**RESEARCH INSTITUTE
FOR INTELLIGENT COMPUTER SYSTEMS**

**TERNOPIL NATIONAL ECONOMIC UNIVERSITY,
MINISTRY OF EDUCATION AND SCIENCE, UKRAINE**

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

ANNUAL REPORT

2024

Ternopil – 2025

CONTENTS

FOREWORD

The ICS counts the 17 Research Groups which are described below. During its history, the ICS staff has received more than 150 invention certificates of the former USSR and 76 Ukrainian patents. There were published more than 2000 papers and 266 of them in 2024. There were defended 58 DSc and PhD theses.

The competence and expertise of ICS staff has been confirmed since 1997 by awarding 24 international grants and projects within the INTAS, CRDF, NSF, NATO, STCU, and FP7, DAAD, Erasmus+ of the European Union. In these projects, the ICS collaborated with a huge number of world-known universities as well as governmental institutions and IT companies. We continued to run the two European projects: DAAD project ViMaCs Virtual Master Cooperation Data Science (ViMaCs) - Phase 2 and Erasmus+ project WORK4CE: Cross-domain competences for healthy and safe work in the 21st century.

Additional 19 projects have been completed funded by the Ministry of Education and Science, Ukraine, and the project "An intelligent system for studying the energy consumption of IoT modules" has started in 2024.

The ICS holds the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS) every two years since 2001. Proceedings of the conferences are indexed by WoS, EI Compendex and Scopus. Now we are preparing along with a German team, Dortmund University of Applied Sciences and Artsthe the 12 th IDAACS 2023 Conference, which was hold 7-9 September, 2023 in Dortmund, Germany. The next IDAACS'2025 is scheduled to be held on September 4-6, 2025 at the Silesian University of Technology, Gliwice, Poland. The IKS Research Institute has been participating in the organization of the International Symposium on Wireless Systems within the IDAACS Conference since 2012. However, due to the full-scale Russian invasion of Ukraine, IDAACS-SWS was not held in 2022 and 2024.

The ICS staff has a good relationship with the IEEE Student Branch at WUNU and the Instrumentation and Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section. A Chapter has run the four meetings in 2024.

The International Journal of Computing is issued quarterly in cooperation with the Glushkov Institutefor Cybernetics, National Academy of Science, Ukraine. The Journal is indexed by Scopus Elsevier as well as Finnish publication forum, Norwegian Social Science Data Services, Google Scholar, and Index Copernicus. The four regular issues were published in 2024.

Finally, I would like to thank Dr. Taras Lendyuk, Dr. Diana Zahorodnia and Dr. Oleksandr Osolinskyi for their help in preparing, editing and designing this report.

Enjoy,
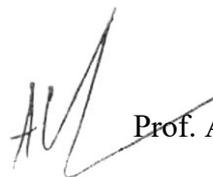
Prof. Anatoliy Sachenko

March 15, 2025

1. GENERAL INFORMATION

ICS History

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

The ICS counts the 17 Research Groups, in particular Intelligent Distributed Systems Group, Intelligent Sensor Data Acquisition Group, Intelligent Robotic Systems Group, Neural Networks and Parallel Computing Group, Knowledge Bases and Ontologies Group, Information Technology and Specialized Computer Systems Group, Image Processing and Pattern Recognition Group, Wireless Systems Security Group, Project and Program Management based on of Information Technologies and Knowledge Group, Cybernetics of Complex Systems Group, Information Security Group, Intelligent Cyber Security and Defense Group, Metrology of Information Measuring Systems Group, Design and Testing of FPGA Component for Safety Related Systems, Virtual Insruments for IoT, Big Data and Data Sciences, Human-Computer Interaction.

ICS Management

Director – Prof. Anatoliy Sachenko
Scientific Advisor – Prof. Volodymyr Kochan
Scientific Secretary – Dr. Diana Zahorodnia

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Principal researcher – Prof. Anatoliy Sachenko
Group members:
- Pavlo Bykovyy
- Volodymyr Kochan
- Myroslav Komar
- Olexandr Osolinskyi
- Vasyl Yatskiv

Intelligent Sensor Data Acquisition Group (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 Vasylkiv

Intelligent Robotic Systems Group (IRS)

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

Group members:
- Oleh Adamiv
- Vladimir Golovko
- Anatoliy Sachenko

Neural Networks and Parallel Computing Group (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 Group (KBO)

Principal researchers – Prof. Uwe Grossmann, Prof. Sergey Rippa

Group members:
- Taras Lendyuk
- Andriy Melnyk
- Anatoliy Sachenko
- Serhiy Voznyak

Information Technology and Specialized Computer Systems Group (ITSCS)

Principal researcher – Prof. Yaroslav Nykolaychuk

Group members:
- Orest Volynskyy
- Arthur Voronych
- Natalia Vozna
- Oleg Zastavnyy

Image Processing and Pattern Recognition Group (IPPR)

Principal researchers – Prof. Bohdan Rusyn

Group members:
- Pavlo Bykovyy
- Ivan Kit
- Dmytro Lindiuk
- Sergiy Rimashevskyy
- Anatoliy Sachenko
- Diana Zagorodnya

Wireless Systems Security Group (WSS)

Principal researchers – Prof. Vasyl Yatskiv, DSc Taras Maksymyuk

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

Project and Program Management based on of Information Technologies and Knowledge Group (PPMITK)

Principal researchers – Prof. Sergey Bushuyev, Prof. Carsten Wolff
Group members:
- Mykhailo Dombrovsky
- Zbyshek Dombrovsky
- Grygoriy Hladiy
- Taras Lendiuk
- Sergey Rippa
- Anatoliy Sachenko
- Marian Senkiv
- Iryna Turchenko
- Nadiia Vasylkiv
- Victoria Vozniak
- Daria Vynohradova

Cybernetics of Complex Systems Group (CCS)
Principal researcher – DSc Roman Pasichnyk
Group members:
- Dmytro Bodnar
- Grygoriy Hladiy
- Igor Dobrotvor
- Andriy Melnyk
- Yuriy Pigovskyy

Information Security Group (IS)
Principal researchers – Prof. Mykola Karpinsky, Prof. Sergiy Lysenko
Group members:
- Pavlo Bykovyy
- Lesya Dubchak
- Myroslav Komar
- Ihor Romanets
- Nazar Vivchar

Intelligent Cyber Security and Defense Group (ICSD)
Principal researchers – Prof. George Markowsky, Prof. Oleg Savenko
Group members:
- Pavlo Bykovyy
- Vladimir Golovko
- Stepan Ivasiev
- Volodymyr Karpinskyy
- Myroslav Komar
- Pavlo Radiuk
- Vasyl Yatskiv

Metrology of Information Measuring Systems Group (MIMS)
Principal researcher – Prof. Roman Kochan
Group members:
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- Olexandr Osolinskyi
- Hryhorii Sapozhnyk
- Nadiia Vasylkiv

Design and Testing of FPGA Component for Safety Related Systems (DTFPGA)
Principal researchers – Prof. Vladimir Opanasenko, DSc Kostiantyn Zashcholkin
Group members:
- Viktor Antoniuk

- Miroslav Drozd
- Oleksandr Martynyuk
- Olexandr Osolinskyi

Virtual Insruments for IoT (VIIoT)

Principal researcher – Prof. Orest Kochan
Group members:

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- Ivan Kit
- Volodymyr Kochan
- Oleksandr Osolinskyi

Big Data and Data Sciences (BDDS)

Principal researchers – Prof. Natalya Shakhovska, Prof. Vasyl Lytvyn
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- Myroslav Komar
- Khrystyna Lipyanina-Goncharenko
- Anatoliy Sachenko
- Oleg Savenko

Human-Computer Interraction Group (HCIG)

Principal researcher – Prof. Juergen Sieck
Group members:

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- Ivan Kit
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Hybrid Systems of Computational Intelligence (HSCI)

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- Serhii Kostiuk
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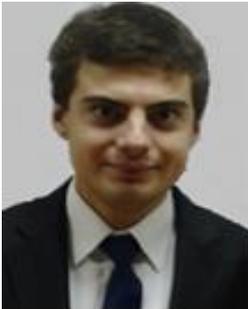
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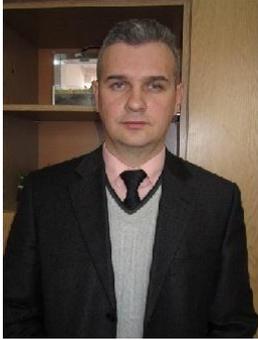
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Research interests: economic-mathematical ultisen, project management.

