Ministry of Science and Higher Education of
the Russian Federation

ST. PETERSBURG INSTITUTE FOR INFORMATICS
AND AUTOMATION
OF THE RUSSIAN ACADEMY OF SCIENCES

Annual Report
2019

St. Petersburg, 2019

SPIIRAS

Ministry of Science and Higher Education of
The Russian Federation

ST. PETERSBURG INSTITUTE FOR INFORMATICS AND
AUTOMATION OF THE RUSSIAN ACADEMY OF SCIENCES

Annual Report

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St. Petersburg, 2019

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GENERAL INFORMATION

St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences was founded in 1978 according to the Decree of the Council of Ministers of the USSR dated 12/19/1977 and to the Decision of the Presidium of the USSR Academy of Sciences dated 01/19/1978 on the basis of the Computer Science Department of Ioffe Physical and Technical Institute of the USSR Academy of Sciences, and was assigned the name of Leningrad Research Computer Center (LRCC) of the USSR Academy of Sciences. Currently the Institute is the only one scientific institution in the North-West region of Russia that does basic research in informatics, information technologies, automation and robotics.

The Institute Director is Professor of the Russian Academy of Sciences Andrey L. Ronzhin appointed by order of the Ministry of Science and Higher Education of the Russian Federation No. 20-3/114 п-о of 07/18/ 2018 on the basis of the minutes of the SPIIRAS staff meeting of 03/23/2018. The Institute scientific leader is Honored Scientist of RF, Corresponding Member of RAS Rafael M. Yusupov.

Based on LRCC one of the first global computer and information networks in the country the Academic Network “North-West” was created. In 1985 LRCC was transformed into Leningrad Institute for Informatics and Automation of the USSR Academy of Sciences.

By 1991 the Institute grew into a large scientific research organization, and its several departments gave rise to a new institution of the Academy of Sciences: Center of Ecologic Security of the St. Petersburg Scientific Research Center of RAS. In 1992 when historic name of St. Petersburg was returned to the city the Institute in turn was renamed in St. Petersburg Institute for Informatics and Automation of RAS (SPIIRAS). According to the Decree of the Russian Federation Government dated 12/30/2013 No.2591-p the Institute was handed over to the RF Federal Agency for Scientific Organizations (FASO Russia**).** By the Decree of the Council of Ministers of the Russian Federation dated 06/27/2018 No.1293-p the Institute was transferred to the management of the Ministry of Science and Higher Education of the Russian Federation.

In accordance with the Order of the Ministry of Science and Higher Education of the Russian Federation dated 12/18/2019 No.1399

St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences will be transformed into St. Petersburg Federal Research Center of the Russian Academy of Sciences incorporating the following research entities: "Novgorod Research Institute of Agriculture" (FSIS "Novgorod RIA), "Northwest Center for Interdisciplinary Study of the Food Security Problems" (NWCFSP), «Northwest Research Institute for Agriculture Economy and Organization" (FSIS NWRIAE), St. Petersburg Research Center of Ecological Security of RAS (RCES RAS), Institute of Limnology of RAS (IL RAS).

The scientific and methodological guidance of the Institute research activity is provided by the Department of Nanotechnologies and Information Technologies of the Russian Academy of Sciences (Division of Information Technologies and Automation).

The Institute purpose and object of activities are to do basic, prediscovery and applied scientific, including those of interdisciplinary nature, research in informatics, automation and robotics, information and telecommunication technologies intended for solving actual scientific and engineering as well as social and economic problems in the following areas as specified by the Institute Charter:

- Fundamental basics of the society and regions informatization, regional information and computer systems and networks, information security;
- Theoretic basics of developing the hard- and software complexes intended for real-time information processing;
- Fundamental basics, models and methods to study the information processes in complex (socio-, eco-, bio-, geo- and other) systems.
- Fundamental basics of developing information technologies for intelligent systems of automation in control, manufacturing (production) and research including those regarding nanotechnologies, and biotechnologies;
- Fundamental basics of integration and self-organization in computer and communication software and hardware distributed complexes aimed at intelligent space development;
- Fundamental basics in design and implementation of ambient intelligent space that encompasses technologies of ubiquitous computing, communications and multimodal users' interfaces;
- Fundamental basics of complex modeling, forecasting and optimization of information processes in natural and artificial systems of living and inanimate nature;

– Fundamental basics in modeling the processes at developing the industry of nanotechnologies and convergence of information, nano-, bio- and cognitive technologies.

Within the Government order approved in 2019 by the Ministry of Science and Higher Education of the Russian Federation the Institute worked on seven budget tasks:

– State and prospects of the information society development in Russia.
– Development of theoretic and technological basics of context managed recommending servers and intelligent personified assistive decisions for socio-cyber systems.
– Theoretical and technological basics in development and joint use of the existing and prospective state and commercial information-management and telecommunication systems and networks at different stages of their life-cycle.
– Theoretic basics and algorithmic models of cognitive control, interaction and groups' state analysis of heterogeneous robotic complexes.
– Fundamental basics and practical applications of information security.
– Fundamental basics and Big Data technologies for socio-cyber systems.
– Fundamental basics and cyber-security technologies in critical infrastructures and in developing post-quantum cryptosystems.

Research done on 81 projects included 2 projects on grants of the President of the Russian Federation, 6 – on the grants of the Russian Science Foundation, 50 – on the grants of the Russian Foundation for Basic Research; 2 – on the projects of Federal target programs and programs of the Russian ministries and services, 2 – on the project of MIC, 11 – on the projects of industrial enterprises, 8 – on the contracts with international partners.

The following organizations acted as customers:

LLC "Systems for Monitoring the Vehicle Fleet – Result in Technologies" (LLC "SMVF-RT"); FSBEI HPE "Volga State University of Technology", Yoshkar Ola; PJSC "MTS" ("Mobile TeleSystems"), Moscow; LLC "ACM Decisions", Moscow; FSUE "State Research Institute of Applied Problems" (SRIAP); LLC "Ravelin, LTd"; LLC

“Transoil”; – JSC “RNIC in Leningrad Region”; FSUE “Arsenal Design Bureau” named after M. V. Frunze; “SRI SS named after A. A. Maximov” – branch of FSUE “Khrunichev State Research and Production Space Center”, Interparliamentary Assembly of Member Nations of the Commonwealth of Independent States (IPA CIS); Ford Motor Company; Huawei Technologies Co, FESTO AG & Co.KG.

In 2019 the Institute researchers have delivered over 380 presentations at 129 conferences, published over 570 works including:

– 77 publications indexed in the WoS system (out of them 50 articles – in the journals, including 4 articles in the Q1 journals);
– 173 publications indexed in the Scopus system (out of them 40 articles - in the journals, including 4 articles in the Q1 journals);
– 324 publications indexed in the RSCI system (out of them 123 articles – in the journals from the current list of the Higher Attestation Commission (VAK).

Certain results of the Institute intellectual activity have been proved by obtaining five patents for inventions, one data base and 50 certificates of state registration of computer programs.

During 2019 the Institute took part in the organizing of 8 international scientific conferences; proceedings of 7 conferences are indexed in the international data bases WoS/Scopus.

Currently the Institute staff consists of 238 members among them: 12 Honored Scientists of the Russian Federation, one Corresponding Member of RAS, one Professor of RAS, 38 full professors and 60 scientists bearing Ph. D. degrees.

SPIIRAS has the state accreditation of educational activities valid until 05/18/2022, and has a right to perform the educational activity in accordance with the license No. 2719 issued on 04/04/ 2012 by the Federal Service for Supervision in the Sphere of Education and Science in the following areas of post-graduate students’ training:

– 09.06.01 Informatics and Computer Science

a) direction “System analysis, control and information processing” (05.13.01);

b) direction “Mathematic- and software of computers, computer complexes, and computer networks” (05.13.11);

– 10.06.01 Information Security

a) direction “Methods and systems for information security, information assurance”(05.13.19).

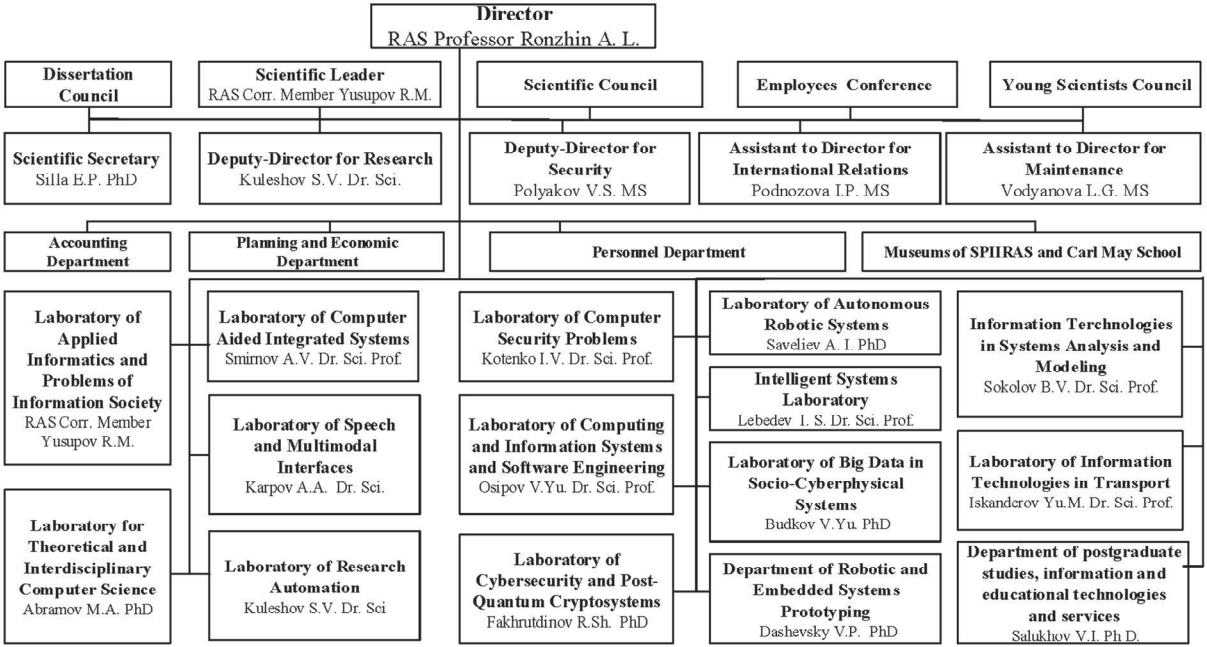
Currently, the SPIIRAS post-graduate course counts 35 post graduate students.

The Doctoral Dissertation Council functions in the following specialities: 05.13.01 “System analysis, control, and information processing”; 05.13.11 “Mathematic- and soft- ware of computers, computer complexes, and computer networks”; 05.13.19 “Methods and systems for information security, information assurance”. In 2019 three Cand. Sci. (Tech.) and one doctoral thesis in engineering have been defended.

The Museums of SPIIRAS and Carl May School are established and maintained at the Institute that currently occupies the building that used to be the above mentioned school premises. 40 members of the Russian Academy of Sciences and the Academy of Fine Arts, 156 Full Professors, two ministers, seven governors, four members of the State Council, twenty generals and admirals, three Heroes of Socialist Labor, two pilot-cosmonauts G. M. Grechko and A. I. Borisenko are among the C. May School alumni.

Using the Museums’ factual database the Institute scientists run enlightenment and educational activities at the secondary and higher schools of St. Petersburg promoting, at that, the best scientific, pedagogic, cultural and ethical traditions of the Russian education and science.

SPIIRAS STRUCTURE



SPIIRAS Economical Agencies

LLC «Strategic information technologies» (SIT)

LLC "R&D Center of Cryptography SPIIRAS" (R&DCC SPIIRAS)

LLC «R&D Center for Innovative Space Technologies SPIIRAS» (R&DCIST SPIIRAS)

Organization of Conferences, Participation in Exhibitions

- "Russian Speech Analysis" AP3-2019, http://phonetics.spbu.ru/?q=seminar-ar3, St. Petersburg (Russia), SPbU, January18, 2019 (papers are indexed in RSCI). *(Karpov A.A., Ronzhin A.L.*).
- 27-th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP'2019), www.pdp2019.eu, Pavia (Italy), February 13-15, 2019 (papers are indexed in Scopus, ScienceDirect, and ISI Web of Knowledge). (*Kotenko I.V.*).
- XIV All-Russian Scientific and Practical Conference " Prospective Systems and Management Tasks», Nalchik (Russia), April 1-5, 2019. *(Yusupov R. M., Ronzhin A.L.*).
- XIV International Conference on Electromechanics and Robotics "Zavalishin's Readings" (ER(ZR)-2019). http://confs.guap.ru/zav-read. Kursk (Russia), April 17-20, 2019 (papers are indexed in WoS, Scopus). (*Ronzhin A.L.*).
- V All-Russian Theoretical and Practical Workshop "Unmanned Vehicles with Artificial Intelligence Elements" (UV-AI-2019), http://2019.ai-uv.ru/. St. Petersburg (Russia), May 22-24, 2019 (papers are indexed in RSCI). (*Saveliev A. I., Ronzhin A.L.*).
- 5-th International Scientific and Practical Conference " Simulation and Complex Modeling of Marine Equipment and Marine Transport Systems» (SCM MTMTS -2019), http://simulation.su/static/ru-ikm-mtmts-2019.html, St. Petersburg (Russia), July 10, 2019 (papers are indexed in RSCI). *(Sokolov B.V.).*
- 21-st International Conference "Speech and Computer" SPECOM-2019. http://specom.nw.ru, Istanbul (Turkey), August 20-25, 2019 (papers are indexed in WoS, Scopus). (*Karpov A.A.*).
- IV International Conference "Interactive Collaborative Robotics" ICR-2019, http://specom.nw.ru/icr2019, Istanbul (Turkey), August 20-25, 2019 (papers are indexed in WoS, Scopus). (*Ronzhin A.L.*).
- 9-th IFAC Conference on Manufacturing Modeling, Management, and Control (MIM 2019), www.mim2019.com, Berlin (Germany), August 28-30, 2019 (Proceedings: Elsevier in IFAC-PaperOnline:https://www.journals.elsevier.com/ifac-papersonline/, papers are indexed in WoS, Scopus, Science Direct). *(Sokolov B.V.).*

- V Interregional Theoretical and Practical Conference: “Advanced Lines of Development in National Information Technologies”, http://pnroit.code-bit.com, Sevastopol (Crimea, Russia), September 18-22, 2019. (*Yusupov R.M.*).
- The 13th International Symposium on Intelligent Distributed Computing (IDC 2019), https://idc2019.ru/index.html, St. Petersburg (Russia), October 7-9, 2019 *(Kotenko I.V.*).
- 5-th International Scientific School "Incident Management and Countering Targeted Cyber-Physical Attacks in Distributed Large-Scale Critical Systems" (IM&CTCPA 2019), http://www.comsec.spb.ru/en/imctcpa19, St. Petersburg (Russia), October 09-10, 2019. (*Kotenko I.V.*).
- 9-th All-Russian Theoretical and Practical Conference “Simulation. The Theory and Practice” (IMMOD-2019), http://simulation.su/static/ru-immod-2019.html. St. Petersburg (Russia), October 16-18, 2019, (papers are indexed in RSCI). *(Sokolov B. V.).*
- XI St. Petersburg Interregional Conference “Information Security of the Russian Regions (ISRR-2019)”. http://www.spoisu.ru/conf/ibrr2019 St. Petersburg (Russia), October 23-25, 2019. *(Yusupov R. M.).*
- Scientific Symposium at the International Competition: RoboCup of Asia-Pacific region, Moscow (Russia), November 6-10, 2019. *(Saveliev A.I., Ronzhin A.L.*).
- III International Conference on Engineering and Applied Linguistics “Piotrowski’s Readings” St. Petersburg (Russia), November 27-28, 2019 (papers are indexed in WoS, Scopus). *(Karpov A.A., Ronzhin A.L.*).

Conferences to be Organized by SPIIRAS in 2020

- 28-th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP’2020), Special Session "Security in Parallel, Distributed and Network – Based Computing (SPDNS 2020)". http://www.pdp2020.com, Vasteras (Sweden), March 11-13, 2020 (papers are indexed in WoS, Scopus). *(Kotenko I.V.*).
- XV All-Russian Scientific and Practical Conference "Prospective Systems and Management Tasks», Dombaj (Russia), April 6-10, 2020 *(Yusupov R. M., Ronzhin A.L.*).

- XV International Conference on Electromechanics and Robotics "Zavalishin's Readings" (ER(ZR)-2020), http://confs.guap.ru/zav-read, Ufa (Russia), April 15-18, 2020 (Springer, SIST: papers are indexed in WoS, Scopus, RSCI). (*Ronzhin A.L.*).
- VI Interregional Theoretical and Practical Conference: "Advanced Lines of Development in National Information Technologies", http://pnroit.code-bit.com, Sevastopol (Crimea, Russia), September 22-24, 2020. *(Yusupov R.M.).*
- 22-nd International Conference "Speech and Computer" SPECOM-2020, http://www.specom.nw.ru/2020, St. Petersburg (Russia), October 06-10, 2020 (Springer, LNCS: papers are indexed in WoS, Scopus, RSCI). (*Karpov A.A.*).
- V International Conference "Interactive Collaborative Robotics" (ICR-2020), http://specom.nw.ru/icr2020, St. Petersburg (Russia), October 06-10, 2020 (Springer, LNCS: papers are indexed in WoS, Scopus, RSCI). (*Ronzhin A.L.*).
- 11-th Conference "Information Technologies in Control (ITC-2020) in the framework of 12-th Russian Multiconference on Control Problems (RMCCP-2020), St. Petersburg (Russia), October, 2020. *(Yusupov R.M.).*
- 6-th International Scientific School «Incident Management and Countering Targeted Cyber-Physical Attacks in Distributed Large-Scale Critical Systems» (IM&CTCPA 2020), http://www.comsec.spb.ru/en/conferences, St. Petersburg (Russia), October 12-14, 2020 (papers are indexed in Scopus, RSCI). *(Kotenko I.V.*)
- XVII St. Petersburg International Conference "Regional Informatics (RI-2020)", http://spoisu.ru. St. Petersburg (Russia), October 28-30, 2020. (*Yusupov R.M.*)

International Cooperation

In 2019 SPIIRAS continued to extend its engagement with international research community by strengthening the existing interactions and international scientific cooperation through international contracts, agreements, grants, has further proceeded with the established R&D contacts, information exchange; a number of international scientific centers SPIIRAS keeps in touch with accepted the Institute scientists delegated to

participate in joint projects, conferences and other meetings outside Russia. In addition SPIIRAS put a sincere effort in receiving international scholars, professionals and delegations on the Institute premises; international conferences were organized and held.

