RESEARCH INSTITUTE
FOR INTELLIGENT COMPUTER SYSTEMS

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

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

ANNUAL REPORT

2019

Ternopil – 2020

CONTENTS

FOREWORD

The ICS counts the 14 Research Groups which are described below. During its history, the ICS staff has received more than 150 invention certificates of the former USSR and 68 Ukrainian patents. There were published more than 1230 papers and 126 of them in 2019. There were defended 48 DSc and PhD theses, in particular the four in 2019.

A competence and expertise of ICS staff has been confirmed since 1997 by awarding 21 international grants and projects within the INTAS, CRDF, NSF, NATO, STCU, and FP7, DAAD, Erasmus+ of the European Union, in particular the one in 2019. In these projects, the ICS collaborated with a huge number of world-known universities as well as governmental institutions and private companies. We started to run a new DAAD project Virtual Master Cooperation Data Science (ViMaCs) in 2019.

Additional 16 projects have been completed funded by the Ministry of Education and Science, Ukraine; in particular, the project "Methods for intelligent processing and analysis of Big Data based on deep neural networks" by Intelligent Cyber Security and Defense Group led by Prof. Vladimir Golovko and Anatoliy Sachenko.

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 Metz, France, 18-21 September 2019. Proceedings of the conferences are indexed by IEEE Xplore, EI Compendex and Scopus, and a most of them are indexed by WoS. Now we are preparing along with a Polish team the 11th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems, which will be held in September, 2021, Cracov University of Technology, Cracov, Poland.

The ICS has been taking a 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 17-18 September, 2020 in Dortmund, Germany and ICS team is invoved in its preparation.

The ICS staff has a good ralationship with the IEEE Student Branch at TNEU and the Instrumentation and Measurement / Computational Intelligence Joint Societies Chapter of IEEE Ukraine Section. A Chapter has run the nine meetings in 2019.

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 by Scopus Elsevier as well as Finnish publication forum, Norwegian Social Science Data Services, Google Scholar, and Index Copernicus International. The four regular issues were published in 2019.

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

Enjoy,

Prof. Anatoliy Sachenko

March 12, 2020

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 Security, Project and Program Management based on IT and Knowledge, Cybernetics of Complex Systems, Information Security, Intelligent Cyber Security and Defense, Metrology of Information Measuring Systems, Simulation and Algoritmization of Complex Technological Processes.

ICS Management

Director – Prof. 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
- 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
- Stepan Ivasiev
- Myroslav Komar
- Volodymyr Karpinskyy
- Oleg Savenko
- Vasyl Yatskiv

Metrology of Information Measuring Systems Group (MIMS)

Principal researchers – Prof. Volodymyr Kochan, Prof. 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
- Grygoriy Gladiy
- Diana Zahorodnia
- Khrystyna Lipyanina-Goncharenko

2. ICS RESEARCH STAFF

Senior Staff

Oleh Adamiv

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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.

Robert Hiromoto

Ph.D., University of Texas, Dallas, USA, Professor of Computer Science, University of Idaho, Idafo-Falls, USA, Fulbright Program Fellow (2013-2014), TNEU, Co-Head of IRS Group (2013), WSS Group Member (2013).

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

Grygoriy Gladiy

Specialist (1979), Applied Mathematics, Chernivtsi State University, Ph.D. (1990), Mathematical Methods, Models and Information Technologies in Economics, Associated Professor (2013), Department for Information Computer Systems and Control, CCS Group Member (2013), PPMITK Group Member (2014), SACTPC Group Member (2014).

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

Vladimir Golovko

Master (1979), Computer Engineering, Moscow Bauman State Technical University, PhD (1990), in Computer Science (1990), Doctor of Technical Sciences (2003), Head of Intelligence Information Technologies Department and Laboratory of Artificial Neural Networks of the Brest State Technical University, IRS Group Member (2014), Co-head of ICSD Group.

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

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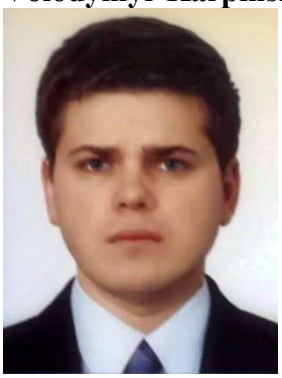
Research interests: specialized computer systems, wireless information technologies and systems of their security.

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.

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Research interests: artificial intelligence, systems of information security.

Vasyl Koval

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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.

Taras Lendyuk

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.

Khrystyna Lipyanina-Goncharenko

Bachelor (2011), Economic Cybernetics, Ternopil National Economic University, Master (2012), Economic Cybernetics, Ternopil National Economic University, Lecturer at Department for Information Computer Systems and Control (2019), PhD (2019), Senior Lecturer at Department for Information Computer Systems and Control (2020), SACTPC Group member (2019).

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Research interests: economic-mathematical ultisen, project management.

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Bachelor (2005), Economic Cybernetics, Ternopil Academy of National Economy, Master in Economic Cybernetics (2006), Ternopil State Economic University, Ph.D. student (2007), Ph.D. in Information Technologies (2012), KBO Group Member (2005), CCS Group Member (2009).

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Research interests: ontology, knowledge discovery.

Yaroslav Nykolaychuk

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

Olexandr Osolinskyi

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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.

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Research interests: knowledge bases, ontology, knowledge discovering.

Oleksiy Roshchupkin

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Room 2009, phone 47-50-50

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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).

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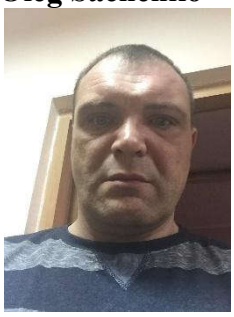
Research interests: Artificial intelligent systems, distributed sensor networks, computational, intelligence, intelligent robotics systems, parallel computation systems, cybersecurity and safety systems, project management, wireless sensor networks.

Oleg Sachenko



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Research interests: project management

Oleg Savenko

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

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Research interests: Information security in computer systems and networks

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

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

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

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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

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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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e-mail: ovo@tneu.edu.ua

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),.

Room 2305B phone: 47-50-0*12-321
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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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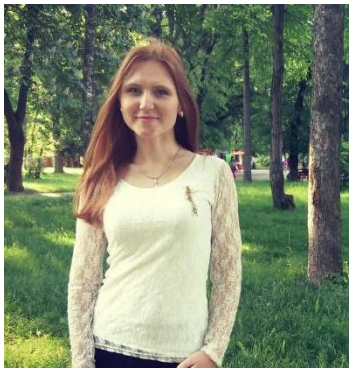
Research interests: neural networks

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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e-mail: o.dunets@tneu.edu.ua

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

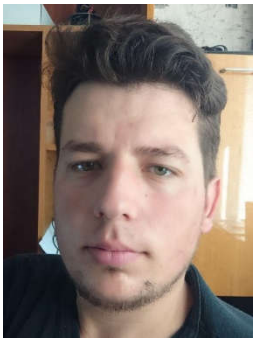
Andriy Kaniovskyi

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

e-mail: andriy.kanovskyy@gmail.com

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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e-mail: kitivan400@gmail.com

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).

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

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

3. RESEARCH PROJECTS

Current

[Project 1] Methods and means of structural-statistical identification of hierarchical objects by characteristic points of their contours

Principal investigator of project – PhD Diana Zahorodnia;
Co-investigator – PhD Hrystyna Lipyanina-Goncharenko.