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Sergiy Lysenko

2005 – graduated from Khmelnytskyi National University with a degree in Computer Systems and Networks. 2011 – defended a candidate's thesis on the topic: "Adaptive information technology for diagnosing computer systems for the presence of Trojan programs" on 05.13.06 - "Information technologies". 2013 – obtained the academic title of associate professor of the Department of System Programming, IS group.

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Research interests: development of intelligent decision-making support systems, introduction of metrics for determining evaluations of various properties of knowledge bases, construction of ontologies of subject areas.

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Research interests: telecommunications; heterogeneous mobile communication networks.

George Markowsky

A Professor and Chair of Computer Science Missouri University of Science and Technology. George Markowsky has published 115 journal papers, book chapter, book reviews and conference papers on various aspects of Computer Science and Mathematics.

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Research interests: from pure mathematics to the application of mathematics and computer science to biological problems. He has also built voice controlled and enhanced keyboard terminals for use by paralyzed individuals.

Oleksandr Martynyuk

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Research interests: analysis of protocols and verification of computer networks, synthesis of tests for computer systems.

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Research interests: mathematical modeling, algorithms.

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Master (2017), Mathematical and Computer Modeling, Khmelnytskyi National University, PhD (2021), Computer Science, doctor of Science (1998), scholarship of the Cabinet of Ministers of Ukraine for young scientists (2014).

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Research interests: systems modeling and systems analysis; computer vision; optimization methods; artificial intelligence systems; data mining; machine learning; deep learning; medical image analysis and processing.

Sergey Rippa

Specialist in Organizing Machine Processing of Economic Information (1979), Rostov-on-Don Institute of National Economy, Ph. D. in Economic-Mathematical Methods and Usage of Computer Engineering in National Economy Control (1985), D. Sc. in Economic-Mathematical Modelling (1998), Head of Department of Calculating-Information Technologies Development at Taxing Problems Research Center at Academy of Tax Service of Ukraine (1999), Prof. (1999), Department of Intelligent Information Technologies, Head of KBO Group (2008), PPMITK Group Member (2014).

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Research interests: knowledge bases, ontology, knowledge discovering.

Oleksiy Roshchupkin

Specialist (2004), Computer Systems and Networks, Yuriy Fedkovych Chernivtsi National University, Assistant at Department of Computer Systems and Networks, Faculty of Computer Science, Yuriy Fedkovych Chernivtsi National University (2005), PhD Student at Ternopil National Economic University (2010), Computer Systems and Components, Head of IEEE student branch at TNEU, ISDA Group Member (2004).

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Research interests: information-measuring systems, microcontrollers, ultisensory systems, neural networks, sensors.

Bohdan Rusyn

Doctor of Technical Sciences (1998), professor, head of the department of methods and systems of image processing, analysis and identification of the Institute of Physics and Mechanics named after H. V. Karpenko of the National Academy of Sciences of Ukraine. Professor of the "Telecommunications" department of the Lviv Polytechnic National University.

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Research interests: pattern recognition systems with small databases; systems of synthesis, processing and recognition of complex structured images.

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Research Interests: Labour protection.

Anatoliy Sachenko

Specialist in Information Measurement Technology (1968), Ph.D. in Electrical Engineering (1978), Scientific Advisor of Branch Research Laboratory for Automated Systems and Networks (1984), DSc in Computer Engineering (1988), Prof. of Department for Information Computer Systems and Control (1991), Honored Inventor of Ukraine (1992), Full Member of Ukrainian Academy of Economic Cybernetics (1998) and New-York Academy of Sciences (1998), Member of Specialized Scientific Council in State University "Lviv Polytechnic" (1994), Chairman of Specialized Scientific Counsil K58.082.02 at TNEU (2002), Editor-in-Chief of International Journal of Computing, Doctoral Dissertations Chapter Editor in "IEEE I&M Magazine", Head of Department for Information Computer Systems and Control, Dean of Institute for Computer Information Technologies (1994-2005), Scientific Advisor of the ICS (2004), IDAACS 2001-2013 Co-Chairman, Head of IDS Group (2004), Co-Head of ICSD (2014), NNPC Group Member (2004), KBO, WSS Groups Member (2008), IPPR, PPMITK and SACTPC Groups Member (2014).

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Research interests: Artificial intelligent systems, distributed sensor networks, computational, intelligence, intelligent robotics systems, parallel computation systems, cybersecurity and safety systems, project management, wireless sensor networks.

Oleg Savenko

Specialist (1993), Mathematics, Kamyanets-Podilsky State Pedagogical Institute, PhD in Computer Systems and Components (1999), Dean of the Faculty of Programming and Computer and Telecommunication Systems, Khmelnytsky National University (2012), DSc. in Computer Systems and Components (2019), ICSD Group Member (2019).

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Research interests: Information security in computer systems and networks

Natalya Shakhovska

Doctor of technical sciences, professor, head of the department of artificial intelligence systems of the Institute of Computer Sciences and Information Technologies of the Lviv Polytechnic National University.

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Research interests: spaces and data repositories; intelligent decision support systems; methods of data integration and aggregation; methods of eliminating uncertainties; design of distributed information systems.

Jürgen Sieck

Master in Mathematics (1981), Humboldt University Berlin, Germany, PhD in Computer Science (1989), Humboldt University Berlin, Germany. Senior researcher at the research group "Informations- und Kommunikationsanwendungen" (INKA), professor for computer sciences with a ultisensoryn on algorithms, multimedia and mobile application for the degree programme Applied Computer Science at the University of Applied Sciences HTW Berlin. WSS Group member.

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Research Interests: multimedia, computer graphics, virtual reality and wireless communication.

Radislav Smid

Ph.D. (2000), Czech Technical university in Prague, Faculty of Electrical Engineering, Head of Laboratory of Diagnostics and Non-destructive Testing, Associate Professor at Department of Measurement, Faculty of Electrical Engineering, Czech Technical university in Prague, Prague, CzechRepublic. Dr Smid is a member of IMEKO and IEEE. ISDA Group member.

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Research Interests: signal processing, measuring, testing, autonomous sensors embedded computer systems.

Taras Tsavolyk

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Research interests: wireless sensor networks, the system of residual classes.

Iryna Turchenko

Specialist (1997), Information Systems in Management, Ternopil Academy of National Economy, training lecturer (2002), Department of Specialized Computer Systems, Ph. D. Student (2003), Information Technologies, Lecturer (2006), Department for Information Computer Systems and Control, Ph. D. (2008), Computer Systems and Components, Assistant Professor of Department for Information Computer Systems and Control (2011), ISDA Group Member (2004).

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Research interests: neural networks, intelligent and distributed sensor networks, multi-parameter sensors.

Volodymyr Turchenko

Specialist (1995), Computing Machines, Systems, Complexes and Networks, Brest Polytechnic Institute (rep. Belarus), Ph. D. in Computer Engineering (2001), Assistant Professor (2002), Associate Professor (2004), Department for Information Computer Systems and Control, IEEE member (1999), IDAACS 2001-2011 OrgCom Vice-Chair and member, member of Specialized Academic Council K58.082.02 at TNEU (2002-2009), FP7 Marie Curie Postdoctoral Research Fellow at the Center of Excellence of High Performance Computing, Department of Electronics, Informatics and Systems, University of Calabria, Italy (2009-2011), Deputy editor-in-chief of International Journal "Computing" (2009), ACM member (2009-2011), Member of Marie-Curie Association, Head of NNPC Group (2004).

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Research interests: Neural networks, parallel programming, parallel and distributed computations.

Nadiia Vasylkiv

Specialist (1981), Physics, Lviv State University, Senior Lecturer (1995), Department for Information Computer Systems and Control, Ph. D. in Devices and Methods of Heat Value Measuring (2011), Assistant Professor of Department for Information Computer Systems and Control (2011), ISDA group member (2012), MIMS groups member (2014).

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Research interests: metrological support for information measurement systems.

Serhii Vladov
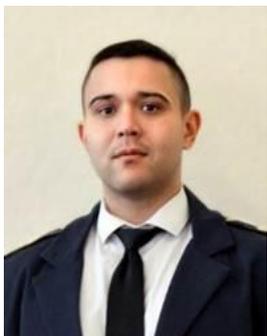
Bachelor (2010), Kremenchuk Mykhailo Ostrogradsky National University, specialty - electronic devices (specialization - production of electronic devices), qualification - technical specialist in electronic devices, Ph.D. Kharkiv National University of Radio Electronics, specialty 05.11.17 - Biological and medical devices and systems (152 Metrology and information and measuring equipment; 163 Biomedical engineering) (2015).

