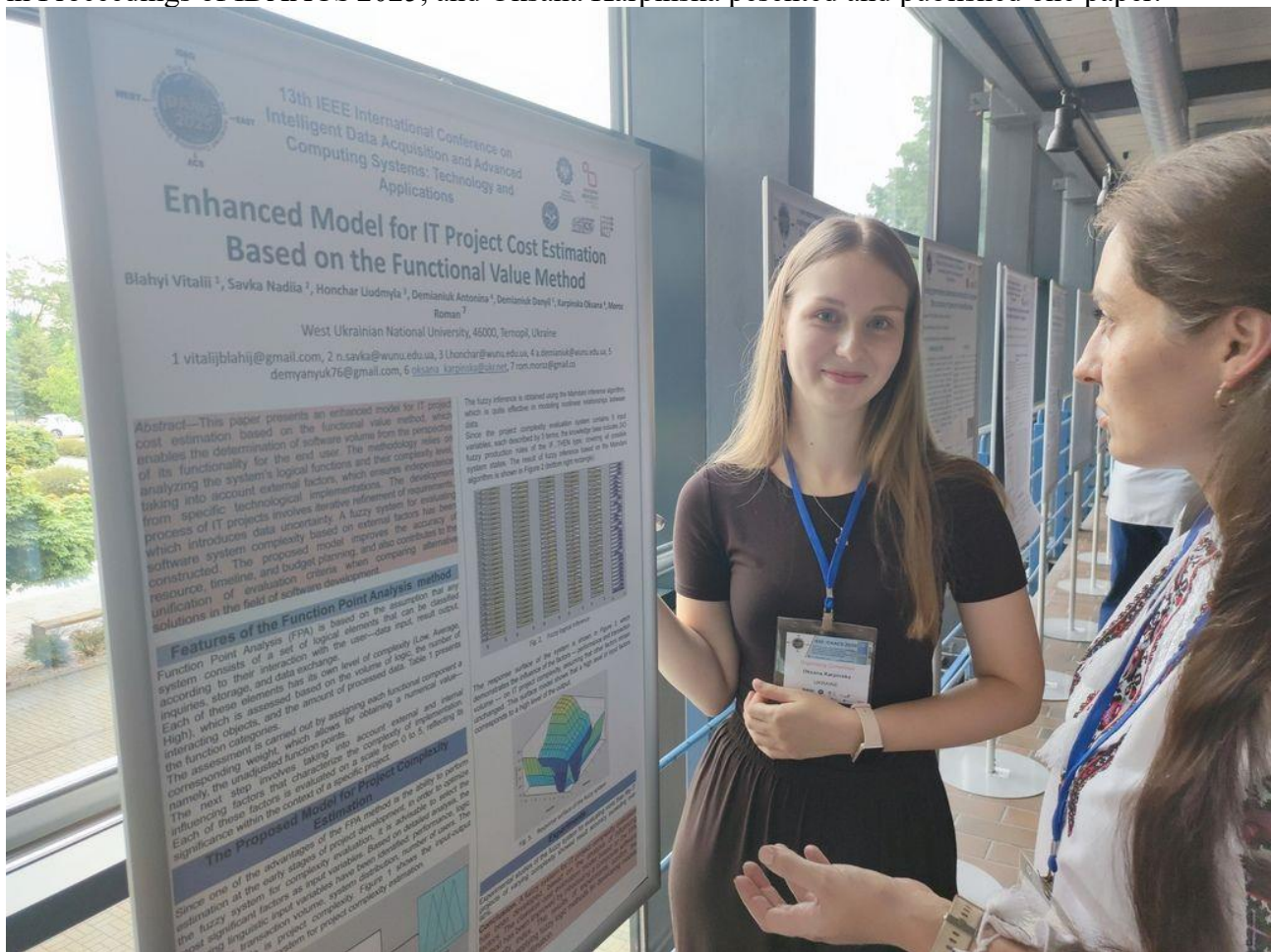
The main advantages of IEEE membership include: access to IEEE electronic resources; subscription to IEEE scientific and popular science journals "Spectrum", "Computer", "IEEE Transactions on Instrumentation and Measurement"; assistance and discounts when participating in international conferences, for example, as an IEEE member you can win a grant for a trip to a conference in a country from your region (Ukraine, along with the countries of Europe, the Middle East and Africa, belongs to Region 8). Most conferences sponsored by IEEE provide discounts to IEEE students upon registration; participation in competitions organized by IEEE in the relevant region.