Duration: 2019 –2020

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

Main results of the project:

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

Team:

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

[Project 2] 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 3] Erasmus+ALIOT

Grantholder – Prof. Chris Phillips, Newcastle University, Newcastle, UK
National coordinator – Prof. Vyacheslav Kharchenko, National Aerospace University KhAI, Kharkiv
Leader of ICS TNEU team – Prof. Anatoliy Sachenko, ICS, Ternopil National Economic University

Duration: 2016 – 2020

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

Interim project results:

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

Team:

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

[Project 4] DAAD programme "Eastern Partnerships"

Project Co-investigator: Prof. Anatoliy Sachenko
Co-investigator – Dr Iryna Turchenko

Duration: 2017 – 2019

Objectives:

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

Main project results:

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

Team:

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

[Project 5] Virtual Master Cooperation Data Science (ViMaCs)

Project Co-investigator: Prof. Anatoliy Sachenko
Co-investigator – Dr Pavlo Bykovyy

Duration: 2019 – 2021

Foreign partner: University of Applied Sciences Dortmund, Gernamy

Main project results:

- Staff and students Mobility to Germany and back
- Holding Summer and Winter Schools every year
- Research Big Data acquisition and collection
- Developing online e-courses

Team:

- Anatoliy Sachenko;
- Pavlo Bykovyy;
- Oleksandr Osolinskyi
- Mykhailo Dombrovskiy

Completed projects

[Project 6] 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 7] 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 8] 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 9] 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 10] 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 11] 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 12] 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 13] 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 14] 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 15] 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 16] 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 17] 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 18] 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 19] 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 20] 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 21] 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 22] 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 23] 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 24] 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 25] 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 26] 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 27] 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 28] 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 29] 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 30] 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 31] 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 32] 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 33] 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.
- 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.
- 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 to design projects perimeter area security systems.
- 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.” Proc. of the 3rd IEEE Int. Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications IDAACS’05 (2005): 388-391. (Bulgaria)

[Project 34] 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 35] 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 36] 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, 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'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.

The 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2019)

From 18 to 21 September 2019 in Metz, France, on the basis of the Technical Institute Ecole Nationale d'Ingénieur de Metz (ENIM) of the University of Lorraine (University of Lorraine) the 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2019) has held. The organizers of IDAACS 2017 were scientists from the Research Institute for Intelligent Computer Systems, Ternopil National Economic University and the VM Glushkov Institute of Cybernetics, NAS of Ukraine, the Conference Co-Chairs were Anatoliy Sachenko and 2019 Kondo Hloindo Adjallah.

On September 18, registration began and a Welcome party took place in the evening. The conference was opened on September 19, morning by the Chairman of the International Advisory Board (IAB) George Markowsky, USA, who offered a minute of silence in memory of Wiesław Winiecki and Domenico Grimaldi. Also at the opening were Pierre Chevrier, Director of the Ecole Nationale d'Ingénieur de Metz, Imed Kacem, Head of the Laboratory of Conception, Optimization and Modeling of Systems (LCOMS), Anatoliy Sachenko and Kondo Hloindo Adjallah. At the end of the session, George Markowsky announced the IAB's decision: the IDAACS SWS 2020 symposium will be held in Dortmund, Germany at the University of Applied Arts in Dortmund in September 2020, and IDAACS'2021 – in Krakow, Poland at Cracow University of Technology in September 2021.

The keynote speaker Jürgen Sieck from Germany presented at the plenary session on September 19 a talk "Augmented and Virtual Reality Applications for Culture and Tourism". One poster and 11 oral sessions were held that day, including a memorial session in memory of Wiesław Winiecki. The day ended with an interesting tour of the city.

On September 20, keynote speaker Kurosh Madani from France presented at the plenary session a talk "Machine-Awareness Through a Machine-Learning Based Humanization of Robots' Gazing". At the end of the session, Uwe Grossman and Carsten Wolff presented the University of Applied Arts in Dortmund as the hosts of the IDAACS SWS 2020 symposium in September 2020, and Zbigniew Kokosiński as the University of Cracow, Poland as the host of the next IDAACS 2021 conference in Krakow. In total, one poster and 12 oral sessions were held on this day, including a memorial session in memory of Domenico Grimaldi. The day ended with a gala dinner at the attractive house "Arsenal".

A keynote speaker Fabio Scotti from Italy presented at the plenary session on 21 September a talk "Artificial Intelligence for Biometric Systems: Applications, Innovative Systems, and Trends".

One poster and four oral sessions were held on the same day, as well as Round Table and a Closing Ceremony.

At the closing ceremony, the chair of the selected committee of scientists, John Kalomiros, based on the evaluation of all papers and ranking of presentations by the chairmen of the sessions, announced the best papers. The title of the best report with a cash prize of 400 CHF Swiss francs from the sponsor MDPI Sensors each received the report of scientists from Lithuania – Rytis Augustaukas, Arūnas Lipnickas, as well as the report of young scientists from Canada – Stéphane Duguay, Steven Pigeon. Three best oral reports by scientists from Slovakia – Štefan Balogh, Ján Mojžiš, Ukraine – Olena Golembovska, Vyacheslav Kharchenko, Igor Shostak, Mariia Danova, Olena Feoktystova, Vladyslav Plietnov and Germany – Ingo Kunhrle, Hendrik, were awarded books – monographs by River Publishers. Kuller, Nursi Karaoglan, Fabian Kohlmorgen, Jörg Bauer, as well as all co-chairs of the sessions. In addition, the comments of the participants were heard and discussed, in particular on new streams and topics of sessions, the time of the conference, etc. Proposals by Vyacheslav Kharchenko on the topic of books (based on selected works of the IDAACS'2019 conference) for River Publishers were also heard.

The 314 papers by authors from 42 countries were submitted to the International Program Committee (IPC). As a result of the review, 213 papers were accepted and published in the collection of conference proceedings in two volumes (Vol. 1, 1–578, Vol. 2, 579–1147). The collection is indexed in IEEE Xplore and Scopus

Professors Anatoliy Sachenko and Volodymyr Kochan, associate professors Pavlo Bykovy, Svitlana Sachenko and Iryna Turchenko, Ph.D. Taras Lendyuk, PhD student Vitaliy Dorosh and Master student Ivan Kit presented the ICS-TNEU team.

In general, according to the participants and the feedback that was later received by OrgCom, the 10th IEEE IDAACS'2019 conference has held with a great success.

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) was held in 2018.

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

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; Data Science; Digital Signal Processing; Distributed Systems and Remote Control; Education in Computing; Embedded Systems; High Performance Computing, GRIDs, Parallel and Distributed Computing; Human-Computer Interaction; Image Processing and Pattern Recognition; Intelligent Robotics Systems; Internet of Things; IT Project Management; Systems and Control; Wireless Systems.

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- 2019, Vol. 18, Issue 3
- 2019, Vol. 18, Issue 2
- 2019, Vol. 18, Issue 1
- 2018, Vol. 17, Issue 4
- 2018, Vol. 17, Issue 3
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- 2014, Vol. 13, Issue 4 – thematic issue "ICT in Project Management"
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- 2011, Vol. 10, Issue 4 – Special Issue on Wireless Systems
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- 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
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- 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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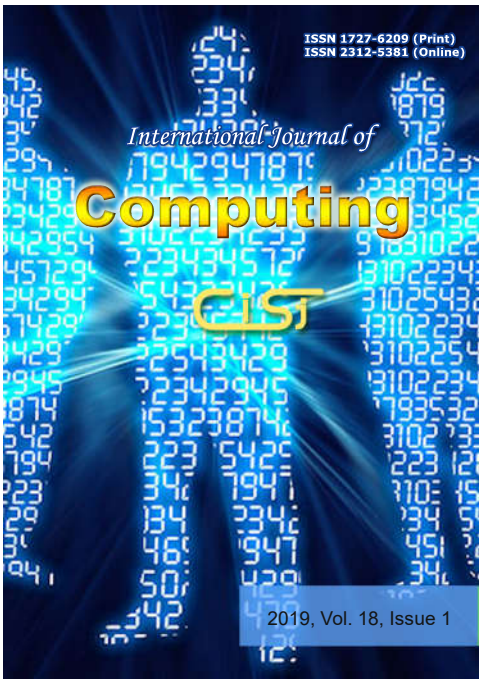

1. V. Turchenko, E. Chalmers, A. Luczak. A Deep Convolutional Auto-Encoder with Pooling – Unpooling Layers in Caffe. – pp. 8-31.
2. M. Fisun, M. Dvoretskyi, H. Horban, M. Komar. Knowledge Management Applications Based on User Activities Feedback. – pp. 32-44.
3. M. Eshtay, A. Sleit, M. Aldwairi. Implementing Bi-Temporal Properties into Various NOSQL Database Categories. – pp. 45-52.