The following professional contacts are worth mentioning and include:

- National Academy of Sciences of Belarus, the Belarusian State University, the Academy of Belarus Ministry of Domestic Affairs, Institute of National Security of Belarus, The Belarusian State University of Informatics and Radioelectronics (Belarus);
- Institute of Information and Communication Technologies, Laboratory of Telematics, Space Research and Technology Institute of the Bulgarian Academy of Sciences (Bulgaria);
- University of Hertfordshire (UK);
- Research institutions of Vietnam Academy of Science and Technology (Vietnam);
- University of Berlin, Higher Berlin School of Economics and Law, University of Bremen (EC Program: ERASMUS), FESTO AG & Co.KG; Leipzig University of Telecommunications, University of Munich, Fraunhofer Institute, University of Rostock; Ulm University (Germany);
- Cyprus University of Technology (Greece);
- National University of Distance Education (Spain);
- National Academy of Sciences of the Republic of Kazakhstan; The L. N. Gumilyov Eurasian National University (Kazakhstan);
- Riga Technical University (Latvia);
- Institute of Mathematics and Informatics of the Academy of Sciences of Moldova (Moldova);
- Poznań Economics University (Poland);
- Faculty of Technical Sciences at the University of Novi Sad (Serbia);
- The University of Ljubljana (Slovenia);
- Yale University, University of Northern Iowa (USA);
- Bosphorus University, Erzurum Technical University (Turkey);
- Academy of Sciences of Uzbekistan (Uzbekistan);
- University of Helsinki, Natural Resources Institute of Finland in Punkaharju, Open Innovations Association FRUCT (Finland);
- University Paris VII, Paul Sabatier University (Toulouse III) (France);

– University of West Bohemia, Technical University of Ostrava, CzechGlobe – Global Change Research Institute of the Czech Academy of Sciences (GCRI) (Czechia),
– Jonkoping University (Sweden),

as well as a number of EC institutions participating in programs like TEMPUS and ERASMUS.

The research works were done on the contracts and orders by Ford Motor Company (USA); the Secretariat of the CIS Interparliamentary Assembly; the EC Program ERASMUS; University of West Bohemia in Plzen (Czechia); Leipzig University of Telecommunications, FESTO AG & Co.KG.(Germany); Erzurum Technical University (Turkey); Faculty of Technical Sciences at The University of Novi Sad (Serbia); Vietnam Academy of Science and Technology (Vietnam); Huawei Technologies, Co., Ltd. (China).

Intensive scientific exchange totally comprised 77 business trips of 36 SPIIRAS scientists: 60 trips to International Conferences, Congresses, Workshops and Exhibitions and 17 had been made to the meetings related to the current research projects.

In turn SPIIRAS received quite a few international scholars, for instance, directly at the Institute 54 scientists and doctoral students from 14 countries had been received including eight – from Belarus; three- from Bulgaria; eight - from Vietnam; eight – from Germany; one - from Kazakhstan; four - from China, one – from Moldova; one - from Serbia; one – from Singapore; one – from Uzbekistan; four – from France; twelve - from Czechia; one - from Sweden; one- from Ukraine. Visa support had been arranged for 22 scientists and professionals.

Links with the Higher School and Branch Science

The Institute administers five basic departments in the leading St. Petersburg universities as well as six joint research laboratories.

Basic Departments:

– Research Automation at The St. Petersburg State Electrical Engineering University, established in 1979.
– Distributed Intelligent Automation Systems at The St. Petersburg State Polytechnic University, established in 2009.
– Information Security at The St. Petersburg State University of Transport Communications, established in 2010.

– Information Systems and Technologies in Economics at The St. Petersburg University of Economics, established in 2017.
– Information Technologies in Logistics at The St. Petersburg School of Economics and Management NRU HSE, established in 2018.

Research Laboratories:

– R&D Laboratory of Information Technologies in Transport Systems, Power Engineering, Automation and Modeling Systems at Mari State Technical University, established in 2012.
– International Research Laboratory "Intelligent Proactive Protected Technologies and Systems" at ITMO University, established in 2014.
– International Research Laboratory "Intelligent Technologies for Socio-Cyber-Physical Systems" at ITMO University, established in 2014.
– International Research Laboratory "Information Security of Cyber Physical Systems" at ITMO University, established in 2017.
– Virtual Joint Laboratory at The Military Teaching and Research Center of the RF Air Force "Military Air Force Academy", Voronezh, established in 2015.
– Joint Research Laboratory for Robotic Systems' Design and Programming at The St. Petersburg State University of Aerospace Instrumentation, established in 2016.

The Institute also has cooperation with a number of universities in St. Petersburg, Moscow and other cities: Russian State Pedagogical University, Moscow State University, Moscow Engineering and Physical Institute, Moscow Physical and Technical Institute, Moscow State Technical University, Tomsk State University of Control Systems and Radioelectronics, Astrakhan State University, Petrozavodsk State University, South Federal University, Northern Caucasian State Technological University, Naval Academy named after N.G. Kuznetsov, Mozhaysky Military Space Academy and other.

SPIIRAS scholars deliver lectures for the students of the basic departments and other higher schools in the advanced areas of informatics, information and telecommunication technologies, engage students in research activities, encourage the most capable ones to joint SPIIRAS post-graduate course, teach courses at SPIIRAS centers: Research and Education Center of Computer Studies (RECCS); Research and Education Center "Technologies of Intelligent Space"; Innovation and Education Center of Space Services; Educational Center for Training Certified Specialists in Processing Data of the Earth Remote Sensing.

Sessions of the city seminar on “Informatics and Automation” at the Scientific Council for Informatization of St. Petersburg are held by the Institute on a weekly basis under the leadership of Corresponding Member of RAS Yusupov, R. M. and Professor Osipov, V. Yu. The seminar, on the one hand, is aimed at maintaining professional exchange of the latest scientific developments in informatics and computer technologies at the city level and, on the other hand, at involving young researchers in submitting presentations on their own in front of highly competent scientists. Thus, the seminar contributes to integration of St. Petersburg higher school and academic science, clearly recognizes talented young people and fosters their professional growth.

Major Publications

Monographs

- Ivanov D., Dolgui A., Sokolov B. Handbook of Ripple Effects in the Supply Chain. Springer Nature Switzerland. 2019. 332 p. http://doi.org/ 10.1007/978-3-030-14302-2.
- Korzun D., Balandina E., Kashevnik A., Balandin S.F., Viola F. (University of Bologna). Ambient Intelligence Services in IoT Environments. IGI Global. 2019. 199 p. DOI: 10.4018/978-1-5225-8973-0.
- Kotenko I.V., Saenko, I.B., Chehculin A. A., Shorokhov A. V., Polubelova O. V, Novikova, E. S., Doynikova E. V., Desnitsky V. A. Intelligent Services for Information Security in Critical Infrastructures. SPb.: BKHV- Petersburg. 2019. 400 p.
- Vatamanyuk I. V., Levonevsky D.K., Malov D. A., Yakovlev R. N., Saveliev A.I. Models and Methods of the User’s Interaction with Cyberphysical Intelligent Space: monograph. SPb.: Lanj, 2019. 212 p.

Conference Proceedings

- Proceedings of the 8˙th Interdisciplinary Workshop “Russian Speech Analysis” AP3-2019, St. Petersburg (Russia), SPbU, http://phonetics.spbu.ru/corpora/AR3-2019.pdf.
- Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”, ER(ZR) 2019, Kursk, Russia, 17-20 April 2019 – Springer Singapore. A. Ronzhin and V. Shishlakov (Eds.): eBook ISBN 978-981-13-9267-2, ISSN 2190-3018, 2019, vol. 154, 791 p. DOI: 10.1007/978-981-13-9267-2.

- Proceedings of the V All-Russian Theoretical and Practical Workshop “Unmanned Vehicles with Artificial Intelligence Elements” (UV-AI-2019). Pereslavl-Zalessky: Russian Artificial Intelligence Association, 2019. 264 p. http://2019.ai-uv.ru/images/news/ai-uv-2019-book.pdf , ISBN 978-5-6042802-0-1.
- Proceedings of the 5-th International Scientific and Practical Conference " Simulation and Complex Modeling of Marine Equipment and Marine Transport Systems» (SCM MTMTS-2019). M.: PERO Publishers, 2019. 229 p. ISBN 978-5-00150-311-8. https://elibrary.ru/download/elibrary_39165714_65530068.pdf
- Proceedings of the 21st International Conference, on Speech and Computer SPECOM 2019, Istanbul, Turkey, August 20–25, 2019 – Springer Nature Switzerland AG 2019. A. Karpov eta. (Eds.): LNCS/LNAI 11658. 2019. 978 p. URL: https://link.springer.com/book/10.1007/978-3-030-26061-3.
- Proceedings of the 4th International Conference Interactive Collaborative Robotics ICR-2019, Istanbul, Turkey, August 20–25, 2019 – Springer Nature Switzerland AG 2019. A. Ronzhin, G. Rigoll, R. Meshcheryakov (Eds.): ISSN 0302-9743, ISBN 978-3-030-26117-7, LNCS/LNAI 11659, 2019, DOI: 10.1007/978-3-030-26118-4.
- Proceedings of the 13th International Symposium on Intelligent Distributed Computing (IDC 2019), October 7-9, 2019, St. Petersburg, Russia. 2019. https://doi.org/10.1007/978-3-030-32258-8. ISSN 1860-949.
- Proceedings of the 9-th All-Russian Theoretical and Practical Conference on Simulation and its Application to Science and Industry “Simulation. The Theory and Practice” (IMMOD-2019), http://simulation.su/static/ru-articles-immod-2019.html
- Materials of St. Petersburg Interregional Conference “Information Security of the Russian Regions (ISRR-2019)”. St. Petersburg, Russia, October 23-25, 2019: SPOISU-SPb., 2019. 596 p. ISBN 978-5-907223-31-8
- Proceedings of St. Petersburg Interregional Conference “Information Security of the Russian Regions” Regional Informatics and Information Security. Proceedings. Issue No. 7. SPOISU- SPb., 2019. 446 p. ISBN 978-5-907223-38-7.

- Prospective Systems and Management Tasks: Materials of XIV All-Russian Theoretical and Practical Conference and X Youth School-Seminar “Information Management and Processing in Technical Systems”; Southern Federal University. Rostov-on-Don; Taganrog: Southern Federal University Press. 2019. 490 p. ISBN 978-5-9275-3146-2.
- Proceedings of the 27-th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP2019), Pavia, Italy, February 13-15, 2019. DOI:10.1109/EMPDP.2019.8671632.

Scientific Journal “SPIIRAS Proceedings”

Print Media and Electronic Media – “SPIIRAS Proceedings” Journal has been published since 2002, in VAC list since 2011, in the international data base SCOPUS since 2016 (CiteScoreTracker 2018: 0,57, SJR:0,17). ISSN: 2078-9181 E-ISSN: 2078-9599. Subscription Index (Catalogue "Post of Russia"): П5513. Languages: Russian, English. Publication Frequency: 6 issues a year.

The Journal publishes articles within the following VAK specialities:

- 01.01.02 – Differential equations, dynamical systems and optimal control (physical and mathematical Sciences);
- 01.01.05 – Probability theory and mathematical statistics (physical and mathematical Sciences);
- 01.01.09 – Discrete mathematics and mathematical Cybernetics (physical and mathematical Sciences);
- 05.13.00 – Informatics, computer engineering and management;
- 05.13.01 – System analysis, management and information processing (by industry) (technical Sciences);
- 05.13.11 – Math- and soft-ware for computers, complexes and computer networks (technical Sciences);
- 05.13.15 – Computing machines, complexes and computer networks (technical Sciences);
- 05.13.17 – Theoretical foundations of computer science (technical Sciences);
- 05.13.19 – Methods and systems of information protection, information security (technical Sciences).

The Journal subject with regard to AJSC Scopus: Computer Science. The journal main headings:

– Mathematical Modeling and Applied Mathematics.
– Artificial Intelligence, Data and Knowledge Engineering.
– Digital Information and Telecommunication Technologies
– Robotics, Automation and Control Systems.
– Information Security.

Full-text papers' versions are available on the journal site: http://proceedings.spiiras.nw.ru/

One of the scientific journal **"**SPIIRAS Proceedings" activity was a development of the SPIIRAS electronic editing platform to get automated many routine operations encountered by the scientific journals publishers and editorials, as well as to ensure the editorial process transparency, statics generation at citation and data import/export into global indices and aggregators of scientific information.

Honors and Awards

Yusupov R.M. – Title of Honor: "Honorary Worker of Science and High Technologies of the Russian Federation" for significant accomplishments in science and long-term conscientious work (Ministry of Science and Higher Education of the Russian Federation, Order No. 38/ pr of June 26, 2019).

Yusupov R.M. – Honorary Certificate of the Russian Academy of Sciences – for long-term conscientious work for the good of Russian science in the field of information technology, preservation and development of scientific schools, training of highly qualified scientific personnel (Decree of RAS No. 10105-497 of May 28, 2019).

Geida A.S. – Best Keynote talks (ITIDS'2019). Certificate.

Abramov M.V. – Winner's Diploma of the 2019 St. Petersburg Grants' Contest for young candidates of sciences from the St. Petersburg Government.

Azarov A.A. – Winner's Diploma of the St. Petersburg Grants' Contest of 2019 for young candidates of sciences from the St. Petersburg Government.

Kharitonov N.A. - Winner's Diploma of the St. Petersburg Grants' Contest of 2019 for young scientists from the St. Petersburg Government.

Khlobystova A.O. – Winner's Diploma of the St. Petersburg Grants' Contest of 2019 for young scientists from the St. Petersburg Government.

Abramov M.V. – Winner of the competition for the Russian Federation President's scholarship (SPbU order No. 6045/3 of May 21, 2019).

Abramov M.V. – Winner of the competition for the SPbU Rector's Scholarship.

Zavalishin A.D. – National Winner of the Team Competition International Quant Championship.

Maximov A.G. – Prizewinner of the Open Championship of the South of Russia in Sports Programming

Maximov A.G. – Prizewinner of the Game Strategy Tournament: Code Warriors Challenge.

Kharitonov N.A. – State Academic Increased Scholarship (the spring semester of 2018-2019 academic year).

Khlobystova A.O. – State Academic Increased Scholarship (the spring semester of 2018-2019 and the fall semester of the 2019-2020 academic years).

Kashevnik A.M., Lashkov I.B., Teslya N.N., Ponomaryov A.V. – Diploma IP No. 11/19 to the winners of the 2019 competition for the best innovative projects in science and higher education in St. Petersburg (nomination: "The Best Scientific and Innovative Idea" in the area of "Transport and Space Systems» for the project "System for Monitoring the Driver's Dangerous Conditions by Using a Smart phone Camera".

Kashevnik A.M., Lashkov I.B., Ponomaryov A.V. – The Best Demo Award for "Cloud Oriented Intelligent Driver Support System: Dangerous States Recognition in Vehicle Cabin and Recommendations Generation" at The 24-th Conference of the FRUCT Open Innovations Association (April, 2019).

Kashevnik A.M., Lashkov I.B., Teslya N.N., Ponomarev A.V., Mikhailov S.A. - The Best Demo Development: "Analysis of the Drivers Behavior in Drive Safely system" at the 25-th Conference of the FRUCT Open Innovations Association, supported by Future Internet Magazine (November, 2019).

Kashevnik A.M. – Advanced Training Program "Scientific and Technological Breakthrough Leaders", Moscow Business School "Skolkovo" (Russia), Diploma No. 0014839.

Karpov A.A. – Honorary Certificate "For Significant Accomplishments in Science and Long-Term Conscientious Work"

(Ministry of Science and Higher Education of the Russian Federation, Order No. 38/ pr of June 26, 2019).

Desnitsky V.A., Doynikova E.V., Chechulin A.A. – I Place at the session “ Transportation Systems” of the III International Conference “Science of the Future” for the project "Self-learning Hardware and Software Robotics Complex for Emergency Situations".

Desnitsky V.A., Fedorchenko A.V. –Winners of the 2019 contest for subsidy’s provisions to young scientists, young candidates of sciences at higher schools and academic institutions located in St. Petersburg.

Chechulin A.A. – Winner of the 2019 contest for the right to receive St. Petersburg grants in the sphere of scientific and scientific – technical activities.

Pronoza A.A. – Winner of the 2019 competitive selection for the right to receive grants for the students of higher schools located in St. Petersburg, post-graduate students of higher schools, branch and academic institutions located in St. Petersburg.

Pavlyuk N.A. – Winner of a competitive selection for the RF Government Scholarship in priority areas of training for 2018/2019 academic year.

Malov D.A. – Winner of a competitive selection for the RF Government Scholarship in priority areas of training for 2019/2020 academic year.

Tokarev D.V., Fominova N.N., Kochyurina N.A., Dormidontova N.A. “SPIIRAS Technology for preserving scientific schools and career development of a young Russian scientist” - Prizewinner of the competition of the St. Petersburg Governor Administration in the nomination: “The Best Personnel Technology in the Area of Personnel Motivation”.

