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

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FOREWORD

It is my pleasure to present the Annual Report of Research Institute for Intelligent Computer Systems (ICS), Ternopil National Economic University (TNEU) and the Glushkov Institute for Cybernetics, National Academy of Science, Ukraine. The ICS was established in 2004 on the basis on the Branch Research Laboratory for Automated Systems and Networks founded in 1984.

The ICS counts the 14 Research Groups, in particular Intelligent Distributed Systems, Intelligent Sensor Data Acquisition, Intelligent Robotic Systems, Neural Networks and Parallel Computing, Knowledge Bases and Ontologies, Information Technology and Specialized Computer Systems, Image Processing and Pattern Recognition, Cybernetics of Complex Systems, Wireless Systems and Networks, Project and Program Management based on IT and Knowledge, Information Security, Intelligent Cyber Security and Defense, Metrology of Information Measuring Systems, Simulation and Algoritmization of Complex Technological Processes. During its history, the staff of the ICS has received more than 150 invention certificates of the former USSR and 66 Ukrainian patents. There were published more than 1100 papers and 163 of them in 2018. There were defended 44 DSc and PhD theses, in particular the four in 2018.

The high level of research and development of ICS has been confirmed since 1997 by awarding 20 international grants and projects within the INTAS, CRDF, NSF, NATO, STCU, and FP7 of the European Union, in particular the two in 2018. In these projects, the ICS collaborated with a huge number of world-known universities as well as governmental institutions and private companies. In addition, we are running a huge Erasmus+ project ALIOT entitled Internet of Things: Emerging Curriculum for Industry and Human Applications, which started in 2016 and DAAD project “Eastern Partnerships”which was run in 2017.

Additional 15 projects have been completed funded by the Ministry of Education and Science, Ukraine; in particular, the project "Theoretical Foundations and Hardware for Improving the Performance of Wireless Sensor Networks" (2017-2018) was executed by the research group led by DSc Vasyl Yatskiv.

In 2018, the reseach group of intelligent cybersecurity and defence, project leader Prof. Anatoliy Sachenko, a contact person Dr. Myroslav Komar, ran a new project “Methods for intelligent processing and analysis of Big Data based on deep neural networks”.

The ICS along with a Dept for Information Computer Systems and Control has established in April 2018 the Ukrainian-German Educational and Research Center, thanking to Prof. Juergen Sieck, HTW Berlin.

The ICS holds the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS), www.idaacs.net every two years since 2001. In particular, the last one took place in Bucharest, Romania, 21-23 September, 2017. Proceedings of the conferences are indexed in Web of Science, EI Compendex and Scopus. Now we are preparing the 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems, which will be held in September 18–21, 2019, University of Lorraine, Metz, France.

The ICS has been taking part in organization of International Symposia on Wireless Systems within the IDAACS Conference since 2012. The 5th IEEE International Symposium on Wireless Systems within the IDAACS Conference (IDAACS-SWS’2020) will be held in September, 2020 in Dortmund, Germany.

The staff of the ICS has a good ralationships with the IEEE Student Branch at TNEU and the Instrumentation and Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section. A Chapter held eight meetings in 2018.

The International Journal of Computing is issued quarterly in cooperation with the Glushkov Institute for Cybernetics, National Academy of Science, Ukraine. The Journal is indexed in Scopus Elsevier, by Finnish publication forum, Norwegian Social Science Data Services, Google Scholar, and Index Copernicus International. The four regular issues were published in 2018.

Finally, I would like to thank to Dr. Diana Zahorodnia, Dr. Inna Shylinska, Dr. Taras Lendyuk and Dr. Pavlo Bykovyy and Ivan Kit for their help in preparing, editing and designing this report.

Enjoy,

Prof. Anatoliy Sachenko

March 24, 2019

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 14 Research Groups, in particular Intelligent Distributed Systems, Intelligent Sensor Data Acquisition, Intelligent Robotic Systems, Neural Networks and Parallel Computing, Knowledge Bases and Ontologies, Information Technology and Specialized Computer Systems, Image Processing and Pattern Recognition, Wireless Systems, Project and Program Management based on IT and Knowledge, Cybernetics of Complex Systems, Information Security and Intelligent Cyber Security and Defense, Metrology of Information Measuring Systems, Simulation and Algoritmization of Complex Technological Processes.

ICS Management

Director – Dr. Volodymyr Kochan
Scientific Advisor – Prof. Anatoliy Sachenko
Scientific Secretary – Dr. Myroslav Komar

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ICS Frame

Intelligent Distributed Systems Group (IDS)

Principal researcher – Prof. Anatoliy Sachenko
Group members:

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

Intelligent Sensor Data Acquisition Group (ISDA)

Principal researcher – Prof. Volodymyr Kochan
Group members:

- Zbyshek Dombrovsky
- Orest Kochan
- Olexandr Osolinskyy
- Oleksiy Roshchupkin
- Radislav Smid
- Iryna Turchenko
- Nadia Vasylkiv

Intelligent Robotic Systems Group (IRS)

Co-Researchers, Principal researchers – Prof. Robert Hiromoto, Dr. Vasyl Koval
Group members:

- Oleh Adamiv
- Vladimir Golovko
- Anatoliy Sachenko

Neural Networks and Parallel Computing Group (NNPC)

Principal researcher – Dr. Volodymyr Turchenko
Group members:

- Vitaliy Dorosh
- Volodymyr Kochan
- Anatoliy Sachenko
- Myroslav Komar
- Iryna Strubytska

Knowledge Bases and Ontologies Group (KBO)

Principal researcher – Prof. Sergey Rippa
Group members:

- Anatoliy Sachenko
- Taras Lendyuk
- Andriy Melnyk
- 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. Viktor Krylov
Group members:

- Anatoliy Sachenko
- Diana Zagorodnya
- Ivan Kit
- Denys Zolotukhin

Wireless Systems Security Group (WSS)

Principal researcher – DSc Vasyl Yatskiv
Group members:

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

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

Principal researcher – Prof. Sergey Bushuyev
Group members:

- Mykhailo Dombrovsky
- Zbyshek Dombrovsky
- Oksana Dunets
- Grygoriy Gladiy
- Yuriy Ivanyshak
- Taras Lendyuk
- Sergey Rippa
- Anatoliy Sachenko
- Oleg Sachenko
- Iryna Turchenko
- Nadiia Vasylkiv

Cybernetics of Complex Systems Group (CCS)

Principal researcher – Dr. Roman Pasichnyk
Group members:

- Grygoriy Gladiy
- Andriy Melnyk
- Yuriy Pigovskyy

Information Security Group (IS)

Principal researcher – Prof. Mykola Karpinsky
Group members:

- Pavlo Bykovyy
- Lesya Dubchak
- Myroslav Komar

Intelligent Cyber Security and Defense Group (ICSD)

Principal researchers – Prof. Vladimir Golovko, Prof. Anatoliy Sachenko
Group members:

- Pavlo Bykovyy
- Myroslav Komar
- Volodymyr Karpinskyy
- Stepan Ivasiev
- Vasyl Yatskiv

Metrology of Information Measuring Systems Group (MIMS)

Principal researchers – Prof. Volodymyr Kochan, DSc Roman Kochan,
Group members:

- Orest Kochan
- Olexandr Osolinsky
- Nadiia Vasylkiv
- Andrii Karachka
- Hryhorii Sapozhnyk

Simulation and Algoritmization of Complex Technological Processes Control Group (SACTPC)

Principal researcher – DSc Igor Dobrotvor

Group members:

- Dmytro Bodnar
- Anatoliy Sachenko
- Grygoriy Gladiy
- Diana Zahorodnia

2. ICS RESEARCH STAFF

Senior Staff

Oleh Adamiv

Specialist (2000), Information Systems in Management, Ternopil Academy of National Economy, Master of Economic Cybernetics (2001), Ternopil Academy of National Economy, Ph. D. student (2001), Computational Machines, Systems and Networks, Department for Information Computer Systems and Control, IEEE member (1998), IEEE Student Branch Chairman in TANE (1998), Lecturer (2002), Department for Information Computer Systems and Control, Ph. D. in Artificial Intelligence Systems and Tools (2007), IDAACS 2001-2009 Organizing Committee Member, IRS group (2004).

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

Dmytro Bodnar

Specialist (1971), Mathematics, Ivan Franko Lviv State University, Doctor of Physics and Mathematics, Professor, Mathematical Analysis, Professor at Department of Economic Cybernetics and Informatics, Ternopil National Economic University, SACTPC Group Member (2014).

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Research interests: analytical foundations of the theory of branched continued fractions and their usage.

Pavlo Bykovyy

Bachelor (2004), Computer Engineering, Ternopil Academy of National Economy, Specialist (2005), Computer Systems and Networks, Engineer (2005), Basics PC Construction Laboratory of Department for Information Computer Systems and Control, IEEE Member (2004), IEEE Student Branch Chairman in Ternopil State Economical University (2005), Ph.D. Student (2007), Ph.D. in Computer Systems and Components (2011), IDAACS 2003-2017 Organizing Committee Member, IDS Group Member (2004), IS Group Member (2012), ICSD Group Member (2014).

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Research interests: security systems, databases, software development.

Sergey Bushuyev

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

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Research interests: project management.

Igor Dobrotvor

Specialist (1979), Mathematics and Physics, PhD Student (1979), PhD in Physics and Mathematics (1984), Associated Professor at Department of Intelligent Information Technologies (then International Information, then Economic Cybernetics and Informatics) (2003), Doctor of Technical Sciences (2014), Head of SACTPC Group (2014)

Room 2210

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Research interests: methods and means of digital signal processing: digital filters; decision support systems; mathematical conflictology and pattern recognition

Zbyshek Dombrovskyy

Specialist (1969), Radiotechnics, Kyiv Polytechnic Institute, Master in Organization Management (2000), Senior Researcher at Research Department of Ternopil Finance-Economic Institute, TFEI (1974), Inventor of USSR (1977), Head of Research Laboratory "Informatics" at TFEI (1988), Senior Lecturer (1996), Management Department, PMS group (2007), Ph. D. in Computer Systems and Components (2008), ISDA Group Member (2012), PPMITK Group Member (2012).

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

Lesya Dubchak

Specialist in Mathematics and Informatics, Ternopil V. Hnatiuk State Pedagogical University (2003), Junior Researcher at Department of Information Systems Security (2003), Master in Computer Systems and Network, Ternopil Academy of National Economy (2004), Ph.D. Student (2005), Lecturer at Computer Science Department (2005), Ph.D. (2013), Computer Systems and Components, IS Group Member (2012).

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Research interests: fuzzy logic systems, VHDL language.

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

Grygoriy Gladiy

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Research interests: flow methods of imitation simulation of economy systems and processes.

Vladimir Golovko

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Research interests: artificial intelligence; neural networks; information security, mobile robots

Stepan Ivasiev

Master (2009), Automated Systems Software, Ternopil National Economic University, PhD (2016), Senior Lecturer (2017), Group ICSD (2017).

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Research interests: number theory, programming.

Andriy Karachka

Specialist (1979), Electronic Computers, Lviv Polytechnical Institute, PhD (1995), Instruments and Methods for Measuring Electrical and Magnetic Quantities, Associated Professor at Department for Information Computer Systems and Control (2001), IEEE Member (2001), head of branch of Department for Information Computer Systems and Control at Drohobych Mechanical and Technological College (2011), Group MIMS (2017).