The IEEE WUNU Student Branch resumed its active development in 2025 with the support of the Research Institute for Intelligent Computer Systems, the Faculty of Computer Information Technologies, and the IEEE Instrumentation & Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section. The IEEE WUNU Student Branch currently consists of 12 motivated students and PhD students from different years of study and specialties of the Faculty of Computer Information Technologies, including Computer Science, Computer Engineering, and Cybersecurity. The Executive Committee of the IEEE Student Branch includes: Vitalii Leus, Chair; Oksana Karpinska, Vice Chair; Maksym Palka, Treasurer; and Solomiia Marchuk, Secretary.

The activities of the IEEE Student Branch are supervised by Prof. Anatoliy Sachenko, Branch Counselor, and supported by the Research Institute for Intelligent Computer Systems in cooperation with the Faculty of Computer Information Technologies. The Branch plans to organize and support student-oriented scientific, educational, and professional activities, including technical meetings, seminars, workshops, project initiatives, and events aimed at promoting IEEE values and strengthening cooperation between students, researchers, academic institutions, and international professional communities.



Maksym Palka and Oksana Karpinska took a part in preparing and organizing the IDAACS'2025 in Gliwice, Poland as the members a of IDAACS'2025 OrgCom, and Oksana Karpinska served the Registration Desk there. Moreover, Maksym Palka has published his two papers in Proceedings of IDAACS'2025, and Oksana Karpinska pesented and published one paper.



In October 2025, Vitalii Leus and Vladyslav Khinochek, members of the IEEE WUNU Student Branch, participated in the IEEEExtreme 19.0 global programming competition as a two-person team. The event took place online and lasted 24 hours, covering a total of 30 practical tasks and puzzles spanning programming, algorithms, mathematics, and cybersecurity. Additionally, Vitalii Leus served as an event ambassador, assisting with organization and student engagement in Ternopil by raising awareness about IEEEExtreme.

5. ACADEMIC ACTIVITIES

Cooperation Agreements with Universities and Companies

- [Agreement 1] Donetsk National Technical University, Ukraine.
- [Agreement 2] Zaporizhya National Technical University, Ukraine.
- [Agreement 3] Institute for Cybernetics, National Academy of Sciences of Ukraine, Kyiv, Ukraine.
- [Agreement 4] Institute of Space Research, National Academy of Sciences of Ukraine and NCAO, Kyiv, Ukraine.
- [Agreement 5] Institute of Artificial Intelligence, Donetsk.
- [Agreement 6] Odessa National Polytechnic University, Ukraine.
- [Agreement 7] Technical University of Sofia, Bulgaria.
- [Agreement 8] University of Calabria, Italy.
- [Agreement 9] Tsinghua University, China.
- [Agreement 10] University of Maine, USA.
- [Agreement 11] University of New Hampshire, USA
- [Agreement 12] University of South Carolina, USA.
- [Agreement 13] Physics-Mechanics Institute of G. Karpenko, National Academy of Sciences of Ukraine, Lviv, Ukraine.
- [Agreement 14] University of Siegen, Germany
- [Agreement 15] Chernivtsi National University by Yu.Fedkovich, Chernivtsi, Ukraine
- [Agreement 16] Wuhan University of Technologies, Wuhan, Hubei, China
- [Agreement 17] Kaunas University of Technology, Lithuania
- [Agreement 18] Hochschule für Technik und Wirtschaft Berlin, University of Applied Sciences, Germany
- [Agreement 19] Fachhochschule Dortmund, University of Applied Sciences, Germany
- [Agreement 20] Pre-Carpathian National University by Vasyl Stefanyk, Ivano-Frankivsk, Ukraine
- [Agreement 21] Silesian Technical University, Poland.
- [Agreement 22] Warsaw University of Technology, Poland
- [Agreement 23] National University of State Tax Service of Ukraine, Irpin, Kiev region.
- [Agreement 24] National University of Water and Environmental Engineering, Rivne, Ukraine.
- [Agreement 25] Kiev National University of Construction and Architecture, Ukraine.
- [Agreement 26] Lviv State University of Life Safety, Lviv, Ukraine
- [Agreement 27] Ivan Franko National University of Lviv, Lviv, Ukraine