4. S. Mashtalir, O. Mikhnova, M. Stolbovyi. Multidimensional Sequence Clustering with Adaptive Iterative Dynamic Time Warping. – pp. 53-59.
5. Z. Saaya, T. W. Hong. The Development of Trust Matrix for Recognizing Reliable Content in Social Media. – pp. 60-66.
6. P. Zhezhnych, A. Shilinh, V. Melnyk. Linguistic Analysis of User Motivations of Information Content for University Entrant's Web-Forum. – pp. 67-74.
7. K. Kalare, J. Tembhurne. A Work Distribution Strategy for Global Sequence Alignment. – pp. 75-81.
8. I. Gorbenko, A. Kuznetsov, Yu. Gorbenko, S. Vdovenko, V. Tymchenko, M. Lutsenko. Studies on Statistical Analysis and Performance Evaluation for Some Stream Ciphers. – pp. 82-88.
9. K. Lisickiy, V. Dolgov, I. Lisickaya, K. Kuznetsova. Block Symmetric Cipher with Random S-Boxes. – pp. 89-100.

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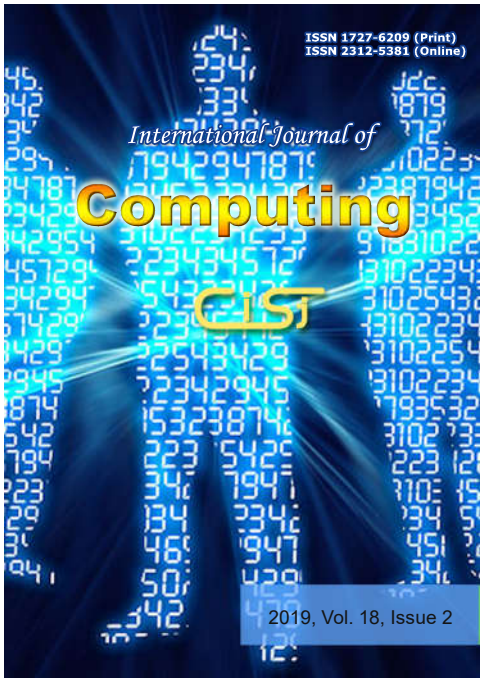
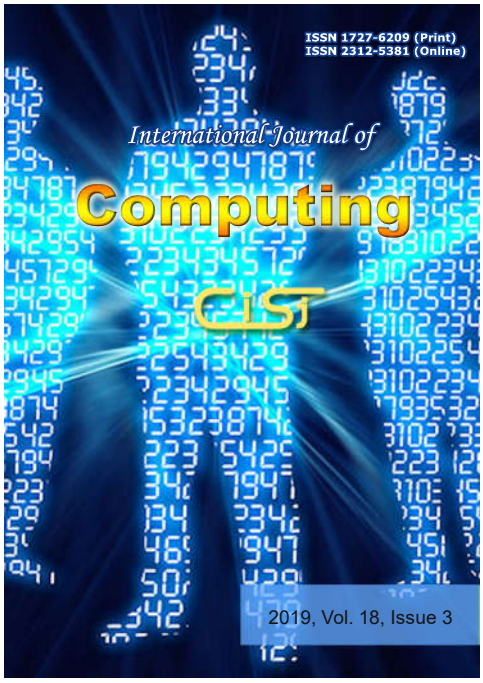
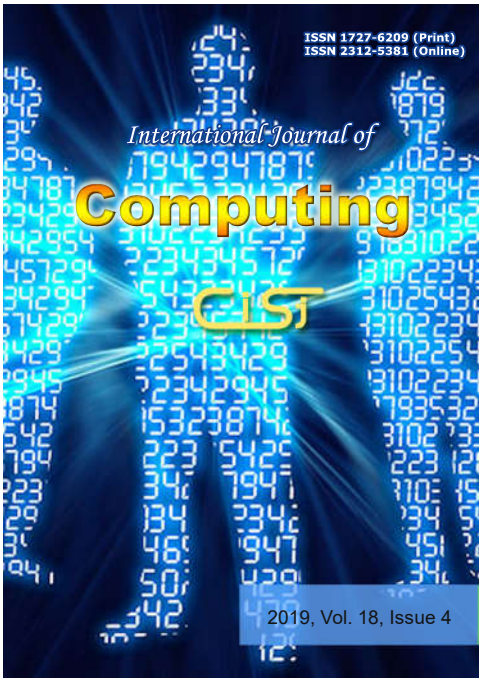


Journal Contents, 2019, Vol. 18, Issue 3



Journal Contents, 2019, Vol. 18, Issue 4



Specialized Scientific Council K58.082.02

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

The following PhD theses were defended in 2019:
- **A. I. Sydor,** PhD thesis "Methods and processors for recognizing multidimensional images in Hamming space", specialty 05.13.05 – Computer Systems and Components. Supervisor Professor Ya.M. Nykolaychuk.
- **Kh. V. Lipyanina-Goncharenko,** PhD thesis "Information technology of modeling and analysis of tourist demand on the basis of cognitive-statistical approach", specialty 05.13.06 – Information Technology. Supervisor Professor V.M. Krylov.
- **N. R. Grabovska,** PhD thesis "Information technologies of three-dimensional reconstruction of images of surface defects for the Lambert model of light reflection", specialty 05.13.06 – Information Technology. Supervisor Professor B.P. Rusyn.

IEEE Instrumentation & Measurement/Computational Intelligence Joint Societies Chapter

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

Prof. S. Antoshchuk, Odessa National Polytechnic University
Dr P. Bykovyy, Ternopil National Economic University
Prof. M. Dorozhovets, Lviv National Technical University
Prof. A. Drozd, Odessa National Polytechnic University
Prof. O. Ivakhiv, Lviv National Technical University
Prof. R. Kochan, Lviv National Technical University
Dr O. Kochan, Ternopil National Economic University
Prof. V. Kochan, Ternopil National Economic University
Prof. V. Krylov, Odessa National Polytechnic University
Dr S. Lysenko, Khmelnytsky National University
Prof. V. Lytvynenko, Kherson National Technical University
Dr V. Mukhin, National Technical University of Ukraine "Kyiv Polytechnic Institute"
Dr O. Osolinskyi, Ternopil National Economic University
Prof. S. Rippa, National University of the State Taxation Department of Ukraine
Prof. A. Sachenko, Ternopil National Economic University
Dr V. Turchenko, Ternopil National Economic University
Dr G. Shilo, Zaporizhzhya National Technical University
Dr V. Yatskiv, Ternopil National Economic University

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

I. At January 11, 2019 within the framework of the specialized multi department scientific seminars: "Advance and Challenges in Computing", was held the meeting of IEEE I&M/CI Chapter at TNEU. There were representatives from the Ternopil Ivan Pului National Technical University, Odessa National Polytechnic University and the National University "Lviv Polytechnic". There were presented two presentations by the Hrystyna L'ipyanina-Goncharenko entitled "Information technology modeling and analysis of tourist entertainment based on a

cognitive-statistical approach" and associate professor of the National University of Lviv Polytechnics, Lesia Myczuda entitled "Theory and practice of analog-to-digital functional converters on commutated capacitors". There were 12 participants of the seminar.