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Research interests: Information systems for control and diagnostics of gas turbine engines, Reliability and diagnostics of aviation equipment, Thermodynamics and heat transfer, Operation of aircraft equipment in aviation units of the Ministry of Internal Affairs, Technical diagnostics and non-destructive testing.

Orest Volynskyy

Master (2009), Specialized Computer Systems, Ternopil National Economic University, Training-Researcher RIICS (2009), Ph. D. (2013), ITSCS group member (2009), WSS group member (2014).

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Reasearch interests: special processors in bounded systems of resiadual classes.

Artur Voronych

Master (2008), Automation Control of Technological Processes, Ph.D. student (2010), Department of Computer Systems and Network, Ivano-Frankivsk National Technical University of Oil and Gas, ITSCS group (2012).

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Research interests: signal processing, theory of information and data encryption.

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Specialist (1998), Management Information Systems, Ternopil Academy of National Economy, PhD student (2005), Computers, Systems and Networks, lecturer (2009), Department of Specialized Computer Systems, PhD (2009), Computer Systems and Components, ITSCS group (2013).

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Research interests: computer systems design, information theory and data decoding, lower computer networks.

Carsten Wolff

A full professor for computer science at Dortmund University of Applied Sciences and Arts since 2007. He studied electrical engineering and economics at Paderborn University and did a PhD in electrical engineering at the Heinz Nixdorf Institute. In his industrial career, Dr. Wolff was in the semiconductor industry (Infineon AG). He is a founding member of the research centre PIMES (www.pimes.de).

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Research interests: development of methodology and tools for embedded systems, processing technologies and transmission projects in the field of mechatronic systems, mobile communication and renewable energy sources.

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Reasearch interests: human-computer ultisensor; wireless communication technologies**.**

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Research interests: cordless optical connection channels, modular arithmetic based special processors development.

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Reasearch interests: image identification, image analysis algorithms for computer recognition systems.

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Research interests: FPGA-based systems, digital watermarks, digital steganography.

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Research interests: computational internet, medical image processing.

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Research interests: data mining, databases, computer systems and networks.

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

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Research interests: Network security, wavelet analysis, real-time threat detection, Haar's wavelet transform, interdisciplinary approach, Internet of Things security, cybersecurity, anomaly detection.

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Research interests: Wi-Fi, VoIP, LAN, Cybersecurity, Video surveillance, Linux.

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Research interests: project management.

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Research interests: project management.

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

3. RESEARCH PROJECTS

Current

[Project 1]   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 Zagorodnya

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 2]   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 3] **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.
- Western Ukrainian National University (Ukraine, Ternopil), WUNU.
- viv 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/

[Project 4] **"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 5] **"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 tom project web-site: https://go-study-europe.de/vimacs/

[Project 6]   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
- Azerbaycan Respublikasi Dovletgomruk Komitesinin Akademiyasi
- Azerbaycan Dovlet Neft ve Senaye Unversiteti
- 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 Vasylkiv;
- 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/

Completed projects

[Project 7]   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 8] **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 Kaniovskyi;
- Denys Zolotukhin;
- Andriy Sydor;
- Dmytro Lendiuk.

[Project 9]   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 10]   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 knowledghe 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 architucture 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 Vasylkiv;
- Taras Lendyuk;
- Pavlo Bykovyy;
- Diana Zahorodnia;
- Vitaliy Dorosh;
- Oleksandr Osolinskyy;
- Grygoriy Gladiy;
- Oleksiy Roshchupkin;
- Volodymyr Turchenko

[Project 11]   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 Strubytska;
- Zbyshek Dombrovskiy;
- Mykhailo Dombrovskiy
- Oksana Dunets;
- Pavlo Bykovyy;
- Diana Zahorodnia;
- Oleksandr Osolonskyy;
- Vitaliy Dorosh

[Project 12]   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 13] **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 (VSN) 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 14]   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 15]   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 Vasylkiv;
- Oleksiy Roshchupkin;
- Diana Zahorodnia;
- Yuriy Ivanyshak;
- Olexandr Osolinsky;
- Taras Lendyuk;
- Oksana Dunets.

[Project 16] **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, whih provide high efficiency of parallelization and development of grid-based library functions for paralel 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 Humenyy

[Project 17] 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 18] **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 19]   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 20]   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 21]   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 humen 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 22]   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 relive 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 – Kyyiv: 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 23]   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 of 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 24]   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

Objectifes: 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 25] 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 26]   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 (CIMSA 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 27]   Computer Telecommunication System Based on Noise Signals

Principal investigator: Prof. Yaroslav Nikolaychuk

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 28] 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., Vasylkiv 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 netwok 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 secuential interfaces controllers realization // Proceedings of 11-th International Conference "System Analysis and Information Technologies" (SAIT-2009). – Kyyiv (Ukraine), 2009. – pp. 437.

7. Maykiv I.M. Netwok capable application processor for distributer measuring-control systems // Transaction "Problems of Informatization and Control", Kyyiv (Ukraine). – 2009. – No. 2 (28). – pp. 187-191.

8. Maykiv I.M. Universal controlle of serial interfaces // Transactions of Chernivstsi University. Series: Physics. Electronics, Chernnivtsi (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 29]   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 ans Management. -2007. Las Vegas, NV (USA).

[Project 30] 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 Khmelnytskyy 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 31]   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 intelectulazation 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 32]   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 33] 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 34]   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., Vasylkiv 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 Simposium SAS'2009, 17-19 February, 2009, New Orleans, USA, pp. 293-297.

[Project 35] **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 36]   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 37]   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 38]   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 39] 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 40] 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 41]   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 Vasylkiv
-   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., Vasylkiv 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 42]   Using Multisensor Fusion and Neural Networks Techniques for Robot Control
Foreign partner: Laboratory of Robotics Systems, Unevirsity 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 43] 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., Vasylkiv 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 Intenational 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 Bandwith 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:

- 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 та 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 Cracov Tehnology University, Cracov, 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.
  - Sposors: 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
  - Sposors: 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: Anatoly 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 atCzech Technical University, Office of Naval Research, Honeywell spol. S r.o., H TEST a.s., authorized distributor of Agilent Technologies Agilent TechnologiesH 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'202020) 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 Hononary 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 Hononary 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 Hononary Chairman: Anatoliy Sachenko, Ukraine;
- Symposium Co-Chairmen: Volodymyr Brovkov, 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 Hononary Chairman: Anatoliy Sachenko, Ukraine;
- Symposium Co-Chairmen: Svitlana Antoshchuk, Volodymyr Brovkov, 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 Hononary 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 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.

Since November 2016, the IJC Journal is indexed in Scopus Elsevier. In addition, the Journal is indexed by Finnish publication forum, Norwegian Social Science Data Services, Google Scholar, and Index Copernicus International.

Journal Topics are: Algorithms and Data Structure, Software Tools and Environments; Bio-Informatics; Computational Intelligence; Computer Modeling and Simulation; Cyber and Homeland Security; Data Communications and Networking; Data Mining, Knowledge Bases and Ontology; Data Science; Digital Signal Processing; Distributed Systems and Remote Control; Education in Computing; Embedded Systems; High Performance Computing, GRIDs, Parallel and Distributed Computing; Human-Computer Interaction; Image Processing and Pattern Recognition; Intelligent Robotics Systems; Internet of Things; IT Project Management; Systems and Control; Wireless Systems.

Co-Editors-in-Chief: Prof. Anatoliy Sachenko, Research Institute for Intelligent Computer Systems, West Ukrainian National University, Ukraine; Prof. George Markowsky, Kennesaw State University, United States; Dr. Piotr Bilski, Institute of Radioelectronics, Warsaw University of Technology, Poland; Executive Editor, Dr. Volodymyr Turchenko, Ontario Institute for Studies in Education, University of Toronto, Canada; Associate Editors: Prof. Francesca Guerriero, University of Calabria, Italy; Prof. Tetiana Hovorushchenko, Khmelnytskyi National University, Ukraine, Prof. Robert E. Hiromoto, Department of Computer Science, University of Idaho, United States, Prof. Volodymyr Kochan, Research Institute for Intelligent Computer Systems, West Ukrainian National University, Ukraine. The Journal staff includes Mr. Taras Lendyuk, the Technical Editor, Dr Inna Shylinska, the Language Editor and Mrs. Halyna Kryva, the Economist.