Awarded Degrees and Defended PhD Theses

Defended PhD and Doctoral Theses

- [Def 1] Khrystyna Lipyanina-Honcharenko, dissertation work for the degree of Doctor of Technical Sciences, “Theoretical and Applied Principles of Information Technology for Intellectual Analysis of Socio-Economic Data of Territorial Communities”, specialty 05.13.06 – Information Technologies, defense took place at Khmelnytskyi National University on February 14, 2025
- [Def 2] Faifura V. V. – dissertation on the topic: “Mathematical and software for modeling the distribution of microplastics in the surface layer of the atmosphere” for the degree of Doctor of Philosophy in the field of knowledge 12 “Information Technologies” in the specialty 121 “Software Engineering”. Specialized Academic Council DF 58.082.071 at the West Ukrainian National University, defense date August 14, 2025
- [Def 3] Simak A. Yu. – dissertation on the topic: “Intellectualized software system for analyzing and rating the activities of scientific and pedagogical workers” for the degree of Doctor of

Philosophy in the field of knowledge 12 “Information Technologies” in the specialty 121 “Software Engineering”. Specialized Academic Council DF 58.082.085 at the West Ukrainian National University, defense date 11/19/2025.

- [Def 4] Pan Tiande – dissertation on the topic: “Methods and software tools for recognizing false or irrelevant information in the content of news social networks” for the degree of Doctor of Philosophy in the field of knowledge 12 “Information Technologies” in the specialty 121 “Software Engineering”. Specialized Academic Council DF 58.082.087 at the West Ukrainian National University, defense date 12/18/2025.

Internship of Staff and Graduate Students

Staff Internship

- [Internship 1] Mykhailo Dombrovskiy, Technische Universität Dresden, March-October 2025
[Internship 2] Viktoria Voznyak, Dortmund (Germany), March-October 2025

6. PUBLICATIONS

Monographs (Parts of Monographs)

- [Publ 1]. Kh. V. Lipyanina-Honcharenko, Intelligent methods for detecting disinformation in Ukrainian text data. Ternopil: Economichna Dumka, 2025, 201 p.