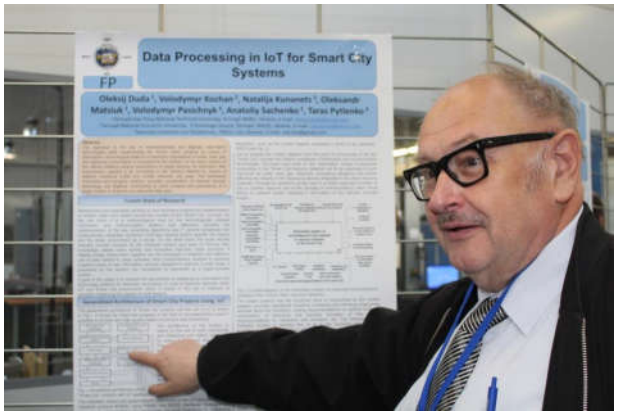
II. At February 5, 2019, within the framework of Winter School under the Erasmus + ALIoT project ("Internet of Things: Emerging Curriculum for Industry and Human Applications" which was held from January 31 to February 6, 2019) a Meeting of the IEEE I&M / CI Chapter was held in Yaremche, Ivano-Frankivsk region, Ukraine. Dr. Pavlo Bykovyy presented the report "ThingSpeak as an open Cloud Platform for the Internet of Things". A graduate of TNEU, Master student Andrii Kanovskyi , presented a report "3D LED Cylindrical Display for IoT". A total of 38 people took part in the seminar.

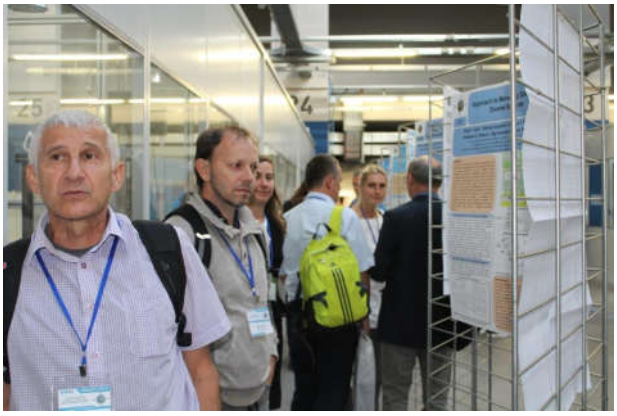
III. At April 6, 2019 as part of a joint scientific seminar "Advances & Challenges in Computing" on the basis of the Department of ICSC and Research Institute of Intelligent Computer Systems, a meeting of the IEEE I&M/CI Chapter, in which scientists from Ternopil, Odessa and Khmelnytsky took part. Professor, Dean of the Faculty of Programming and Computer and Telecommunication Systems of Khmelnytsky National University, O. Savenko presented a report on "Theory and practice of creating distributed malware detection systems in local computer networks". DsC, Associate Professor V. Yatskiv presented a report "Internet of Things Technologies for Cyber Physical Systems". A total of 25 people took part in the seminar.


IV. At May 21, 2019 within the Spring School Training STraS-2019, held on May 17 – May 21, 2019 under the project Erasmus+ ALIoT "Internet of Things: Emerging Curriculum for Industry and Human Applications" at the base of National University "Zaporizhzhya Polytechnics", a meeting of the IEEE I&M/CI Chapter was held. Prof. Anatoliy Sachenko told about the current results of the ERASMUS + Aliot project by the TNEU team. Ph.D., O. Osolinskyi made a report on "Using virtual instruments in IoT" and also presented intermediate projects included in this topic. A graduate of TNEU, Master Andriy Kanyovsky made a report on "Remote drone for IoT (power supply)". A total of 30 people took part in the seminar


V. At July 5, 2019 within the framework of the joint interdepartmental scientific seminar "Advances & Challenges in Computing", a meeting of the IEEE I&M/CI Chapter was held in TNEU. Reports were presented by Andriy Sydor entitled "Methods and processors of recognition of multidimensional images in the hemming space" and Khrystyna Lipyanina-Goncharenko entitled "Information technology of modeling and analysis of tourist demand based on cognitive-statistical approach". A total of 20 people took part in the seminar

VI. At September 21, 2019 within the international conference IDAACS'2019, which took part from 18 to 21 September 2019 in Metz, France, on the basis of the Technical Institute Ecole Nationale d'Ingénieur de Metz (ENIM), University of Lorraine, a meeting of the IEEE I&M/CI Chapter was held. Reports were presented by: Volodymyr Kochan on "Open Data Processing in IoT for Smart City Systems"; Oleksandr Drozd on the topic "The Basic Model of Attack Resistance Estimation for Monitoring the Program Code Integrity of the FPGA-Based Systems". A total of 32 people took part in the seminar





VII. At September 13, 2019 as part of the First International Week at TNEU, which lasted from 9 to 15 September 2019 at the Ukrainian-German Training and Research Center TNEU a meeting of the IEEE I&M/CI Chapter was held. Reports were presented by: Carsten Wolff (University of Applied Sciences and Arts, Dortmund, Germany, Carsten Wolff, Dortmund University of Applied Sciences and Arts, Germany) on "Exchange of experience in projects under European educational and research programs", Prof. Anatoliy Sachenko on the topic "Application of augmented reality in cyberphysical systems".A total of 29 people took part in the seminar.

VIII. At October 3, 2019 within the framework of the joint interdepartmental scientific seminar “Advances & Challenges in Computing”, a meeting of the IEEE I&M/CI Chapter was held, which was attended by employees of the departments of ICSC, EC, KN, KB, Research Institute of Intelligent Computer Systems. Mykhailo Dombrovsky presented a report on the topic: “Proactive project management of organizational development of energy supply companies in a turbulent environment:, Ph.D. Taras Lendyuk: presented the report “Methods of improving computerized distance learning systems”. A total of 15 people took part in the seminar

IX. At December 6, 2019, as part of the first winter school of informatization (project “Virtual Master Data Data Science ViMaCs”) in National University “Zaporizhzhya Polytechnics”, which lasted from 2-6 December 2019, a meeting of the IEEE I&M/CI Chapter was held. Reports were conducted by: PhD O. Osolinskiy entitled “Using virtual instruments in IoT”; DsC G. Shilo entitled “IEEE Region 8 Voluntary contribution fund for granted support of participating the IEEE Conferences”. A total of 36 people took part 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.

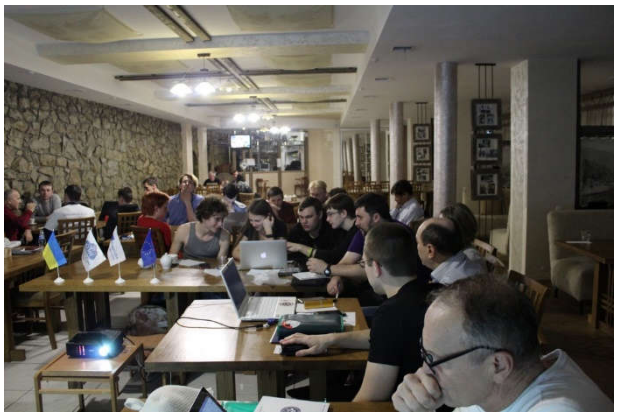
Student Branch involves students of the Faculty of Computer Information Technologies, PhD students and junior researchers of TNEU. The 3 active members of the Student Branch were in 2019. The Branch Committee consists of the Chairperson – O. Dunets, a Student Branch Advisor is Prof. Anatoliy Sachenko.

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

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

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

Students branch members took part in Winter School within the Erasmus + ALIoT project "Internet of Things: Emerging Curriculum for Industry and Human Applications" and International Summer School "Augmented Reality".