The Editorial Board consists of more than 75 recognised scientists from 21 countries: Bulgaria, Canada, China, Czech Republic, Estonia, France, Germany, Greece, Italy, Japan, Lithuania, Mexico, Norway, Poland, Portugal, Romania, Slovakia, South Africa, Spain, Ukraine, USA.
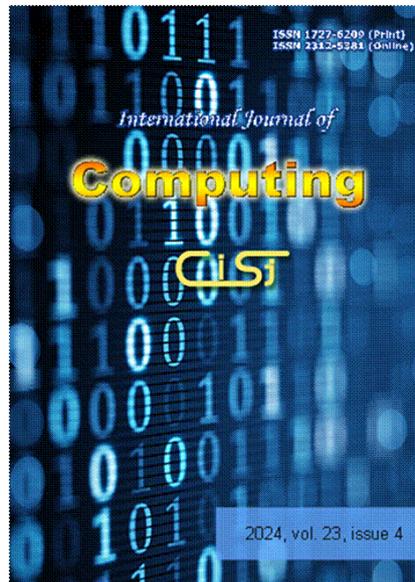
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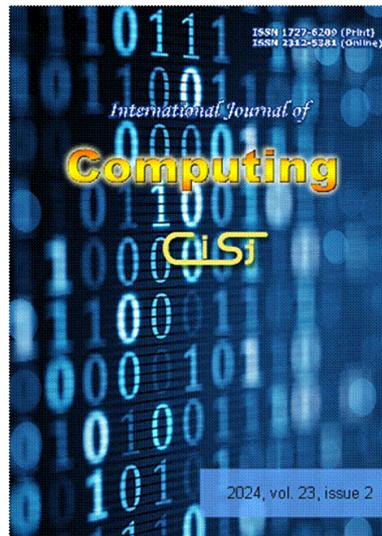
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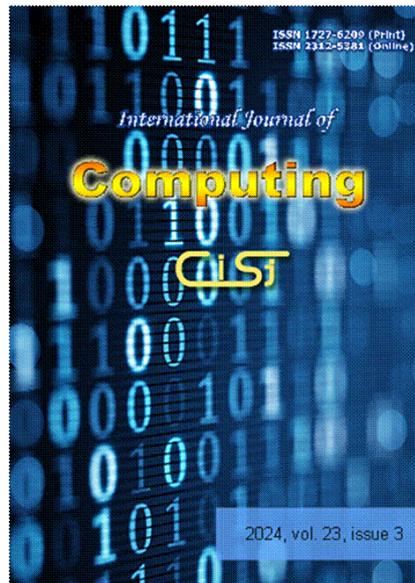
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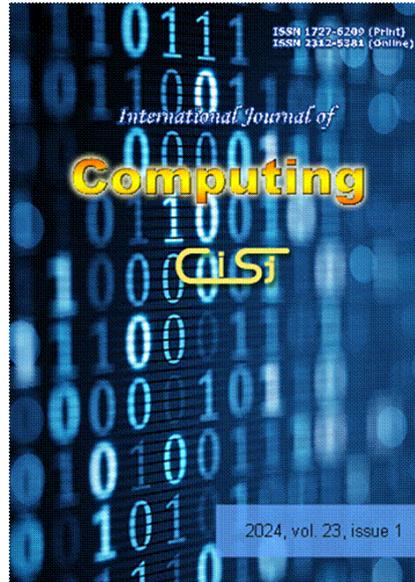
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Specialized Scientific Council K58.082.02

Specialized scientific council in specialties:
- 05.13.05 – Computer Systems and Components;
- 05.13.06 – Information Technologies;

In 2024, the following dissertations were defended:

– Manzhula V.I. – doctoral dissertation on the topic: "Methods and software tools for identifying interval models of static systems with nonlinear characteristics" in the specialty 01.05.02 – Mathematical modeling and computational methods. Specialized academic council DF 58.082.02 at the West Ukrainian National University.

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, Khmelnytskyy, 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. A. Drozd, Odessa National Polytechnic 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

List of scientific meetings, which were held by I&M/CI Chapter:

I. On March 27, 2024, as part of the joint international seminar "Advances & Challenges in Computing", an online meeting of the joint session of the IEEE I&M/CI section was held. The meeting began with a report by Dr. Viktor Kremen, Senior Chief Engineer at Infineon Technologies. The topic of his speech was "Trends and Challenges in Displays and Sensor Technologies for Vehicles". The second speaker was Ivan Zholubak, Senior Lecturer at the Department of Electronic Computing at the National University "Lviv Polytechnic", with the topic "Methods and Tools for Implementing Galois Field Multipliers GF(pn) in FPGAs for Cyber-Physical Systems". 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 Western Ukrainian National University and Institute of Cybernetics of V. M. Glushkov NAS of Ukraine, presented a report

on the topic "Current Status and Future Scientific Projects and Conferences". The event was attended by 30 participants, including 10 IEEE members.

II. On June 26, 2024, as part of the joint international seminar "Advances & Challenges in Computing", an online meeting of the joint session of the IEEE I&M/CI section was held. The meeting began with a report by Ph.D. Serhiy Vladov, Head of the Department of Scientific Labor Organization and Gender Issues, Kremenchuk Flight College of the Kharkiv National University of Internal Affairs. The topic of his speech was "Monitoring of Helicopter Turboshaft Engines Using Neural Networks During Operation". After discussion, his report was recommended for publication in the International Journal of Computing. The second speaker was Prof. Anatoliy Sachenko, Director of the Research Institute of Intelligent Computer Systems of the Western Ukrainian National University and Institute of Cybernetics of V. M. Glushkov NAS of Ukraine, who presented a report on the topic "Current Status and Future Scientific Projects and Conferences." The event was attended by 30 participants, including 10 IEEE members.
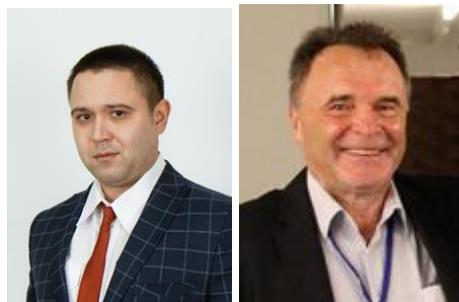
III. On September 25, 2024, as part of the regular international seminar "Advances & Challenges in Computing", an online meeting of the joint session of the IEEE I&M/CI section was held. The meeting began with a report by Ph.D. Volodymyr Manzhula, Associate Professor of the Department of Computer Science of the Western Ukrainian National University. The topic of his speech was "Methods and software tools for identifying interval models of static systems with nonlinear characteristics". After discussion, his report was recommended for publication in the International Journal of Computing. The second speaker was Prof. Anatoliy Sachenko, Director of the Research Institute of Intelligent Computer Systems of the Western Ukrainian National University and Institute of Cybernetics of V. M. Glushkov NAS of Ukraine, who presented a report on the topic "Current status and future scientific projects and conferences". The event was attended by 23 participants, including 10 IEEE members.

IV. On December 18, 2024, as part of the joint international seminar "Advances & Challenges in Computing", an online meeting of the joint session of the IEEE I&M/CI section was held. The meeting began with a report by Dr. Marina Kolisnyk, Associate Professor of the Department of Computer Systems, Networks and Cybersecurity of the National Aerospace University "Khaylovar". The topic of her speech was "Methods and Models for Ensuring Reliability (Fault Tolerance and Cybersecurity) of Industrial Internet of Things Systems". After discussion, her report was recommended for publication in the International Journal of Computing. The second speaker was Prof. Anatoliy Sachenko, Director of the Research Institute of Intelligent Computer Systems of the West Ukrainian National University and the Institute of Cybernetics of V. M. Glushkov NAS of Ukraine, who presented a report on the topic "Current Status and Future Scientific Projects and Conferences." The event was attended by 35 participants, including 10 IEEE members.

IEEE Student Branch

The Institute of Electrotechnical and Electronics Engineers (IEEE) Student Branch at Ternopil National Economic University (TNEU) was founded in 1998.

Student Branch involves students of the Faculty of Computer Information Technologies, PhD students and junior researchers of TNEU. The 3 active members of the Student Branch were in 2019. The Branch Committee consists of the Chairperson – O. Dunets, a Student Branch Advisor is Prof. Anatoliy Sachenko.