MAIN RESEARCH RESULTS OF LABORATORIES

Laboratory of Applied Informatics and Problems of Information Society

Head of Laboratory: Corresponding Member of the RAS, Honored Scientist of the Russian Federation, Winner of the RF Government Prize, Honorary Academician of Tatarstan Academy of Sciences, Emeritus Professor of the Military Space Academy named after A.F. Mozhaisky, Honorary Doctor of Petrozavodsk State University and St. Petersburg University of Management and Economics, Head of basic department at SPb Electrotechnical University "LETI'" Professor of SPbSU, SPIIRAS Scientific Adviser, Dr. Tech. Sci., Professor Rafael M. Yusupov – scientific fundamentals of computer science, Informatization problems of society and regions, Information and National Security, Model's qualimetry, yusupov@iias.spb.su.

Laboratory Staff –18 members.

Research Activities – scientific foundations of Computer Science, problems of development of information society in the world, countries and regions, Applied Informatics, Information and National security, syntax-directed data processing, integrated simulation of the radiation fields of natural environments in the problems Earth remote sensing, space geoinformatics, mesoanalysis, development and research of new information technologies and hardware-software tools for processing electrophysiological signals and for intelligent analysis of clinical and experimental data in biomedical diagnostic systems, monitoring the functional state and lending support to medical decisions; survey of different organizational, technical and socio-economic systems at stages of their life cycle, target-oriented planning and management; models and methods of planning processes in the corporate governance systems, capacities, operation efficiency.

Research fellows and brief information of the research-work direction

Chief researcher, Dr. Sci. (Phys.-Math.), Professor, Honored Scientist of the Russian Federation, Winner of the RF Government Prize – Oleg I. Smokty – remote sensing of the environment from space, information providing and technology connected with the modeling for

radiation fields of systems "object-environment", radiative transfer theory, space geoinformatics, lai@iias.spb.su.

Chief researcher, Dr. Sci. (Med.), Professor – Sergey A. Lytaev – modeling and assessment of physiological, psychological and sensory parameters of functional states and performance; neurocognitive technology, expanded consciousness; applied aspects of healthcare informatization; human-computer interaction; slytaev@gmail.com.

Leading researcher, Dr. Sci. (Tech.), Professor – Igor V. Lysenko – modelling, technologies of information analysis, economic analysis of techno-organizational and socio-economic systems, planning–programming–budgeting and management, models and methods of technological processes planning in corporate governance systems, fuzzy numbers and fuzzy functions theory and its applications, ilys@iias.spb.su.

Leading researcher, Dr. Tech. Sci. – Sergei B. Rudnitsky – distance biometry, chronobiology, integrated signal processing, radio navigation. sbr@spiiras.ru.

Leading researcher, Dr. Sci. (Tech.), Professor – Sergey A. Soldatenko – mathematical modeling of geophysical processes, the sensitivity of deterministic and stochastic dynamic systems, information support of modeling and forecasting processes occurring in the Earth system, variational methods of assimilation of information, the theory of radiative transfer, remote sensing of the Earth from space, technology and information support of modeling the natural radiation field systems, space geoinformatics, soldatenko@iias.spb.su.

Leading researcher, Dr. Sci. (Tech.) – Leonid N. Sorokin – problems of the impact of environmental factors on information systems, ensuring reliability of spacecraft electronic equipment under the influence of space ionizing radiation, designing of the estimation of the methods, modelling and research of the radio receiver resistance to high-intensity electromagnetic influence and protection in emergency situations, sorokinln@mail.ru.

Senior Researcher, Cand. Sci. (Tech.), Assistant Professor – Vladislav S. Blum –modeling and analysis of primary medical information flows, as well as problems of security for Public Health. vlad@blum.spb.su.

Senior Researcher, Cand. Sci. (Tech.), Assistant Professor – Alexander S. Geyda – transformational modeling theory, socio-economic systems capability and risks assessment and investigation, model based architecture of software for project management, geida@iias.spb.su.

Senior Researcher, Cand. Sci. (Tech.), Assistant Professor – Vladimir P. Ivanov – mathematical modeling of complex processes and optimal control of systems, applications of the special method to applied problems of aircraft control, game control problems, vpivanov.spb.su@gmail.com.

Senior Researcher, Cand. Sci. (Tech.) – Andrey Yu. Perevarukha – nonlinear dynamics of the models for biological processes, temp_elf@mail.ru.

Senior Researcher, Cand. Sci. (Tech.), Assistant Professor – Ludmila N. Fedorchenko – syntax-directed data processing; methods and algorithms of grammar regularization; parsing; tools Syntax Graph Transformations, lnf@iias.spb.su.

Researcher – Oleg V. Zhvalevsky – mathematical processing of biometric data; development of software and incorporation of application, ozh@spiiras.nw.ru.

Researcher – Nickolay K. Kartashev – research of human brain electric activity; study of safe computing environment design problems; design of psychophysiological testing systems; polygraphy; telemedicine, kolq@kolq.ru.

Junior Researcher – Mikhail S. Lytaev – mathematical modeling of wave processes, visualization of data and processes, development of software systems for numerical modeling, development of graphical user interfaces and human-computer interaction, mikelytaev@gmail.com.

Junior researcher – Alexey S. Usychenko

– modeling effects of electromagnetic pulses (EMP) for electromechanical and digital systems, which would be developed methods for estimating characteristics of EMP emitters. Spectral analysis and digital signal processing, a.usychenko@gmail.com.

Grants and projects

Yusupov R.M., Fedorchenko L.N. – IPA CIS Project "Recommendations "On the Ethics of Nanotechnology", 2017-2019.

Yusupov R.M., Blum V.S. – Project of IPA CIS Secretariat on a model state law “On the Development of the Information Society”, 2018-2020.

Sorokin L.N. – License agreement LPI-2018 / DF / 1, 2018-2019.

Sorokin L.N. – Grant RFBR №. 19-29-06010 "The concept and methodology of remote suppression of unmanned vehicles, which threaten the normal functioning of a “smart city” 2019–2020.

University Courses

SUAI: Institute of Technologies of Entrepreneurship, the Chair of Information Technologies of Entrepreneurship: lectures "Intellectual data

analysis", "Linguistic support of information systems", "Information-retrieval systems". Workshop on the course of lectures – Blum V.S.

NWIM RANEPA: Department of Business Informatics. Lecture courses: “Operations Research”, “Mathematics and Statistics” – Geyda S.A.

SPbU: Math.-Mech. Faculty, Department of Computer Science. Lectures of Assistant Professor: "Theory of Formal languages and Translations" and practical lessons on the course of lectures – Fedorchenko L.N.

SUAI: lectures of Assistant Professor: "Information Technologies in Medicine" – Ivanov V.P.

SPbPMU: lecture courses — general physiology of excitable tissues, psychophysiology of sensory systems, physiology of the central nervous system, physiology of mental functions, psychophysiology of stress — Lytaev S.A.

Scientific and organizational activities

XI St. Petersburg Interregional Conference "Information Security Regions of Russia (ISRR-2019)", St. Petersburg, 23-25 of October 2019. Chairman of the Organizing Committee of the Conference – Yusupov R.M.

24th Conference of open innovations association, FRUCT24. Moscow, 2019. The member of technical committee – Geyda A.S.

VII Conference with international participation "Clinical neurophysiology and neurorehabilitation". Member of the organizing committee – Lytaev S.A.

Ivanov V.P. participated in organizing the shootting of the two-part record film “Nezabudki” on patriotic theme (shown by Central TV on October 7-8, 2019). He was conducting a meeting dedicated to Cosmonautics Day in the Central Library of Priozersk (April 2019) and was participating in the Days of Science Gymnasium No. 168 of St. Petersburg (October 2019).

Conferences, Workshops, Exhibitions

International Conference on Information Technologies ICIT–2019: Information and Communication Technologies for Industry and Research, February 7-8, 2019, Saratov, Russia – Geyda A.S.

3rd World Summit on Climate Change and Global Warming. February 27-28, 2019. Prague, Czech Republic – Soldatenko S.A., Yusupov R.M.

V St. Petersburg International Economic Congress (SPEC –2019) "FORSIGHT" RUSSIA: The Future of Technology, Economics and Man, St. Petersburg, April 03, 2019 – Blum V.

Conference of open innovation association FRUCT (FRUCT'24), April 8-12, 2019, Moscow, Russia – Geyda A.S.

International Conference "Polynomial Computer Algebra'2019", April 15-20, 2019, Euler International Mathematical Institute, St. Petersburg, Russia – Fedorchenko L.N., Perevaryukha A.Yu.

Modern methods, problems and applications of operator theory and harmonic analysis, April 22-25, 2019, Rostov-on-Don, Russia – Perevaryukha A.Yu.

XI International Scientific and Practical Conference "State and Business. Ecosystem of the digital economy", St. Petersburg. April 24-26, 2019 – Geyda A.S.

Collaborative Conference on Computational & Data Intensive Science (C3DIS 2019), May 6-10, 2019, Canberra, Australia – Soldatenko S.A.

VIII All-Russian Scientific and Technical Conference "Electromagnetic Compatibility", May 23-24, 2019, Moscow, Russia – Sorokin L., Usychenko A.

XIX International Scientific Conference on Differential Equations (Erugin Readings – 2019), May 14-17, 2019, Mogilev, Belarus – Perevaryukha A.Yu.

VII All-Russian Scientific Conference with International Participation "Information Technologies of Intellectual Decision Support" (ITIDS'2019). Ufa, May 28-30, 2019 – Geyda A.S.

III National Congress with international participation "Healthy children – the future of the country", St. Petersburg, May 29-31, 2019 – Lytayev S.A.

4th International Conference on Stochastic Methods Novorossiysk, June 2-9, 2019 – Perevaryukha, A.Yu.

International Symposium "Atmospheric Radiation and Dynamics" (MSARD-2019). June 25-27, 2019, St. Petersburg, Russia – Soldatenko S.A., Yusupov R.M.

International scientific conference "Ordinal analysis and related issues of mathematical modeling", July 15-20, 2019, Village Tsey – Perevaryukha A.Yu.

X Applied Human Factors & Ergonomics International Conference. July 23-27, 2019, Washington, DC, USA – Lytayev S.A.

Innovation and transformation in a Digital World. 27th Interdisciplinary Information Management Talks (IDIMT-2019), September 4-6, 2019, Kutna Hora, Czech Republic – Geyda A.S.

XII-th International Conference “Security of Information and Networks (SIN 2019)”, September 12–15, 2019, Sochi, Russia. – Fedorchenko L.

XVIII All-Russian Conference-School for Young Researchers "Modern Problems of Mathematical Modeling", dedicated to the memory of L.A. Krukiera, September 16-21, 2019, Novorossiysk, Russia – Perevaryukha A.Yu.

V Interregional Scientific and Practical Conference "Perspective Directions for the Development of Domestic Information Technologies" September 24-28, 2019, Sevastopol – Perevaryukha A.Yu.

VI All-Russian scientific and technical conference with international participation "Actual problems of rocket and space technology" ("VI Kozlov readings"), Samara, September 30 – October 3, 2019 – Ivanov V.P.

Workshop on computer science and information technologies 21th CSIT’2019, October 5-8, 2019, Vienna, Austria – Geyda, A.S.

The 13th International Symposium on Intelligent Distributed Computing (IDC 2019) Saint-Petersburg, Russia, October 7-9, 2019 – Geyda A.S.

13th International Symposium on Intelligent Distributed Computing (IDC 2019), October 7-10, 2019 St. Petersburg, Russia – Perevaryukha A.Yu.

2019 IEEE 13th International Conference on Application of Information and Communication Technologies (AICT), October 23-25, 2019, Baku, Azerbaijan – Kartashev N.K.

XI St. Petersburg Interregional Conference "Information Security Regions of Russia (ISRR-2019)", 23-25 of October 2019, Saint-Petersburg, Russia – Yusupov R.M. (chairman), Blum V.S., Fedorchenko L.N., Ivanov V.P., Perevarukha A.Yu.

XL International Scientific Annual Conference of the St. Petersburg Branch of the Russian National Committee on the History and Philosophy of

Science and Technology of the Russian Academy of Sciences "Scientific St. Petersburg: on the 295th Anniversary of the Russian Academy of Sciences", October 28 - November 1, 2019, St. Petersburg, Russia – Ivanov V.P.

96-th American Congress Rehabilitation Medicine, November 2019, Chicago, IL, USA – Lytayev S.A.

VII conference with international participation "Clinical neurophysiology and neurorehabilitation". November 6-7, 2019, St. Petersburg, Russia – Lytayev S.A.

Conference of open innovations association FRUCT (FRUCT'25), November 6-8, 2019, Helsinki, Finland – Geyda A.S.

International Conference on Research and Practical Issues of Enterprise Information Systems, December 16-17, 2019, Prague, Czech Republic – Geyda A.S.

IV International Scientific Conference "Mathematical Modeling and Differential Equations", December 17-21, 2019, Grodno, Belarus – Perevaryukha A.Yu.

Membership in Russian and international organizations, editorial boards of journals, etc.

Yusupov R.M. – President of the National Society for Simulation, Chairman of the Joint Scientific Council of the St. Petersburg Scientific Center RAS on Informatics, Telecommunications and Management, Deputy Chairman of the Scientific Council on Informatization of St. Petersburg, Co-Chair of the Partnership Coordinating Council for the Development of the Information Society in the North-West of Russia, Honorary Doctor of Petrozavodsk State University, Honorary Doctor of St. Petersburg University of Management and Economics, Member of the Scientific Council of the Russian Academy of Sciences "Scientific Telecommunications and Information Infrastructure"; Member of the Scientific Council of the Russian Academy of Sciences on the theory of controlled processes and automation; Professor Emeritus Mozhaysky; Member of the Russian National Committee for Industrial and Applied Mathematics; Member of the Council of the Russian Academy of Sciences "High-Performance Computing Systems, Scientific Telecommunications and Information Infrastructure; member of the editorial committee of the international journal "Actual problems of aviation and aerospace systems"; Member of the editorial boards of the magazines Armament, Politics, Conversion, Informatics and its

Applications, Telecommunications, Information and Control Systems, Mechatronics, Automation and Control, International Journal of Control and Informatics Problems, Journal of Intelligent Control Neurocomputing and Fuzzy Logic (USA), Cybernetics and information technologies Bulgarian Academy of Sciences, Information and Space, Journal of the University of Water Communications, etc.

Smokty O.I. – Member of the International Astronautical Federation (IAF), Member of the Russian Geographical Society (RGO), full-Member of the International Academy of Astronautics (IAA).

Ivanov V.P. – Member of the Section of the History of Aviation and Cosmonautics of St. Petersburg Branch of the Russian National Committee of the History and Philosophy of Science and Technology at the Presidium of the Russian Academy of Sciences; Member of the Writers' Union of Russia.

Sorokin L.N. – Member of the Editorial Board of the journal "Applied Problems of Safety of Technical and Biotechnical Systems" Federal State Unitary Entrepreneurship "State Research Institute for Applied Problems" (GosNIIPP).

Lytaev S.A. – National delegate (from RAS) at the International Federation of Clinical Neurophysiology (IFCN), Washington, DC, USA, Member of the editorial board of the journals Russian Biomedical Research, Bulletin of Clinical Neurophysiology, member of the editorial board of the journal Pediatrician, member of the dissertation council of SPbSPMU, expert of the Ministry of Education and Science of the Russian Federation ("Directorate of Scientific and Technical Programs").

Fedorchenko L.N. – Scientific Secretary of the city permanent seminar "Informatics and Automation" at the Scientific Council for Informatization of St. Petersburg (headed by Corresponding Member of the RAS Rafael M. Yusupov)

Intellectual property

Certificate on state registration of a computer program No. 20169665677 dated November 27, 2019. The module for generating stimulus material is "Generator–001". Zhvalevsky O.V., Rudnitsky S.B.

Certificate on state registration of computer programs No. 2016666371 dated December 10, 2019. The module for collecting experimental data "Registrator-001". Zhvalevsky O.V., Rudnitsky S.B.

Certificate of state registration of a computer program No. 20169665703 dated November 28, 2019. The module for mathematical processing of experimental data “Analyzer–001”. Zhvalevsky O.V., Rudnitsky S.B.

Recent results

1. The project with the IPA «Recommendations “On the Ethics of Nanotechnology”, which constitute the scientific basis for the development of both legislative standards of the Commonwealth of Independent States and international law under the auspices of UNESCO, which allowed for the first time at the interstate level to raise ethical standards in the conduct of scientific research and the production of high-tech products. The document was adopted at the 49th plenary meeting of the Commonwealth of Independent States on April 19, 2019 [43].

2. The draft model law “On the digital development of states”, aimed at mutually harmonizing the laws of the member states of the Commonwealth of Independent States to ensure the continuous effective progress of the economies of both individual states and the Commonwealth as a whole, was approved at a meeting of the Permanent Commission of the Interparliamentary Assembly of States Parties The Commonwealth of Independent States on October 10, 2019 [44].

3. The methods of assessments of the parameters of the Earth's atmosphere (baroclinic instability feedbacks between layers and al.) have been developed. And also the evaluation of external influences on climate change have been studied. The novelty of the results lies in new comprehensive assessments of pollution levels, that differs in the nature of disturbing climate change factors. It allows to take into account the effect of various atmospheric parameters on the prognosis of climate change [2–5].

4. A new model in the form of systems of equations with delay is developed. It represents the scenario of a destructive oscillating outbreak of the number of insect pests causing long-term defoliation of valuable forest massifs with spontaneous completion of the eruptive phase of population dynamics. The model provides an assessment of the prediction of the level of exposure [16].

5. New models for evaluating the effectiveness of specific mechanisms of sensory identification and population dynamics have been developed, which differ in the coordination of external factors and the development of biosystems, providing more accurate account of the

influence of external factors on the parameters of systems, which increases the reliability of the forecast for the development of biosystems [17].

6. An original model has been developed to assess the effectiveness of specific mechanisms of sensory identification, namely invariant assessment of signals, short-term visual memory, spatial analysis and synthesis, which are associated with the electrophysiological characteristics of the perception of structural multi-contrast afferentation, which gives more accurate assessment of the condition of a person as a whole [25–27].