Other Research Activities

[Org 1] Sergey Bushuyev

- Reviewing 10 papers for international and national conferences.
- Reviewing 11 articles in international and national scientific journals.
- Member of the organizing / program committee:
  - Bukovel, February 2019, Strategic Project Management;
  - Kyiv, May 2019, Project Management in the Development of Society;
  - Mykolaiv, September 2019, Practical Aspects of Project Management;
  - Odessa, December 2019, Project management: Innovations, Nonlinearity, Synergetics;
  - Metz, France, IDAACS-19, 18-21 September

[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-19, 18-21 September, Metz, France.
- 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'2019)”;
- 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 ICSC, TNEU;

[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’2019), Czeske Budejovice, Czech Republic, June 2019;
- Member and a Vice-Chairman of the Specialized Scientific Council K.58.082.02 in TNEU.

[Org 5] Roman Pasichnyk

- Reviewing 9 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’2019), Czeske Budejovice, Czech Republic, June 2019;
- 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 5 articles in international and national scientific journals.
- Reviewing the 2 PhD Theses.
- A member of specialized academic council K 27.855.01 at NUSTA.
- Acting as an opponent at the defense of 1 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";
- Acting as an opponent at the defense of one DsC and 3 PhD dissertations.
- Reviewing 26 papers for international and national conferences.
- Reviewing two DSc Theses.
- Reviewing five PhD Theses.
- Co-Chairman of10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2019;
- Member of the Program Committee of 8 International Conferences.

[Org 8] Volodymyr Turchenko

- Deputy Editor at International Journal of Computing, participated in preparating four issues of the Journal, reviewed 3 articles.
- Reviewing papers for international conferences IIDAACS'19, IJCNN'19, PDP'19, DCAI'19.
- Reviewing papers for journals Computer Science, Advances in Cyber-Physical Systems, IEEE Journal of Biomedical and Health Informatics.
- Reviewer of applications of the Fulbright Academic Exchange Program in Ukraine

[Org 9] Vasyl Yatskiv

- Reviewing 2 PhD Thesis and 1 DSc Thesis.
- Member of the Program Committee of the international conference "Advanced Computer Information Technologies", (ACIT'2019), Czeske Budejovice, Czech Republic, June 2019;
- 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] Oleg Savenko defended DSc Thesis titled “Theory and Practice of creation of Distributed Systems of Detection of Malible Software in Local Computer Networks”, 05.13.05 – Computer Systems and Components, Co-Advisors Prof. George Markowsky, Missouri University of Science and Technology, USA and Prof. Anatoliy Sachenko
[Def 2] Khrystyna Lipyanina-Goncharenko defended PhD thesis titled “Information technology for modeling and analysis of tourist demand based on the cognitive-statistical approach”, 05.13.06 – Information Technology, supervisor Prof. V.M. Krylov
[Def 3] Andriy Sydor defended PhD thesis titled “Methods and processors for recognizing multidimensional images in the Hamming space”, 05.13.05 – Computer Systems and Components, supervisor Prof. Ya.M. Nykolaychuk
[Def 4] Mykhailo Dombrovsky defended PhD thesis titled “Proactive project management of organizational development of energy supply companies in a turbulent environment”, 05.13.22 – Project and Program Management, supervisor Prof. A. O. Sachenko

Defended Master Theses

[DefMas 1] Vasyl Antonyk, Hardware-Software Complex of Tensometric Measurements Based on the LabView Package, PhD, Assoc. Prof. Volodymyr Kochan

[DefMas 2] Yuriy Antoniuk, The Algorithm of Interacting with a Model for 3D Configurator, PhD Assoc. Prof. Iryna Turchenko

[DefMas 3] Oleh Bandriskiy, The Algorithm for Protection of Video Data Integrity Based on the Blockchain Technology, PhD, Assoc. Prof. Nataliya Yatskiv

[DefMas 4] Valentyn Blazhko, Supply Chain Management System based on Blockchain Technology, PhD, Assoc. Prof. Nataliya Yatskiv

[DefMas 5] Yaroslav Gevko, The Algorithm for Data Reliable Storage in Virtual Repositories, PhD, Assoc. Prof. Nataliya Yatskiv

[DefMas 6] Nazariy Kotsiy, Algorithm of Parallelization of Deep Learning of the Neural Network at the Level of the Training Set, PhD Myroslav Komar

[DefMas 7] Yuriy Kryzhanisktiy, Detection and Classification of Objects in Satellite Images Based on Deep Neural Network, PhD Myroslav Komar

[DefMas 8] Roman Melnykovych, Neural Network Method of Preliminary Processing of Input Data, PhD Myroslav Komar

[DefMas 9] Anastasia Novosad, Classification Algorithm for Fashion Accessories Based on Convolutional Neural Network, PhD, Assoc. Prof. Volodymyr Kochan

[DefMas 10] Anton Pelyak, Intelligent Algorithms for Malware Detection in Computer Systems, PhD Myroslav Komar

[DefMas 11] Viktor POsviatovsky, Algorithm for Movie Selection Based on Convolutional Neural Network and Cloud Technologies, PhD, Assoc. Prof. Volodymyr Kochan

[DefMas 12] Sergiy Rimashevskyo, Method for Detecting Intrusions in Computer Networks Based on Artificial Intelligence, DSc, Prof. Anatoliy Sachenko

[DefMas 13] Nazariy Sadovyi, Software Model of Reliable Data Storage System Based on Residue Number System, PhD, Assoc. Prof. Nataliya Yatskiv

[DefMas 14] Oleg Sysak, Model of a Method for Diagnosing the State of Thermoelectrodes, PhD, Assoc. Prof. Volodymyr Kochan

[DefMas 15] Taras Sobshuk, The Algorithm for Allocating Access to the Subsystems of the Information System, PhD Nadiia Vasylkiv

[DefMas 16] Serhiy Sokalskyi, Deep Neural Network Model for Markup of Text Documents, PhD Myroslav Komar

[DefMas 17] Roman Stasyshyn, Wireless Post-Emergency Monitoring for Complex Technical Objects, Prof. Anatoliy Sachenko

[DefMas 18] Ivan Usik, Hardware-Software Complex for Measuring Humidity Based on the LabView Package, PhD, Assoc. Prof. Volodymyr Kochan

[DefMas 19] Volodymyr Sharshyn, The Network Data Repository Based on Corrective Codes, PhD, Assoc. Prof. Nataliya Yatskiv

[DefMas 20] Kateryna Kovalkovska, The System of Prediction of Crime by Methods of Spatial Regression, PhD Nadiia Vasylkiv

[DefMas 21] Pavlo Yakobchuk, Neural Network Model and Deep Learning Algorithms for Image Recognition, PhD Myroslav Komar

[DefMas 22] Andriy Baziuk, Project Risk Management in the Unmanned Aviation Area, PhD Oleg Sachenko

[DefMas 23] Pavlo Bohach, Managing the Value of Project for CRM System Implementation, PhD Zbyshek Dombrovsky

[DefMas 24] Yuriu Vasiutyn, Project Management of Implementing the ERP System for Small Business, PhD Assoc. Prof. Grygoriy Hladiy

[DefMas 25] Taras Gaidar, Quality Management Project for Creating Autopilot for Modern Car, Prof.