Members of the IEEE Student Branch at TNEU take a part in international schools as well as international conferences and projects. Also, they assisted in organization and preparation of the series of Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS)) – IDAACS'2003, IDAACS'2005, IDAACS'2007, IDAACS'2009, IDAACS'2011, IDAACS'2013, IDAACS'2015, IDAACS'2017 and IDAACS'2019.

The main advantages of IEEE membership include access to IEEE electronic resources, IEEE subscription in the scientific magazines and popular scientific literature "Spectrum", "Computer", "IEEE Transaction on Instrumentation and Measurement"; assistance and discounts for participation at international conferences, for example, being a member of IEEE a scientist could win a travel grant to the conference in the country region (Ukraine, along with Europe, Middle East and Africa, belongs to region 8). Almost all conferences sponsored by IEEE offer discounts to students for registration fee, participation in competitions organized by IEEE in the region.

Overall, IEEE supports scientific activities of students and young scientists, supporting them in the development of their scientific career, increases collaboration between scientists from different universities and international scientific – educational organizations. For example, IEEE members have access to a digital library of articles Xplore IEEE conferences, are printed journals IEEE, have the opportunity to join the scientific communities in different scientific fields can win grants to visit academic conferences and receive a discount when registering them. Also, between branches and regions there is a contest for the best scientific article or website and mobile robots. Each of these competitions is accompanied by cash prizes.

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, Kyyiv, 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] Fachochschule Dortmunt, 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, Defended PhD Theses and Master Theses

Defended PhD and Doctoral Theses

[Def 1] Diana Zagorodnya, awarded the academic title of Associate Professor of the Department of Information and Computing Systems and Management.
[Def 2] Andriy Melnyk, awarded the academic title of Professor of the Department of Computer Science.

Awarded Degrees

[Def 3] Volodymyr Manzhula, dissertation for the degree of Doctor of Technical Sciences, "Methods and software tools for identifying interval models of static systems with nonlinear characteristics", 01.05.02 - mathematical modeling and computational methods.
[Def 4] Arzu Khalilov. Management of construction projects using BIM technologies and artificial intelligence on a digital platform. Specialty: 073 - Management Field of knowledge: 07 -

"Management and administration" 2024. Supervisor: Doctor of Technical Sciences, Prof. Bushuev S.D.

[Def 5] Bogdan Savenko, dissertation for the degree of Doctor of Philosophy, "Method and partially centralized systems for detecting malicious software in computer networks", 123 - Computer Engineering. Supervisor - Doctor of Technical Sciences, Prof. Lysenko S.M.

Defended Master Theses

[DefMas 1]   Oleksandr Babenko, A Multi-Criteria Analysis Method for Choosing SQL or NoSQL Databases Based on Project Conditions Ph.D., D. I. Zahorodnia

[DefMas 2]   Volodymyr Hadevych, Method for Selecting Hardware Resources for Streaming Services Based on Ant Media Server Using Machine Learning Ph.D., Associate Professor, P. E. Bykovyy

[DefMas 3]   Yaroslav Gonchar, Methods of Missing Data Recovery Based on Neural Networks Professor, M. P. Komar

[DefMas 4]   Yuriy Gotyash, Method for Selecting Streaming Protocols RTMP and DASH Using Machine Learning Ph.D., Associate Professor, P. E. Bykovyy

[DefMas 5]   Rostyslav Hrytsay, Cloud-based real-time video transmission model, Ph.D., Associate Professor, O. R. Osolinsky

[DefMas 6]   Vladyslav Demchyshyn, IoT-Edge Model Based on Low Latency Data Flow and Distributed Deep Neural Network for Big Data Environment, Professor, V. V. Kochan

[DefMas 7]   Mykhailo Karnydal, Method for Detection and Classification of Vehicles Based on Computer Vision, Ph.D., Associate Professor, D. I. Zagorodnya

[DefMas 8]   Eduard Kolivoshko, Classification method for fake news based on keywords, Ph.D., Associate Professor, Kh. V. Lipyanina-Honcharenko

[DefMas 9]   Georgy Kondratyuk, A Method for Predicting Corporate Financial Distress Based on Deep Learning Using Semantic Features and User Reactions, Ph.D., Associate Professor, Kh. V. Lipyanina-Honcharenko

[DefMas 10] Oleksandr Kravets, IoT system for efficient water use in agriculture, Professor, V. V. Kochan

[DefMas 11] Bohdan Luchyshyn, Method for Developing a Discord Bot Based on Machine Learning for Stock Market Analysis, Ph.D., Associate Professor, P. E. Bykovyy

[DefMas 12] Svyatoslav Luchka, A Multistage Model for Deepfake Video Detection Based on Deep Learning, Professor, V. V. Kochan

[DefMas 13] Andriy Lyapandra, Models of Computational Resource Allocation between Fog Computing Systems and IoT Devices, Ph.D., I. M. Maykiv

[DefMas 14] Sergiy Maritchak, Neural Network Method for Object Recognition in Satellite Images, Doctor of Technical Sciences, Professor, M. P. Komar

[DefMas 15] Mykola Matviychuk, A Model for Integrating Emotional, Semantic, and Domain Features for Fake News Detection, Ph.D., Associate Professor, Kh. V. Lip'yanina-Honcharenko

[DefMas 16] Volodymyr Oleshchuk, A secure data routing method for the Internet of Things, Ph.D., Associate Professor, D. I. Zahorodnia

[DefMas 17] Antony Parkhin, Methods for Recovering Missing and Corrupted Data in Internet of Things Networks, Professor, M. P. Komar

[DefMas 18] Nazar Pylypyak, Method for Enhancing the Trustworthiness of IoT Network Nodes Based on Ensemble Deep Learning, Professor, V. V. Kochan

[DefMas 19] Oleksandr Protsyk, Warehouse Inventory Management Model Based on Computer Vision and Machine Learning Technologies, Professor, M. P. Komar

[DefMas 20] Viktor Ryabiy, Neural Network Method for Generating Personalized Horoscopes for a Web Application Ph.D., Associate Professor, D. I. Zagorodnya

[DefMas 21] Andriy Sereda, Method for Counting Grains in Wheat Spikes Using Deep Learning Algorithms, Ph.D., Associate Professor, D. I. Zagorodnya

[DefMas 22] Sofia Tarasyuk, Speech Emotion Recognition Method Based on Deep Learning, Ph.D., Associate Professor, Kh. V. Lip'yanina-Honcharenko

[DefMas 23] Andriy Vysotsky, A Project Selection Model for Pharmaceutical Portfolio under Cost Uncertainty Based on Binary Decision Trees, Ph.D., I. M. Maykiv

[DefMas 24] Oleksandr Vivchar, IT project management using artificial intelligence tools, Ph.D., Associate Professor, I. V. Turchenko

[DefMas 25] Nazar Vivyurka, Software Project Defect Prediction Model Based on Machine Learning, Ph.D., I. M. Maykiv

[DefMas 26] Vadym Vintskevich, Project Management of the product experimentation platform development, Ph.D., Associate Professor, I. V. Turchenko

[DefMas 27] Nikola Kostyuk, Human Resource Capacity Planning in Scrum team of IT project, Ph.D., Associate Professor, I. V. Turchenko

[DefMas 28] Nazariy Levandivskyi, A Metamodel for Integrating Business Goals and Technologies in Machine Learning Projects, Ph.D., I. M. Maykiv

[DefMas 29] Andriy Mys, Method for Risk Prediction in Software Projects Using Machine Learning. Ph.D., Associate Professor, G. M. Hladiy

[DefMas 30] Andriy Mormul, The Software Cost Estimation Method Based on Analogies Using an Evolutionary Approach and Machine Learning, Ph.D., I. M. Maykiv

[DefMas 31] Bohdan Rypich, Method for Software Development Project Management Based on Fuzzy Logic and Neural Networks, Ph.D., Associate Professor, G. M. Hladiy

[DefMas 32] Sofia Stuliy, Methodology for the Transition from Agile to ShapeUp Technology in IT Project Management, Ph.D., Associate Professor, G. M. Hladiy

[DefMas 33] Bohdan Sulyma, Predicting Method delays and cost overruns in engineering projects using deep learning models, Ph.D., I. M. Maykiv

[DefMas 34] Alina Farafonova, Flexible Management of the Computerization Project for the Homeless Animal Adoption Center, Ph.D. (Econ.), Associate Professor, G. M. Hladiy