Journal Papers

- [Publ 2]. J. Su, H. Wang, K. Przystupa, O. Kochan, D. Liu, and T. I., “Dynamic spatio-temporal residual hypergraph convolutional networks for traffic flow forecasting,” *Transportation Research Record*, pp. 596–614, 2025, doi: 10.1177/03611981241295706.
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- [Publ 7]. Y. Bodyanskiy, Y. Zaychenko, O. Kuzmenko, and H. Zaichenko, “Hybrid system of computational intelligence based on fuzzy bagging and group method of data handling,” in *System Analysis and Data Mining*, M. Zgurovsky and N. Pankratova, Eds., *Studies in Systems, Decision and Control*, vol. 609. Cham, Switzerland: Springer, 2026. [Online]. Available: https://doi.org/10.1007/978-3-031-97529-5_14
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- [Publ 9]. I. Kogut, V. Hryha, B. Dzundza, L. Hryha, and I. Hatala, “Research and Design of a Matrix Multiplier on FPGA,” *Advances in Cyber-Physical Systems*, Lviv Polytechnic National University Publishing, vol. 10, no. 1, pp. 10–15, 2025. Available: <https://doi.org/10.23939/acps2025.01.010>
- [Publ 10]. V. V. Dovgy, V. M. Griga, B. S. Dzundza, I. V. Svyd, A. I. Terletsy, and M. F. Pavlyuk, “Analysis of digital data transmission interfaces in communication channels of computer systems,” *Radio Engineering Journal*, no. 222, pp. 161–171, 2025. Available: <https://doi.org/10.30837/rt.2025.3.222.15>
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- [Publ 165]. Ya. M. Nykolaychuk, I. Z. Yakymenko, S. V. Ivasiev, and V. M. Hryga, “Device for comparing data represented in a non-positional number system of the remainder class,” patent for utility model No. 160091, Ukraine, Bull. No. 32, Aug. 6, 2025.

7. PARTICIPATION IN INTERNATIONAL CONFERENCES, SYMPOSIUMS AND WORKSHOPS, AND RESEARCH VISITS

International conferences, symposiums and workshops

[Visit 1] 5th In IEEE 13th International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS), Gliwice, Poland, 2025

- | | |
|-----------------------|---------------------------------|
| - Anatoliy Sachenko | - Oleksandr Osolinsky |
| - Orest Kochan | - Khrystyna Lipyana-Honcharenko |
| - Volodymyr Kochan | - Diana Zahorodnia |
| - Oleg Savenko | - Taras Lendyuk |
| - Serhiy Lysenko | - Nataliya Dzyubanova |
| - Oleg Savenko | - Taras Tsavolyk, |
| - Pavlo Radiuk | - Vasyl Yatskiv |
| - Carsten Wolff | - Andriy Melnyk |
| - Serhiy Bushuyev | - Ihor Romanets |
| - Lesya Dubchak | - Vasyl Lytvyn |
| - Leonid Bytsyura | - Volodymyr Holovko |
| - Bohdan Derish | - Ruslan Savchysyn |
| - Nadiya Vasylkiv | - Nonna Kulishova |
| - Maksym Palka | - Yevhen Bodiansky |
| - Mykhailo Dombrovsky | - George Markowsky |
| - Iryna Turchenko | - Mykola Karpinsky |

[Visit 2] CMIS-2025: Eighth International Workshop on Computer Modeling and Intelligent Systems, May 5, 2025, Zaporizhzhia, Ukraine

- Yevheniy Bodyanskiy
- Iryna Pliss
- Olga Chala

[Visit 3] 15th International Conference on Advanced Computer Information Technologies (ACIT), Sibenik, Croatia, 2025

- | | |
|-----------------------|-----------------------|
| - Oleg Savenko | - Oleksandr Papa |
| - Serhiy Lysenko | - Yaroslav Tsapiv |
| - Yevhen Bodianskyi | - Vasyl Yatskiv |
| - Iryna Pliss | - Natalia Yatskiv |
| - Olga Chala | - Stepan Ivasiev |
| - Natalia Dzyubanova | - Taras Tsavolyk |
| - Mykhailo Kasyanchuk | - Roman Pasichnyk |
| - Mykola Dyvak | - Mykhailo Machuliak |
| - Andriy Melnyk | - Mykhailo Kasyanchuk |
| - Yuriy Maslyak | - Andriy Pukas |
| - Ihor Romanets | - Andriy Simak |
| - Serhiy Voznyak | - Natalia Vozna |

[Visit 4] CITI'2025: 3rd International Workshop on Computer Information Technologies in Industry 4.0, June 11-12, 2025