7. The technology of computer simulation and optimization of the characteristic parameters of the emitters ultrashort electromagnetic pulseshas been developed. It provides an energy-efficient impact on electronic hardware with nondirectional electromagnetic energy receptors [38].

Awards, diplomas, scholarships

Yusupov R. M. – "Honorary Worker of Science and High Technologies of the Russian Federation" for significant merits in the field of science and many years of conscientious work (Order of the Ministry of Education and Science No. 38 / к-н of June 26, 2019)

Yusupov R. M. – Certificate of honor of the Russian Academy of Sciences - for many years of conscientious work for the benefit of Russian science in the field of information technology, the preservation and development of scientific schools, the training of highly qualified scientific personnel (Decree of the RAS No. 10105-497 of May 28, 2019)

Geyda A. S. – Certificate of best keynote talks on the conference ITIDS'2019.

References:

Papers prepared jointly with foreign organizations:

1. *Yatsishin A.V., Perevaryukha A.Yu., Mikhailov V.V.* Development, verification and scenario experiments in the aggregated model of trophodynamics of a large reservoir // Mathematical machines and systems. 2019. vol. 2. pp. 90–100.

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2. *Soldatenko, S.A., Yusupov, R.M.* Optimal Control for the Process of Using Artificial Sulfate Aerosols for Mitigating Global Warming // Atmospheric and Oceanic Optics. 2019. vol. 32(1). pp. 55–63. DOI: 10.1134/S1024856019010172. (Scopus, SJR = 0.31, Q3).

3. *Soldatenko S.A., Yusupov R.M.* Model for Estimating the Transient Response of the Global Mean Surface Temperature to Changes in the Concentrations of Atmospheric Aerosols and Radiatively Active Gases // Atmospheric and Oceanic Optics. 2019. vol. 32(5). pp. 578–585. DOI:10.1134/S1024856019050154. (Scopus, SJR = 0.31, Q3).
4. *Soldatenko S.A., Yusupov R.M.* Estimating the Influence of Thermal Inertia and Feedbacks in the Atmosphere-Ocean System on the Variability of the Global Surface Air Temperature // Izvestiya, Atmospheric and Oceanic Physics. 2019. vol. 55. no. 6. pp. 114–126. DOI: 10.1134/S000143381906015X. (Scopus).
5. *Soldatenko S.A.* Estimated impacts of climate change on eddy meridional moisture transport in the atmosphere // Applied Sciences. 2019. vol. 9. no. 23. ID 4992. 24 p. (Scopus, SJR = 0.22, Q2).
6. *Wasserman E.L., Denisova D.M., Rudnitsky S.B.* Methods of remote non-contact measurement of physiological parameters of a person for the diagnosis and monitoring of his functional state // Aerospace and environmental medicine. 2019. Issue 53. vol. 3. pp. 20–32. DOI: 10.21687 / 0233-528X-2019-53-3-20-32. (Scopus, SJR-0.23, Q3).
7. *Geyda A.S.* Dynamic Capabilities Indicators Estimation of Information Technology Usage in Technological Systems // International Conference on Information Technologies. 2019. pp. 379–395. DOI: 10.1007/978-3-030-12072-6_31. (Scopus).
8. *Geyda A.S., Lysenko I.V.* Modeling of Information Operations Effects: Technological Systems Example // Future Internet. 2019. vol. 11(3). pp. 62. DOI: 10.3390/fi11030062. (Scopus, SJR-0,24, Q3).
9. *Geyda A.* Predictive models of digitalization effects and indicators: Technological system example // 27-th Interdisciplinary Information Management Talks – IDIMT-2019. 2019. DOI: 10.1007/978-3-319-94845-4_8. (Scopus).
10. *Geyda A.* Models and Methods of Optimal Information Operations Use for System Functioning // 7th Scientific Conference on Information Technologies for Intelligent Decision-Making Support (ITIDS 2019). (In print). (Scopus).
11. *Geyda A.* Models and methods to estimate digitalization success predictively // Workshop on computer science and information technologies 21th CSIT'2019. 2019. (In orint). (Scopus).

12. *Geyda A.* Conceptual and Formal Models of Information Technologies Use for Decisions Support in Technological // Systems Springer Nature Switzerland AG 2020I. 2020. pp. 1–7. DOI: 10.1007/978-3-030-32258-8_49. (Scopus).
13. *Geyda A.* Conceptual and Formal Models of Usage Effects of Information Operations in Technological Systems // Conference of Open Innovations Association (FRUCT). 2019. pp. 84. (Scopus).
14. *Geyda A.* Digitalization Effects and Indicators Estimation // Conference of open innovations association (FRUCT'25). № 87. 2019. (Scopus).
15. *Geyda A.* Models and Methods to Estimate InformationSystem Use Efficiency Indicators Predictively // International Conference on Research and Practical Issues of Enterprise Information Systems (In Print). (Scopus).
16. *Perevaryukha A.Yu.* Continuous Model for the Devastating Oscillation Dynamics of Local Forest Pest Populations in Canada // Cybernetics and Systems Analysis. 2019. vol. 55. no. 1. pp. 141–152. DOI: 10.1007/s10559-019-00119-6. (Scopus, SJR = 0,29, Q2).
17. *Perevaryukha A.Yu.* Comparative analysis of the results of modeling of extreme population processes for fish and insects // Journal of Automation and Information Sciences. 2019. vol. 51. no. 2. pp. 11-21. (Scopus, SJR-0,23, Q3).
18. *Afanasieva L., Fedorchenko D., Levonevskiy D., Novikov F.* Verification of Internet Protocol Properties Using Cooperating Automaton Objects // Proceedings of the XII International Conference Security of Information and Networks (SIN 2019). 2019. DOI: 10.1145/3357613.3357639. (Scopus).
19. *Vavilov S.A., Lytaev M.S.* Modelling Equation of Electromagnetic Scattering on Thin Dielectric Structures // Journal of Mathematical Sciences. 2019. vol. 238. no. 5. pp. 621–629. DOI: https://doi.org/10.1007/s10958-019-04261-6.

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

20. *Ivanov V.P.* Using the conditional indicator method for a comprehensive assessment of the level of air pollution in St. Petersburg // Regional Ecology 2019 No. 12. (In Russ.). (In press).

21. *Yusupov R.M., Vorobiev V.I., Petrov M.Yu.* Presentation of the evolution of computer technology in the exposition of the SPIIRAN Museum of History // Information Technology. 2019. vol. 25. no. 5. pp. 283–292. (VAK, Impact-factor – 0,457). (In Russ.).
22. *Yusupov R.M., Musaev A.A.* Information mirror of the university // Proceedings of the St. Petersburg State Technological Institute (Technical University). 2019. Vol.48 (74). pp. 22–35. (VAK).(In Russ.).
23. *Geyda A.S.* Assessment of operational properties in the design of digital transformation of systems // Design ontologies. 2019. (VAK). (In Russ.). (In press.).
24. *Ivanov V.P.* Mathematical methods in assessing the development of technology // Scientific session of SUAI. Part II. Technical science. 2019. pp. 156–162. (In Russ.).
25. *Lytaev S., Aleksandrov M., Lytaev M.* Estimation of Emotional Processes in Regulation of the Structural Afferentation of Varying Contrast by Means of Visual Evoked Potentials // Advances in Intelligent Systems and Computing. 2019. vol. 953. pp. 288–298. https://doi.org/10.1007/978-3-030-20473-0_28.
26. *Lytaev S.A., Aleksandrov M.V., Susin D.S., Lytaev S.A.* Dynamics of Recovery of Cognitive Impairment in Parkinson's Disease According to AEPs and PET-scan // Archives of Physical Medicine and Rehabilitation. 2019. vol. 100. no. 10. pp. 65. https://doi.org/10.1016/j.apmr.2019.08.183.
27. *Lytaev S., Aleksandrov M., Popovich T., Lytaev M.* Auditory Evoked Potentials and PET scan: Early and Late Mechanisms of Selective Attention // Advances in Intelligent Systems and Computing. 2019. vol. 775. pp. 169–178. https://doi.org/10.1007/978-3-319-94866-9_17.
28. *Perevaryukha A.Yu.* Scenarios of a critical outbreak of an invasive species in a modification of the Gompertz equation // Vladikavkaz mathematical journal. 2019. vol. 21. no. 1. pp. 51–61. (VAK, Impact-factor – 0,280). (In Russ.).
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species // Mathematical physics and computer modeling. 2019. vol. 22. no. 1. pp. 54–70. (VAK). (In Russ.).

31. *Perevaryukha A.Yu.* Modeling the growth rate of alien insect species, differentiated by the stages of ontogenesis // Bulletin of Samara University. Natural science series. 2019. vol. 25. no. 2. pp. 100–109. (In Russ.).
32. *Perevaryukha A.Yu.* Forest pest outbreak model with a repeated peak of Activity // Modeling, Decomposition and Optimization of complex dynamic processes. 2019. vol. 34. no. 1 (34). pp. 105–113. (In Russ.).
33. *Perevaryukha A.Yu.* Simulation of a spontaneous transition from critical K-capacity to alternative asymptotic states of a population // Dynamic systems. 2019. vol. 9. no. 1. pp. 82–94. (In Russ.).
34. *Dubrovskaya V.A., Perevaryukha A.Yu.* Models of specific forms of biological flares in modifications of the Bazykin and Verhulst-Pearl equations // Tauride Journal of Informatics and Mathematics. 2019. vol. 2 (43). pp. 26–38. (VAK, impact-factor – 0,186). (In Russ.).
35. *Fedorchenko L.N.* A homomorphism of equivalent grammar transformations used in the generation of language analyzers // Bulletin of the Buryat State University. Mathematics, computer science. 2019. vol. 2. pp. 44–60. (VAK, impact-factor – 0,062). (In Russ.).
36. *Geyda A.S.* Conceptual and formal models for the use of information technology as an example of digital medicine systems // Materials of the XI International scientific-practical conference. 2019. pp. 137–140. (In Russ.).
37. *Soldatenko S.A., Yusupov R.M.* Application of the cybernetic approach to the optimal control of the Earth's climate by introducing aerosol into the stratosphere // International Symposium "Atmospheric Radiation and Dynamics" (MSARD-2019). 2019. pp. 214–215. (In Russ.).
38. *Usychenko A.S., Sorokin L.N.* Estimation of energy efficiency of radiation of unipolar and bipolar ultrashort pulses with horn antennas based on computer simulation // VIII All-Russian Scientific and Technical Conference "Electromagnetic Compatibility". 2019. pp. 80–90.

Other publications

39. *Ivanov V.P.* Executive devices of automation on electrically controlled polymer hydrogels // Information technology and

technical equipment for special purposes. 2019. vol. 1. pp. 73–80. ISBN 978-5-907054-56-1, ISBN 978-5-907054-57-8.
40. *Geyda A.S., Lysenko I.V.* Analytical evaluation of performance indicators using information technology // Proceedings of the International scientific and technical conference "Actual problems of applied mathematics, computer science and mechanics". 2019. ISBN: 978-5-6042216-1-7.
41. *Yusupov R.M., Blum V.S., Fedorchenko L.N., Naumov V.B., Kubar O.I.* On the Recommendations of Inter-Parliamentary Hearings on the Ethics of Nanotechnology for Legislative Support of the Member States of the Commonwealth of Independent States // Dialog. 2019.
42. *Mikhailov A., Spesivtsev V., Sobolevsky N., Kartashev N.* Multi-Model Estimation of the Dynamics of Plant Community Phytomass // 2019 IEEE 13th International Conference on Application of Information and Communication Technologies (AICT). 2019. pp. 324–328.
43. The Project “Recommendations "On the Ethics of Nanotechnology" // 49th session of the IPA CIS. 2019. URL: http://iacis.ru/activities/documents/.
44. Draft Model Law on Digital Development. // Meeting of the IPA CIS Permanent Commission on October 10, 2019. URL: http://iacis.ru/activities/events/komissii_mpa_sng_zasedanie_postoyannoy_komissii_mpa_sng_po_kulture_informatsii_tirizmu_i_sportu/.

Popular science publications:

45. *Ivanov V.P.* Chief designer of rocket technology N.N. Polikarpov // Engine. 2019. vol. 2 (122). pp. 34–37.
46. *Ivanov V.P.* Student of the Leningrad Military Mechanical Institute D.I. Kozlov // Actual problems of space rocket science and technology (VI Kozlov readings). 2019. vol. 2. pp. 389–390. ISBN 978-5-93424-842-1.

Laboratory for Theoretical and Interdisciplinary Computer Science

Head of Laboratory: Cand. Sci. (Tech.) Maksim V. Abramov – information security, social engineering attacks, analysis of the security of users of information systems from social engineering attacks; analysis of the spread of information in social networks based on the models used in the analysis of the security of users of information systems from social engineering attacks; analysis and modeling of social networks; client-server technologies; the study of the relation between content published by users on social networking services and offline behavior; business analytics, social computing, business intelligence, mva@dscs.pro.

Laboratory staff – 8 members and 1 postgraduate student.

Research activities – theoretical and technological principles, algorithms and software tools for Bayesian networks, probabilistic graphical models, logic-probabilistic graphical models, relational-probabilistic models and other models based on probability and degree of belief models of cognitive systems, sociotechnical systems (including information security), biosocial systems, decision support system under uncertainty; theory and technology of programming; sets of methods, techniques, tools and languages for data storage, processing and analysis in interdisciplinary research; technological principles and software tools for behavior analysis in social networks.

Research fellows and brief information of the research-work direction

Principal researcher, Dr. Sci. (Phys. and Math.), Prof. – Alexander L. Tulupyev – processing of data and knowledge with uncertainty, applications in socio-cultural research, alt@dscs.pro.

Senior Researcher, Dr. Sci. (Med.), Assoc. Prof. – Tatiana V. Krasnoselskikh – the rationale and development of modern multidisciplinary STI prevention strategies for the high risk populations, tatiana.krasnoselskikh@gmail.com.

Senior Researcher, Cand. Sci. (Psychology.), Assoc. Prof. – Tatiana V. Tulupyeva – application of mathematical methods and informatics to humanities research, informatization of the psychology research management and conduct, biostatistics methods and mathematical models in epidemiology psychology of personality, psychology of management, tvt@dscs.pro.

Junior Researcher, postgraduate – Valeriya F. Stolyarova – probabilistic aspects of the algebraic Bayesian networks theory: local learning; experiments design in epidemiology and medicine, statistical and probabilistic analysis, probabilistic graphical models and copulas in risk assessment, valerie.stoliarova@gmail.com.

Junior Researcher – Anastasia O. Khlobystova – information security, social engineering attacks, multistep social engineering attacks, building a user's security profile, social networking services analysis, quantifying ratings, assessing the intensity of interaction, linguistic values of a variable, maximum likelihood estimation, reliability engineering, critical documents, criticality of a development scenario of a social engineering attack, aok@dscs.pro.

Junior Researcher — Anatolii G. Maximov – probabilistic graphical models algebraic Bayesian networks, probabilistic-logical inference, graph-theoretic properties and invariants of global structures of algebraic Bayesian networks, combinatorial analysis and graph theory, algorithms, mathematical chemistry, agm@dscs.pro.

Junior Researcher – Anastasiya A. Korepanova – information security, social engineering attacks, building a user's security profile, social networking services analysis, social graphs analysis, aak@dscs.pro.

Junior Researcher – Arseniy D. Zavalishin – Data Science, algebraic Bayesian networks, mathematical chemistry, probabilistic graphical models, adz@dscs.pro.

Postgraduate students

Stoliarova V.F. – Probabilistic graphical models in methods and algorithms for analysis of risks associated with respondents' behavior. Research advisor – Tulupyev A.L.

Grants and Projects

Tulupyev A.L. – RFBR project No. 18-01-00626-a, Methods for representation, truth estimates synthesis, and machine learning in algebraic Bayesian networks and related models of knowledge with uncertainty: probabilistic-logic approach and graph systems (2018-2020).

Abramov M.V. – RFBR project No. 18-37-00323-mol-a, Social engineering attacks in corporate information systems: approaches, methods and algorithms for identifying the most probable traces (2018-2019).

Azarov A.A. – RFBR project No. 18-37-00340-mol-a, Methods for analyzing the stability of the informational system's user's social connection structure to the social engineering attack actions of the malefactor on the basis of the application of genetic algorithms (2018-2019).

Abramov M.V. – Government of St. Petersburg, Committee on Science and Higher Education, grant for young scientists and Cand. Sci. (Tech.) scientists, project "Soft estimates of the degree of user protection from social engineering attacks: a fuzzy combination of digital twins of the user and the attacker in predicting the success of the attack" (2019).

Azarov A.A. – Government of St. Petersburg, Committee on Science and Higher Education, grant for young scientists and Cand. Sci. (Tech.) scientists, project "Assessing the change in the resistance of users of information systems to social engineering attacks using a combined approach to changing their vulnerabilities: training and adding new users, changing access rights" (2019).

Kharitonov N.A. – Government of St. Petersburg, Committee on Science and Higher Education, grant for young scientists and Cand. Sci. (Tech.) scientists, project "Merging algebraic Bayesian networks as models for working with incomplete information" (2019).

Khlobystova A.O. – Government of St. Petersburg, Committee on Science and Higher Education, grant for young scientists and Cand. Sci. (Tech.) scientists, project "The methods of greatest likelihood in identifying trajectories of socioengineering attacks and compromised users of information systems: models, algorithms, software implementation" (2019).

University Courses

SPbU: Faculty of Mathematics and Mechanics, Computer Science department: "Models and architectures of programs and knowledge", "Bayesian network theory", "Applied technologies of analysis and modeling of social networks", "Frequency methods for analyzing information", "Content management systems", "Graduate practice" – Abramov M.V.

SPbU: Faculty of Mathematics and Mechanics, Computer Science department: "Data Science: software systems", "Bayesian network theory", "Advanced Computer Science 1", "Frequency methods for analyzing information", "Data Science: Toolkit and Project Life Cycle" – Tulupyev A.L.