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Research interests: computer architecture, computer circuitry, design of computer systems and networks.

Mykola Karpinskyy

Specialist (1980), Electrical Drive and Automation of Industrial Units, Ph.D. Student (1985), Ph.D., Lviv Polytechnical Institute (1989), D.Sc. in Devices and Means of Electrical and Magnete Values Measuring (1995), Professor, Department of Information Systems Security (2001), Head of IS Group (2012).

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Research interests: specialized computer systems, wireless information technologies and systems of their security.

Volodymyr Karpinskyy

Master (1980), Computer Systems and Networks, Ph.D. Student (2008-2012), Ph.D. in Mathematical modelling and computational methods, Ivan Puluj National Technical University, Ternopil (2012), Ph.D. in Computer Science, West Pomeranian University of Technology, Szczecin, Poland (2013).

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Research interests: mathematical modelling, metrology, computational methods, Computer Systems and Networks, Computer Science.

Orest Kochan

Specialist (2006), Physics of Metals, Lviv National University named after I. Franko, IDSCS group member (2007), training researcher (2008), Research Institute for Intelligent Computer Systems, Ph. D. Student (2008), Ph. D. in Devices and Methods of Heat Value Meausring (2011), Senior Lecturer, Department for Information Computer Systems and Control (2011), ISDA Group Member (2008), MIMS Group Member (2014).

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Research interests: intelligent temperature measurement systems.

Roman Kochan

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

Volodymyr Kochan

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

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

Myroslav Komar

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Research interests: artificial intelligence, systems of information security.

Vasyl Koval

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Artificial Intelligence Systems and Means (2004), Associate Professor of the Department for Information Computer Systems and Control (2007), Faculty of Computer Information Technologies, IDAACS 2005-2007 OrgCom Vice-Chair, Co-Head of the IRS group (2009),.

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

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Research interests: digital images processing, images recognizing.

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Specialist (1985), Industry Planning, Ternopil Finance Economic Institute, Engineer-Programmer (1986), Ph. D. student (1999), Economic-Mathematical Modelling, Department for Information Computer Systems and Control, IDAACS 2001-2011 organizing committee member, KBO Group Member (2009), PPMITK Group Member (2014).

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Research interests: economic-mathematical ultisen, project management.

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Research interests: ontology, knowledge discovery.

Yaroslav Nykolaychuk

Specialist in Electrification and Automation of Oil and Gas Production (1967), Lviv Polytechnic Institute, Ph. D in Elements and Devices of Computer

Engineering and Control Systems (1980), D. Sc. in Elements and Devices of Computer Engineering and Control Systems (1989), Prof. (1993), Department of Automated Control, Ivano-Frankivsk Institute of Oil and Gas, director of Carpathian State Center of Information Tools and Technologies of National Academy of Sciences of Ukraine (1994), full member of Ukrainian Academy of National Progress (1995), Head of Department of Specialized Computer Systems (1999), Vice-director on science of Institute of Computer Information Technologies (2000), IEEE member (2000), Vice-head of Special Scientific Council K58.082.02 at TNEU (2002), Head of ITSCS group (2007).

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Research interests: embedded computer systems, signal processing, information theory and data encoding, autonomous sensors, low-level sensor networks.

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Room 2002, phone: 47-50-50
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Research interests: software development, web-design, distributed systems, computer systems architectures.

Roman Pasichnyk

Specialist in Applied Mathematics (1979), Lviv State University named after I.Franko, Ph. D. in Physics and Mathematics (1989), Computational Mathematics, Assistant Prof. of Department of Economic Cybernetics, (1997), Vice-head of Department of Economic Cybernetic (2001), DsS. In Mathematical Modeling and Computing Tools (2016), Head of CCS Group (2009).

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Research interests: ontologies, knowledge discovery.

Yuriy Pihovsky

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Research interests: mathematical modeling, algorithms.

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).

Room 2009, phone 47-50-50

e-mail: o.roshchupkin@chnu.edu.ua, alrosh@rambler.ru

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

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).

Room 2302, phone: 47-50-50 ext. 12-322

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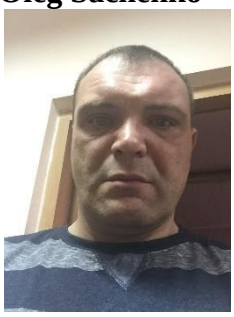
Research interests: Artificial intelligent systems, distributed sensor networks, computational, intelligence, intelligent robotics systems, parallel computation systems, cybersecurity and safety systems, project management, wireless sensor networks.

Oleg Sachenko



Specialist (1992), International Economy, Ternopil Institute of National Economy, Lecturer, Department for Information Computer Systems and Control, TNEU (2013), Ph. D. in Projects and Programs Management (2016), PPMITK Group Member (2014).

Room 2011, phone: 47-50-50

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Research interests: project management

Grygoriy Sapozhnyk

Specialist (1979), Automation and Telemechanics, Lviv Polytechnic Institute, Head of Education Laboratories (1994), Lecturer (2000), PhD in histirical sciences (2004), Department for Information Computer Systems and Control, Group MIMS.

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Research Interests: Labour protection.

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

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

Iryna Strubytska

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Research Interests: parallel computing, GPU computing, CUDA technology, supercomputers.

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.

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.

Natalia Vozna

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.

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.

Natalia Yatskiv

Specialist (1997), Physics-Engineer, Ivano-Frankivsk Oil and Gas State Technical University, Ph. D. in Technical Sciences, Computational Machines, Systems and Networks (2003), Associate Professor (2007), Department for Information Computer Systems and Control, WSS Group Member (2012).

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

Vasyl Yatskiv

Specialist (1996), Automation Technological Processes and Manufacturing, Ivano-Frankivsk Oil and Gas State Technical University, Ph. D. in Technical Sciences, Computational Machines, Systems and Networks (2001), Senior Lecturer (2001), Associate Professor (2002), Department of Specialized Computer Systems, DsS in Computer Systems and Components (2016), Secretary of the Specialized Academic Council K58.082.02 at TNEU (2002), IDS Group Member (2004), Head of WSS Group (2012),.

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

Diana Zahorodnia

Bachelor (2008), Pedagogic Education, Teacher of Mathematics and Basics of Informatics, V. Hnatiuk Ternopil National Pedagogic University, Master (2009), Pedagogic Education, Teacher of Mathematics and Basics of Informatics, V. Hnatiuk Ternopil National Pedagogic University, Head of Training Cources (2009), Ternopil Municipal “Station of Junior Technics”, Administrative Assistant, Ph.D. student (2012), Department for Information Computer Systems and Control, Ternopil National Economic University (2012), IPPR Group Member (2012), SACTPC Group Member (2014).

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

Oleh Zastavny

Specialist (2002), Information Security in Computer Systems, Ternopil Academy of National Economy, Ph. D. student (2002), Elements and Devices of Computer Engineering and Control Systems, Assistant (2002), Department of Specialized Computer Systems, Ph. D. (2007), Elements and Devices of Computer Engineering and Control Systems, ITSCS group (2007).

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Research interests: embedded computer systems, signal processing, information theory and data encoding, autonomous sensors, low-level sensor networks.

Junior Staff

Mykhailo Dombrovsky

Specialist (1998), Finances and Credit, Ternopil Academy of National Economy, training management and information systems Consortium for improving business and management education in Ukraine (2000-2002), research fellow (part-time work) Scientific Research Department of Ternopil National Economic University (TNEU) (2009-2013), engineer of the first category in the University educational computer cybernetic laboratory TNEU (2015), part-time lecturer (2000-2012), Department of International Economics, PPMITK Group Member (2013).

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Research interests: project management.

Vitaliy Dorosh

Bachelor (2009), Software of Automated Systems, Ternopil National Economic University, Engineer (2009), ISDA Group Member (2009), Laboratory of Personal Computers at Department for Information Computer Systems and Control, NNPC Group Member (2013).

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Research interests: neural networks

Oksana Dunets

Bachelor (2015), Information Technologies, Computer Science, Ternopil National Economic University, is pursuing Master degree in Project Management (2017), technician at Department for Information Computer Systems and Control (2015), PPMITK Group Memeber (2015).

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Research interests: neural networks, web development, project management, artificial intelligence, modeling, web technologies.

Yuriy Ivanyshak

Bachelor (2014), International Information, Master (2015), Project Management, Ternopil National Economic University, Engineer (2015), PhD Student (2015), Department for Information Computer Systems and Control, PPMITK Group Memeber (2015).

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Research interests: cybernetics in management, system approach in management, TRIZ.

Andriy Kaniovskyi

Bachelor (2017), Computer Science, Ternopil National Economic University, магістр (2018), Master at Department for Information Computer Systems and Control, WSS Group member (2018).

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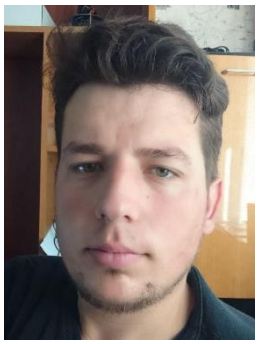
Research interests: Electronics, Mechanics, 3D Modeling.

Ivan Kit



Bachelor (2018), Computer Science, Ternopil National Economic University, магістр (2020), Personal Computer Lab Technician (2305), IPPR Group Member (2018).

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Research interests: image identification, image analysis algorithms for computer recognition systems, neural networks.

Serhiy Voznyak

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

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Research interests: computer networks and infrastructure, web-technologies

Denys Zolotukhin

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

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

3. RESEARCH PROJECTS

Current

[Project 1] 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 2] 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 – 2019

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 3] 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 4] DAAD programme "Eastern Partnerships"

Project Co-investigator: Prof. Anatoliy Sachenko

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.

Completed projects

[Project 5] 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;
- Lesia Dubchak;
- Pavlo Bykovyy;
- Diana Zahorodnia;
- Vitaliy Dorosh;
- Taras Tsavolyk;
- Stepan Ivasiev;
- Grygoriy Sapozhnyk;
- Andriy Karachka.

[Project 6] 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 7] 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 8] 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 9] 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 10] 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 11] 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 12] 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 13] 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 14] 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 15] 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 16] 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 17] 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 18] 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 19] 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 20] 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 21] 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 22] 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 23] 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 24] 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 25] 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 26] 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 27] 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 28] 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 29] 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 30] 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 31] 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 32] 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 33] 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 34] 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'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.

- 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'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'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'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'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'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, THEУ, 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'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'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.

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.

- 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.

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

The 4th IEEE International Symposium on "Wireless Systems within the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems IDAACS-SWS-2018" was held in Lviv, September 20-21,2018, 'Lvivska Politekhnika' (Lviv Polytechnic National University).

IDAACS-SWS-2018 was organized by the Department of Telecommunications of the Institute of Telecommunications, Radio Electronics and Electronics, the Institute of Computer Technology, Automation and Metrology of LPNU, Offenburg University of Applied Sciences, (Germany), the Research Institute for Intelligent Computer Systems of Ternopil National Economic University and the Glushkov Institute for Cybernetics, National Academy of Science, (Ukraine).

Sponsors: Lviv Polytechnic National University, IEEE Ukraine Section IM/CIS Joint Chapter, IEEE Instrumentation & Measurement Society.