[DefMas 35] Vadym Shevchuk, Project Management Model and Implementation of a System for Effective Buffer Monitoring and Management Based on Blockchain Technology, Ph.D. (Econ.), Associate Professor, G. M. Hladiy

[DefMas 36] Vladyslav Nykytchuk, Green Energy Multi-Project Management in European sustainable development policy context, Ph.D., M. Z. Dombrovskyy

[DefMas 37] Tetyana Knysh, Method of creation and functioning of deep neural networks based on the evolutionary approach, Professor, M. P. Komar

[DefMas 38] Katerina Kravets, Text Classification Method Based on Deep Learning, Professor, M. P. Komar

[DefMas 39] Khrystina Khrun, Deep Neural Network Model for Stock Index Prediction Based on Big Data, Professor, V. V. Kochan

[DefMas 40] Yuriy Turchyn, Algorithms of access distribution in IP-telephony, Ph.D., Associate Professor, L. O. Dubchak

[DefMas 41] Yuriy Kononovich, Algorithm for assessing the stability of cryptoprotocols, Ph.D., Associate Professor, L. O. Dubchak

[DefMas 42] Marta Miruta, Algorithm of fuzzy management of a "smart" house, Ph.D., Associate Professor, L. O. Dubchak

[DefMas 43] Denys Tsymbal, Algorithms of fuzzy management of the enterprise security system, Ph.D., Associate Professor, L. O. Dubchak

[DefMas 44] Yuriy Dmytriv, Automated system for monitoring air quality in cities using IoT, Ph.D., I. M. Maykiv

[DefMas 45] Roman Dolinovsky, Automated IoT system for efficient water use in agriculture, Ph.D., I. M. Maykiv

[DefMas 46] Taras Maykiv, Automated greenhouse sprayer carriage control system, Ph.D., O. M. Zastavny

[DefMas 47] Volodymyr Martyts, Computer-integrated system for real-time monitoring and management of traffic in the IoT environment, Ph.D., I. M. Maykiv

[DefMas 48] Taras Priemsky, Automated system for creating a holographic digital twin of equipment, Professor, A. O. Sachenko

[DefMas 49] Andriy Protsyk, Automated system for preparation of nutrient solutions for hydroponics systems, Professor, A. O. Sachenko

[DefMas 50] Andriy Dunets, Automation system for the process of moving and separating oil refining products, Professor, N. Ya. Vozna

[DefMas 51] Roman Dyakun, Computerized control system for the robotic portion mechanism, Professor, N. Ya. Vozna

[DefMas 52] Iryna Kin, Automation system for the warehouse production process, Professor, N. Ya. Vozna

[DefMas 53] Andriy Luchka, Integrated system of regional environmental monitoring and management based on the Internet of Things, Professor, V. V. Kochan

[DefMas 54] Andriy Popyk, Automated system for detecting attacks on IoT networks based on MQTT, Ph.D., I. M. Maykiv

[DefMas 55] Yaroslav Rodz, Automated car wash control system, Ph.D., O. M. Zastavny

[DefMas 56] Mykhailo Stakhiv, Computer-integrated system based on IoT and holographic technologies for monitoring and managing industrial processes, Professor, A. O. Sachenko

[DefMas 57] Bohdan Shevchuk, Automated liquid product packaging system, Ph.D., O. M. Zastavny

[DefMas 58] Volodymyr Shevchuk, Automated system for the separation process of naphtha-gas-water mixture, Professor, N. Ya. Vozna

[DefMas 59] Dmytro Yurchuk, IoT system for automating energy consumption monitoring in residential complexes, Professor, A. O. Sachenko

[DefMas 60] Alina Yavna, Automated robot processing system for the production of prosthetic parts, Professor, N. Ya. Vozna

[DefMas 61] Yuriy Yakubets, Automated home control system using Bluetooth and Android, Ph.D., Associate Professor, O. R. Osolinsky

[DefMas 62] Volodymyr Basarabchuk, Automated system for monitoring the condition of road surfaces using IoT, Ph.D., I. M. Maykiv

[DefMas 63] Nazariy Korenkivskyi, Automated greenhouse microclimate control system, Ph.D., O. M. Zastavny

[DefMas 64] Volodymyr Kulikovskyi, Computer-integrated IoT system for forecasting and optimizing energy consumption in smart grids, Professor, V. V. Kochan

[DefMas 65] Oleg Martsiyash, Automated control system of the heating system at the car wash, Ph.D., O. M. Zastavnyi

[DefMas 66] Nikola Stefanyshyn, Automated system for detecting cyberattacks on industrial facilities, Professor, A. O. Sachenko

[DefMas 67] Eduard Tarasyuk, Automated system for data collection and analysis in the concept of digital twins, Professor, A. O. Sachenko

[DefMas 68] Taras Budnik, Gamified learning elements to increase student motivation, Doctor of Technical Sciences, Professor, Pasichnyk R.M.

[DefMas 69] Andriy Holovatyy, A system for generating quest tasks to stimulate the acquisition of programming skills, Doctor of Technical Sciences, Professor, Pasichnyk R.M.

[DefMas 70] Ruslana Kolinets, Methods for detecting authentication vulnerabilities in Saas-services, Doctor of Technical Sciences, Professor, Pasichnyk R.M.

[DefMas 71] Oleksandr Stadnytskyi, A system for assessing the quality of acquired skills in educational games. Development of automatic assessment and verification systems that are integrated into educational games, Professor, Pasichnyk R.M.

[DefMas 72] Dmytro Bobyk, Malware Detection Algorithms for Android OS Doctor of Technical Sciences, Professor, V. V. Yatskiv

[DefMas 73] Ivan Kashtelyan, Algorithms for Privacy Protection During Data Analysis, Ph.D. S. V. Ivasiev

[DefMas 74] Andriy Lototsky, Cryptographic Data Protection Algorithms in Cloud Services, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 75] Stepan Melnyk, Method of Detecting the Vulnerability of WEB Resources Using SQL Injections, T. G. Tsavolyk

[DefMas 76] Roman Myronyuk, Distributed Key Generation Based on Schnorr Threshold Signature, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 77] Oleg Petryk, Evaluation of the Effectiveness of Algorithms for Detecting and

Preventing DDoS Attacks in Corporate Networks, Ph.D., S. V. Ivasiev

[DefMas 78] Pavlo Bylen, Intelligence Algorithms for Open Sources in Cyber-Security Tasks, Ph.D., S. V. Ivasiev

[DefMas 79] Dmytro Vasylkiv, Locality-Sensitive Hash-Based Malware Detection Algorithms, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 80] Arsen Vitvitskyi, A Specialized Password Management System for Access to Enterprise Resources, Ph.D., S. V. Ivasiev

[DefMas 81] Viktor Voloshin, An Intrusion Detection System for the Internet of Things, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 82] Roman Dudanets, Digital Signature Algorithm Based on the Niederreiter Cryptosystem, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 83] Vitaly Zayats, Data Encryption Algorithms Based on Codes for the Internet of Things, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 84] Maxim Kalushka, Algorithms of Hybrid Encryption, Professor, V. V. Yatskiv

[DefMas 85] Aladdin Mabrouk, Cyber-Security Incident Detection System Using Security Onion, Professor, V. V. Yatskiv

[DefMas 86] Mykyta Onyshchenko, Algorithms for Authentication of Industrial Internet of Things Devices, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 87] Andriy Pekar, Algorithms of User Identification and Management of Access to Network Resources, Ph.D., T. G. Tsavolik

[DefMas 88] Rostislav Radchuk, A Method of Encryption Images in the Residue Number System, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 89] Oleg Romaniv, Malware Detection and Protection Algorithms, Ph.D., S. V. Ivasiev

[DefMas 90] Orest-Ostap Romaniuk, Monitoring Dark Web Resources Using Open Source Intelligence to Prevent Cybercrime, Ph.D., T. G. Tsavolik

[DefMas 91] Vladislav Sviridov, Algorithms for Detecting Anomalous Internet of Things Traffic, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 92] Nazariy Stadnik, Digital Signature Algorithms Based on the Hash Function, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 93] Andriy Tymchak, Homomorphic Encryption Algorithms for Secure Cloud Computing, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 94] Nazariy Flyashko, Malware Detection Algorithms Using Wazuh, Ph.D., Associate Professor, N. G. Yatskiv

[DefMas 95] Vadim Shukhmann, Digital Signature Algorithms for Blockchain Technologies, Professor, V. V. Yatskiv

Intership of Staff, PhD Students and Students

Staff Intership

[Internship 1] Diana Zagorodnia, Associate Professor, Department of Information and Computing Systems and Management, Silesian University of Technology (Republic of Poland), January-March 2024

[Internship 2] Oleksandr Osolinskiy, Associate Professor, Department of Information and Computing Systems and Management, IT company Sigma Software, program "SSWU: Teachers' Smart Up:Winter Edition 3.0", January 2024

[Internship 3] Vasyl Koval, Associate Professor of the Department of Information and Computing Systems and Management, IT company Sigma Software University, program "TEACHERS` SMARTUP: Summer Edition 2024", July 2024.