SPbU: Faculty of Mathematics and Mechanics, Computer Science Department: “Data Science: Essentials of the data analysis and data processing”, “Technologies of Professional Communication” – Tulupyeva T.V.

Educational Center "St. Petersburg Union of Doctors" – a series of online lectures for doctors and pharmaceutical workers on syphilis and infectious dermatoses – Krasnoselskikh T.V. 12 lectures were delivered during the reporting period. Lectures are accredited in the system of continuing medical education.

International Cooperation

Tulupyev A.L. – organization of section at EUSFLAT 2019 with Institute for Research and Applications of Fuzzy Modeling (IRAFM), University of Ostrava, Czech Republic.

Tulupyev A.L. – organization of section at IITI–2019 “Bayesian Networks and Trust Networks, Fuzzy-Stocastical Modelling”, University of Ostrava, Czech Republic.

Conferences

ICIT-2019 International Scientific Conference, Saratov, February 7-8, 2019, Saratov, Russia – Abramov M.V., Tulupyev A.L., Kharitonov N.A., Maksimov A.G., Khlobystova A.O .;

International Scientific Conference "Winter School on the Psychology of States." February 21-22, 2019, Kazan, Russia – Abramov M.V., Tulupyev A.L., Tulupyeva T.V.;

Forum workshop aimed at the digital transformation of state corporations and entrepreneurship – “Digital” forum, April 4, 2019, St. Petersburg, Russia – Abramov M.V., Tulupyev A.L., Tulupyeva T.V.;

All-Russian Scientific Conference on Informatics Problems LIST 2019, April 23-26, 2019, St. Petersburg, Russia – Abramov M.V., Tulupyev A.L., Kharitonov N.A., Maksimov A.G., Khlobystova A.O., Korepanova A.A.;

XIX All-Russian Congress of Dermatovenerologists and Cosmetologists. May 18-21, 2019, Moscow, Russia – Krasnoselskikh T.V.;

The 11th Conference of the European Society for Fuzzy Logic and Technology organized jointly with the IQSA Workshop on Quantum Structures (EUSFLAT-2019), September 9-13, 2019, Prague, Czech Republic – Abramov M.V., Tulupyev A.L.;

IV St. Petersburg Forum on HIV with international participation, October 3-4, 2019, St. Petersburg, Russia – Krasnoselskikh T.V.;

The 13th International Symposium on Intelligent Distributed Computing (IDC 2019), October 7-9, 2019, St. Petersburg, Russia – Abramov M.V., Tulupyev A.L., Khlobystova A.O.;

Seventeenth national conference on artificial intelligence with international participation KII-2019, October 21-25, 2019, Ulyanovsk, Russia – Abramov M.V., Tulupyev A.L., Tulupyeva T.V., Kharitonov N.A., Maksimov A.G. , Korepanova A.A.;

XI St. Petersburg Interregional Conference "Information Security of Russian Regions (IBRR-2019)", October 23-25, 2019, St. Petersburg, Rusia – Abramov M.V., Tulupyev A.L., Tulupyeva T.V., Kharitonov N.A., Maksimov A.G., Korepanova A.A., Khlobystova A.O., Zavalishin A.D.;

XIII scientific-practical conference of dermatovenereologists and cosmetologists "St. Petersburg Dermatological Readings", October 24-26, 2019, St. Petersburg, Russia – Krasnoselskikh T.V.;

V Interregional Conference on Plastic Surgery, Aesthetic Medicine and Cosmetology, November 7-8, 2019, Yekaterinburg, Russia – Krasnoselskikh T.V.;

AINL: Artificial Intelligence and Natural Language Conference, November 20-22, 2019, Tartu, Estonia – Abramov M.V., Tulupyev A.L.;

The 4th International Scientific Conference “Intelligent Information Technologies for Industry”, December 2-7, 2019, Ostrava, Prague, – Abramov M.V., Tulupyev A.L., Tulupyeva T.V., Kharitonov N.A., Maksimov A. G., Korepanova A.A., Khlobystova A.O.

Membership in Russian and International societies, editorial boards, etc.

Tulupyev A.L. – expert of the Russian Academy of Sciences, member of the Russian Association of Fuzzy Systems and Soft Computing, IEEE (Institute of Electrical and Electronics Engineers) member, ACM (Association for Computing Machinery) member, INSTICC (Institute for Systems and Technologies of Information, Control and Communication) member, editorial board member of Fuzzy Systems and Soft Computing Journal, Herald of Tver State University. Series: Applied Mathematics, Soft Computing and Measurement Journal.

Krasnoselskikh T.V. – member of St.Petersburg V.M. Tarnovsky Medical Research Association of Dermatovenerologists.

Abramov M.V., Stoliarova V.F. – IEEE (Institute of Electrical and Electronics Engineers) members.

Abramov M.V., Tulupyev A.L. – EUSFLAT (European Society for Fuzzy Logic and Technology) members.

Intellectual property

Not/and/or Expression Simplifier Version 01 (n/a/o ExpSimp v.01) Certificate No 2019666364. Registered in the Computer Program Registry 09.12.2019. Maximov A.G., Zavalishin A.D., Abramov M.V., Tulupyev A.L.

Realization b-tree with compression Version 01 for CPlusPlus (RoBtreeCom v.01) Certificate No 2019666627 Registered in the Computer Program Registry 12.12.2019. Zavalishin A.D., Maximov A.G., Abramov M.V., Tulupyev A.L.

Recent results

1. Methods to identify the most damage-critical paths for the implementation of social engineering attacks and compromised users of information systems, using a hybrid model of a linguistic fuzzy variable. This allows to conduct an initial investigation of information security incidents [1,6,10,13].

2. The method of quantifying the linguistic values of variables used in the methods for assessing the influence of various relationship types between users, presented in the social networks VKontakte and Instagram, on the probability of the spread of a social engineering attack [3, 7, 12].

3. A method for assessing the probability of success of a social engineering attack on a user, based on a soft composition of assessments of the expression degree of a user's vulnerabilities, and the degree of competencies of an attacker, and taking into account the limited combinations of these values. The severity of a user's vulnerabilities is associated with his meta-profile, built by matching information from different sources, as well as the use of new methods for matching accounts in various social networks [8,16,19].

4. A method of maintaining external and internal consistency in Bayesian algebraic networks, which differs from existing methods in parallel execution and provides a significant reduction in the time required for calculations. The significance of the result lies in acceleration of verifying the correctness of knowledge bases with uncertainty, formed on

the basis of expert knowledge and incomplete, inaccurate, non-numerical information about objects of various subject areas [2,4,5,9,14].

5. Methods of isolated merging of knowledge patterns of Bayesian algebraic networks and local machine learning of such knowledge patterns from samples with gaps over intersecting but not coincident sets of random elements. It allows synthesizing refined estimates of incomplete sets of parameters of a complex object, using inaccurate information from various sources about such parameters. This avoids in a certain class of situations more complex and time-consuming observations, experiments or surveys in order to form a single sample without gaps [15,17,18].

6. A technique for constructing a fragment of a user's vulnerability profile based on assessing the following characteristics: expression degree of his psychological features, digital culture in the context of social networks as a tool for communication, self-expression, content creation and sharing, and a source of information about personal features of users and, indirectly, their vulnerabilities to social engineering (sociotechnical) attacks [11].

Awards, diplomas, scholarships

Abramov M.V. – Winner's Diploma of the 2019 St. Petersburg Grants' Contest for young candidates of sciences from the St. Petersburg Government.

Azarov A.A. – Winner's Diploma of the St. Petersburg Grants' Contest of 2019 for young candidates of sciences from the St. Petersburg Government.

Kharitonov N.A. - Winner's Diploma of the St. Petersburg Grants' Contest of 2019 for young scientists from the St. Petersburg Government.

Khlobystova A.O. – Winner's Diploma of the St. Petersburg Grants' Contest of 2019 for young scientists from the St. Petersburg Government.

Abramov M.V. – Winner of the competition for the Russian Federation President's scholarship (SPbU order No. 6045/3 of May 21, 2019).

Abramov M.V. – Winner of the competition for the SPbU Rector's Scholarship.

Zavalishin A.D. – National Winner of the Team Competition International Quant Championship.

Maximov A.G. – Prizewinner of the Open Championship of the South of Russia in Sports Programming.

Maximov A.G. – Prizewinner of the Game Strategy Tournament: Code Warriors Challenge.

Kharitonov N.A. – State Academic Increased Scholarship (the spring semester of 2018-2019 academic year).

Khlobystova A.O. – State Academic Increased Scholarship (the spring semester of 2018-2019 and the fall semester of the 2019-2020 academic years).

Abramov M.V., Khlobystova A.O. – Winners of the SPIIRAN youth grant competition for participation in international scientific conferences.

References:

Papers Published in Editions Indexed by WoS, Scopus

1. *Khlobystova A.O., Abramov M.V., Tulupyev A.L.* An approach to estimating of criticality of social engineering attacks traces // Studies in Systems, Decision and Control. 2019. vol. 199. pp. 446–456. DOI: 10.1007/978-3-030-12072-6_36 (Scopus, SJR=0,13, Q4).
2. *Kharitonov N.A., Maximov A.G., Tulupyev A.L.* Algebraic Bayesian Networks: The Use of Parallel Computing While Maintaining Various Degrees of Consistency // Studies in Systems, Decision and Control. 2019. vol. 199. pp. 696–704. DOI: 10.1007/978-3-030-12072-6_56 // ICIT (Scopus, SJR=0,13, Q4).
3. *Khlobystova A.O., Abramov M.V., Tulupyev A.L.* Soft Estimates for Social Engineering Attack Propagation Probabilities Depending on Interaction Rates Among Instagram Users // International Symposium on Intelligent and Distributed Computing. 2019. pp. 272–277. DOI: 10.1007/978-3-030-32258-8_32 (Scopus).
4. *Kharitonov N.A., Malchevskaia E.A., Zolotin A.A., Abramov M.V.* External consistency maintenance algorithm for chain and stellate structures of algebraic Bayesian networks: statistical experiments for running time analysis // International Conference on Advances in Intelligent Systems and Computing. vol. 875. pp. 23–30. DOI: 10.1007/978-3-030-01821-4_3 (Scopus, SJR=0,17, Q3).
5. *Kharitonov N.A., Maximov, A.G., Tulupyev A.L.* Algebraic Bayesian Networks: Naïve Frequentist Approach to Local Machine Learning Based on Imperfect Information from Social Media and Expert Estimates // Russian Conference on Artificial Intelligence. 2019. pp. 234–244. (Scopus)
6. *Kharitonov N.A., Maximov A.G., Tulupyev A.L.* Algebraic Bayesian networks: parallel algorithms for maintaining local consistency // IITI-2019. 2019.
7. *Khlobystova A.O., Abramov M.V., Tulupyev A.L.* Employees' social graph analysis: a model of detection the most criticality trajectories of the social engineering attack's spread // IITI–2019. 2019.

8. *Khlobystova A.O., Tulupyeva T.V., Maksimov A.G., Korepanova A.A.* An approach to quantification of relationship types between users based on the frequency of combinations of non-numeric evaluations // IITI–2019. 2019.
9. *Abramov M.V., Tulupyev A.L.* Soft Estimates of User Protection from Social Engineering Attacks // Conference on Artificial Intelligence and Natural Language (AINL-2019). 2019. pp. 47–58. (Scopus)
10. *Azarov A.A., Vasileva O.V., Tulupyeva T.V.* Randomized General Indices for Evaluating Damage Through Malefactor Social Engineering Attacks // Russian Conference on Artificial Intelligence. 2019. pp. 218–225. (Scopus).

Papers Published in Russian Journals Indexed by RSCI

11. *Tulupyeva T.V., Abramov M.V., Tulupyev A.L.* Digital culture: social networks and social engineering attacks [chapter in the monograph] // Psychological health and health-saving technologies in the modern educational environment. 2019. pp. 322–345. (In Russ.).
12. *Khlobystova A.O., Abramov M.V., Tulupyeva T.V., Tulupyev A.L.* Social influence on a user in a social network: types of relationships in assessing behavioral risks associated with social engineering attacks // Management Consulting. 2019. vol. 3: pp. 104–117. DOI: 10.22394 / 1726-1139-2019-3-104-117 (List of Higher Attestation Commission, RSCI). (In Russ.). (VAK)
13. *Khlobystova A.O., Abramov M.V., Tulupyev A.L.* Maximum likelihood estimation approaches to the problem of identifying trajectories of social engineering attacks and compromised users of information systems // Management, communication and security systems. 2019. vol. 3: pp. 202–219. DOI: 10.24411 / 2410-9916-2019-10310 (List of Higher Attestation Commission, RSCI). (In Russ.). (VAK).
14. *Kharitonov N.A., Tulupyev A.L.* Algebraic Bayesian networks: isolated merging of pieces of knowledge in conditions of lack of information // Scientific and Technical Journal of Information Technologies, Mechanics and Optics. 2019. Issue 19. vol. 4. pp. 641–649. DOI: 10.17586/2226-1494-2019-19-4-641-649 (List of Higher Attestation Commission, RSCI). (In Russ.). (VAK).
15. *Maximov A.G., Zavalishin A.D., Abramov M.V., Tulupyev A.L.* Chemoinformatics: computer science applications in the analysis of

chemical structures (for example, cadmium sulfide) // Computer tools in education. 2019. vol. 3. (In Russ.). (VAK, impact factor – 0,218).

16. *Korepanova A.A., Oliseenko V.D., Abramov M.V., Tulupyev A.L.* Application of machine learning methods to the user accounts identification in two social networking sites // Computer tools in education. 2019. vol. 3. (In Russ.). (VAK, impact factor – 0,218).
17. *Maximov A.G., Zavalishin A.D., Tulupyev A.L., Abramov M.V.* Identification of joint graph families in tree families and the additionality criterion // Computer tools in education. 2019. vol. 3. (In Russ.). (VAK, impact factor – 0,218).
18. *Maximov A.G., Zavalishin A.D., Tulupyev A.L., Abramov M.V.* Graphs of derivatives in the global structures of algebraic bayesian networks // Computer tools in education. 2019. vol. 3. (In Russ.). (VAK, impact factor – 0,218).
19. *Korepanova A.A., Abramov M.V., Tulupyeva T.V.* Identification of user accounts on the social networks Vkontakte and Odnoklassniki // Seventeenth National Conference on Artificial Intelligence with international participation (KII-2019). 2019. vol. 2. pp. 153–163. (In Russ.)

Other publications:

20. *Abramov M.V., Tulupyev A.L., Tulupyeva T.V.* Psychological features, the mental state of the user and the profile of his vulnerabilities in the context of socioengineering attacks // Psychology of mental states: a collection of articles of students, undergraduates, graduate students and young scientists. 2019. pp. 312–317. (In Russ.).
21. *Khlobystova A.O., Abramov M.V.* Distribution of access rights in the system as a measure of reducing the likelihood of success of a social engineering attack // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019. pp. 454–455. (In Russ.).
22. *Khlobystova A.O.* “SHARENTING” – as a threat-generating behavior towards social engineering attacks // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019: Conference proceedings. pp. 452–454. (In Russ.).

23. *Kharitonov N.A., Tulupyev A.L.* Probabilistic graphical models in social computing // XI St. Petersburg Interregional Conference Information Security of Russian Regions (IBRR-2019). 2019. pp. 451–452. (In Russ.).
24. *Kharitonov N.A.* Algebraic Bayesian networks: machine learning of models // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019. pp. 450–451. (In Russ.).
25. *Tulupyeva T.V.* Vulnerabilities of users in the context of social engineering attacks: psychological aspects // XI St. Petersburg Interregional Conference Information Security of Russian Regions (IBRR-2019). 2019. pp. 448–450. (In Russ.).
26. *Toropova A.V.* Hidden variables in the model of socially significant behavior // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019. pp. 447–448. (In Russ.).
27. *Maximov A.G.* Algebraic Bayesian networks: synthesis of adjacency graphs of the secondary structure // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019. pp. 445–447. (In Russ.).
28. *Korepanova A.A., Tulupyeva T.V.* Identification of user accounts in various social networks by social environment // XI St. Petersburg Interregional Conference Information Security of Russian Regions(ISRR-2019). 2019. pp. 442–443. (In Russ.).
29. *Korepanova A.A.* Comparison of user accounts based on behavioral patterns // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019. pp. 441–442. (In Russ.).
30. *Zavalishin A.D.* The use of Bayesian networks to solve the classification problem // XI St. Petersburg Interregional Conference Information Security of Russian Regions (ISRR-2019). 2019. pp. 430–431. (In Russ.).
31. *Khlobystova A.O., Abramov M.V.* An approach to the analysis of the social graph of company employees in order to increase the level of information system security from SEA // Materials of the 8th All-Russian Scientific Conference on Informatics Problems (SPISOK-2019). 2019. (In Russ.).