Anatoliy Sachenko

[DefMas 26] Vadym Horbach, Creation and Development of Highly Effective Project Teams, PhD Assoc. Prof. Iryna Turchenko

[DefMas 27] Volodymyr Dzhuryn, Methods of Web Studio Projects Control, PhD Assoc. Prof. Iryna Turchenko

[DefMas 28] Yevhen Kohut, Risk Management of Project for Creating the Smart House, PhD Zbyshek Dombrovsky

[DefMas 29] Maksym Kondratyuk, The Model of Stakeholder Behavior During the Implementation of IT Project, PhD Nadiia Vasylkiv

[DefMas 30] Andriy Kryvyy, Project Management of New Business Creation, PhD Oleg Sachenko

[DefMas 31] Mykola Kriukov, Quality Management Project for Creating an Automated System to Monitor the Energy Consumption of Microcontroller, Prof. Anatoliy Sachenko

[DefMas 32] Andriy Moruzhko, Influence of Environment on the IT Project Effectiveness, PhD Nadiia Vasylkiv

[DefMas 33] Olexandr Nakonechny, Management of IT Project Stakeholders, PhD Nadiia Vasylkiv

[DefMas 34] Vitaliy Oksiutych, Monitoring the Performance of IT Project, PhD Assoc. Prof. Grygoriy Hladiy

[DefMas 35] Oleg Romaniv, Digitilization of Business Processes for Project Management in Shipping Company, Prof. Anatoliy Sachenko

[DefMas 36] Yulia Skorobahata, Project Management of Social Network Creation, PhD Assoc. Prof. Iryna Turchenko

[DefMas 37] Rostyslav Stasiv, Managing IT Project Team Based on Coaching, PhD Oleg Sachenko

[DefMas 38] Oleksandr Fedak, Quality Management of City Development Project Based on the Marketplace Platform, PhD Zbyshek Dombrovsky

[DefMas 39] Maksym Fedoruk, Risk and Uncertainty Management in Implementation of BlockChain Technologies in Banking Sector, PhD Oleg Sachenko

[DefMas 40] Andriy Beryslavsky, Algorithms for Detecting Malware on Android Based on Intelligent Technologies, PhD Pavlo Bykovyy

[DefMas 41] Oleg Vereshchak, Algorithms for Predicting Computer Network Parameters Based on Intelligent Technology, PhD Pavlo Bykovyy

[DefMas 42] Viktoria Kasheba, Algorithm for Identification Human Facial Image in Video Surveillance Systems, PhD Pavlo Bykovyy

[DefMas 43] Yuriy Kril, Intelligent Methods and Algorithms for Classification of Information, PhD Pavlo Bykovyy

[DefMas 44] Volodymyr Lisovenko, Big Data Conversion Algorithms in Distributed Information Systems, PhD Myroslav Komar

[DefMas 45] Mykhailo Lushchak, Algorithms for Intrusion Detection on Distributed Computer Systems, PhD Myroslav Komar

[DefMas 46] Nazar Mycak, Algorithm for Integrating Artificial Neural Networks with Knowledge Bases for Building Decision Support Systems, Prof. Anatoliy Sachenko

[DefMas 47] Vasyl Nesterenko, Vector Quantization Based Image Coding Algorithm, PhD Pavlo Bykovyy

[DefMas 48] Volodymyr Ogar, Malware Detection Algorithms in Local Area Networks, PhD Myroslav Komar

[DefMas 49] Andriy Prokopiv, Method for Improving the Accuracy of Data Clustering Using Neural Networks, PhD, Assoc. Prof., Volodymyr Kochan

[DefMas 50] Bohdan Skoropad, Algorithms and Hardware-software for Improving the Reliability of Information Security System, PhD Andriy Karachka

[DefMas 51] Ihor Khrkavtsiv, Algorithms for Protecting the Network Perimeter from Unauthorized Access, PhD Myroslav Komar

[DefMas 52] Roman Yavorsky, Algorithms for Protecting Email Users from Unauthorized Mass Mailings, PhD Myroslav Komar

[DefMas 53] Oleg Stashkiv, Managing the Strategic Portfolio of Innovative Projects of Energy

Companies, PhD Oleg Sachenko

[DefMas 54] Mamoud Kargbou, Model of Digital Transforming the Electric Power, Prof. Anatoliy Sachenko

[DefMas 55] Richard Nana Otabil, Design Thinking in Project Management, PhD, Assoc. Prof., Iryna Turchenko

[DefMas 56] Adrian Isheunesu Madhigi, Strategic planning improvement of portfolio for innovative energy efficiency projects, PhD Zbyshek Dombrovsky

[DefMas 57] Joseph KayukaKayuka Ngoy, Development of methodology for IT projects management, PhD Zbyshek Dombrovsky

[DefMas 58] Smytro Liskovetsky, The Algorithm for Compression of the Sequence of Multi-Digit Primes for Information Security Systems, PhD Stepan Ivasiev

[DefMas 59] Yuriy Molyavchyk, Algorithms for Encrypting Information on the Basis of Determining the Remainder of the Binary Number, PhD, Orest Volynsky

[DefMas 60] Mykhailo Bondarchuk, The Algorithms for Detecting Botnets in the Internet of Things, PhD Taras Tsavolyk

[DefMas 61] Vitaliy Vashchuk, Internet of Things Penetration Testing Algorithms, PhD Taras Tsavolyk

[DefMas 62] Yuriy Vertsimaga, Algorithms for Protecting Information in the Internet of Things Using the Blockchain Technology, DSc., Prof., В. В. Яцків

[DefMas 63] Nazar Havrylyak, Protected Network Gateway Internet of Things Based on a Single-Payment Computer, DSc., Prof., Vasyl Yatskiv

[DefMas 64] Roman Dymashevsky, Algorithm for Factorizing Multi-Digit Numbers Based on the properties of Mersen numbers, PhD Stepan Ivasiev

[DefMas 65] Mykola Drachuk, Intrusion Prevention System Based on Machine Learning Methods, DSc., Prof., Vasyl Yatskiv

[DefMas 66] Oleg Karpyuk, Algorithms of Inter-Baseline Transition in Problems of Cryptographic Transformations, PhD Stepan Ivasiev

[DefMas 67] Dmytro Kuzyk, The Algorithm of Protected Distributed Storage of Large Volumes of Information, PhD Stepan Ivasiev

[DefMas 68] Igor Nebesny, Information Security Incident Management System, PhD Taras Tsavolyk

[DefMas 69] Oleg Nebesny, Algorithms for Encryption of Information Based on the Transformation of the System of Residual Classes, PhD Taras Tsavolyk

[DefMas 70] Yuriy Tumoshchuk, Intrusion Detection System Based on Machine Learning Methods, DSc., Prof., Vasyl Yatskiv

[DefMas 71] Ivan Folvarkov, Algorithms for Calculating Hash Values Based on the Whirlpool Function, PhD Orest Volynsky

[DefMas 72] Vadym Chernyak, Algorithms for Counteracting Unauthorized Scanning of Software, PhD Orest Volynsky

[DefMas 73] Andriy Shumsky, Algorithms for Determining the Interval Solution of the Factorization Problem, PhD Stepan Ivasiev

[DefMas 74] Oleksandr Vykeryk, The information and analytical support of the enterprise management based on CRM-technologies, PhD Assoc. Prof., Pleg Adamiv

[DefMas 75] Volodymyr Leshchenkov, The computer model of parametric dependencies of physical and mechanical characteristics of epoxy composites, DSc., Igor Dobrotvor

[DefMas 76] Oleksandr Mayevsky, The analysis of enterprise information security risk management process, DSc., Prof., Dmytro Bodnar

[DefMas 77] Ivan Matvyyshyn, The mobile subsystem supports the recipes of dishes based on available products, DSc., Prof., Dmytro Bodnar

[DefMas 78] Petro Nemesh, The methods of the dynamics parameters identification of the composites microstructures distribution, DSc., Igor Dobrotvor

[DefMas 79] Dmytro Soroka, The analysis system for referral to technical support service, DSc., Prof., Roman Pasichnyk

[DefMas 80] Vasyl Yablonsky, The forecast of the industrial production marks modification success,

DSc., Prof., Roman Pasichnyk

[DefMas 81] Andriy Soroka, The technologies for assessing the supplier's reliability in the market of software services, DSc., Prof., Dmytro Bodnar

[DefMas 82] Andriy Yakymiv, The model of the innovative offers support in conditions of uncertainty, DSc., Prof., Roman Pasichnyk