- | | |
|--------------------|------------------|
| - Orest Kochan | - Vasyl Yatskiv |
| - Roman Kochan | - Oleg Zastavnyi |
| - Mykola Karpinsky | - Vasyl Lytvyn |

[Visit 5] IV International Scientific and Practical Conference “Green Construction”

- Orest Kochan

[Visit 6] Doors-2025: 5th Edge Computing Workshop, April 4, 2025, Zhytomyr, Ukraine

- Orest Kochan
- Pavlo Radiuk

[Visit 7] The Second International Conference of Young Scientists on Artificial Intelligence for Sustainable Development (YAISD), May 8-9, 2025, Ternopil, Ukraine

- | | |
|-----------------------------------|-----------------------|
| - Mykola Dyvak | - Volodymyr Manzhula |
| - Roman Pasichnyk | - Andriy Melnyk |
| - Leonid Bytsyura | - Vasyl Tymchyshyn |
| - Lesia Dubchak | - Andriy Pukas |
| - Vasyl Koval | - Oleksandr Osolinsky |
| - Pavlo Radiuk | - Maxym Palka |
| - Khrystina Lipyanina-Honcharenko | - Nadiya Vasylykiv |
| - Natalia Dzyubanovska | |

[Visit 8] 2025 IEEE 12th International Workshop on Metrology for AeroSpace (MetroAeroSpace), Naples, Italy, 2025

- Roman Kochan
- Orest Kochan

[Visit 9] 15th International Conference on Measurement, Smolenice, Slovakia, 2025

- Yuriy Maslyiak
- Orest Kochan

[Visit 10] PhD Workshop on Artificial Intelligence in Computer Science at 9th International Conference on Computational Linguistics and Intelligent Systems (CoLInS-2025), May 15–16, 2025, Kharkiv, Ukraine

- Anatoliy Sachenko
- Vasyl Lytvyn
- Lesia Dubchak

[Visit 11] 2025 IEEE European Technology and Engineering Management Summit (E-TEMS), Bruges, Belgium, 2025

- Carsten Wolff,
- Anatoliy Sachenko

[Visit 12] 2025 IEEE European Technology and Engineering Management Summit (E-TEMS), Bruges, Belgium, 2025

- Sergiy Bushuyev

[Visit 13] Metallurgy and related topics: Proceedings of 18th symposium “Materials and metallurgy”. SHMD’2025, Croatia (published in: Metalurgija 64 (2025))

- | | |
|--------------------|-----------------|
| - Natalia Vozna | - Yuri Maslyak |
| - Victoria Voznyak | - Oleg Zastavny |

[Visit 14] BAITmp'2025: The 2nd International Workshop on "Bioinformatics and Applied Information Technologies for medical purpose", November 12-13, 2025, Ben Guerir, Morocco

- Mykola Karpinsky
- Khrystyna Lipyanina-Honcharenko

[Visit 15] Collection of materials of the international scientific conference "Information problems of computer systems, energy, modeling and control" (ICSM-2025). Nadvirna, 2025

- Yaroslav Nykolaychuk
- Natalia Vozna
- Oleg Zastavny
- Stepan Ivasiev

[Visit 16] Modern Data Science Technologies Doctoral Consortium (MoDaST 2025), Lviv, Ukraine

- Anatoliy Sachenko
- Lesya Dubchak
- Oleg Savenko
- Yuriy Maslyak
- Bogdan Derysh

[Visit 17] AI'25: 5th International Workshop of IT-professionals on Artificial Intelligence, October 15–17, 2025, Liverpool, UK

- Yevhen Bodiansky
- Nonna Kulishova

[Visit 18] ITTAP'2025: 5h International Workshop on Information Technologies: Theoretical and Applied Problems, October 24-25, 2025, Ternopil, Ukraine, Opole, Poland

- Mykola Karpinsky
- Iryna Turchenko
- Khrystyna Lipyanina-Honcharenko
- Myroslav Komar
- Lesya Dubchak,
- Nadiya Vasylykiv