On September, 20th, the symposium was officially opened by Vice-Rector for Scientific Work of LPNU Natalia Chukhrai and IDAACS Chairman Anatoliy Sachenko. The invited speaker Axel Sikora from Germany made a keynote presentation at the first plenary session "How does LPWA and NB-IoT change the wireless

world?". Two oral sessions on Wireless Radio Technologies, Advanced IoT Applications and Services session and a poster session were also held. Participants went for excursion to the old city center and had dinner at the extremely attractive beer restaurant "Pravda".

On September 21th, at the second plenary session a keynote speaker Rainer Leupers made a report "Enabling Future Wireless Platforms with Heterogeneous Multicore SoC´s". Then, two oral sessions were held, in particular Wireless Network Architectures and Advanced IoT Applications and Services. It should be noted that the first session was organized as a videoconferencing to involve the authors from China and aroused great interest.

At the end of the symposium, a round table discussion was held (co-chairs Uwe Grossman, Anatoliy Sachenko, Axel Sikora), where participants exchanged views on the content and organization of the symposium. The co-chairs informed that proceedings would be submitted to IEEE Xplore and subsequently indexed in Scopus. In addition, the selected papers would be sent for indexing in Web of Science. One of the cities in Germany was chosen as the venue for the next symposium in two years and in four years the symposium will be held Ukraine.

At the end of the round table discussion Victor Kremin, a sponsor representative of CYPRES distinguished three of the best works and handed out valuable gifts: 1st place – Taras Maksymyuk, Juraj Gazda, Oleh Yaremko, Denys Nevinskiy for report "Deep Learning Based Massive MIMO Beamforming for 5G Mobile Network", 2 nd place – Mykhaylo Palamar, Volodymyr Kruglov, Andrii Chaikovskyi for report "Modeling Digital Radio System Secure Connection with Changing the Operating Frequency", 3 rd place – Artem Tulenkov, Anzhelika Parkhomenko, Aleksandr Sokolyanskii, Aleksandr Stepanenko, Yaroslav Zalyubovskiy for report "The Features of Wireless Technologies Application for Smart House Systems".

In addition, Workshop "Managing the Digital Transformation" was held within the symposium with the participation of scientists and students of Dortmund University of Applied Sciences, LPNU and TNEU.

In total, 71 works of authors from 12 countries were submitted to the International Programme Committee for consideration, 25 reports and 26 poster presentations were made.

Professors Anatoliy Sachenko and Volodymyr Kochan, Assistant Professors Pavel Bykovyy and Vasyl Yatskiv, Ph.D. Oleksandr Osolinskyy made their reports (TNEU). As a result of reviewing, 51 papers were accepted and published in the conference proceedings. The percentage of rejected papers counts 28%.

Pavlo Bykovyy, Oleksandr Osolinskyy, Taras Lendyuk, as well as Master's student Olga Kuhta (TNEU) were the members of the organizing committee (chairman Orest Kochan).

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.

The Journal's Editor-in-Chief is Prof. Anatoliy Sachenko, the Executive Editor is PhD, Dr Volodymyr Turchenko, and Associated Editors are Prof. Robert E. Hiromoto, University of Idaho, USA and Prof. Volodymyr Kochan. 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 40 recognised scientists from 17 countries: Australia, Belarus, Bulgaria, Czech Republic, France, Germany, Greece, Italy, Japan, Lithuania, Norway, Poland, Portugal, Romania, Russia, Spain, Ukraine and USA.

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; Digital Signal Processing; Distributed Systems and Remote Control; Education in Computing; Embedded Systems; High Performance Computing and GRIDS; Image Processing and Pattern Recognition; Intelligent Robotics Systems; Internet of Things; IT Project Management; Wireless Systems.

Issues	
● 2017, Vol. 16, Issue 4 ● 2017, Vol. 16, Issue 3 ● 2017, Vol. 16, Issue 2 ● 2016, Vol. 16, Issue 1 ● 2016, Vol. 15, Issue 4 ● 2016, Vol. 15, Issue 3 ● 2016, Vol. 15, Issue 2 ● 2016, Vol. 15, Issue 1 ● 2015, Vol. 14, Issue 4 ● 2015, Vol. 14, Issue 3 ● 2015, Vol. 14, Issue 2 ● 2015, Vol. 14, Issue 1 ● 2014, Vol. 13, Issue 4 – thematic issue "ICT in Project Management" ● 2014, Vol. 13, Issue 3 ● 2014, Vol. 13, Issue 2 ● 2014, Vol. 13, Issue 1 ● 2013, Vol. 12, Issue 4 ● 2013, Vol. 12, Issue 3 ● 2013, Vol. 12, Issue 2 ● 2013, Vol. 12, Issue 1 ● 2012, Vol. 11, Issue 4 – Special Issue on Advanced Computing Systems ● 2012, Vol. 11, Issue 3 ● 2012, Vol. 11, Issue 2 ● 2012, Vol. 11, Issue 1– Special Issue on Pattern Recognition and Intelligent Processing	● 2011, Vol. 10, Issue 2 ● 2011, Vol. 10, Issue 1 – Special Issue on Neural Networks and Artificial Intelligence ● 2010, Vol. 9, Issue 4 ● 2010, Vol. 9, Issue 3 – Special Issue on Wireless Systems ● 2010, Vol. 9, Issue 2 ● 2010, Vol. 9, Issue 1 – Special Issue on Interactive Systems in Culture and Creative Industries ● 2009, Vol. 8, Issue 32009, Vol. 8, Issue 2 ● 2009, Vol. 8, Issue 22009, Vol. 8, Issue 1 – Special Issue on Artificial Neural Networks and Intelligent Information Processing ● 2008, Vol. 7, Issue 3 ● 2008, Vol. 7, Issue 2 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems ● 2008, Vol. 7, Issue 1 ● 2007, Vol. 6, Issue 3 ● 2007, Vol. 6, Issue 2 – Special Issue on Virtual Instrumentation and Virtual Laboratories ● 2007, Vol. 6, Issue 1 ● 2006, Vol 5, Issue 3 – Special Issue on Neural Network and Artificial Intelligence ● 2006, Vol5, Issue 2 ● 2006, Vol 5, Issue 1

● 2011, Vol. 10, Issue 4 – Special Issue on Wireless Systems ● 2011, Vol. 10, Issue 3	

● 2005, Vol. 4, Issue 3 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems ● 2005, Vol. 4, Issue 2 – Special Issue on Cyberspace Security ● 2005, Vol. 4, Issue 1 ● 2004, Vol. 3, Issue 3 ● 2004, Vol. 3, Issue 2 ● 2004, Vol. 3, Issue 1 – special issue ICNNAI'2003, Minsk, Belarus	● 2003, Vol. 2, Issue 3 ● 2003, Vol. 2, Issue 2 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems ● 2003, Vol. 2, Issue 1 ● 2002, Vol. 1, Issue 2 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems 2002, Vol. 1, Issue 1 – Special Issue on Intelligent Data Acquisition and Advanced Computing Systems

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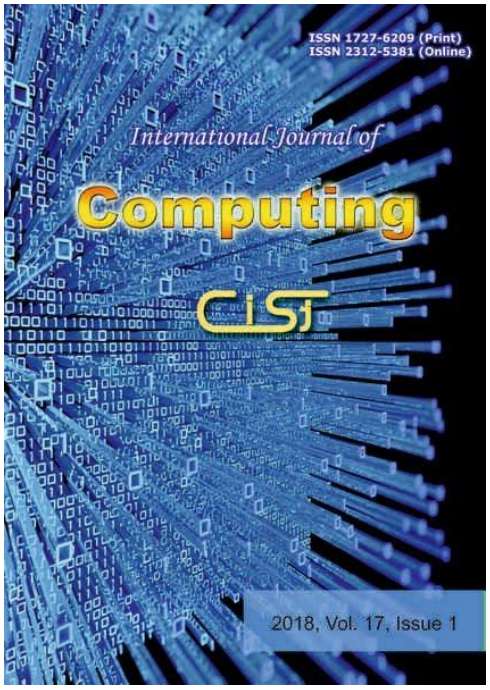

1. M. O. Taranov, Yu. P. Kondratenko. Models of Robot's Wheel-Mover Behavior on Ferromagnetic Surfaces. – pp. 8-14.
2. K. Singh, K. Singh Dhindsa, B. Bhushan. Performance Analysis of Agent Based Distributed Defense Mechanisms Against DDoS Attacks. – pp. 15-24.
3. N. Shakhovska, R. Kaminskyy, E. Zasoba, M. Tsiutsiura. Association Rules Mining in Big Data. – pp. 25-32.
4. Yu. Kondratenko, Yu. Zaporozhets, J. Rudolph, O. Gerasin, A. Topalov, O. Kozlov. Modeling of Clamping Magnets Interaction with Ferromagnetic Surface for Wheel Mobile Robots. – pp. 33-46.
5. V. Lysenko, O. Opryshko, D. Komarchuk, N. Pasichnyk, N. Zaets, A. Dudnyk. Information Support of the Remote Nitrogen Monitoring System in Agricultural Crops. – pp. 47-54.

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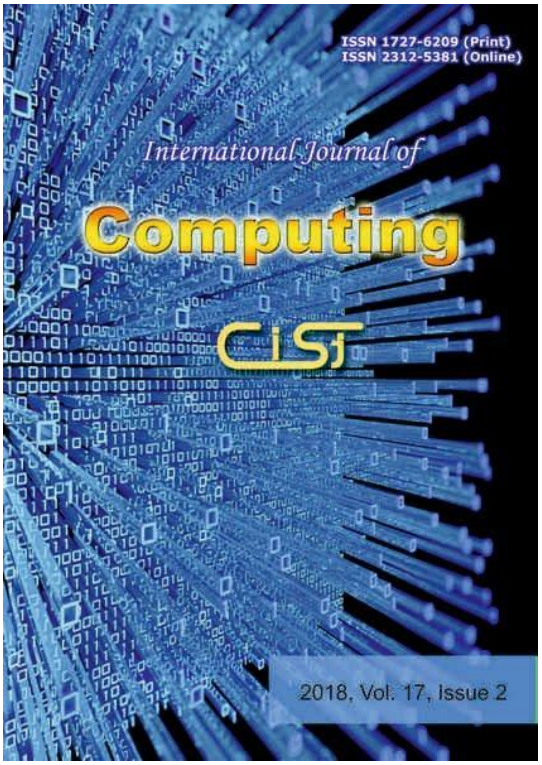

1. Z. Al-Ameen. Contrast Enhancement for Color Images Using an Adjustable Contrast Stretching Technique. – pp. 74-80.
2. V. M. Hung, V. Mihai, C. Dragana, I. Ion, N. Paraschiv. Dynamic Computation of Haptic-Robot Devices for Control of a Surgical Training System. – pp. 81-93.
3. D. Fedasyuk, T. Marusenkova, R. Chopey. A Method of Predicting the Maintenance Period of Embedded Systems for Preventing Breach of Their Time Requirements. – pp. 94-101.
4. S. O. Obadan, Z. Wang. A Hybrid Optimization Approach for Complex Nonlinear Objective Functions. – pp. 102-112.
5. I. Perova, Ye. Bodyanskiy. Adaptive Human Machine Interaction Approach for Feature Selection-Extraction Task in Medical Data Mining. – pp. 113-119.