[DefMas 83] Sergiy Soroka, Automated system for monitoring the level of filling of fuel tanks at gas stations, PhD, Assoc. Prof., Nataliya Vozna

[DefMas 84] Hanna Vozna, The system of automated monitoring of the status of the electric substation, DSc., Prof., Yaroslav Nykolaychyk

[DefMas 85] Oleksandr Mishchenko, Automated active navigation system in parking, DSc., Prof., Yaroslav Nykolaychyk

[DefMas 86] Sergiy Nedoshytko, Automated packaging system for bulk materials, PhD, Assoc. Prof. Nataliya Vozna

[DefMas 87] Stepan Pryyma, Resistant to interference coding of information in wireless sensor networks, PhD, Assoc. Prof., Oleg Zastavny

Intership of Staff, PhD Students and Students

Staff Intership

[Internship 1] Anatoliy Sachenko, Professor and Head of Department for Information Computer Systems and Control, Berlin University of Applied Sscience (HTW Berlin) and Humboldt University, October-November 2019

Student Intership

[Internship 2] Vasyl Antonyk, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 3] Yuriy Antonyuk, Research Institute for Intelligent Computer Systems TNEU У, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 4] Oleg Bandrivsky, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 5] Valentyn Blazhko, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 6] Yaroslav Gevko, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 7] Nazariy Kotsiy, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 8] Yuriy Kryzhanivsky, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 9] Roman Melnykovych, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 10] Anastasia Novosad, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 11] Anton Pelyak, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 12] Viktor Posvyatovsky, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 13] Sergiy Rimashevsky, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 14] Taras Sobchuk, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv

[Internship 15] Sergiy Sokalsky, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv
[Internship 16] Roman Stasyhyn, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv
[Internship 17] Ivan Usik, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv
[Internship 18] Volodymyr Sharshyn, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv
[Internship 19] Pavlo Yakobchuk, Research Institute for Intelligent Computer Systems TNEU, PhD, Assoc. Prof. Nataliya Yatskiv
[Internship 20] Pavlo Bohach, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 21] Yuriy Vasyutyn, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 22] Taras Haudar, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 23] Volodymyr Dzhuryn, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 24] Yechen Kohut, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 25] Maksym Kondratyuk, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 26] Andriy Kryvyy, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 27] Mykola Kriukov, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 28] Oleksandr Nakonechny, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 29] Vitaliy Oksyutych, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 30] Oleg Romaniv, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 31] Rostyslav Stasiv, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 32] Oleksandr Fedak, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 33] Maksym Fedoruk, Research Institute for Intelligent Computer Systems TNEU, PhD, Oleg Sachenko
[Internship 34] Oleg Ulishkovych, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 35] Yuriy Zubal, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 36] Valentyna Makhnitska, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 37] Marko Solopenko, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 38] Vasyl Tushets, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 39] Anna Lopushynska, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 40] Igor Sliusar, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar

[Internship 41] Yuriy Demydas, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 42] Maksym Kovaliv, Research Institute for Intelligent Computer Systems TNEU, PhD, Myroslav Komar
[Internship 43] Olga Sodomora, Research Institute for Intelligent Computer Systems TNEU, PhD, Grygoriy Sapozhnyk
[Internship 44] Roman Goncharenko, Research Institute for Intelligent Computer Systems TNEU, PhD, Grygoriy Sapozhnyk
[Internship 45] Vitaliy Vyhnanets, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 46] Tymofiy Gadevych, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 47] Oleksandr Godomych, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 48] Oleg Golodiuk, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 49] Nazariy Dovgopoly, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 50] Rostyslav Zhmurko, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 51] Taras Kostiv, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 52] Nataliya Kushnir, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 53] Maryan Lylyk, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 54] Dmytro Nespyak, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 55] Andriy Baryla, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 56] Nazariy Bashnyak, Research Institute for Intelligent Computer Systems TNEU, PhD, Grygoriy Sapozhnyk
[Internship 57] Dmytro Vasylchuk, Research Institute for Intelligent Computer Systems TNEU, PhD, Taras Lendyuk
[Internship 58] Yuriy Kushnir, Науково-дослідний інститут інтелектуальних систем TNEU, DSc., Prof., Oleg Zachko
[Internship 59] Vitaliy Lys, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 60] Volodymyr Lutsenko, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 61] Yuriy Myts, Науково-дослідний інститут інтелектуальних систем TNEU, DSc., Prof., Oleg Zachko
[Internship 62] Oleksandr Pylypyuk, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 63] Petro Svergun, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 64] Youliya Fedash, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 65] Volodymyr Pshonyak, Research Institute for Intelligent Computer Systems TNEU, DSc., Prof., Oleg Zachko
[Internship 66] Samuel Aikwei Arye, Research Institute for Intelligent Computer Systems TNEU, PhD, Iryna Strybytska

[Internship 67] Sila Guimess Bikouta, Research Institute for Intelligent Computer Systems TNEU, PhD, Iryna Strybytska

[Internship 68] George Blais Viredu, Research Institute for Intelligent Computer Systems TNEU, PhD, Iryna Strybytska

[Internship 69] Bela Ovojeloche Ogbe, Research Institute for Intelligent Computer Systems TNEU, PhD, Iryna Strybytska

[Internship 70] Mohamed Barrie, Research Institute for Intelligent Computer Systems TNEU, PhD, Iryna Strybytska

[Internship 71] Ezekiel Femi Jegede-Williams, Research Institute for Intelligent Computer Systems TNEU, PhD, Iryna Strybytska

[Internship 72] Sergiy Rimashevsky, University of Applied Sciences HTW Berlin, Germany, from September 2019 till December 2019

[Internship 73] Yuriy Antoniuk, University of Applied Sciences HTW Berlin, Germany, from September 2019 till December 2019

[Internship 74] Oleksandr Godomych, University of Applied Sciences HTW Berlin, Germany, from September 2019 till December 2019.

6. PUBLICATIONS

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

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

Conferences

[Visit 1] **39 International Conference "ELECTRONICS and NANOTECHNOLOGY (ELNANO-2019)", 16-18 April 2019, Kyyiv, Ukraine**

- Volodymyr Kochan

[Visit 2] **XVI International Conference "Project Management in the Development of Society", 17-18 May 2019, Kyyiv, Ukraine**

- Sergiy Bushuyev
- Gregoriy Hladiy

[Visit 3] **14 International Conference on pattern recognition and information processing (PRIP-2019), May 21-23, 2019, Belarusian State University of Informatics and Radio Electronics, Minsk, Belarus**

- Denys Zolotukhin
- Anatoliy Sachenko

[Visit 4] **14 International Conference "Intellectual Systems of Decision-Making and Problems of Computational Intelligence (ISDMCI-2019)", 21-25 May 2019, Zaliznyy port, Kherson region, Ukraine**

- Pavlo Bykovyy
- Diana Zahorodnia

[Visit 5] **9th International Conference on Advanced Computer Information Technologies (ACIT'2019), 5-7 May 2019, Cheske Budejovice, Czech Republic**

- Andriy Melnyk
- Natalya Yatskiv
- Vasyl Yatskiv
- Roman Pasichnyk

[Visit 6] **XV International Conference "Information and Communication Technologies in Education, Research and Industrial Applications", ICTERI-2019, 12-15 June 2019, Kherson State University, Kherson, Ukraine**

- Denys Zolotukhin

[Visit 7] **The 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2019), 18-21 September 2019, Metz, France**

- Anatoliy Sachenko
- Volodymyr Kochan
- Pavlo Bykovyy
- Vitaliy Dorosh
- Taras Lendyuk
- Ivan Kit
- Iryna Turchenko

Research Visits

ICS' staff visits

[Visit 8] Anatoliy Sachenko and Pavlo Bykovy visited the University of Lorraine, National School of Engineers in Metz (ENIM), (Metz, France) from February 25 to March 1, 2019, to discuss the organizational issues of the 10th IEEE International Conference on intelligent data acquisition systems and modern computer systems: development and application (IDAACS'2019).