[Visit 19] Modern Problems of Science and Technology: materials of the Proceedings of the International Scientific and Practical Conference (Tallinn, Estonia, March 17-19, 2025). Tallinn, 2025

- Iryna Turchenko

[Visit 20] 2025 IEEE 5th International Conference on Smart Information Systems and Technologies (SIST), Astana, Kazakhstan, 2025

- Sergiy Bushuyev

[Visit 21] Proceedings of the 7th International Workshop on Modern Machine Learning Technologies (MoMLeT-2025), June 14, 2025, Lviv-Shatsk, Ukraine

- Myroslav Komar
- Khrystyna Lipyanina-Honcharenko

[Visit 22] International Workshop on Computational Intelligence, co-located with the IV International Scientific Symposium "Intelligent Solutions" (IntSol-2025), May 01-05, 2025, Kyiv-Uzhhorod, Ukraine

- Yevhen Bodiansky

- [Visit 23] Proceedings of the 2nd International Scientific and Practical Conference (Luxembourg, March 5-7, 2025). Luxembourg, 2025**
- Iryna Turchenko
- [Visit 24] Development of science: theories, discoveries and practical results: materials of the 4th international scientific and practical conference (June 9-11, 2025). Zurich, 2025**
- Iryna Turchenko
 - Mykhailo Machuliak
- [Visit 25] Scientific Papers “International Scientific Unity” with Proceedings of the 1st International Scientific and Practical Conference. March 19-21, 2025. Sofia, Bulgaria**
- Nadiya Vasylykiv
 - Mykhailo Dombrovskyi
 - Iryna Turchenko
- [Visit 26] AISSLE-2025: The International Workshop on Applied Intelligent Security Systems in Law Enforcement, October, 30–31, 2025, Vinnytsia, Ukraine**
- Oleksandr Papa
 - Oleg Savenko
 - Iryna Pliss
 - Evgeny Bodiansky
- [Visit 27] Modern challenges and innovations in science: an interdisciplinary approach to the development of education, technology, society and economy: Abstracts of the international scientific and practical conference. (April 4, 2025, Kremenchuk)**
- Lesya Dubchak
 - Nadiia Vasylykiv
- [Visit 28] SMICS-2025: Security of modern information and communication systems:**
- Nadiia Vasylykiv
- [Visit 29] Prospects for the development of high-quality training of future specialists: XI International Scientific and Practical Conference. March 17-19, 2025. Antwerp, Brussels**
- Mykhailo Kasyanchuk
 - Vasyl Yatskiv
 - Stepan Ivasiev
- [Visit 30] ModelOps, and AIOps integration in scalable medical systems 8th International Conference on Informatics & Data-Driven Medicine - Bratislava, Slovakia**
- Vasyl Koval
- [Visit 31] Modern Science, Economy and Digital Innovation: materials of the Proceedings of the International Scientific and Practical Conference (Bucharest, RoMania, March 12-14, 2025). Bucharest, 2025**
- Iryna Turchenko
- [Visit 32] The 12th International scientific and practical conference “Perspectives of contemporary science: theory and practice” (January 13-15, 2025) SPC “Sci-conf. com. ua”, Lviv, Ukraine. 2025**

- Roman Pasichnyk

[Visit 33] Intelitsis'25: The 6th International Workshop on Intelligent Information Technologies & Systems of Information Security, April 04, 2025, Khmelnytskyi, Ukraine

- Anatoliy Sachenko
- Pavlo Radiuk

[Visit 34] 2025 IEEE 6th KhPI Week on Advanced Technology (KhPIWeek), Kharkiv, Ukraine, 2025

- Vasyl Lytvyn

[Visit 35] 15th International Conference. MEASUREMENT 2025, Smolenice, Slovakia. 2025

- Bohdan Maslyiak
- Nataliia Vozna

[Visit 36] ICL 2025: 28th International Conference on Interactive Collaborative Learning. 54th IGIP International Conference on Engineering Pedagogy Lecture Notes in Networks and Systems; 2025.