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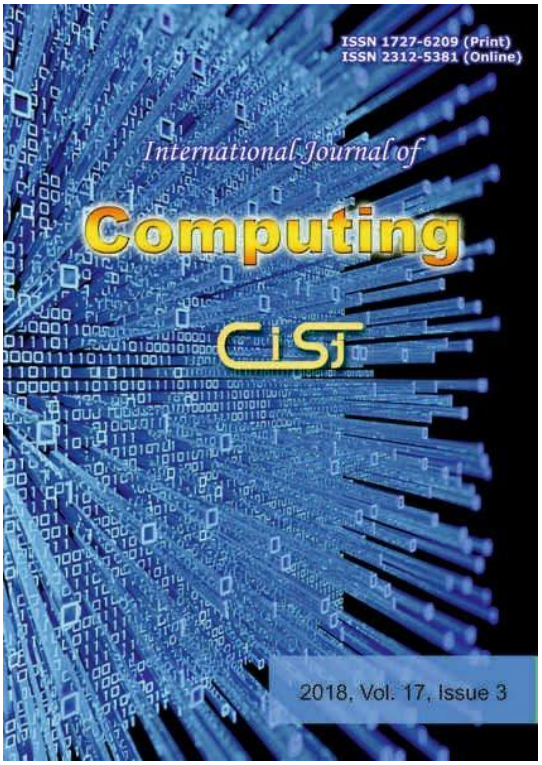

1. S. Bhatia, M. Sharma, K. K. Bhatia, P. Das. Opinion Target Extraction with Sentiment Analysis. – pp. 136-142.
2. S. Antoshchuk, M. Kovalenko, J. Sieck. Creating an Interactive Musical Experience for a Concert Hall. – pp. 143-152.
3. K. Bazilevych, M. Mazorchuk, Yu. Parfeniuk, V. Dobriak, Ie. Meniailov, D. Chumachenko. Stochastic Modelling of Cash Flow for Personal Insurance Fund Using the Cloud Data Storage. – pp. 153-162.
4. J. He, J. Quantz. Interactive Knowledge Visualization Tools for Exhibition Curation. – pp. 163-170.
5. D. Rosas, V. Ponomaryov, R. Reyes-Reyes. Primitive Visual Relation Feature Descriptor Applied to Stereo Vision. – pp. 171-179.
6. J. Letellier, J. Reinhardt, P. Scholl, J. Sieck, M. Thiele-Maas. Providing Adittional Content to Print Media Using Augmented Reality. – pp. 180-189.

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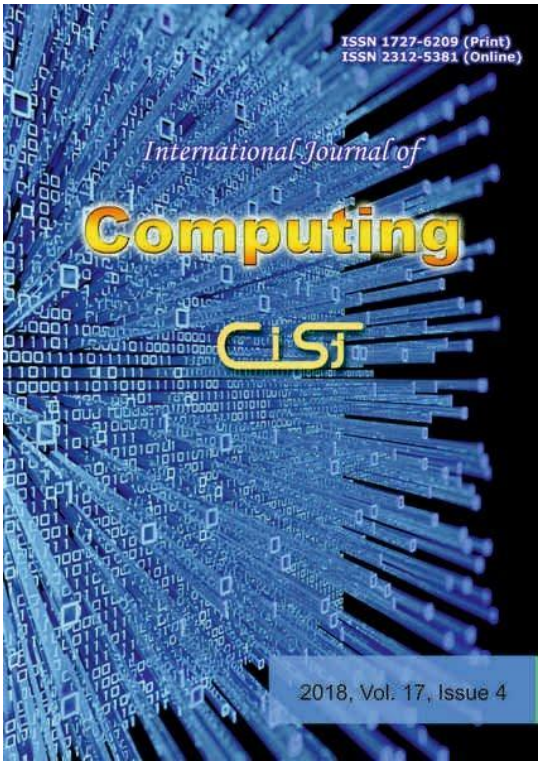

1. M. R. Baharon, M. F. Abdollah, N. A. Abu, Z. Z. Abidin, A. Idris. Secure Video Transcoding in Mobile Cloud Computing. – pp. 208-218.
2. Yu. M. Monakhov, M. Yu. Monakhov, V. N. Lantsov. An Algorithm for Assessing the Availability Criteria in Telecommunication Networks. – pp. 219-225/
3. K. S. Krasnikov. Computation of Heat and Mass Distribution in Sinter Layer Based on PDEs. – pp. 226-233.
4. Helen Josephine V. L., Duraisamy S. Novel Pre-Processing Framework to Improve Classification Accuracy in Opinion Mining. – pp. 234-242.
5. N. Harum, Z. Z. Abidin, W. Md Shah, A. Hassan. Implementation of Smart Monitoring System with Fall Dectector for Elderly Using IoT Technology. – pp. 243-249.
6. A. Bomba, N. Kunanets, V. Pasichnyk, Y. Turbal. Process Modeling of Message Distribution in Social Networks Based on Socio-Communicative Solitons. – pp. 250-259.
7. A. C. Adamuthe, T. R. Nitave. Adaptive Harmony Search for Optimizing Constrained Resource Allocation Problem. – pp. 260-269.

Specialized Scientific Council K58.082.02

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

In 2018, such theses were defended:
- **T. G. Tsavolyk**, PhD thesis "Methods and Means of Data Transmission on Wireless Sensor Networks Based on Modular Correction Codes", specialty 05.13.05 – Computer Systems and Components. Scientific adviser: PhD, Associate Professor V. Yatskiv
- **I. Z. Manuliak**, PhD thesis "Information-measuring system of gas flow rate based on binary signal entropy estimates", specialty 05.13.05 – Computer Systems and Components. Scientific adviser: PhD, Associate Professor S. Melnychuk
- **R. O. Bagrii,** PhD thesis "Information technology of alternative communication for people with disabilities", specialty 05.13.06 – Information Technology. Scientific adviser: PhD, Professor O. V. Barmak
- **A. O. Nicheporuk**, PhD thesis "Information technology for detecting metamorphic viruses in local computer networks", specialty 05.13.06 – Information Technology. Scientific adviser: PhD, Associate Professor O. S. Savenko

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. The Chairman of the Chapter is Prof. Anatoliy Sachenko. The Chapter consists of 38 members from Lviv, Ternopil, Khmelnytskyy, Kyiv, Kharkiv, Ivano-Frankivsk, Zaporizhzhya, Chernivtsi and Odessa, in particular:

Prof. S. Antoshchuk, Odessa National Polytechnic University
Dr P. Bykovyy, Ternopil National Economic University
Dr O. Blazhko, Odessa National Polytechnic University
Prof. E. Volodarsky, National Technical University of Ukraine “Kyiv Polytechnic Institute”
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
Dr V. Kochan, Ternopil National Economic University
Prof. V. Krylov, Odessa National Polytechnic University
Dr S. Lysenko, Khmelnytsky National University
Dr V. Lyashkevych, Yury Fedkovych Chernivtsi State University
Dr I. Maykiv, Ternopil National Economic University
Dr V. Mukhin, National Technical University of Ukraine “Kyiv Polytechnic Institute”
Dr A. Piskozub, Lviv National Technical University
Prof. O. Pomorova, Khmelnytsky National University
Prof. M. Pryymak, Ternopil Ivan Pul’uj State Technical 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
Prof. M. Cherkassky, Lviv National Technical University
Dr G. Shilo, Zaporizhzhya National Technical University
Dr V. Yatskiv, Ternopil National Economic University

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

I. On January 12, 2018, a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University within the framework of the TNEU team working meeting on the Erasmus + Aliot project. The reports were presented by Dr. Z. Dombrovskyy: “The technological basis of the Smart Grid concept for innovative electric power development using the Smart Grid concept” and Ph.D. Olexandr Osolinskyy: "The system of traffic flow intensity control". There were 12 participants of the seminar.

II. On February 9, 2018, a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University, which was attended by teachers and students of the Department of Information Computer Systems and Management of TNEU as well as by Ph.D., Professor of the Department of Computer Intelligent Systems and Networks of the Odessa National Polytechnic University Olexandr Drozd. The reports were presented by Prof. Olexandr Drozd on the topic "A Resource Approach to the Development of Green Technologies in Computer Systems and Components" and Ph.D. Taras Lendyuk on the topic "Application of ontology in the context of knowledge mastering by students". 17 people participated in the seminar.

III. March 7, 2018 a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University. Dr., Professor of the Department of Project Management, Information Technology and Telecommunications of Lviv State University of Life Safety Oleh Zachko made a report on the topic “Methodology of project security management”. Mykhailo Dombrovskyy also gave a presentation on the topic “Proactive project management of organizational development of energy supply companies in a turbulent environment”. In total, 15 people participated in the seminar.

IV. On April 13, 2018 a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University within the visit of Juergen Sieck, Professor of the Berlin University of Engineering and Economics (Germany). Further cooperation and prospects for Ukrainian – German Training and Research Center development, student and teacher exchange under the Erasmus + programme were discussed. Prof. Juergen Sieck gave a presentation on "Augmented Virtual Reality in a Cultural Environment". The presentation was followed by active discussion and demonstration of mobile applications developed by students at the Berlin University of Engineering and Economics. After the presentation given by Prof. Juergen Sieck, the scientific results of the Research Institute for Intelligent Computer Systems groups were presented and Dr.Pavlo Bykovyy made a report on the topic "Prospects for the development of the Ukrainian-German Training and Research Center". In total, 41 people participated in the seminar.

V. On April 18, 2018, a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University.The reports were presented by Prof. Valentin Tomashevskyi, Department of Automated Information Processing and Control Systems of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute", on the topic "Simulation Modeling" and Dr. Grygoriy Gladiy on "Deep neural networks for cyberattacks detection". In total, 32 people participated in the seminar.

VI. On April 26, 2018, a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University. The seminar was attended by the scientists from Ternopil, Khmelnytskyi, Odesa, Severodonetsk and Ivano-Frankivsk. Professor of the Department of Applied Mathematics and Information Technology of Odessa National Polytechnic University, PhD Viktor Krylov presented a report on the topic "Methods for image processing and recognition based on wavelet analysis". Professor of Computer Engineering Department of Volodymyr Dahl East Ukrainian National University Inna Skarga-Bandurova presented a report on "Dynamic gesture recognition for designing future interaction". In total, 14 people participated in the seminar.

VII. On June 7, 2018 Victor Kremin, Olexandr Karpin and Sviatoslav Paliy as representatives of the Lviv branch of the elite Semiconductor IT company Cypress Semiconductor Corporation paid a working visit to the Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems in Ternopil National Economic University and Ukrainian – German Training and Research Center. They saw educational laboratories of the Department of Information Computer Systems and Management and the Ukrainian-German Training and Research Center, as well as were acquainted with the computing cluster and the results of the research projects of Research Institute. Then a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University.Victor Kremin and his colleagues made a presentation for the staff and students on topic "Secure Fingerprint Sensing and Identification for IoT", and discussed the multifaceted possibilities of expanding cooperation. In particular, it was mentioned the possibility of employment for students and graduate students, summer

school for students, scientific programs for teachers, etc. In addition, Dr. Olexandr Osolinskyy presented a report "Virtual stand structure based on LabVIEW". In total, 42 people participated in the seminar.