[Internship 4] Vasyl Koval, Associate Professor of the Department of Information and Computing Systems and Management, Research Institute of the Lublin Science and Technology Park and IESF International Foundation of Scientists and Educators, Lublin (Republic of Poland), October 2024.

Student Intership

[Internship 5] Dmytro Yefanov, FOP Dorosh Vitaliy Ivanovych, Lviv region, Sokalsky district, Ostriv village, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 6] Yuriy Kotkevych, Department of Digital Transformation of the Ternopil Regional State (Military) Administration, Tenopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 7] Volodymyr Tedash, FOP Halyas Yuriy Volodymyrovych, Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 8] Oleksandr Abenko, WUNU, Research Institute for Intelligent Computer Systems, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 9] Volodymyr Gadevych, PE "MagneticVan", Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 10] Yaroslav Gonchar, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village of Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 11] Yuriy Gotyash, PE "MagnetikVan", Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 12] Rostyslav Hrytsay, LLC "MagneticVan Municipal Technologies", Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 13] Vladislav Demchyshyn, LLC "MagneticVan Municipal Technologies", Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 14] Mykhailo Karnydal, LLC "Lionwood Software Ukraine", Lviv, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 15] Eduard Kolivoshko, Department of Digital Transformation of the Ternopil Regional State (Military) Administration, Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 16] Georgy Kondratyuk, Department of Digital Transformation of the Ternopil Regional State (Military) Administration, Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 17] Oleksandr Kravets, Individual Entrepreneur Dorosh Vitaliy Ivanovych, Lviv region, Sokal district, Ostriv village, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 18] Bohdan Luchyshyn, Individual Entrepreneur Tedash Volodymyr Ivanovych, Lviv region, Drohobych district, Drohobych city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 19] Andriy Lyapandra, Individual Entrepreneur Dyug Dmytro Anatoliyovych, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 20] Serhiy Maritchak, Individual Entrepreneur Dyug Dmytro Anatoliyovych, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 21] Mykola Matviychuk, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village of Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 22] Antony Parkhin, FOP Poydych Vladyslav Serhiyovych, Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 23] Nazar Pylypyak, LLC "INTELLIAS SOLUTIONS", Lviv city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 24] Oleksandr Protsyk, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village of Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 25] Viktor Ryabiy, LLC "ELEKS", Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 26] Andriy Sereda, FOP Poydych Vladyslav Serhiyovych, Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 27] Sofia Tarasyuk, FOP Broschak Ivan Ivanovych, Ternopil region, Ternopil district, village Ostriv, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 28] Bohdan Kravchuk, LLC "MagneticVan Municipal Technologies", Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 29] Andriy Vlasenko, LLC "Fighting Birds of Ukraine", Bila Tserkva city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 30] Andriy Vysotsky, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 31] Oleksandr Vivchar, FOP Kostyuk Mykola Igorovych, Ternopil city, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 32] Nazar Vivyurka, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 33] Vadym Vintskevich, LLC "Community Film Production", Kyiv, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 34] Mykola Kostyuk, LLC "ELEKS", Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 35] Nazariy Levandivsky, PE "MagnetikVan", Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 36] Andriy Mys, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 37] Andriy Mormul, LLC "TI-SPARK", Kharkiv region, Kharkiv district, village of Tsyrkuny, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 38] Bogdan Rypych, LLC "Relokia", Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 39] Bogdan Sulima, WUNU, Research Institute for Intelligent Computer Systems, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 40] Alina Farafonova, FOP Galyas Yuriy Volodymyrovych, Ternopil, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 41] Vadym Shevchuk, WUNU, Research Institute for Intelligent Computer Systems, Doctor of Technical Sciences, Professor, M. P. Komar

[Internship 42] Mykola Shynkarchuk, LLC "AKSDRAFT", Kyiv, Doctor of Technical Sciences, Professor, M. P. Komar

6. PUBLICATIONS

Monographs (Parts of Monographs), Books (Parts of Books)

[Publ 1]. Knowledge-oriented systems for the identification of interval mathematical models of complex dynamic and static objects [Electronic resource]: monograph / M. P. Dyvak, A. M. Melnyk, V. I. Manzhula [et al.]. - Ternopil: ZUNU, 2024. - 288 p.

[Publ 2]. V. Yesin, M. Karpinski, M. Yesina, V. Vilihura, R. Kozak, and R. Shevchuk, "Introducing a Technique for Searching Data in a Cryptographically Protected SQL Database", MCSCD-V1, pp. 1–29, Jul. 2024.

[Publ 3]. Data encoding and organization of distributed databases in extended Galois fields / Sharyak V.V., Vozna N.Ya., Nikolaychuk Y.M. - Ternopil: ZUNU, 2024. - 267 p.

Journal Papers

[Publ 4]. Nataliia Vozna. New Approach to Assessing Structural Complexity. In: Artificial Intelligence, Medical Engineering and Education. IOS Press, 2024. p. 351-365. https://ebooks.iospress.nl/doi/10.3233/ATDE231346

[Publ 5]. Lipianina-Honcharenko, K., Bodyanskiy, Y., Kustra, N., Ivasechko, A. OLTW-TEC: Online Learninshag with Sliding Windows for Text Classifier Ensembles. Frontiers in Artificial Intelligence, 7, 1401126, 2024. https://doi.org/10.3389/frai.2024.1401126

[Publ 6]. O. Kuznetsov, N. Poluyanenko, E. Frontoni, S. Kandiy, M. Karpinski, and R. Shevchuk, "Enhancing Cryptographic Primitives through Dynamic Cost Function Optimization in Heuristic Search," Electronics, Vol. 13(10), 1825. https://doi.org/10.3390/electronics13101825

[Publ 7]. Mykytyuk, P., Brych, V., Manzhula, V., Borysiak, O., Sachenko, A., Banasik, A., Kempa, W.M., Mykytyuk, Y., Czupryna-Nowak, A., Lebid, I. Efficient Management of Material Resources in Low-Carbon Construction. Energies 2024, 17, 575. https://doi.org/10.3390/en17030575.

[Publ 8]. Dyvak, M., Manzhula, V., Melnyk, A., Rusyn, B., & Spivak, I. Modeling the Efficiency of Biogas Plants by Using an Interval Data Analysis Method. Energies, 17(14), 2024, 3537. https://doi.org/10.3390/en17143537.

[Publ 9]. Vladov, S., Scislo, L., Sokurenko, V., Muzychuk, O., A model of an intelligent clustering system, V., Sachenko, A., Yurko, A. Helicopter Turboshaft Engines' Gas Generator Rotor R.P.M. Neuro-Fuzzy On-Board Controller Development. Energies 2024, 17, 4033. https://doi.org/10.3390/en17164033.

[Publ 10]. Dubchak, L.; Sachenko, A.; Bodyanskiy, Y.; Wolff, C.; Vasylkiv, N.; Brukhanskyi, R.; Kochan, V. Adaptive Neuro-Fuzzy System for Detection of Wind Turbine Blade Defects. Energies 2024, 17, 6456. https://doi.org/10.3390/en17246456.

[Publ 11]. Kuznetsov, O., Frontoni, E., Kuznetsova, K., Shevchuk, R., & Karpinski, M. "NFT Technology for Enhanced Global Digital Registers: A Novel Approach to Tokenization." Future Internet, 16(7), 2024, 252. https://doi.org/10.3390/fi16070252.

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Patents

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[Publ 265]. Olexandr Drozd, Anatoly Sachenko, Konstantin Zachoulkin, Myroslav Drozd, Volodymyr Kochan, Jacek Voloshyn. Programmable device. Decision of UKRNOIVI on state registration of the invention under application a202105325 dated 09/14/2024.