32. *Khlobystova A.O.* The ranking of the propagation paths of SEA depending on the expected damage // Materials of the 8th All-Russian Scientific Conference on Informatics Problems (SPISOK-2019). 2019. (In Russ.).
33. *Korepanova A.A., Abramov M.V.* Comparison of public profiles of user accounts in various social networks // Materials of the 8th All-Russian Scientific Conference on Informatics Problems (SPISOK-2019). 2019. (In Russ.).
34. *Kharitonov N.A.* Design of an experiment for obtaining data on the operating time of algorithms for maintaining the consistency of the algebraic Bayesian network of VVM // Materials of the 8th All-Russian Scientific Conference on Informatics Problems (SPISOK-2019). 2019. (In Russ.).
35. *Kharitonov N.A.* The results of an experiment on obtaining data on the operating time of algorithms for maintaining the consistency of an algebraic Bayesian network // Materials of the 8th All-Russian Scientific Conference on Informatics Problems (SPISOK-2019). 2019. (In Russ.).
36. *Maximov A.G.* Implementation of the synthesis algorithm for the minimal adjacency graph // Materials of the 8th All-Russian Scientific Conference on Informatics Problems (SPISOK-2019). 2019. (In Russ.).
37. *Abramov M.V.* Soft estimates of the degree of user protection against social engineering attacks: a fuzzy combination of digital twins of the user and the attacker in predicting the success of the attacking effect // Transactions of the 24th assembly of young scientists and specialists. 2019. pp. 159. (In Russ.).
38. *Azarov A.A.* Assessing the change in the resistance of users of information systems to social engineering attacks using a combined approach to changing their vulnerabilities: training and adding new users, changing access rights // Transactions of the 24th assembly of young scientists and specialists. 2019. pp. 159. (In Russ.).
39. *Kharitonov N.A.* Merging algebraic Bayesian networks as models for working with imperfect information // Transactions of the 24th Assembly of Young Scientists and Specialists. 2019. pp. 140. (In Russ.).
40. *Khlobystova A.O.* Most plausible methods in identifying trajectories of social engineering attacks and compromised users of information systems: models, algorithms, software implementation // Proceedings of the 24th assembly of young scientists and specialists. 2019. pp. 160–161. (In Russ.).

Laboratory of Computer Aided Integrated Systems

Head of laboratory: Dr. Sci. (Tech.), Prof., Honored Scientist of the Russian Federation Prof. Alexander V. Smirnov – intelligent configuration management of virtual & networked organizations and knowledge logistics, smir@iias.spb.su; http://cais.iias.spb.su.

Laboratory staff: 19 members.

Research activities – methods and technologies for knowledge logistics and intelligent management of virtual resource networks.

Research fellows and brief information of the research-work direction

Senior Researcher Cand. Sci. (Tech.) – Alexey M. Kashevnik – methods and technologies for knowledge management in intelligent environments, alexey@iias.spb.su.

Senior Researcher Cand. Sci. (Tech.) – Tatiana V. Levashova – methods and technologies for ontology management, tatiana.levashova@iias.spb.su.

Senior Researcher Cand. Sci. (Tech.) – Nikolai A. Mustafin – methods and models for complex decision support.

Senior Researcher Cand. Sci. (Tech.) – Michael P. Pashkin – Internet-based technologies for group decision support, michael@.iias.spb.su.

Senior Researcher Cand. Sci. (Tech.) – Andrew V. Ponomarev – methods and technologies for complex decision support, ponomarev@iias.spb.su.

Senior Researcher Cand. Sci. (Tech.) – Sergey V. Savosin – methods and information technologies for business process management.

Senior Researcher Cand. Sci. (Tech.) – Oksana V. Smirnova – methods and information technologies for ontology-oriented decision support, sov@oogis.ru.

Senior Researcher Cand. Sci. (Tech.) Assoc. Prof. – Nikolai G. Shilov – models and methods for networked organization configuration, nick@iias.spb.su.

Senior Researcher Cand. Sci. (Tech.) – Nikolai N. Teslya – smart space technologies, intelligent technologies for smart cities, digital ledger technologies, teslya@iias.spb.su.

Senior Reseacher Cand. Sci. (Tech.) – Igor B. Lashkov – technologies for dangerous situations prevention of vehicles based on mobile video measurements of driver behavior, igor-lashkov@ya.ru.

Researcher MSc – Maxim S. Shchekotov – mobile services and social media technologies, maxim.shchekotov@gmail.com.

Junior Reseacher MSc – Sergey A. Mikhailov – technologies for context-driven proactive decision support, mikhaylovsergeyandreevich@gmail.com.

Junior Reseacher MSc – Mikhail V. Petrov – technologies for ontology-oriented competence management, dragon294@mail.ru.

Junior Researcher MSc – Igor A. Ryabchikov – intelligent technologies for smart cities, digital ledger technologies.

Grants and projects

Smirnov A.V. – Intelligent Content Management for on-Demand Personalized Tours in Smart Destinations (Ford Motor Company, USA, 2017-2019).

Smirnov A.V. – Knowledge Network for Language Experts (Festo, Germany, 2018-2019).

Kashevnik A.M. – European Mobility Program ERASMUS+ with Hellenic Mediterranean University, Crete, Greece in the topic of Context-Oriented Recommendation Systems.

Smirnov A.V. – Models and Methods of Decision Support Based on Human-Machine Collective Intelligence (the Russian Science Foundation, 2019-2021 – Grant No. 19-11-00126).

Ponomarev A.V. – Development and Analysis of Quality Control Methods in Large-Scale Human-Computer Computation Systems (the Russian Foundation for Basic Research, 2016-2019 – Grant No. 16-37-60107 mol_dk).

Smirnov A.V. – Decision Support Models at Joint Activities of Socio-Cyberphysical System Participants (the Russian Foundation for Basic Research, 2017-2019 – grant № 17-07-00247).

Levashova T.V. – Models of Knowledge Acquisition by Resources of Socio-Cyberphysical Systems at Decision Making (the Russian Foundation for Basic Research, 2017-2019 – grant № 17-07-00248).

Savosin S.B. – Ontology Alignment Method Development Based on Composition of Neural Networks (the Russian Foundation for Basic Research, 2017-2019 – grant № 17-07-00328).

Teslya N.N. – Development of Theoretical and Technological Foundations of Cognitive Assistants for Decision Making in Ontology

Alignment (the Russian Foundation for Basic Research, 2017-2019 – grant № 17-07-00327).

Shilov N.G. – Development of Models for Vehicle Incidents Alerting based on Mobile Video Measurements of a Driver Behavior (the Russian Foundation for Basic Research, 2017-2020 – grant № 17-29-03284-ofi).

Teslya N.N. – Theoretical and Technological Foundations of the Formation and Decentralized Planning of the Intellectual Robots Coalition Behavior Based on Socio-inspired Self-organization and Smart Contracts (the Russian Foundation for Basic Research, 2017-2020 – grant № 17-29-07073-ofi, jointly with Prof. B. Sokolov lab, SPIIRAS).

Lashkov I.B. – Software and Infoware for Intelligent Analysis of Video and Audio Information for Assistive Mobile Systems in Vehicles (the Russian Foundation for Basic Research, 2019-2022 – Grant No. 19-29-09081, jointly with Dr. A. Karpov lab, SPIIRAS).

Lashkov I.B. – Development of Methods for Vulnerabilities Detection for Human-Computer Interaction Interfaces of Smart City Transport Infrastructure (the Russian Foundation for Basic Research, 2019-2022 – Grant No. 19-29-06099, jointly with Prof. I. Kotenko lab, SPIIRAS).

Smirnova O.B. – Development of the Theoretical Framework of Context-Driven Information Integration for Decision Support in the Area of Marine Traffic Safety (the Russian Foundation for Basic Research, 2018-2020 – grant № 18-07-01203).

Shilov N.G. – Development of Theoretical and Technological Foundations of Intelligent Decision Support in the Area of Integrated Urban Arterial Transportation Planning in Metropolitan Areas Taking into Account Preferences of Passengers of Various Social Groups (the Russian Foundation for Basic Research, 2018-2020 – grant № 18-07-01272, jointly with Prof. B. Sokolov lab, SPIIRAS).

Kashevnik A.M. – Ontology-Oriented Competence Management Models for Intelligent Decision Support of User Groups (the Russian Foundation for Basic Research, 2019-2021 – Grant No. 19-07-00670).

Pashkin M.P. – Theoretical and Technological Fundamentals of Building Recommender Systems for Context-Aware Dynamic Configuration of Smart Contracts for Service Packages (the Russian Foundation for Basic Research, 2019 – 2021 – Grant No. 19-07-00630).

Ponomarev A.V. – Development of Ontology-Based Methods of Integration of Fragments of Information Objects Descriptions in Human-

Machine Computation Systems (the Russian Foundation for Basic Research, 2019-2021 – Grant No. 19-07-01120).

Mustafin N.A. – Theoretical Foundations for Decision Support Systems Configuration Based on Knowledge-Driven Automated Service Composition (the Russian Foundation for Basic Research, 2019-2021 – Grant No. 19-07-00928).

Shchekotov M.S. – Methods for constructing adaptive indoor navigation systems (RFBR project 19-07-00886, 2019-2021).

Kashevnik A. – Software Development for Driver Monitoring Devices (LLC "Fleet Monitoring Systems – Result in Technology" (LLC "SMA-RT"), Russia, 2019-2020).

Kashevnik A. – License agreement with the LLC "Fleet Monitoring Systems – Result in Technology" (LLC "SMA-RT"), under which LLC "SMA-RT" will use developed in SPIIRAS software "Mobile Service for dangerous situation prevention and recommendation generation for vehicle driver based on information from front-facing camera and sensors of smartphone" (registration no.: # 2017611299, 10.04.2017) for driver monitoring device creation and pay SPIIRAS for every sold item.

University courses

SPbETU “LETI”: Department of Information Technologies and Information Security: Intelligent Data Analysis –Shilov N.G.

SPbETU “LETI”: Decision Making Theory –Ponomarev A.B.

SPbETU “LETI”: Functional and Logical Programming – Ponomarev A.V.

ITMO University: Information Technologies and Programming Faculty: Information Technologies for Socio-Cyberphysical Systems –Smirnov A.V.

ITMO University: Knowledge Management, Service-Oriented Intelligent Systems – Kashevnik A.M., Teslya N.N.

SPIIRAS: Department of Post-Graduate Studies, Information & Educational Technologies, and Services – Technologies and Program Tools for Intelligent Systems Creation –Kashevnik A.M., Ponomarev A.V.

International cooperation

Smirnov A.V. – consulting of Ford Motor Company (USA) and Festo (Germany).

Participation in conferences and exhibitions

VIII All-Russian Scientific & Practical Conference “Theory and Practice of System Dynamics", April 1-5, 2019, Apatity, Russia – Smirnov A.V.

The 24th Conference of Open Innovations Association FRUCT (FRUCT24), April 8-12, 2019, Moscow, Russia – Kashevnik A.M., Ponomarev A.V., Shilov N.G.

International Conference on Cloud Computing and Services Science, May 2-4, 2019, Heraklion, Crete – Smirnov A.V.

The 21st International Conference on Enterprise Information Systems, May 3-5, 2019, Heraklion, Crete – Smirnov A.V.

The 5th International Conference on Vehicle Technology and Intelligent Transport Systems, May 3-5, 2019, Heraklion, Crete – Smirnov A.V.

III International Scientific Conference "Science of the Future", May 14-17, 2019, Sochi, Russia – A.M. Kashevnik.

The 14th International Conference on System of Systems Engineering (SoSE), May 19-22, 2019, Anchorage, Alaska – Kashevnik A.M.

The Information Fusion and Intelligent Geographic Information Systems 2019 (IFGIS2019), May 22-24, 2019, St. Petersburg, Russia – Smirnov A.V.

2019 IEEE International Black Sea Conference on Communications and Networking, BlackSeaCom 2019, 7th IEEE International Black Sea Conference on Communications and Networking (BlackSeaCom 2019), June 3-6, 2019, Sochi, Russia – Teslya N.N.

The 22nd International Conference on Business Information Systems, June 26-28, 2019, Sevilla, Spain – Teslya N.N.

The 19th International Conference on Computational Science and its Applications (ICCSA 2019), July 1-4, 2019, St. Petersburg, Russia – Teslya N.N.

The IFIP 16th International Conference on Product Lifecycle (PLM'2019), July 8-12, 2019, Moscow, Russia – Smirnov A.V. *(panel keynote)*.

The15th International Conference on Control and Automation (IEEE ICCA 2019), July 16-19, 2019, Edinburg, Scotland – Kashevnik A.M.

The 22nd IEEE International Conference on Computational Science and Engineering, August 1-3, 2019, New York, USA. – Lashkov I.B.

The 4th International Conference on Interactive Collaborative Robotics (ICR 2019), August 20-25, 2019 –Kashevnik A.M.

The 19th International Conference, NEW2AN 2019, and The12th Conference, ruSMART 2019, August 26-28, 2019, St. Petersburg, Russia – Ponomarev A.B.

The 9th IFAC/IFIP/IFORS/IISE/INFORMS Conference Manufacturing Modelling, Management and Control (MIM 2019), August 28-30, 2019, Berlin, Germany. – Smirnov A.V.

The SAI Intelligent Systems Conference, September 5-6, 2019, London, United Kingdom. – Lashkov I.B.

The 11th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management, September 17-19, 2019, Vienna, Austria – Smirnov A.B.

The Second Workshop on Interaction-Based Knowledge Sharing (WINKS-2) at the Joint Ontology Workshop (JOWO), September 23-25, 2019, Graz, Austria – Levashova T.B.

The 12th All-Russian Multiconference on Control Problems (MCCP-2019), September 23-29, 2019, Divnomorskoe, Russia – Smirnov A.B.

The BIR 2019 Workshops and Doctoral Consortium, 11th Workshop on Information Logistics and Digital Transformation (ILOG 2019), September 23-25, 2019, Katovice, Poland – Shilov N.G.

The 25th Conference of Open Innovations Association FRUCT (FRUCT'25), November 5-8, 2019, Helsinki, Finland – Smirnov A.V., Kashevnik A.M., Teslya N.N.

The 16th International Conference Applied Computing, November 7-9, 2019, Cagliari, Italy – Ponomarev A.V.

The SDPD Workshop 2019 Emerging Technologies for Future Engeneering, November 25-26, 2019, Madrid, Spain. – Kashevnik A.M.

Membership in Russian and International societies, editorial boards, etc.

Smirnov A.V. – a member of technical committee of IFAC TC 5.1 on Manufacturing Plant Control; a member of technical committee of IFIP TC WG5.1 on Global Product Development for the Whole Life-Cycle; a member of IEEE, a member of technical committee of IEEE SMC TC on Cyber-Physical Cloud Systems; a member of technical committee of IEEE SMC TC on Cognitive Situation Management, a honorary member of International Association "Institute for Systems and Technologies of Information, Control and Communication", and a fellow of the European Academy of Industrial Management. A member of Advisory Committee & Editor Boards: Journal on Information Technologies and Computer Systems (Russian Academy of Sciences, Russia); Journal "Proceeding of the Institute for Systems Analysis of the Russian Academy of

Sciences" (Russian Academy of Sciences, Russia) Journal on Artificial Intelligent and Decision Making (Russian Academy of Sciences, Russia; Scopus); Journal of Information & Control Systems (Russia, Scopus); Journal "SPIIRAS Proceedings" (SPIIRAS, Russia; Scopus), Journal of Intelligent Manufactirung (Springer, Scopus, WoS, Q1); International Journal of Multiagent and Grid Systems (IOS Press, Scopus); International Journal of Data Analysis Techniques and Strategies (Inderscience Publishers, Scopus); Management and Production Engineering Review (the Polish Academy of Sciences, Scopus); International Journal of Product Lifecycle Management (Inderscience Publishers, Scopus).

Levashova T.B. – a member of Editor Board of Journal "Complex Systems Informatics and Modeling Quarterly" (RTU Press).

Kashevnik A.M. – a secretary of the Working Group on Smart Spaces, the Open Innovations Association FRUCT (Finnish-Russian University Cooperation in Telecommunications); an Associate Editor of International Journal of Embedded and Real-Time Communication Systems (IGI Global, Scopus).

Shilov N.G. – a member of Editor Board of international Journal of Embedded and Real-Time Communication Systems (IGI Global, Scopus).

Ponomarev A.B. – a member of ACM, a member of Editor Board of international Journal of Embedded and Real-Time Communication Systems (IGI Global, Scopus).

Intellectual property

Patent for Invention "Method for Determining Dangerous States on Public Roads Based on the Monitoring the Situations Inside the Vehicle Cabin", registration date Oct. 16, 2019, registration number №RU 2703341 – Lashkov I.B., Kashevnik A.M., Smirnov A.B.

Software “Competence Management System for Expert Network Participants”, registration number: 2019612011 – Kashevnik A., Petrov M.

Software “Multi-Criteria Recommender Systems Programming Library”, registration number: 2019663205 – Ponomarev A.

Recent results

1. A set of algorithms for multicriteria context-aware recommendation services for socio-cyberphysical systems participants has been developed (in particular, an algorithm for finding personalized criteria weights based on the analysis of the ontological description of previously

made decisions and on the selection of context concepts that affect decision-making, an algorithm for generating recommendations, and an algorithm for group analysis of Pareto front of recommendations) [14, 16, 19, 23, 47, 58].

2. An algorithm has been developed that generates context-aware recommendations for a vehicle driver in case of identification of dangerous states (drowsiness and distraction) while driving based on the information, obtained from smartphone sensors and personalization of interaction with a driver depending on the class of the dangerous state and context of the system "driver – vehicle – road infrastructure", recommendations from three groups can be generated to adjust the driver's behavior, providing options to continue driving or make a short or long stop [1, 2, 15, 18, 48].

3. A conceptual model of a new class of decision support systems operating on the basis of human-machine collective intelligence has been developed that allows to ensure the interaction of participants (experts and program agents) in the decision support process based on the mechanisms of their self-organization and semantic interoperability based on multi-aspect ontologies [39, 41 - 44].

4. A conceptual model of an expert network for intelligent decision support has been developed together with an algorithm of expert group formation for joint tasks solving based on a dynamic motivation model that allows to take into account various criteria for group formation: competencies and experts' time costs, requirements and task budget, psychological compatibility of experts; as well as to provide an ability to flexibly configure expert search parameters by selecting a set of search criteria depending on the task context [13, 51, 52].

5. A method for ontology matching has been developed based on a pre-trained vector model of words as a hidden layer of a deep neural network with additional training, taking into account the context of ontology concepts for higher matching accuracy. The proposed method has been implemented using the TensorFlow platform version 1.13 and pre-trained model based on the Google News text corpora (the model parameters are dictionary of 3 million word forms with a latent factor vector size of 300) [21, 34].

6. A mechanism for socio-inspired self-organization of an intelligent robots coalition has been developed based on the coalition behavior norms, presented in the form of basic self-organization rules, implemented through smart contracts in a distributed ledger on the HyperLedger Fabric platform using the Go programming language and the REST programming interface,

which provides for verification of the process of self-organization and problem solving by all coalition members [8, 11, 37, 60].