VIII. 18 - 20 July, 2018, the Head of the Department of Intelligent Information Technologies of Brest State Technical University, Doctor of Technical Sciences, Prof. Vladimir Golovko paid a working visit to the Department of Information Computer Systems and Management. Within this visit a joint research seminar of IEEE I & M / CI Chapter, Department of Information Computer Systems and Management and the Research Institute for Intelligent Computer Systems was held at Ternopil National Economic University. On July 19, 2018, a round table discussion on “Perspectives of deep learning in the framework of the development of artificial intelligence technologies” was held, in which staff and students of the department participated. On July 20, 2018, the Director of the Educational and Scientific Center for Information Technology Ihor Romanets made a presentation on "Methods of protection of traffic determination in VoIP". The seminar was attended by the staff of the department, graduate students and students and by the Head of the Department of Intelligent Information Technologies of Brest State Technical University, Doctor of Technical Sciences, Prof. Vladimir Golovko. In total, 14 people participated in the seminar.

IX. The 4th IEEE International Symposium on Wireless Systems within the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems" IDAACS-SWS-2018 was held on September 20 - 21, 2018, Lviv, Ukraine, in Lviv Polytechnic National University (LPNU). A joint research seminar of IEEE I & M / CI Chapter, was held within the Symposium. The reports were presented by Dr. Vasyl Yatskiv "Adaptive Data Communication Protocol for Wireless Sensor Networks" and Prof. Volodymyr Kochan “Green wave regulation for special purpose vehicles”. In total, 46 people participated in the seminar.

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. In 2016 there were 3 active members of the Branch. The Branch Committee consists of the Chairperson – O. Dunets, Advicer – Prof. Anatoliy Sachenko.

Members of the IEEE Student Branch at TNEU take part in international conferences and projects. Also, they assist 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.

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 Hplore 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.

Other Research Activities

[Org 1] Sergey Bushuyev

- Reviewing 12 papers for international and national conferences.
- Reviewing 14 articles in international and national scientific journals.
- Member of the organizing / program committee:
  - Bukovel, February 2018, Strategic Project Management;
  - Kyiv, May 2018, Project Management in the Development of Society;
  - Mykolaiv, September 2018, Practical Aspects of Project Management;
  - Odessa, December 2018, Project management: Innovations, Nonlinearity, Synergetics.

[Org 2] Volodymyr Kochan

- Member of the Editorial Board of International Journal of Computing.
- Reviewing the papers for international and national conferences.
- Member of the Specialized Scientific Council K58.082.02 at TNEU.
- Reviewing 3 PhD Theses.
- Member of organizing committee of IDAACS-SWS'2018, 20-21, September, Lviv Polytechnic National University, Ukraine.
- Team member of Erasmus+ALIOT project "Internet of Things: Emerging Curriculum for Industry and Human Applications".

[Org 3] Vasyl Koval

- Member of the Specialized Scientific Council K58.082.02 at TNEU.
- Subreviewer of the International Conference "Modern Computer Information Technologies (ACIT'2018)";
- Team member of Erasmus+ALIOT project "Internet of Things: Emerging Curriculum for Industry and Human Applications".
- Member of the support group of Specialty 122 – "Computer Sciences";
- Manager of the research seminar "Advances & Challenges in Computing, A2C" hold by the Research Institute for Intelligent Computer Systems, TNEU;
- Head of the research seminar of the Department of ICSM, TNEU;
- Presented a report of reviewing the dissertation for the Degree of Candidate of Technical Sciences in the research seminar of the Department of ICSM (H. Lipyanina).

[Org 4] Yaroslav Nykolaychuk

- Reviewing articles in international and national scientific journals and conferences;
- Member of the Program Committee and Head of the 9 Workshop of the international conference "Advanced Computer Information Technologies", (ACIT'2018), Czeske Budejovice, Czech Republic, June 2018;
- Member and a Vice-Chairman of the Specialized Scientific Council K.58.082.02 in TNEU.

[Org 5] Roman Pasichnyk

- Reviewing 12 papers in international and national journals and conferences;
- Member of the Program Committee and Head of the 9 Workshop of the international conference "Advanced Computer Information Technologies", (ACIT'2018), Czeske Budejovice, Czech Republic, June 2018;
- Member of the Specialized Scientific Council K.58.082.02 in TNEU.

[Org 6] Sergey Rippa

- Reviewing the 14 papers for international and national conferences.
- Reviewing the 7 articles in international and national scientific journals.
- Reviewing the 6 PhD Theses.
- A member of specialized academic council K 27.855.01 at NUSTA.
- Acting as an opponent at the defense of 3 dissertations.

[Org 7] Anatoliy Sachenko

- Chairman of the Specialized Scientific Council K58.082.02 at TNEU;
- Member of the Specialized Scientific Council D35.052.08 at National University "Lviv Polytechnics";
- Editor-in-Chief, International Journal of Computing;
- Editor-in-Chief, "International Journal for Information Engineering and Electronic Business";
- Reviewing 19 papers for international and national conferences.
- Reviewing five DSc Theses.
- Reviewing six PhD Theses.
- General Chairman of "4th IEEE International Symposium on Wireless Systems within the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems» IDAACS-SWS-2018";
- Member of the Program Committee of 9 International Conferences

[Org 8] Volodymyr Turchenko

- Deputy Editor at International Journal of Computing, participated in preparating four issues of the Journal, reviewed 4 articles.
- Reviewing papers for international conferences IJCNN'18, PDP'18, DCAI'18, WCCI'18.
- Reviewing papers for journals Neurocomputing, Computer Science (Krakow), IEEE Instrumentation and Measurement Magazine, IEEE Transactions on Cloud Computing, IEEE Systems.

[Org 9] Vasyl Yatskiv

- Acting as an opponent at the defense of 1 dissertation.
- Reviewing 2 PhD Thesis and 1 DSc Thesis.
- Member of Technical Program Committee IDAACS-SWS 2018.
- Member of the Program Committee of the international conference "Advanced Computer Information Technologies", (ACIT'2018), Czeske Budejovice, Czech Republic, June 2018;
- Member of the Organizing Committee of International Scientific and Practical Conference "Applied Scientific and Technical Research", Ivano-Frankivsk;
- Scientific Secretary of the Specialized Scientific Council K58.082.02 at TNEU.
- Team member of Erasmus+ALIOT project "Internet of Things: Emerging Curriculum for Industry and Human Applications".
- Head of Cisco Networking Academy at Ternopil National Economic University.

5. ACADEMIC ACTIVITIES

Cooperation Agreements with Universities and Companies

[Agreement 1] Belarus State University of Informatics and Radioelectronics, Minsk, Belarus.
[Agreement 2] Brest State Technical University, Belarus.
[Agreement 3] Donetsk National Technical University, Ukraine.
[Agreement 4] Zaporizhya National Technical University, Ukraine.
[Agreement 5] Institute for Cybernetics, National Academy of Sciences of Ukraine, Kyyiv, Ukraine.
[Agreement 6] Institute of Space Research, National Academy of Sciences of Ukraine and NCAO, Kyiv, Ukraine.
[Agreement 7] Institute of Control, Russian Academy of Sciences, Moscow, Russia.
[Agreement 8] Institute of Artificial Intelligence, Donetsk.
[Agreement 9] Odessa National Polytechnic University, Ukraine.
[Agreement 10] Technical University of Sofia, Bulgaria.
[Agreement 11] University of Calabria, Italy.
[Agreement 12] Tsinghua University, China.
[Agreement 13] University of Maine, USA.
[Agreement 14] University of New Hampshire, USA
[Agreement 15] University of South Carolina, USA.
[Agreement 16] Physics-Mechanics Institute of G. Karpenko, National Academy of Sciences of Ukraine, Lviv, Ukraine.
[Agreement 17] University of Siegen, Germany
[Agreement 18] Chernivtsi National University by Yu.Fedkovich, Chernivtsi, Ukraine
[Agreement 19] Wuhan University of Technologies, Wuhan, Hubei, China
[Agreement 20] Kaunas University of Technology, Lithuania
[Agreement 21] Hochschule für Technik und Wirtschaft Berlin, University of Applied Sciences, Germany
[Agreement 22] Fachochschule Dortmunt, University of Applied Sciences, Germany
[Agreement 23] Pre-Carpathian National University by Vasyl Stefanyk, Ivano-Frankivsk, Ukraine
[Agreement 24] Silesian Technical University, Poland.
[Agreement 25] Warsaw University of Technology, Poland
[Agreement 26] National University of State Tax Service of Ukraine, Irpin, Kiev region.
[Agreement 27] National University of Water and Environmental Engineering, Rivne, Ukraine.
[Agreement 28] Kiev National University of Construction and Architecture, Ukraine.
[Agreement 29] Lviv State University of Life Safety, Lviv, Ukraine
[Agreement 30] Ivan Franko National University of Lviv, Lviv, Ukraine

Defended Theses and Awarded Degrees

[Def 1] T. Tsavolyk defended PhD thesis titled “Methods and Means of Data Transmission in Wireless Sensor Networks Based on Modular Corrective Codes”, 05.13.05 – Computer Systems and Components, Scientific supervisor: Dr V. Yatskiv.
[Def 2] M. Dorosh defended PhD thesis titled “Convergence of Project Management Systems duue to Value-Oriented Approach”, 05.13.22 - Project and Program Management, Scientific supervisor: DrSc, Prof S. Bushuev
[Def 3] R. Yaroshenko defended PhD thesis titled “Methodology of Proactive Threat Management in Financial Organizations Development Programs under the Conditions of Turbulent Environment”, 05.13.22 - Project and Program Management, Scientific supervisor: DrSc, Prof. S. Bushuev

[Def 4] O. Mikheeva defended PhD thesis titled "Harmonizing the Competencies of International Project Management Teams in a Multicultural Environment", 05.13.22 - Project and Program Management, Scientific supervisor: DrSc, Prof. S. Bushuev

Defended Master Theses

[DefMas 1] Roman Bocharskyi, The Algorithm for Controlling by the Mobile Robot Engines Using Artificial Neural Network, Assoc. Prof. V. Koval

[DefMas 2] Denys Zolotuchin, Methods and Algorithm for 3D Model Development for Video Images, Prof. A. Sachenko

[DefMas 3] Volodymyr Voloshyn, Algorithms for Controlling Access of Users to Information System Resources, Assoc. Prof. M. Komar

[DefMas 4] Roman Dovhan, Information Control System for Houses Based on Internet of Things Technology, Assoc. Prof. N. Yatskiv

[DefMas 5] Valerii Kazmirchuk, Method of Fuzzy Estimation of the Service Personnel Influence on the Quality of the Information System Functioning, Assoc. Prof. N. Vasylkiv

[DefMas 6] Andrii Kaniovskyi, Method for Spatial Display of Graphic Information, Assoc. Prof. V. Kochan

[DefMas 7] Maksym Kindrat, Model of the Input of the Data Acquisition Module, Assoc. Prof. V. Kochan

[DefMas 8] Vitalii Lichak, An Algorithm for Recognition of Road Signs on the Image, Assoc. Prof. V. Koval

[DefMas 9] Oleh Lutsiv, Microcontroller Power Consumption Module, Assoc. Prof.V. Kochan

[DefMas 10] Volodymyr Mostovyi, The Algorithms for Protecting Mobile Wireless Sensor Networks from Attacks, Assoc. Prof. N. Yatskiv

[DefMas 11] Volodymyr Terefenko, An Algorithm for Three-dimensional Environment Structure Design Based on Stereo Vision Methods, Assoc. Prof. N. Yatskiv