[Visit 9] Anatoliy Sachenko, Oleksandr Osolinskyi and Andriy Kanyovsky took a part in the Spring School STraS-2019 on the basis of the National Technical University "Zaporizhzhya Polytechnic" on May 17-21, 2019, within the framework of the Erasmus + ALIoT project "Internet of Things: Emerging Curriculum for Industry and Human Applications"

[Visit 10] Iryna Turchenko, under invitation of Professor of the University of Applied Sciences in Berlin Juergen Sieck, took a part in the XVII International Conference "Culture and Computer Science: Virtual History and supplemented modernity", held in Berlin on May 23-24, 2019.

[Visit 11] Anatoliy Sachenko, Iryna Turchenko and students Andriy Kanyovsky, Dmytro Kostyuk, Pavlo Bohach, Yulia Skorobogata took a part in the International Research Conference 2019 and the Dortmund International Summer School 2019 from June 28 to July 5, 2019. Both events were organized by the Dortmund University of Applied Sciences (Dortmund, Germany) within the DAAD EuroPIM, DAAD East Partnership Project and Ruhr Master School.

[Visit 12] Anatoliy Sachenko, Volodymyr Kochan, Pavlo Bykovy, Vitaliy Dorosh, Taras Lendyuk, Ivan Kit and Iryna Turchenko visited the University of Lorraine, Metz (France) to run the 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2019).

[Visit 13] Students Yuriy Zubal, Volodymyr Zhabyuk and Vladyslav Dombrovsky from 18 to 22 November 2019 took a part in the winter school, which was held for students, graduate students and lecturers at the University of Applied Sciences in Dortmund and its partners in the DAAD EuroPIM, DAAD East Partnership Project and Ruhr Master School.

[Visit 14] Oleksandr Osolinsky, took a part in the First Winter School "Virtual Master Data Cooperation Science" from December 2 to 6, 2019 which was held within the project "Virtual Master Data Data Science (ViMaCs)" at the National University "Zaporizhzhya Polytechnic".

International and National Collaborators Visits

[Visit 15] Viktor Krylov (Odessa National Polytechnic University), Mychuda Lesya (Lviv Polytechnic National University) attended a scientific seminar of the ICS Research Institute "Advances & Challenges in Computing", on January 11, 2019. Lesya Michuda presented a talk on "Theory and practice of analog-to-digital functional converters on switched capacitors".

[Visit 16] Chris Phillips, (University of Newcastle, UK), Associate Professor Ah-Lian Kor and Prof. Anatolii Gorbenko (University of Leeds, UK) and representatives of the M.E. Zhukovsky National Aerospace University "Kharkiv Aviation Institute" (led by Prof. Vyacheslav Kharchenko), Yu. Fedkovych Chernivtsi National University (headed by Assoc. Prof. Georgy Vorobets), Zaporizhia National Technical University (headed by Assoc. Prof. Ravil Kudermetov), V. Dahl East Ukrainian National University (led by Prof. Inna Skarga-Bandurova), Odessa National Polytechnic University (led by Prof. Dmitry Mayevsky and Prof. Alexander Drozd), P. Mohyla Black Sea National University (led by Prof. Yuriy Kondratenko), IT Alliance (Olena Golembovska) took a part in the Winter School from January 31 to February 2, 2019 within the Erasmus + ALIoT project "Internet of Things: Emerging Curriculum for Industry and Human Applications".

[Visit 17] Oleksandr Drozd (Odessa National Polytechnic University), Anatoliy Melnyk and Orest Kochan (Lviv Polytechnic National University), Oleh Savenko (Khmelnytsky National University) took a part at the scientific seminar of Advances & Challenges in Computing, and Oleg Savenko presented a talk on "Theory and practice of creating distributed malware detection systems in local computer networks".

[Visit 18] Vladimir Golovko (Head of the Department of Intelligent Information Technologies, Brest State Technical University) visited the ICS on July 5-6, 2019. During the visit hehich he took a part in the specialized scientific council K58.082.02.

[Visit 19] Representatives of the Erasmus + National Office – Analytics Manager Prof. Zhanna Talanova and Project Manager Petro Krainik conducted an One Day advisory monitoring of the Erasmus + № 573818 project "Internet of Things: a new educational program for the needs of industry and society" on August 29, 2019. Prof. Chris Phillips (University of Newcastle, UK) and project partners: M.E. Zhukovsky National Aerospace University "KHAI" – Prof. Vyacheslav Kharchenko and Ph.D. Oleg Ilyashenko, P. Mogyla Black Sea National University, Prof. Yuriy Kondratenko, Zaporizhia National Technical University, Assoc. Prof. Ravil Kudermetov, V. Dahl East Ukrainian National University, Ph.D. Maxim Nestorov, Odessa National Polytechnic University, Prof. Dmytro Maevsky, Yu. Fedkovych Chernivtsi National University, Assoc. Prof. Georgy Vorobets, G.Ye. Pukhov Institute of Modeling Problems in Energy, Deputy Director Alexander Chemeris took a part in this event.

[Visit 20] Carsten Wolff (University of Applied Sciences and Arts, Dortmund, Germany) took a part at the First International Week at TNEU on September 13, 2019 and presented a talk "Exchange of experience in projects under European educational and research programs."

[Visit 21] Juergen Sieck (Professor of the Berlin University of Applied Sciences, Germany) and students of the Berlin University of Applied Sciences, Odessa National Polytechnic University, National University "Zaporizhzhya Polytechnic" visited the ICS on September 30 – October 4, 2019 within the International Summer School "Augmented Reality".

8. AWARDS

[Award 1]. Mykola Kryukov was awarded a diploma for the third place in the second stage of the All-Ukrainian competition of student research papers in Computer Engineering (March 27, 2019, Khmelnytsky National University, Khmelnytsky), a supervisor Prof. Volodymyr Kochan.

[Award 2]. Anatoliy Sachenko, Iryna Turchenko and students Andriy Kanyovsky, Dmytro Kostyuk, Pavlo Bohach, Yulia Skorobohata received a grant to participate in the International Week at Dortmund University of Applied Sciences and Arts, July, 2019, Dortmund, Germany.

[Award 3]. Students Yuriy Zubal, Volodymyr Zhabyuk, Vladyslav Dombrovsky received a grant to participate in the winter school from 18 to 22 November 2019, 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.

[Award 4]. Anatoliy Sachenko received a DAAD grant for an internship at the University of Applied Sciences in Berlin (HTW Berlin) and Humboldt University, October-November 2019.

[Award 5]. Students Sergiy Rimashevky, Yuriy Antoniuk and Oleksandr Godomych received a grant for internship at University of Applied Sciences HTW Berlin, Germany, September-December 2019.

9. STATISTICAL DATA

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	**2019**
Number of Senior Researches	9	15	18	19	20	22	27	30	34	39	40	39	45	**47**
Number of Junior Researches	14	17	15	18	18	15	13	11	14	16	12	10	8	**7**
Number of Active Research Projects	9	7	7	8	4	2	2	3	3	3	3	2	4	**4**
Publications	26	58	57	72	77	104	109	126	127	113	131	115	163	**126**
Patents and applications for the invention	more than 150 invention certificates of the former USSR and 68 Ukrainian patents										9	10	8	**2**
Participation in Conferences, Symposia and Wokshops	13	18	19	21	36	29	33	28	23	33	24	32	33	**21**
Number of Defended PhD and DrSc Theses	–	3	3	2	–	3	3	3	3	7	7	6	4	**4**
Number of Defended Master Theses	1	10	7	20	23	22	39	22	48	60	12	54	88	**87**
Number of Received Awards	1	2	5	7	5	3	2	3	2	5	6	5	7	**5**

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