7. The user profile model has been developed that is aimed to interaction support with collaborative robotic systems and oriented to preference accumulation and user context detection that enables for proactive information support of the user during the task definition to the robotic systems [29, 50, 61].

8. A set of methods has been developed for ensuring quality of labeling objects with large-scale human-machine computing, based on modeling labeling error profiles of participants using formal uncertainty processing techniques (Shortliffe-Buchanan scheme and probabilistic graphical models), as well as on taking additional information into account when reconciling data received from different participants (in particular, semantic relations between labels defined in an OWL ontology) [46, 49].

Awards

Kashevnik A.M, Lashkov I.B, Teslya N.N., Ponomarev A.B. – Diploma IP № 11/19 of the competition winner for the best innovative projects in the field of science and higher education in St. Petersburg in 2019 in the nomination “Best scientific and innovative idea” in the research field “Transport and space systems” for the project “System for monitoring dangerous conditions of a driver using a smartphone camera».

Kashevnik A.M., Lashkov I.B., Ponomarev A.B. – Best Demo Award " Cloud Oriented Intelligent Driver Support System: Dangerous States Recognition in Vehicle Cabin and Recommendation Generation " on the 24th conference of the FRUCT Open Innovation Association (April, 2019).

Kashevnik A.M., Lashkov I.B., Teslya N.N., Ponomarev A.B, Mikhailov S.A. – The best demo “Analysis of the drivers behavior in Drive Safely system” on the 25th conference of the FRUCT Open Innovation Association, supported by Future Internet Magazine (November 2019).

Kashevnik A.M. – Education Program “Scientific and Technological Breakthrough Leaders”, Moscow Business School “Skolkovo” (Russia), Diploma # 0014839.

Teslya N.N., Lashkov I.B. – Winners of the SPIIRAS’ youth grant competition for participation in international scientific conferences.

References

Monography:

1. *Korzun D., Balandina E., Kashevnik A., Balandin S., Viola F.* Ambient Intelligence Services in IoT Environments // IGI Global. 2019. 199 p. DOI: 10.4018/978-1-5225-8973-0. (Scopus).

Papers prepared jointly with foreign organizations:

2. *Kashevnik A., Lashkov I., Gurtov A.* Methodology and Mobile Application for Driver Behavior Analysis and Accident Prevention // IEEE Transactions on Intelligent Transportation Systems 2019. pp. 1–10. DOI: 10.1109/TITS.2019.2918328. (WoS, Scopus, SJR=1,412, Q1).
3. *Kim J., Sato K., Hashimoto N., Kashevnik A., Tomita K., Miyakoshi S., Takinami Y., Matsumoto O., Boyali A.* Context-Based Rider Assistant System: Application for Two Wheeled Self-Balancing Vehicles // SPIIRAS Proceedings. 2019. vol. 18(3). pp. 583–614. DOI: 10.15622/sp.2019.18.3.582-613. (Scopus).
4. *Sandkuhl K., Smirnov A., Shilov N.* Targeted Digital Signage: Possible Solutions // SPIIRAS Proceedings. 2019. vol. 18(4). pp. 831–857. DOI: 10.15622/sp.2019.18.4.831-857. (Scopus). (In Russ.).
5. *Sandkuhl K., Shilov N., Smirnov A.* Facilitating Digital Transformation by Multi-Aspect Ontologies: Approach and Application Steps. IFAC-PapersOnLine // Proceedings of the 9th IFAC/IFIP/IFORS/IISE/INFORMS Conference Manufacturing Modelling, Management and Control (MIM 2019). (Scopus). (SJR=0,298, Q3).
6. *Merkuryeva G., Valberga A., Smirnov A.* Demand Forecasting in Pharmaceutical Supply Chains: a Case Study // Procedia Computer Science. 2019. vol. 149. pp. 3–11. DOI: 10.1016/j.procs.2019.01.100. (Scopus).
7. *Kashevnik A., Mikhailov S., Papadakis H., Fragopoulou P.* Context-Driven Tour Planning Service: An Approach Based on Synthetic Coordinates Recommendation // Proceedings of the 24rd Conference of Open Innovations Association FRUCT (FRUCT24). pp. 140–147. DOI: 10.23919/FRUCT.2019.8711949. (Scopus, WoS).
8. *Smirnov A., Sheremetov L., Teslya N.* Fuzzy Cooperative Games Usage in Smart Contracts for Dynamic Robot Coalition Formation: Approach and Use Case Description // Proceedings of the 21st International

Conference on Enterprise Information Systems (SCITEPRESS). 2019. vol. 1. pp. 361–370. DOI: 10.5220/0007763003610370. (Scopus).

9. *Smirnov A., Kashevnik A., Shilov N., Mikhailov S., Gusikhin O., Martinez H.* Intelligent Content Management System for Tourism Smart Mobility: Approach and Cloud-based Android Application // Proceedings of the 5th International Conference on Vehicle Technology and Intelligent Transport Systems (SCITEPRESS). 2019. vol. 1. pp. 426–433. DOI: 10.5220/0007715304260433. (Scopus).
10. *Smirnov A., Kashevnik A., Mikhailov S., Shilov N., Daria O., Gusikhin O., Martinez H.* Context-Driven Tourist Trip Planning Support System: An Approach and OpenStreetMap-Based Attraction Database Formation // Information Fusion and Intelligent Geographic Information Systems (IFGIS2019). 2019. pp. 139–154. DOI: 10.1007/978-3-030-31608-2_10. (WoS, Scopus).
11. *Smirnov A., Sheremetov L., Teslya N.* Robot Coalition Formation Based on Fuzzy Cooperative Games Over Blockchain-based Smart Contracts // IFIP 16th International Conference on Product Lifecycle Management (PLM). 2019. (Scopus, SJR=0,188, Q3).
12. *Lindow F., Kashevnik A.* Driver Behavior Monitoring Based on Smartphone Sensor Data and Machine Learning Methods // Proceedings of the 25th IEEE Conference of Open Innovations Association FRUCT (FRUCT25). 2019. pp. 196–203. (WoS, Scopus, SJR=0.19).
13. *Smirnov A., Kashevnik A., Petrov M., Shilov N., Schäfer T., Jung T., Barsch-Harjau D., Peter G.* Competence-Based Language Expert Network for Translation Business Process Management, // Proceedings of the 25th Conference of Open Innovations Association FRUCT (FRUCT25). pp. 279–284. (WoS, Scopus, SJR=0.19).

Papers published in editions, indexed by WoS, Scopus:

14. *Smirnov A., Levashova T.* Knowledge Fusion Patterns: a Survey // Information Fusion, Elsevier. 2019. Vol. 52. pp. 31–40. DOI: 10.1016/j.inffus.2018.11.007. (WoS, Scopus, SJR=2,238, Q1).
15. *Kashevnik A., Lashkov I., Ronzhin A.* Ontology-based Personalisation for Online Driver Monitoring by Smartphone // Comptes Rendus de l'Acad´emie Bulgare des Sciences. 2019. vol. 72(5). pp. 651–658. DOI: 10.7546/CRABS.2019.05.13. (WoS, Scopus, SJR=0.205, Q2).
16. *Smirnov A., Levashova T., Teslya N., Pashkin M.* Decision Support in Socio-Cyber-Physical Systems: Conceptual Framework and Decision

Making Stages // Comptes Rendus de l 'Academie Bulgare des Sciences. 2019. vol. 72(10), pp. 1374–1382. DOI: 10.7546/CRABS.2019.10.10. (WoS, Scopus, SJR=0,205, Q2).
17. *Smirnov A., Shilov N., Shchekotov M.* Task Model Representation: Approach and Prototype. IFAC-PapersOnLine // Proceedings the 9th IFAC/IFIP/IFORS/IISE/INFORMS Conference Manufacturing Modelling, Management and Control (MIM 2019). (Scopus, SJR=0,298, Q3).
18. *Bogoiavlenskaia O., Vdovenko A., Korzun D., Kashevnik A.*Individual Client Strategies for Active Control of Information-Driven Service Construction in IoT-enabled Smart Spaces // International Journal of Distributed Systems and Technologies, 2019. vol. 10(2). pp. 20–36.DOI: 10.4018/IJDST.2019040102. (Scopus, SJR=0,268, Q3).
19. *Smirnov A., Levashova T.* Models of Decision Support in Socio-Cyberphysical Systems // Information and Control Systems, SPb: SUAI. 2019. vol. 3. pp. 55–70. DOI:10.31799/1684-8853-2019-3-55-70. (Scopus). (In Russ.).
20. *Shilov N.* Personalization of Information Delivery through Digital Signage: Major Requirements and Methodology // Information and Control Systems. 2019. vol 4. pp. 19–28. DOI: 10.31799/1684-8853-2019-4-19-28. (Scopus). (In Russ.).
21. *Karpovich S., Smirnov A., Teslya N.* Classification of Text Documents Based on a Probabilistic Topic Model // Scientific and Technical Information Processing. 2019. vol. 46. no. 5. pp. 1–7. (WoS, Scopus, SJR=0,219, Q3).
22. *Smirnov A., Shilov N.* Ontology-Based Fragmented Company Knowledge Integration: Possible Approaches // Proceedings of the 21st International Conference on Business Information Systems (BIS). 2019. vol. 339. pp. 30–37. DOI: 10.1007/978-3-030-04849-5_3. (WoS, Scopus, SJR=0,243, Q3).
23. *Smirnov A., Shilov N., Ponomarev A., Shchekotov M.* Human-Computer Cloud: Application Platform and Dynamic Decision Support // Proceedings of the 9th International Conference on Cloud Computing and Services Science (SCITEPRESS). 2019. pp. 120-131. DOI: 10.5220/0007725201200131. (Scopus).
24. *Kashevnik A., Karelskaya K., Repp M.* Dangerous Situations Determination by Smartphone in Vehicle Cabin: Classification and Algorithms // Proceedings of the 24th Conference of Open Innovations

Association FRUCT (FRUCT24). 2019. pp. 130–139. DOI: 10.23919/FRUCT.2019.8711943. (WoS, Scopus, SJR=0.19).
25. *Shilov N., Morozova P.* Towards Providing Relevant Digital Signage Advertisement to a Group of Users Based on Users' Interests Investigation // Proceedings of the 24th Conference of Open Innovations Association FRUCT (FRUCT24). 2019. pp. 263–268. DOI: 10.23919/FRUCT.2019.8711896. (WoS, Scopus, SJR=0.19).
26. *Shilov N., Teslya N., Turov N.* Digital Signage Personalization through Analysis of the Visual Information about Viewers // Proceedings of the 24th Conference of Open Innovations Association FRUCT (FRUCT24). 2019. pp. 444–450. DOI: 10.23919/FRUCT.2019.8711893. (WoS, Scopus, SJR=0.19).
27. *Ponomarev A., Chernysheva A.* Adaptation and Personalization in Driver Assistance Systems // Proceedings of the 24th Conference of Open Innovations Association FRUCT (FRUCT24). 2019. pp. 335–344. DOI: 10.23919/FRUCT.2019.8711961. (WoS, Scopus, SJR=0.19).
28. *Shchekotov M., Pashkin M., Smirnov A.* Indoor Navigation Ontology for Smartphone Semi-Automatic Self-Calibration Scenario // Proceedings of the 24th Conference of Open Innovations Association FRUCT (FRUCT24). 2019. pp. 374–388. DOI: 10.23919/FRUCT.2019.8711902. (WoS, Scopus, SJR=0.19).
29. *Smirnov A., Levashova T., Kashevnik A.* Enterprise Ontology for Service Interoperability in Socio-Cyber-Physical Systems // Enterprise Interoperability VIII. 2019. vol. 9. pp. 203–213. DOI: 10.1007/978-3-030-13693-2_17. (Scopus).
30. *Shilov N., Smirnova O., Morozova P., Turov N., Shchekotov M., Teslya N.* Digital Signage Personalization for Smart City: Major Requirements and Approach // Proceedings of the 2019 IEEE International Black Sea Conference on Communications and Networking (BlackSeaCom 2019). 2019. pp. 1–3. DOI: 10.1109/BlackSeaCom.2019.8812820. (WoS, Scopus).
31. *Teslya N., Ryabchikov I., Mikhailov S.* Forming of Smart City Resident Digital Identity Based on the City Sources Analysis // Proceedings of the 2019 IEEE International Black Sea Conference on Communications and Networking (BlackSeaCom 2019). 2019. pp. 1–3. DOI: 10.1109/BlackSeaCom.2019.8812838. (WoS, Scopus).

32. *Shilov N., Teslya, N.* Ontology-Based Fragmented Company Knowledge Integration: Multi-Aspect Ontology Building // Business Information Systems Workshops. 2019 (WoS, Scopus, SJR=0,243, Q3).
33. *Teslya N., Ryabchikov I., Lipkin E.* The Concept of the Deviant Behavior Detection System via Surveillance Cameras // Proceedings of the 19th International Conference on Computational Science and its Applications (ICCSA 2019). 2019. vol. 11624. pp. 169–183. DOI: 10.1007/978-3-030-24311-1_12. (Scopus, SJR=0.315, Q2).
34. *Teslya N., Savosin S.* Matching Ontologies with Word2Vec-Based Neural Network // Proceedings of the 19th International Conference on Computational Science and its Applications (ICCSA 2019). 2019. vol. 11624. pp. 745–756. DOI: 10.1007/978-3-030-24289-3_55. (Scopus, SJR=0.315, Q2).
35. *Smirnov A., Shilov N., Parfenov V.* Building a Multi-Aspect Ontology for Semantic Interoperability in PLM // Proceedings of the IFIP 16th International Conference on Product Lifecycle (PLM). 2019. (Scopus, SJR=0,188, Q3).
36. *Kashevnik A., Lashkov I.* Intelligent Driver Decision Support System in Vehicle Cabin: Reference Model for Dangerous Events Recognition and Learning // Proceedings of the 15th International Conference on Control and Automation (IEEE ICCA 2019). 2019. pp. 27–31. (Scopus).
37. *Teslya N.* Industrial Socio-Cyberphysical System's Consumables Tokenization for Smart Contracts in Blockchain. Business Information Systems Workshops // Proceedings of the 21st International Conference on Business Information Systems (BIS). 2019. vol. 339. pp. 344–355. DOI: 10.1007/978-3-030-04849-5_31. (WoS, Scopus, SJR=0.243, Q3).
38. *Kashevnik A., Lashkov I., Ryumin D., Karpov A.* Smartphone-Based Driver Support in Vehicle Cabin: Human-Computer Interaction Interface. International Conference on Interactive Collaborative Robotics // Proceedings of the 4th International Conference on Interactive Collaborative Robotics (ICR 2019). vol. 11659. pp. 129–138. DOI: 10.1007/978-3-030-26118-4_13. (Scopus, SJR=0.315, Q2).
39. *Smirnov A., Ponomarev A.* Decision Support Based on Human-Machine Collective Intelligence: Major Challenges // Internet of Things, Smart Spaces, and Next Generation Networks and Systems,. 2019. vol. 11660. pp. 113–124.DOI: 10.1007/978-3-030-30859-9_10. (Scopus, SJR=0.315, Q2).

40. *Lashkov I., Kashevnik A.* Smartphone-based Intelligent Driver Assistant: Context Model and Dangerous State Recognition Scheme // Proceedings of SAI Intelligent Systems Conference, Intelligent Systems Conference 2019 (IntelliSys 2019). 2019. vol. 1038(2). pp. 152–165. DOI: 10.1007/978-3-030-29513-4_11. (Scopus, SJR=0.153).
41. *Smirnov A., Levashova T., Shilov N., Ponomarev A.* Multi-Aspect Ontology for Interoperability in Human-machine Collective Intelligence Systems for Decision Support // Proceedings of the 11th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management (IC3K 2019, 11th International Conference on Knowledge Engineering and Ontology Development (KEOD 2019). 2019. vol. 2. pp. 458–465. DOI: 10.5220/0008356304580465. (Scopus).
42. *Smirnov A., Shilov N.* Ontology-Based Semantic Interoperability Support in Human-Machine Collective Intelligence Systems // Joint Proceedings of the BIR 2019 Workshops and Doctoral Consortium, 11th Workshop on Information Logistics and Digital Transformation (ILOG 2019). 2019. vol. 2443. pp. 118–128. (Scopus, SJR=0.167).
43. *Teslya N., Ryabchikov I., Petrov M., Taramov A., Lipkin E.* Smart City Platform Architecture for Citizens' Mobility Support // Procedia Computer Science. 2019. vol. 150. pp. 646–653. DOI: 10.1016/j.procs.2019.02.041. (Scopus).
44. *Smirnov A., Ponomarev A.* Human-Machine Collective Intelligence Environment for Adaptive Decision Support // Proceedings of the 25th Conference of Open Innovations Association FRUCT (FRUCT'25). 2019. pp. 285–291. (WoS, Scopus, SJR=0.19).
45. *Kashevnik A., Teslya N., Mikhailov S., Petrov M., Shabaev A., Krasov A.* Ridesharing for Carsharing Service Provider: Driver and Pedestrian Route Matching // Proceedings of the 25th IEEE Conference of Open Innovations Association FRUCT (FRUCT25). 2019. pp. 146–152. (WoS, Scopus, SJR=0.19).

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

46. *Scherbakov I., Ponomarev A.* SemanTags: Semantic Tagging of Documents Based on Crowdsourcing // Izvestiya LETI. 2019. vol. 3. pp. 56–64. (In Russ.).