[DefMas 12] Denys Figurskyi, An Algorithm for Verifying Meteorological Data from Internet Resources, Assoc. Prof. N. Yatskiv

[DefMas 13] Volodymyr Deka, Static Signature Analysis Method for Web Application Security, Prof. A. Sachenko

[DefMas 14] Oleh Baziuk, Management of Innovative Project for Lighting Device Development, Assoc. Prof. Z. Dombrovskyi

[DefMas 15] Nazar Hamernyk, Methodology for Quantitative Risk Assessment of IT Project Under Restricted Information, Assoc. Prof. G. Gladiy

[DefMas 16] Oleh Kozbur, Project Management of Computer Network Modernization for "Nova Poshta", Assoc. Prof. Z. Dombrovskyi

[DefMas 17] Olha Kuhta, IT-Project Management under the Conditions of Psychological Phenomena and Empirical Laws, Assoc. Prof. I. Turchenko

[DefMas 18] Svitlana Lysynchuk, Proactive Management of the IT-Project Team, Assoc. Prof. I. Turchenko

[DefMas 19] Vasyl Lukyanchuk, Project Management of Creating an Online Store for 3D Tehnologies, O. Sachenko

[DefMas 20] Viktor Maliovanyi, Proactive Management Model of the IT-Project During Implementation, Assoc. Prof. N. Vasylkiv

[DefMas 21] Nazar Mykhalchuk, Forming of Project portfolio based on Integration of DEMATEL and ANP Methods, Prof. A. Sachenko

[DefMas 22] Andrii Prots, Project Management of Creating the Mobile Application for Analysis of the Road Quality, Assoc. Prof. N. Vasylkiv

[DefMas 23] Ivan Serbai, Project Management of Greating a Mobile Application for Fitness, O. Sachenko

[DefMas 24] Oles Telikhovskyi, Happiness Index Application in the Urban Project Management,

Assoc. Prof. G. Gladiy

[DefMas 25] Valerii Tyshkul, Model of Extreme Project Management, Assoc. Prof. I. Turchenko

[DefMas 26] Volodymyr Khmil, Project Management of the High-Tech Vertical Farm Computerization, Assoc. Prof. G. Gladiy

[DefMas 27] Oleh Yankovskyi, Project Approach to Road Management for Smart City, Prof. A. Sachenko

[DefMas 28] Vladyslav Kopytsia, A Method of Parallel Classification of Computer Attacks by Deep Neural Network, Prof. A. Sachenko

[DefMas 29] Roman Luzhetskyi, Method and Algorithm for Reducing of Large Data Size Based on Deep Neural Network, Assoc. Prof. M. Komar

[DefMas 30] Yevhen Lushchak, Method and Algorithm of Artificial Immune Systems for Intrusion Detection, Assoc. Prof. M. Komar

[DefMas 31] Vasyl Metenko, Neural Network Model of Thermoelectric Sensors Error, Assoc. Prof. V. Kotchan

[DefMas 32] Volodymyr Oliiar, The Method of Identification of Employees Based on Fuzzy Logic, Assoc. Prof. N. Vasylkiv

[DefMas 33] Ivan Pokurbaanych, Information System for user's Voice Identification with Increased Protection against Attacks, Assoc. Prof. P. Bykovyi

[DefMas 34] Oleh Skalych, Model and Method of Ensuring the Integrity of Video Information in Modern Information Systems, Assoc. Prof. P. Bykovyi

[DefMas 35] Taras Tabachka, Investigation of Neural Network Method of Multi-Zone Thermal Objects Control, Assoc. Prof. V. Kochan

[DefMas 36] Adrian Madhigi, Algorithm for User Profile Classification based on Intelligent Behavior Analysis, Assoc. Prof. N. Yatskiv

[DefMas 37] Christian Biai Mutombo, Innovative Project Management for Roads Infrastructure Improvement, O. Sachenko

[DefMas 38] David Kodgo, Strategic Management of Projects Portfolio for Modernizying the Electric Power Equipment, O. Sachenko

[DefMas 39] Gdozian Tambe Moninga, Managing the Project of Mobile Monitoring Development for Post-accident Condition in Nuclear Plant, Prof. A. Sachenko

[DefMas 40] Maksym Kovalchuk, Managing the Project of Biometric Intelligent Interface Development Using Agile Metodology, Prof. A. Sachenko

[DefMas 41] Nana Kvadzo Omari Osei Sasu, Method of Ranking Innovaive IT Projects, Assoc. Prof. G. Gladiy

[DefMas 42] Solomon Ebi Ekiyor, System of Strategic Human Resource Project Management Assoc. Prof. Z. Dombrovskyy

[DefMas 43] Pavlo Chechet, Neural network system for spam e-mail messages detecting, Assoc. Prof. L. Dubchak

[DefMas 44] Andrii Barylko, Algorithms for providing in Internet of things integrity datas based on blockchain technology, Prof. V. Yatskiv

[DefMas 45] Nazar Boikiv, Imitation model of the computer equipment store maintenance, Assoc. Prof. l. Dubchak

[DefMas 46] Ihor Hrychannyk, Intelligent Tools for Search Engine Optimizations, Assoc. Prof. O. Adamiv

[DefMas 47] Vitalii Dovhyi, Algorithms for scanning ports detecting procedure in the corporate computer network, Prof. V. Yatskiv

[DefMas 48] Yurii Ilkiv, Algorithms for temperature regimes controlling during goods transporting based on technology blockchain, Prof. V. Yatskiv

[DefMas 49] Oksana Korin, Doctor-expert choosing algorithms in telemedicine system, к.т.н., Assoc. Prof. L. Dubchak

[DefMas 50] Maryan Muryn, Algorithms for Internet things objects identifying based on blockchain technology, Prof. V. Yatskiv

[DefMas 51] Serhii Oliinyk, Secure algorithm for Internet things managing using Web-based

interfaces, Prof. V. Yatskiv

[DefMas 52] Ruslan Trush, Error correction algorithms based on two-dimensional correction codes of the residual classes system, Prof. V. Yatskiv

[DefMas 53] Vasyl Kharchun, Algorithms of the resistant distributed data storing based on correction codes, Prof. V. Yatskiv

[DefMas 54] Andrii Kriuchunin, Fuzzy logic based algorithms for mobile robot navigation, Assoc. Prof. Adamiv

[DefMas 55] Vasyl Oleksiv, The algorithm for the verification symbols formation verification symbols in the residual classes correction codes system, Prof. V. Yatskiv

[DefMas 56] Liubomyr Chumak, The algorithm of two errors correction based on modular correction codes, Prof. V. Yatskiv

[DefMas 57] Bohdan Bandura, The modeling of the optimization of an insurance company regional diversification, Prof. D. Bodnar

[DefMas 58] Nazar Vitovskyi, Information and analytical support of quality management of industrial enterprises production, Prof. D. Bodnar

[DefMas 59] Vasyl Zhyhailo, Information and analytical support of forecasting of financial indicators of enterprise activity, Prof. D. Bodnar

[DefMas 60] Oleh Mykhalskyi, Mathematical tools of the assessing impact of suppliers' reliability on the production processes of the enterprise, Assoc. Prof. R. Pasichnyk

[DefMas 61] Vasyl Chuchko, Adaptive mathematical model of a production enterprise sales, Assoc. Prof. R. Pasichnyk

[DefMas 62] Vasyl Shpylko, The management of the validity of innovative design decisions of the manufacturing enterprise, Assoc. Prof. R. Pasichnyk

[DefMas 63] Maksat Kandymov, The forecast of business processes profitability of industrial enterprise, Assoc. Prof. R. Pasichnyk

[DefMas 64] Oleh Bandura, Intelligent navigation system of a separate mobile robot, Assoc. Prof. O. Adamiv

[DefMas 65] Vladyslav Nazaruk, Forecast of the risk of investing in the modernization of production capacities, Assoc. Prof. R. Pasichnyk

[DefMas 66] Bohdan Stasiuk, The analysis and modeling of digital camera calibration processes, Assoc. Prof. O. Adamiv

[DefMas 67] Serhii Pretentor, The system of the recovery of three-dimensional structure of the environment for technical vision systems, Assoc. Prof. O. Adamiv

[DefMas 68] Oleksandr Markov, Control system of product conformity based on microcontroller PIC16C558, Prof. Y. Nykolaichuk

[DefMas 69] Mykhailo Ilchushyn, Software module of the computer-integrated system for the restoration of fuzzy images, Prof. Y. Nykolaichuk

[DefMas 70] Nazar Konoval, Adaptive system of computerized management of district heating, Assoc. Prof. O. Volynskyi

[DefMas 71] Petro Kryvyi, Self-organizing wireless sensor system for data collection, Assoc. Prof. O. Zastavnyi

[DefMas 72] Ivan Kucher, Adaptive system of recognition transition process in power grids, Assoc. Prof. N. Vozna

[DefMas 73] Yurii Lebediuk, Computerized system of control of industrial autoclave, Prof. Y. Nykolaichuk

[DefMas 74] Vasyl Maksymiv, Routing car computer based on ATmega16 microcontroller, Prof. Y. Nykolaichuk

[DefMas 75] Ihor Matskiv, Computerized control system of mixing type apparatus, Prof. Y. Nykolaichuk

[DefMas 76] Oleh Melnyk, Intelligent lighting control system "Smart Home", Assoc. Prof. O. Volynskyi

[DefMas 77] Vitalii Pasichnyi, Increasing the efficiency of the automated steam boiler control system, Prof. Y. Nykolaichuk

[DefMas 78] Oleksandr Perkhaliuk, Improved turbo boost frequency control system, Prof. Y. Nykolaichuk
[DefMas 79] Nazar Pekh, Automated control system for skip lifting system, Prof. Y. Nykolaichuk
[DefMas 80] Oleh Pytel, Computerized integrated control system for electric drive of an elevator, Assoc. Prof. N. Vozna
[DefMas 81] Yaroslav Ratyshnyi, Computerized system of control of aerial reconnaissance in inaccessible locations, Assoc. Prof. O. Volynskyi
[DefMas 82] Dmytro Stelmashchuk, Wireless data acquisition system for foundry, Assoc. Prof. O. Zastavnyi
[DefMas 83] Alina Khoma, Computerized system of regulatory filing dosed material, Assoc. Prof. N. Vozna
[DefMas 84] Bohdan Popovych, Mathematical tools and software for support the IT company management, Assoc. Prof. Y. Pihovskyi
[DefMas 85] Vladyslav Tsymoshchuk, Mathematical tools and software for search the information resources using semantic technologies, Assoc. Prof. A. Melnyk
[DefMas 86] Andrii Bilyk, Mathematical tools and software for support the processes of furniture production, Assoc. Prof. R. Pasichnyk
[DefMas 87] Bohdan Kostyk, Mathematical tools and software for creating the ontology of subject area for educational web-systems, Assoc. Prof. A. Melnyk
[DefMas 88] Pavlo Pylypchuk, Mathematical tools and software for detecting the text plagiarism using semantic technologies, Assoc. Prof. A. Melnyk