[Publ 266]. A. p. 124518 Ukraine. Computer program "Middleware for multicomputer systems of specialized purpose" (AMJS) / Kashtalyan A.S., Avsievich V.R., Nicheporuk A.O., Savenko O.S. 2024

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

Conferences

[Visit 1] **5th International Workshop on Intelligent Information Technologies & Systems of Information Security with CEUR-WS, Khmelnytskyi, Ukraine, March 28, 2024. IntelITSIS 2024**
– Anatoliy Sachenko
– Vasyl Yatskiv

[Visit 2] **Proceedings of the 8th International Conference on Computational Linguistics and Intelligent Systems. Volume III: Intelligent Systems Workshop Lviv, Ukraine, April 12-13, 2024.**
– Vasyl Lytvyn
– Anatoliy Sachenko

[Visit 3] **First International Workshop of Young Scientists on Artificial Intelligence for Sustainable Development, Ternopil, Ukraine, May 10-11, 2024**
– Mykhailo Dombrowski
– Lesia Dubchak
– Vasyl Koval
– Myroslav Komar
– Khrystyna Lipianina-Honcharenko

[Visit 4] **IEEE 19th International Conference on the Perspective Technologies and Methods in MEMS Design (MEMSTECH), 16-19 May 2024**
– Roman Pasichnyk

[Visit 5] **5th International Workshop IT Project Management (ITPM 2024), May 22, 2024, Bratislava, Slovak Republic**
– Sergiy Bushuyev

[Visit 6] **Proceedings of the Modern Machine Learning Technologies Workshop (MoMLeT 2024), Lviv, Ukraine, May 31 - June 1, 2024.**
– Gryhoriy Hladiy
– Vasyl Koval
– Myroslav Komar
– Taras Lendiuk
– Khrystyna Lipianina-Honcharenko
– Vasyl Lytvyn
– Anatoliy Sachenko

[Visit 7] **1st International Workshop on Intelligent & CyberPhysical Systems (ICyberPhyS 2024) Khmelnytskyi, Ukraine, June 28, 2024.**
– Khrystyna Lipianina-Honcharenko
– Oleg Savenko
– Anatoliy Sachenko

[Visit 8] **IEEE 12th International Conference on Intelligent Systems (IS), Varna, Bulgaria, 29-31 August 2024**
– Anatoliy Sachenko

[Visit 9] **2024 14th International Conference on Advanced Computer Information Technologies (ACIT), Ceske Budejovice, Czech Republic, 19-21 September 2024**
– Nadiia Vasylkiv
– Sergiy Voznyak
– Lesya Dubchak
– Mykola Karpinski

- Andriy Melnyk
- Roman Pasichnyk
- Ihor Romanets
- Anatoliy Sachenko

- Iryna Turchenko
- Vasyl Yatskiv
- Carsten Wolff

[Visit 10] **4th International Workshop of IT-professionals on Artificial Intelligence (ProfIT AI 2024) 2024 Cambridge, MA, USA, September 25-27, 2024.**
- Khrystyna Lipianina-Honcharenko
- Anatoliy Sachenko

[Visit 11] **IEEE 17th International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering (TCSET), Lviv, Ukraine, 08-12 October 2024**
- Vasyl Lytvyn
- Taras Maksymyuk

[Visit 12] **2024 IEEE 4th International Conference on Smart Information Systems and Technologies (SIST), Astana, Kazakhstan, 15-17 May 2024**
- Vasyl Lytvyn

[Visit 13] **Sixteenth International Conference on Correlation Optics (COR 2023), 2023, Chernivtsi, Ukraine**
- Vasyl Lytvyn

[Visit 14] **1st International Workshop on Bioinformatics and Applied Information Technologies (BAIT 2024), Zboriv, Ukraine, October 02-04, 2024**
- Vasyl Lytvyn

[Visit 15] **2nd International Workshop on Computer Information Technologies in Industry 4.0 (CITI 2024), Ternopil, Ukraine, June 12-14, 2024**
- Vasyl Lytvyn

[Visit 16] **Modern Data Science Technologies Workshop (MoDaST-2024). Lviv, Ukraine, May 31 - June 1, 2024**
- Vasyl Lytvyn

Research Visits

ICS' staff visits

[Visit 17] **Anatoliy Sachenko, Iryna Turchenko** and a group of students visited the Catholic University of Leuven (KU Leuven), Belgium from March 11 to 15, 2024, where they participated in a pilot training and working meetings within the framework of the WORK4CE project. In addition to several working meetings with consortium partners, Dortmund University of Applied Sciences and Arts (Germany), KU Leuven, Basque University of Bilbao (Spain), Kyiv National University of Architecture and Construction, State Academy of the Tax Committee of Azerbaijan, Azerbaijan State University of Oil and Industry, Azerbaijan University of Architecture and Construction, the partners discussed: the state of development of eLearning educational modules, pilot training, open educational resources within the framework of the competency model for WORK4.0, the certification model and the possibilities of qualitative data analysis based on the results of the evaluation survey. In addition, the partners discussed the cooperation of master's programs in the virtual international master's school with exchange and double degrees, as well as possible future projects.

[Visit 18] **Anatoliy Sachenko, Pavlo Bykovy and Diana Zagorodnya** visited the Institute for Reliable Embedded Systems and Communications (ivESK) of the Offenburg University of Instrumentation, Federal Republic of Germany from September 8 to 15, 2024, where they held a series of working meetings on the Erasmus+ KA2 SUDEM project "Digitalization of Sustainable Disaster and Emergency Management Processes" with the participation of consortium members from Bulgaria, Germany, Turkey and Ukraine. Pavlo Bykovy and Anatoliy Sachenko presented the interim results of the project implementation by the ZUNU team, in particular the implementation of work package No. 2 "Forecast and 1st stage of development of the education concept and curriculum".

[Visit 19] **Pavlo Bykovy and Mykhailo Dombrovsky** visited the State University of Civil Engineering and Architecture, Baku, Azerbaijan on September 18-21, 2024, where they summarized the results of the Erasmus+ WORK4CE project "Cross-domain Competencies for Healthy and Safe Work in the 21st Century". Six universities participated in this meeting: from Germany, Spain, Belgium, Ukraine and Azerbaijan.

[Visit 20] **Anatoly Sachenko** visited the Hellenic Army Academy in Athens, Greece on October 4-15, 2024. During the visit, Professor Sachenko presented a series of lectures on research topics in the field of computer science, the results of the scientific activities of the Research Institute of Intelligent Computer Systems, and also spoke about the 13th international conference IEEE IDAACS 2025 and the International Journal of Computing. In addition, he delivered a speech at the 14th IEEE International Conference on Reliable Systems, Services and Technologies DESSERT 2024. He also discussed with educators the areas of scientific cooperation between the Hellenic Army Academy in Athens and VUNU, in particular, the preparation of joint publications, mutual visits next year, as well as the possibility of holding the IEEE IDAACS 2027 International Conference in Athens.

Visits of foreign and national collaborators to ICS

[Visit 21] **Professor Carsten Wolff** from Dortmund University of Applied Arts and Sciences, Germany visited the IKS Research Institute, Western 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 of "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, to whom he was awarded the title of Honoris Causa Professor WUNU. After the vote, 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].   Students **Tamara Kasyan, Viktoriya Fedchyshyn and Tetyana Sozanska** received a grant within the framework of the "WORK4CE" project to participate in a pilot training on the topic: "Energy-efficient mobility", which took place in the form of lectures, trainings and team work with the participation of mentor teachers, which was held at the Catholic University of Leuven (KU Leuven), Belgium, from March 11 to 15, 2024.

9. STATISTICAL DATA

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**2024**
Number of Senior Researches	34	39	40	39	45	46	60	60	60	56	**59**
Number of Junior Researches	14	16	12	10	8	8	6	5	5	5	**11**
Number of Active Research Projects	3	3	3	2	4	4	4	3	3	5	**6**
Publications	127	113	131	115	163	114	187	141	128	153	**266**
Patents and applications for the invention	3 / 3		9	10	8	2	8	6	1	1	**3**
Participation in Conferences, Symposia and Wokshops	23	33	24	32	33	21	7	11	12	11	**16**
Number of Defended PhD and DrSc Theses	3	7	7	6	4	3	0	3	0	4	**3**
Number of Defended Master Theses	48	60	12	54	88	87	82	49	55	63	**96**
Number of Received Awards	2	5	6	5	7	4	4	2	2	2	**1**

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