- Carsten Wolff

[Visit 37] AIT&AIS'2025: International Scientific Workshop on Applied Information Technologies and Artificial Intelligence Systems, December 18–19 2025, Chernivtsi, Ukraine

- Oleg Savenko
- Serhiy Lysenko
- Andriy Melnyk

[Visit 38] 29th International Congress on Project Management and Engineering (CIDIP 2025). AEIPRO; Ferrol, Spain

- Carsten Wolff

Research Visits

ICS' staff visits

- [Visit 39] **Mykhailo Dombrovskiy and Iryna Turchenko.** From August 25 to 29, 2025, the International Summer Convention was held at the Dortmund University of Applied Sciences and Arts, Dortmund, Germany. <https://www.fh-dortmund.de/international/veranstaltungsreihen/international-summer-convention.php>. 140 representatives from 40 universities from 18 different countries participated in the program, which combined intercultural learning, research discussions, seminars on cross-border projects, and training for teachers. The West Ukrainian National University, the Faculty of Computer Information Technologies and the Department of Information and Computing Systems and Management were represented by scientists Mykhailo Dombrovskiy and Iryna Turchenko.
- [Visit 40] **Visit Gliwice of WUNU delegation in April 2025 –**[Taras pls take it from ICS/WUNU news](#)

Visits of foreign and national collaborators to ICS

- [Visit 41] **Professor Carsten Wolff** from Dortmund University of Applied Arts and Sciences, Germany visited the IKS Research Institute, West Ukrainian National University, on April 23-26, 2024. On Wednesday morning, April 24, 2024, Professor Carsten Wolff gave a lecture to students of various specialties on the topic "Digital Transformation Projects". This was followed by a short meeting with Ulyana Koruts, Vice-Rector for International Affairs of WUNU. On April 24, 2024, at the meeting of the Academic Council, Carsten Wolff gave a short report, who was awarded the title of Honoris Causa Professor WUNU by the results of the vote. After lunch, Carsten Wolff visited the immersive multifunctional hub of WUNU, as well as the Educational and Scientific Center for Information Technologies of WUNU. At the end of the day, a working meeting was held between Carsten Wolf with Anatoly Sachenko, Mykhailo Dombrovsky, and Iryna Turchenko, at which the general agreement on bilateral cooperation between universities, as well as the agreement on double degrees, were discussed.

8. AWARDS

- [Award 1]. Ph.D., Associate Professor Lesya Dubchak was awarded the international distinction in the field of computer engineering – Women Researcher Award from the Global Particle Physics Excellence Awards (13th Edition). The award was presented on July 22, 2025 for significant contribution and outstanding achievements in the field of innovative scientific research;
- [Award 2]. [Award 2]. Doctor of Technical Sciences, Professor Sergey Bushuyev was awarded the status of Research Achievement Award Winner 2025 by the IPMA Executive Board and Judges of the IPMA Global Research Award 2025 for his significant contribution throughout his professional career in the field of project management.

9. STATISTICAL DATA

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Number of Senior Researches	39	40	39	45	46	60	60	60	56	59	78
Number of Junior Researches	16	12	10	8	8	6	5	5	5	11	13
Number of Active Research Projects	3	3	2	4	4	4	3	3	5	6	5
Publications	113	131	115	163	114	187	141	128	153	266	499
Patents and applications for the invention		9	10	8	2	8	6	1	1	3	9
Participation in Conferences, Symposia and Wokshops	33	24	32	33	21	7	11	12	11	16	65
Number of Defended PhD and DrSc Theses	7	7	6	4	3	0	3	0	4	3	5
Number of Defended Master Theses	60	12	54	88	87	82	49	55	63	96	91
Number of Received Awards	5	6	5	7	4	4	2	2	2	1	2

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