Intership of Staff, PhD Students and Students

Staff Intership

[Internship 1] Volodymyr Kochan, Professor, Department for Information Computer Systems and Control, Ternopil Ivan Puliuy National Technical University, April – May, 2018
[Internship 2] Vasyl Koval, Assoc. Prof., Department for Information Computer Systems and Control, Ternopil Ivan Puliuy National Technical University, April – May, 2018
[Internship 3] Nataliia Yatskiv, Assoc. Prof., Department for Information Computer Systems and Control, Ternopil Ivan Puliuy National Technical University, April – May, 2018
[Internship 4] Zbyshek Dombrovskyi, Assoc. Prof., Department for Information Computer Systems and Control, Ltd' "Neotech" February – March, 2018
[Internship 5] Vasyl Yatskiv, Professor, Department for Information Computer Systems and Control, constructor buerau "Strila", 24.04 – 24.05.2017.
[Internship 6] Mychailo Dombrovskyi, Lecturer, Department for Information Computer Systems and Control, Ltd' "Neotech" March – April, 2018

Student Intership

[Internship 7] Roman Bocharskyi, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 8] Denys Zolotuchin, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 9] Roman Buchunskyi, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 10] Volodymyr Voloshyn, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 11] Roman Dovhan, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 12] Valerii Kazmiruk, "Tarnava" Ternopil, Assoc. Prof. N. Yatskiv
[Internship 13] Andrii Kaniovskyi, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 14] Maksym Kindrat, Training and Research Center of Information Technologies, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 15] Vitalii Lichak, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 16] Oleh Lutsiv, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 17] Volodymyr Mostovyi, "Tarnava", Ternopil, Assoc. Prof. N. Yatskiv
[Internship 18] Volodynyr Terefenko, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. N. Yatskiv
[Internship 19] Denys Fihurskyi, "Maghis", Kyiv, Assoc. Prof. N. Yatskiv
[Internship 20] Volodymyr Deka, "Mediaways", Kyiv, Assoc. Prof. N. Yatskiv
[Internship 21] Oleh Baziuk, LtD "DC Komfort", Ivano-Frankivsk, PhD O. Sachenko
[Internship 22] Yurii Halias, LtD "OGD Solutions", Zaporizzia, PhD O. Sachenko
[Internship 23] Nazar Hamernyk, LtD "Yavare", Ternopil, PhD O. Sachenko
[Internship 24] Oleksandr Kikhtan, LtD "Max-Yavir", Ternopil, PhD O. Sachenko
[Internship 25] Oleh Kozbur, "Tarnava" Ternopil, PhD O. Sachenko
[Internship 26] Pavlo Kuzuk, LtD "Max-Yavir", Ternopil, PhD O. Sachenko
[Internship 27] Olha Kukhta, Private entrepreneur Andrii Bodnar, Ternopil, PhD O. Sachenko
[Internship 28] Svatlana Lysynchuk, Private entrepreneur Volodymyr Horon, village Luka, Horodenkivskyi district, Ivano-Frankivsk region, PhD O. Sachenko

[Internship 29] Vasyl Lukyanchuk, LtD"Magnis", Kyiv, PhD O. Sachenko
[Internship 30] Viktor Maliovanyi, LtD "Tekhnolohii smaku", Ternopil, PhD O. Sachenko
[Internship 31] Nazar Mykhalchuk, LtD "Sharman - Ukraina", Ternopil, PhD O. Sachenko
[Internship 32] Andrii Prots, LtD "Tekhnolohii smaku", Ternopil, PhD O. Sachenko
[Internship 33] Ivan Serbai, LtD "Yavare", Ternopil, PhD O. Sachenko
[Internship 34] Oles Telikhovskyi, LtD "Sharman - Ukraina", Ternopil, PhD O. Sachenko
[Internship 35] Valerii Tushkul, LtD "StartupSoft" Ternopil, PhD O. Sachenko
[Internship 36] Volodymyr Khmil, "Magnis", Kyiv, PhD O. Sachenko
[Internship 37] Oleh Yankovskyi, LtD "Sharman - Ukraina", Ternopil, PhD O. Sachenko
[Internship 38] Christian Biai Motombo, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. I. Turchenko
[Internship 39] Maksym Kovalchuk, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. I. Turchenko
[Internship 40] Sasu Osesi Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. I. Turchenko
[Internship 41] Ebi Solomon Ekiyor Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. I. Turchenko
[Internship 42] Taras Haidar, Ltd "TsSO", Zolochiv, Lviv region, Assoc. Prof. M. Komar
[Internship 43] Mykola Kriukov, Ltd "TsSO", Zolochiv, Lviv region, Assoc. Prof. M. Komar
[Internship 44] Oleh Romaniv, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 45] Roman Levchuk, Ltd "TsSO", Zolochiv, Lviv region, Assoc. Prof. M. Komar
[Internship 46] Oleh Banderivskyi, Sambir Colledge of Economics and Informatics, Sambir, Lviv region, Assoc. Prof. M. Komar
[Internship 47] Pavlo Bohach, Private entrepreneur A. Pyrih, Ternopil, Assoc. Prof. M. Komar
[Internship 48] Yurii Vasiutyn, Private entrepreneur Vasyl Kravets, Stryi, Lviv region, Assoc. Prof. M. Komar
[Internship 49] Vadym Horbach, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 50] Viktor Huzii, Private entrepreneur Vasyl Kravets, Stryi, Lviv region, Assoc. Prof. M. Komar
[Internship 51] Volodymyr Dzhuryn, Private entrepreneur Vasyl Kravets, Stryi, Lviv region, Assoc. Prof. M. Komar
[Internship 52] Yevhen Kohut, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 53] Maksym Kondratiuk, State Educational Establishment, (Children Development Centre), № 4 "Romashka", Kovel, Volynska region, Assoc. Prof. M. Komar
[Internship 54] Andrii Kryvyi, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. M. Komar
[Internship 55] Andrii Moruzhko, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 56] Oleksandr Nakonechnyi, Kovel Industrial Economic Colledge of Lutsk NTU, Kovel, Volynska region, Assoc. Prof. M. Komar
[Internship 57] Vitalii Oksiutych, Web-design Studio "Artes", Ternopil, Assoc. Prof. M. Komar
[Internship 58] Anton Peliak, Private entrepreneur Oleh Horishnyi, Ternopil, Assoc. Prof. M. Komar
[Internship 59] Serhii Rimashevskyi, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 60] Nazarii Sadovyi, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 61] Dmytro Soroka, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 62] Roman Stasyshyn, Web-design Studio "Artes", Ternopil, Assoc. Prof. M. Komar
[Internship 63] Rostyslav Stasiv, " NPP Skolivski Beskydy" Assoc. Prof. M. Komar
[Internship 64] Oleh Stashkiv, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 65] Oleksandr Fedak, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 66] Maksym Fedoruk, "Magnetic One", Ternopil, Assoc. Prof. M. Komar
[Internship 67] Oleksandr Bozhuk, "Light Support", Lviv, Assoc. Prof. M. Komar
[Internship 68] Oleksandr Tyshchuk, Kovel Industrial Economic Colledge of Lutsk NTU, Kovel, Volynska region, Assoc. Prof. M. Komar

[Internship 69] Roman Honcharenko, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. M. Komar
[Internship 70] Serhii Charnozhytskyi, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. M. Komar
[Internship 71] Oleh Rubakha, Kovel Industrial Economic Colledge of Lutsk NTU, Kovel, Volynska region, Assoc. Prof. M. Komar
[Internship 72] Nazarii Sahaidak, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. M. Komar
[Internship 73] Vitalii Halchyshak, Web-design Studio “Artes”, Ternopil, Assoc. Prof. M. Komar,
[Internship 74] Yurii Antoniuk, Private entrepreneur Oleksandr Antoniuk, village Halchyntsi, Teofipol district, Khmelnytsk region, Assoc. Prof. M. Komar
[Internship 75] Valentyn Blazhko, FG “Agro-Fortuna”, village Halchyntsi, Teofipol district, Khmelnytsk region, Assoc. Prof. M. Komar
[Internship 76] Vitalii Bodnar, Web-design Studio “Artes”, Ternopil, Assoc. Prof. M. Komar,
[Internship 77] Yurii Vertsimaha, “Magnis”, Kyiv, Assoc. Prof. M. Komar
[Internship 78] Yaroslav Hevko, TNEU Training and Methodology Department, Ternopil, Assoc. Prof. M. Komar
[Internship 79] Yurii Demydas, Web-design Studio “Artes”, Ternopil, Assoc. Prof. M. Komar
[Internship 80] Mykola Drachuk, LtD, Kyiv, “Smile Ukraina”, Assoc. Prof. M. Komar
[Internship 81] Yurii Kryzhanivskyi, Research Institute for Intelligent Computer Systems, TNEU, Ternopil, Assoc. Prof. M. Komar
[Internship 82] Ivan Matviishyn, "StartupSoft" , Ternopil, Assoc. Prof. M. Komar
[Internship 83] Roman Melnykovych, “Ellada”, Ternopil, Assoc. Prof. M. Komar
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7. PARTICIPATION IN CONFERENCES, SYMPOSIUMS AND WORKSHOPS, AND RESEARCH VISITS

Conferences

[Visit 1] **14th International Conference "Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering" (TCSET-2018), February, 20-24, Slavske, Lviv region, Ukraine**

- Pavlo Bykovyy
- Diana Zahorodnia

[Visit 2] **14th International Conference "Information and Communication Technologies in Education, Research and Industrial Applications", ICTERI-2018, May, 14 -17, 2018, Institute of Postgraduate Education of T. Shevchenko National University of Kyiv, Kyiv, Ukraine**

- Volodymyr Kochan
- Gryhoriy Gladiy
- Pavlo Bykovyi

[Visit 3] **15th International Conference "**Project Management in Society Development", May, 18-19, 2018, Kyiv, Ukraine

- Serhii Bushuiev
- Anatoliy Sachenko

[Visit 4] **14th International Conference "Development and Application Systems (DAS-2018)", May, 24 – 26, 2018,** Stefan cel Mare University, Suceava, Romania

- Oleksandr Osolinskyi
- Pavlo Bykovyy

[Visit 5] **9th International IEEE Conference "Dependable Systems, Services and Technologies DESSERT'2018" , May, 24 – 27, 2018, Kyiv, Ukraine**

- Anatoliy Sachenko
- Pavlo Yakobchuk

[Visit 6] **9 th International Conference on Advanced Computer Information Technologies (ACIT'2018), June, 1 – 3,** Ceske Budejovice, Czech Republic

- Vasyl Koval
- Vasyl Yatskiv
- Nataliia Yatskiv
- Roman Pasichnyk

[Visit 7] **International Research Conference at the University of Applied Sciences and Arts , 29, May – 1, June, 2018, Dortmund, Germany**

- Anatoliy Sachenko
- Iryna Turchenko
- Andrii Kaniovskyi

[Visit 8] **2nd International Conference "Data Stream Mining & Processing", August, 21 – 25, 2018, Lviv, Ukraine**

- Anatoliy Sachenko
- Oleksandr Osolinskyy
- Maksym Kovalchuk

[Visit 9] **13 th International Scientific and Technical Conference "Computer Science and Information Technologies" CSIT-2018), September 11 – 14, 2018, Lviv, Ukraine**

- Taras Lendiuk

[Visit 10] **[Visit 10] 4th IEEE International Symposium on Wireless Systems within the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems (IDAACS-SWS-2018), September, 20-21, Lviv, Ukraine.**

- Anatoliy Sachenko
- Volodymyr Kochan
- Pavlo Bykovyy
- Oleksandr Osolonskyi
- Taras Lendiuk
- Orest Kochan
- Vasyl Yatskiv
- Iryna Turchenko

[Visit 11] **[Visit 11] 1 st International Conference "System Analysis & Intelligent Computing" (SAIC-2018), October, 8–12, 2018, National Technical University of Ukraine "**Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Ukraine

- Grygorii Gladiy

Research Visits

ICS' staff visits

[Visit 12] Anatoliy Sachenko, Volodymyr Kochan, Pavlo Bykovyy, Oleksandr Osolynskyy, Diana Zahorodnia, Gryhorii Gladiy, Zbyshek Dombrovskyi, Vasyl Koval, Myroslav Komar, Vitalii Dorosh took part in the Winter Training School "Internet of Things: A New Course for Industry and Human Applications" within the framework of the Erasmus + Aliot project, February, 10 – 17, 2018.

[Visit 13] Vasyl Yatskiv, Nataliia Yatskiv, invited by Professor of the Berlin University of Applied Sciences, Jurgen Zick, took part in 16th International Conference" Culture and Computer Science", which was held at the Köpenik Palace, district of Berlin, May 24-25, 2018.

[Visit 14] Anatoliy Sachenko, Iryna Turchenko and students Maksym Kovalchuk, Olga Kukhta, Andrii Kaniovskyi participated in the Dortmund International Summer School, June 29 – July 6, 2018, organized annually by the Dortmund University of Applied Sciences (Dortmund, Germany) for Master's Students and PhD students of Dortmund University of Applied Sciences and its partners within the DAAD EuroPIM, DAAD East Partnership Project and Ruhr Master School.

[Visit 15] Anatoliy Sachenko, Oleksander Osolinskyi took part in the meeting of all participants of the Erasmus + ALIOT project, July 6-14, 2018, which was held for the first 5 days at the Newcastle University, School of Computing, UK, and for the last 4 days at the University of Leeds, UK.

[Visit 16] Anatoliy Sachenko and Taras Lendyuk visited the Telecommunication Department of the Institute of Telecommunications, Radio Electronics and Electronic Engineering of Lviv Polytechnic National University, 26, July, 2018, to discuss the organizational issues of the 4th IEEE International Symposium on Wireless Systems within the IEEE International Conferences on Intelligent Data Acquisition and advanced computing systems.

[Visit 17] Anatoliy Sachenko, Iryna Turchenko and students Yurii Antoniuk, Serhii Rimashevskyi, Oleh Bandrivskyi, Nazarii Sadovyi, invited by the moderator of the school, Professor of the Berlin University of Applied Sciences, Honorary Doctor of Ternopil National Economic University Jürgen Sieck participated in Summer School "Augmented Reality: IT and Culture", held at Odessa National Polytechnic University, September 17 – 22, 2018. The participants of the school worked in groups of 4-5 people on augmented reality projects, mastered Unity, Vuforia, ARCore, ARKit.

[Visit 18] Iryna Turchenko and Bachelor's students in Computer Science and Master's students in Project Management participated in the Digital Transformation Management workshop held within the International Symposium «Wireless Systems within the IEEE International Conferences on Intelligent Data Acquisition and Advanced Computing Systems» (IDAACS-SWS 2018), 22, September, 2018, Lviv, National University of Lviv Polytechnic.

[Visit 19] Anatoliy Sachenko visited Kazimierz Pułaski University of Technology and Humanities, Radom, Poland and Dortmund University of Applied Sciences, October, 10 – 19, 2018. The Polish company VISORT, monitoring the size, color and quality of a wide range of products, including vegetables and fruits, coffee beans, solar panels and more based on visual programming, was visited in Radom. He participated in the International Week at DUPN and made a presentation on the academic and scientific activities of TNEU and the Research Institute for ICS. The proposals for student exchange were prepared.

[Visit 20] Iryna Turchenko and students Yulia Skorobohata, Bohdana Bilavych and Sofiia Zhuravel visited Dortmund University of Applied Sciences, Dortmund, Germany to participate in Winter School, November 18 - 23, 2018, which was held for students, graduate students and teachers of Dortmund University of Applied Sciences and its partners within the DAAD EuroPIM, DAAD East Partnership Project and Ruhr Master School.

[Visit 21] Iryna Strubytska participated in the Women in Tech Summit, which was held on November, 28 -29, Warsaw, Poland.

[Visit 22] Anatoliy Sachenko took part in the Consortium Workshop "Managing Projects, Innovations and the Digital Transformation", December 4 - 8, 2018, Dortmund, where the consortium universities were represented: University of Applied Sciences and Arts, Dortmund; Leuven Catholic University, Belgium; Norwegian University of Science and Technology, Trondheim, Norway; Utrecht University, the Netherlands; Kaunas University of Technology, Lithuania; Nazarbayev University, Astana, Kazakhstan and three universities from Ukraine: Kyiv National University of Civil Engineering and Architecture, Ternopil National Economic University and Zaporizhzhia National Technical University.

International and National Collaborators Visits

[Visit 23] Oleksander Drozd (Odessa National Polytechnic University) visited Ternopil National Economic University on February 9, 2018. He took part in a scientific seminar, where the participants presented their work within the framework of the Erasmus + ALIoT project "Internet of Things: Emerging Curriculum for Industry and Human Applications".

[Visit 24] Oleh Zachko (Lviv State University of Life Safety) visited Ternopil National Economic University on March 7, 2018 and presented a report on the topic "Methodology of Project Safety Management" at a scientific seminar.

[Visit 25] Juergen Sieck (Professor, University of Applied Sciences, Berlin, Germany) visited Ternopil National Economic University on April 12-13, 2018. He presented a presentation on "Augmented Virtual Reality in a Cultural Environment". During his visit the Ukrainian-German Training and Research Center was opened, ways of cooperation and prospects for the development of the Ukrainian-German Training and Research Center, including student and teacher exchange within the Erasmus + program were discussed. Also, on April 13, at the meeting of the Academic Council of the University, Professor Juergen Sieck was awarded the honorary title of Doctor Honoris Causa of Ternopil National Economic University.

[Visit 26] Valentin Tomashevsky (National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute") paid a visit on April 18, 2018. He presented a report on "Simulation Modeling" at a scientific seminar.

[Visit 27] Viktor Krylov (Odessa National Polytechnic University), Inna Skarha-Bandurova (Volodymyr Dahl East Ukrainian National University), Oleg Savenko (Khmelnytskyi National University) and others attended a seminar at the ICS on April 26, 2018. Inna Skarha-Bandurova presented report "Dynamic gesture recognition for future interaction design", and Viktor Krylov presented report "Wavelet analysis image processing and recognition methods".

[Visit 28] Janina Sheikh (Certified Business Coach and Doctoral Student at the Strategic Management Department at Dresden University of Technology) met with the students and informed about DAAD and other funding providers (e.g., Conrad Adenauer), spoke about studying and internship in Germany, and scholarship programs) on May 25, 2018.

[Visit 29] Viktor Kremin, Oleksandr Karpin and Sviatoslav Palii (representatives of Cypress Semiconductor Corporation, a branch of IT company in Lviv) paid a working visit on June 7, 2018. They made an interesting presentation for the staff and students of the ICS "Secure Fingerprint Sensing and Identification for IoT" and also told about the multifaceted possibilities of expanding cooperation, in particular the possibilities of employment for undergraduate and graduate students, Summer School for students, a scientific program for teachers, etc.

[Visit 30] Oleh Zachko (Professor, Department of Management and Civil Law, Doctor of Science, Associate Professor, Lviv State University of Life Safety), on July 18, 2018 participated

in a joint scientific seminar of the Research Institute for Intelligent Computer Systems, where Mykhailo Dombrovskyi presented his work for the Scientific Degree.

[Visit 31] Volodymyr Golovko (Head of the Department of Intelligent Information Technologies of Brest State Technical University) was on a visit on July 18 - 20, 2018, whithin which a round table discussion “Perspectives of deep learning in the field of artificial intelligence development” was held at the Department for Information Computer Systems and Control. Staff of the department and students participated in this discussion.

[Visit 32] Axel Sikora (Professor, Offenburg University of Applied Sciences, Scientific Director of the Institute of Embedded Systems and Telecommunication Electronics), paid a working visit on September 22, 2018. During the meeting with the staff of the department the scientific results of both sides were presented, as well as the issues of further cooperation and graduate students supervision were discussed.

[Visit 33] Representatives of the Lviv IT Company SoftServe paid a working visit on October 5, 2018. During this visit a meeting with students and staff of the department was held, at which the participants were told about the company and students were invited for a three-month paid internship with the prospects of further employment.

8. AWARDS

[Award 1]. Pavlo Yakobchuk was awarded an honorary diploma for the 1st place in the 2nd stage of the All-Ukrainian competition of student scientific works in Computer Sciences, April 17, 2018, Khmelnytskyi National University, Khmelnytskyi.

[Award 2]. Svitlana Lysynchuk, Olha Kukhta were awarded the diploma of the third degree as winners of the second stage of the All-Ukrainian competition of student scientific works in Project and Program Management, April 24, 2018, Lesya Ukrainka Eastern European National University, Lutsk.

[Award 3]. Anatoliy Sachenko received a grant to participate in the Consortium Workshop "Managing Projects, Innovations and the Digital Transformation" in Dortmund, Germany on December, 2018.

[Award 4]. Anatoliy Sachenko, Iryna Turchenko and students Maksym Kovalchuk, Olga Kukhta, Andrii Kaniovskyi received a grant for participation in the Dortmund International Summer School, June 29 - July 6, 2018, Dortmund, Germany.

[Award 5]. Anatoliy Sachenko, Iryna Turchenko and students Yurii Antoniuk, Serhii Rimashevskyi, Oleh Bandrivskyi, Nazarii Sadovyi received a grant to participate in Summer School "Augmented Reality: IT and Culture", which was at Odessa National Polytechnic University held on September 17-22, 2018.

[Award 6]. Iryna Turchenko and students Yulia Skorobohata, Bogdana Bilavych and Sofiia Zhuravel received a grant to attend Winter School, November 18 -23, 2018, which was held for students, graduate students and teachers of Dortmund University of Applied Sciences and its partners within DAAD EuroPIM, DAAD EuroPhip, DAAD Project and Ruhr Master School.

[Award 7]. Anatoliy Sachenko received a grant to attend the International Week at Dortmund University of Applied Sciences and Arts, October 2018, Dortmund, Germany.

9. STATISTICAL DATA

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of Senior Researches	9	15	18	19	20	22	27	30	34	39	40	39	**45**
Number of Junior Researches	14	17	15	18	18	15	13	11	14	16	12	10	**8**
Number of Active Research Projects	9	7	7	8	4	2	2	3	3	3	3	2	**4**
Publications	26	58	57	72	77	104	109	126	127	113	131	115	**163**
Patents and applications for the invention	more than 150 invention certificates of the former USSR and 39 Ukrainian patents										9	10	**8**
Participation in Conferences, Symposia and Worshops	13	18	19	21	36	29	33	28	23	33	24	32	**33**
Number of Defended PhD and DrSc Theses	–	3	3	2	–	3	3	3	3	7	7	6	**4**
Number of Defended Master Theses	1	10	7	20	23	22	39	22	48	60	12	54	**88**
Number of Received Awards	1	2	5	7	5	3	2	3	2	5	6	5	**7**

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