47. *Mikhailov S.A.* Intelligent Tourist assistance System: Service-Oriented Architecture and Implementation // Scientific and Technical Journal of Information Technologies, Mechanics and Optics. 2019. Issue 19. vol. 3. pp. 113–121. DOI: 10.17586/2226-1494-2019-19-3-499-507. (In Russ.). (VAK, impact factor – 0,118).
48. *Lashkov I., Kashevnik A.* Determination of Driver Dangerous States Using Smartphone Camera-Based Measurements While Driving // Journal of Information Technologies and Computing Systems. 2019. Issue 19. vol. 3. pp. 84–96. DOI: 10.14357/20718632190209 (In Russ.). (VAK, impact factor – 0,392).
49. *Ponomarev A.* Probabilstic Graphical Models for Data Fusion in Large-Scale Human-Machine Computing Systems // Software Systems and Computational Methods. 2019. vol. 1. pp. 59–69. (In Russ.). (VAK, impact factor – 0,404).
50. *Kalyazina D., Kashevnik A.* Cyber-Physical-Social System Ontology Development and Evaluation Based on the Analysis of Typical Scenarios for Mobile Robots Interaction // Scientific Bulletin of the Novosibirsk State Technical University. 2019. Issue 75. vol. 2. pp. 21–36. (In Russ.). (VAK, impact factor – 0,360).
51. *Petrov M.* Formation of a Performers Group for Joint Problem Solving: Competence Method and Implementation // Scientific Bulletin of the Novosibirsk State Technical University. 2019. vol.75. no 2. pp. 49–68. (In Russ.). (VAK, impact factor – 0,360).
52. *Petrov M.V., Kashevnik A.M.* Human Resources Management for Joint Problem Solving Based on Competence Management and Gamification Approaches // Information-Measuring and Control Systems. 2019. Issue. 17. no. 2. pp. 100–106. (In Russ.). (VAK, impact factor – 0,333).
53. *Mikhailov S.A., Kashevnik A.M.* A Method for a Tourist Route Construction among Attractions Based on Contextual Information // Information-Measuring and Control Systems. 2019. Issue 17. vol. 5. pp. 107–113. (In Russ.). (VAK, impact factor – 0,333).
54. *Shchekotov M.S.* The Combined SLAM Indoor Navigation Method Based on GP-LVM // Information-Measuring and Control Systems. 2019. Issue 17. vol. 5. pp. 114-122. (In Russ.). (VAK, impact factor – 0,333).
55. *Levashova T., Pashkin M.* Models of Dynamic Smart Contracts Configuration for Service Packages // Information-Measuring and

Control Systems. Issue 17. vol. 5. pp. 123–128. DOI: 10.18127/j20700814-201905-16 (In Russ.). (VAK, impact factor – 0,333).

56. *Smirnova O.V.* Algorithm Creation of Homogeneous Metric States Space of Technical Object //Informatization and Communication, 2019. vol. 4. pp. 159–159. (In Russ.). (VAK, impact factor – 0,282).
57. *Smirnova O.V.* Transportation Risk Assessment Method // Highly Available Systems. Issue15. vol. 3. pp. 1–10 (In Russ.). (VAK, impact factor – 0,367).
58. *Smirnov A., Ponomarev A.* Multi-Criteria Context-driven Recommender Systems: Model and Method // Journal on Artificial Intelligent and Decision Making. 2019. vol. 3. pp. 24–31. (VAK, impact factor – 0,811).
59. *Smirnov A., Kashevnik A.* Mobile Robot Information Interaction in Dynamic Coalitions // VIII All-Russian Scientific & Practical Conference “Theory and Practice of System Dynamics". 2019. pp. 139–142. (In Russ.).
60. Smirnov A.V., Sokolov B.V., Teslya N.N. Planning the Actions of a Robots Coalition Based on a Polymodel Description and Mechanisms of Socio-Inspired Self-Organization // XII All-Russian Multiconference on Control Problems, Divnomorskoe. 2019. pp. 104–106. (In Russ.).
61. *Smirnov A., Kashevnik A.* System for Information Interaction Organisation of Mobile Robots in Mixed Coalitions: Scenario Model and Implementation // XII All-Russian Multiconference on Control Problems. 2019. pp. 180–184. (In Russ.).

Other Publications:

62. *Kashevnik A.* Driver Monitoring and Statistics Analysis System Based on Camera and Smartphone Sensors // International Conference Science of the Future – Science of Young. 2019. (In Russ.).

Laboratory of Speech and Multimodal Interfaces

Head of laboratory: Dr. Sci. (Tech.), Assoc. Prof. Alexey A. Karpov – development of speech and multimodal human-computer interfaces and systems, karpov@iias.spb.su, http://hci.nw.ru/en.

Laboratory staff: 14 members.

Research activities – research and development of methods for natural human-computer interaction. Automatic audio-visual speech recognition and understanding. Multimodal user interfaces. Intelligent rooms and spaces. Assistive information technologies and systems for disabled people. Russian sign language research. Computational paralinguistics. Psycho-emotional states recognition.

Research fellows and brief information of the research-work direction

Senior researcher, Cand. Sci. (Tech.) – Irina S. Kipyatkova – methods for language and acoustic modeling based on artificial neural networks for automatic Russian speech recognition systems, kipyatkova@iias.spb.su.

Principal researcher, Dr. Bio. Sci., Prof. – Elena E. Lyakso – paralinguistic speech analysis, psycho-emotional states detection from speech, analysis of children's speech, lyakso@gmail.com.

Principal researcher, Cand. Sci. (Tech.) – Lev A. Stankevich – multimodal interfaces and robotic systems, stankevich_lev@inbox.ru.

Researcher – Denis V. Ivanko – audio-visual Russian speech recognition with the use of a microphone and a high-speed video camera, denis.ivanko11@gmail.com.

Researcher – Dmitry A. Ryumin – automatic recognition of gestures and elements of Russian sign language, dl_03.03.1991@mail.ru.

Junior researcher – Oksana V. Verkholyak – automatic recognition of speaker's emotional states using voice characteristics and tonality of the text of the statement, overkholyak@gmail.com.

Junior researcher (Cand. Sci. (Tech.) student) – Alena N. Velichko – methods for automatic detection of destructive paralinguistic phenomena in colloquial speech, velichko.a.n@mail.ru.

Junior researcher – Ildar A. Kagirov – formal representation of Russian sign language grammatical structures, collection and annotation of Russian sign language databases, investigation of gesture based user interfaces in the area of service robotics, kagirov@iias.spb.su.

Junior researcher – Maxim V. Markitantov – automatic gender and age recognition from speech, m.markitantov@yandex.ru.

Junior researcher – Alexander A. Axyonov – visual features calculation methods for automatic lip-reading, a.aksenov95@mail.ru.

Grants and projects

Karpov A.A. – Agreement N 14.616.21.0095 (ID: RFMEFI61618X0095) with the Ministry of Science and Higher Education of the Russian Federation, Special federal programme "Research and development in priority areas of development of the scientific and technological complex of Russia for 2014-2020" (Event 2.2), project "Multi-modal interface based on gestures, speech, and sign language for control of an assistive mobile information robot - AMIR", foreign partner: The University of West Bohemia, Pilsen, Czech Republic, 2018-2020. (jointly with A. Saveliev's laboratory).

Karpov A.A. – Project of the Russian Science Foundation N 18-11-00145 "Development and research of an intelligent system for complex paralinguistic analysis of speech", 2018-2020.

Karpov A.A. – Project of RFBR N 19-29-09081 mk "Software and infoware for intelligent analysis of video and audio information for assistive mobile systems in vehicles", 2019-2022 (jointly with A. Smirnov's laboratory)

Karpov A.A. – Project of RFBR N 16-37-60100-mol_a_dk "Development of a universal assistive information technology based on multimodal human-computer interfaces", 2016-2019

Kipyatkova I.S. – Project of RFBR N 18-07-01216-a "Development of an end-to-end continuous Russian speech recognition system using deep neural networks", 2018-2020.

Karpov A.A. – Project of RFBR N 18-07-01407-a "Automatic bimodal recognition of natural emotions in Russian speech", 2018-2020.

Ivanko D.V. – Project of RFBR N 18-37-00306-mol_a "Methods, models and algorithms of visual signals processing for lip-reading", 2018-2020.

Karpov A.A. – R&D contracts on "Development of voice control module software for a robotic exoskeleton for medical purposes" with the Volga State Technological University (VSTU, Yoshkar-Ola) within the framework of the integral project in the framework of the Government Statement No. 218, 2017-2019.

Karpov A.A. – R&D contract with Huawei Technologies Co. (Shenzhen, China), within the framework of the innovation research program HIRP Open, 2017-2019.

Karpov A.A. – R&D contract with “Mobile TeleSystems” (MTS, Moscow), 2019.

Karpov A.A. – R&D contract with "ASM Solutions" LLC. (Moscow), 2019.

University courses

ITMO University: Speech Recognition – A. Karpov.

SUAI University: Automated information management systems, Speech Recognition Technologies – I. Kipyatkova.

Scientific and organizational activity

Organization of 21th International Conference on Speech and Computer SPECOM-2019. http://specom.nw.ru/history/sites/2019. Istanbul, Turkey, 20–25 August 2019 – A. Karpov (General co-chair). Proceedings published in: Speech and Computer. Springer International Publishing Switzerland.: SPECOM 2019, LNAI 11658, 2019, 978 p. Available at: https://link.springer.com/book/10.1007/978-3-030-26061-3.

International cooperation

Joint research and organization of scientific events in cooperation with the University of West Bohemia (Czech Republic), Bogazici University (Turkey), Namık Kemal University (Turkey), Leipzig University of Telecommunications (Germany), University of Patras (Greece), Dresden University of Technology (Germany), Ulm University (Germany), United Institute of Information Problems of the National Academy of Sciences of Belarus, University of Aizu (Japan), University of Hertfordshire (Great Britain), Huawei Technologies company (China).

Participation in conferences and exhibitions

8th Seminar on Analysis of spoken Russian AP3-2019, January 18, 2019, St. Petersburg, Russia – Velichko A.N., Markovnikov N.M., Kagirov I.A., Karpov A.A.

17th International Conference on Pervasive Computing PerCom-2019, 11-15 March, 2019, Kyoto, Japan – Ivanko D.V., Karpov A.A.

14th International Conference on Electromechanics and Robotics "Zavalishin's Readings", 17-20 April, 2019, Kurks, Russia – Ivanko D.V.

44th International Conference on Acoustics, Speech and Signal Processing, ICASSP-2019, 12-17 May, 2019, Brighton, UK – Verkholyak O.V., Karpov A.A.

5th International Workshop on "Photogrammetric and computer vision techniques for video surveillance, biometrics and biomedicine" PSBB-2019, May 13-15, 2019, Moskow, Russia – Ryumin D.A., Ivanko D.V.

30th International Conference on Extreme Robotics ER-2019, 13-15 June, 2019, St. Petersburg, Russia –Ryumin D.A., Karpov A.A.

21th International Conference "Speech and Computer" SPECOM-2019, 20-25 August, 2019, Istanbul, Turkey – Karpov A.A., Kipyatkova I.S., Kagirov I.A., Markitantov M.V. (conference co-organization).

4rd International Conference on Interactive Collaborative Robotics ICR-2019, 20-25 August 2019, Istanbul, Turkey – Kagirov I.A., Karpov A.A.

19th International Conference The Special Interest Group on Discourse and Dialogue SIGDIAL-2019, 11-13 September, 2019, Stockholm, Sweden – Karpov A.A.

20th International Conference INTERSPEECH-2019, 15-19 September 2019, Graz, Austria – Karpov A.A.

13th International Symposium on Intelligent Distributed Computing IDC 2019, 7-10 October, 2019, St. Peterburg, Russia – Velichko A.N., Ryumin D.A., Karpov A.A.

27th International Conference on Multimedia ACM Multimedia-2019, 21-25 October, 2019, Nice, France – Karpov A.A.

3rd International Conference in Language Engineering and Applied Linguistics "R. Piotrowski's Readings 2019", November 27, 2019, St. Petersburg, Russia – Karpov A.A., Dvoinikova A.A., Velichko A.N.

Membership in Russian and International societies, editorial boards, etc.

Karpov A.A. – Expert of the RAS; scientific Ambassador of St. Petersburg; member of the European Association for Signal Processing (EURASIP), EURASIP Local Liaison Officer in Russia, member of the International Speech Communication Association (ISCA), member of the

International Association for Pattern Recognition (IAPR); Editorial board member of the journals "SPIIRAS Proceedings" (St. Petersburg), "Speech Technologies" (Moscow) and "Informatics" (Minsk); Guest editor of the Journal on Journal on Multimodal User Interfaces (Springer), Speech Communication (Elsevier), Journal of Electrical and Computer Engineering (Hindawi); reviewer of several international journals IEEE/ACM Transactions on Audio, Speech and Language Processing; IEEE Transactions on Affective Computing; IEEE Transactions on Biomedical Engineering; IEEE Journal of Biomedical and Health Informatics; Neurocomputing; Computer Speech & Language; Speech Communication; IEEE Signal Processing Letters, Pattern Recognition Letters; Pattern Recognition; Language Resources and Evaluation; Soft Computing; Journal of Information Science; Acoustical Physics etc.; co-chair of the International Conference SPECOM series, technical/program committee member of the international conferences INTERSPEECH, ICASSP, ICPR, SLTU, SPECOM, Baltic HLT, HBU, SIU, DOGS, etc.

Kipyatkova I.S. – technical/programme committee member of the international conferences INTERSPEECH, ICASSP, SPECOM, ISNN, member of the organizing committee of the international conference SPECOM series; member of the International Speech Communication Association (ISCA).

Verkholyak O.V. – member of the International Speech Communication Association (ISCA), member of the Association for Computational Linguistics (ACL), member of the IEEE Young Professionals and IEEE Membership.

Ivanko D.V. – scientific committee member of the international conference LREC, IEEE Membership.

Intellectual property

Patent of Russia for invention: Mobile autonomous robotic platform with block structure, No. 2704048 dated 10.23.2019 – Savelyev A.I., Kharkov I.Yu., Pavlyuk N.A., Karpov A.A.

Computer program: Software system for determining the gender and age of a speaker (GASpeakerRecognizer), No. 2019662952 dated 10.10.2019 – Markitantov M.V., Karpov A.A.

Computer program "Software for recording a gesture database using the Kinect v2 sensor", Certificate No. 2019612755 of 02.27.2019 – Ryumin D.A., Karpov A.A.,

Computer program “A software system for automatic speech recognition based on models using connectionist temporal classification”, Certificate No. 2019615375 of April 25, 2019 – Markovnikov N.M., Kipyatkova I.S.,

Database “Corpora of continuous Russian speech for automatic speech recognition systems”, Certificate No. 2019620328 of February 27, 2019 – Kipyatkova I.S., Kagirov I.A., Karpov A.A.

Recent Results

1. End-to-end encoder-decoder models with connectionist temporal classification using various types of neural networks, such as Highway, ResNet, DenseNet, DiracNet, and Transforme trained using data augmentation methods based on tempo and pitch perturbations and adding white noise have been developed for recognition of continuous Russian speech. This allows achieving higher recognition speed comparing to the standart speech recognition system [12, 19, 26].

2. A multimodal method (color video stream and depth map) for recognizing static and dynamic one-handed gestures of the Russian sign language using a three-dimensional convolutional deep neural network with long short-term memory (LSTM) was developed, which allows to extract both short-term and long-term spatio-temporal characteristics of gestures [9, 14, 18, 29].

3. A method for recognizing emotions in conversational speech based on a hierarchical model of a recurrent neural network with long short-term memory (RNN-LSTM), as well as a data adaptation method that allows the efficient use of a cross-corpus experimental setup was developed and made it possible to obtain results that exceed the existing values in the literature [1, 2, 5, 7].

4. A new approach to the recognition of the speaker’s gender and age has been developed based on deep neural networks (DNN), trained and tested on the dataset of German speech aGender using both simple models and more complex ones based on different DNN topologies, including neural networks with fully connected and convolutional layers, which allowed to achieve the best recognition results in gender and age of the speaker by voice [13, 23, 31].

5. New types of informative features based on the color and geometry of the images of the lips for the audio-visual speech recognition system and lip-reading system were developed and implemented using

computer vision libraries and various configurations of Hidden Markov Models, including coupled and multistream ones, which allowed to exceed the recognition accuracy values known in the literature for Russian speech [8, 10, 20].

6. The multimedia database of vocabulary of the Russian sign language has been expanded and annotated, complex analysis has been conducted, which made it possible to clarify the classes of gestures relevant for automatic recognition and describe the variability of the gestures during spontaneous speech and is planned to be used in creating own gesture speech recognition system [3, 21, 22, 27].

7. A model of an intelligent interface for human-machine interaction was developed and justified from the usability point of view, which includes both voice control and a gesture interface and intended for use in assistive technologies (it was also implemented in the robotic medical exoskeleton and in the robotic trolley for supermarkets) [16, 20, 29, 30].

8. Methods of artificially increasing the amount of data using SMOTE and ADASYN techniques were studied, which positively affected the operation of the models; conducted experimental studies using neural networks and the principal component method made it possible to reduce the dimension of data and to clear data from noise, which led to an increase in the accuracy of classification of false and true speech utterances [15, 28].

Awards, certificates, scholarships

Karpov A.A. – Certificate “For significant merits in the field of science and many years of conscientious work”, the Ministry of Science and Higher Education of the Russian Federation, order No. 38 / pr, dated June 26, 2019.

Publications

Papers prepared jointly with foreign organizations:

1. *Verkholyak O., Fedotov D., Kaya H., Zhang Y., Karpov A.* Hierarchical Two-Level Modelling of Emotional States in Spoken Dialog Systems // Proceedings of the 44th IEEE International Conference on Acoustics, Speech, and Signal Processing ICASSP-2019. 2019. pp. 6700–6704. DOI: https://doi.org/10.1109/ICASSP.2019.8683240. (WoS, Scopus, SJR = 0,48).

2. *Kaya H., Fedotov D., Dresvyanskiy D., Doyran M., Mamontov D., Markitantov M., Akdag Salah A., Kavcar E., Karpov A., Salah A.A.* Predicting depression and emotions in the cross-roads of cultures, para-linguistics, and non-linguistics // Proceedings of the 9th International Audio/Visual Emotion Challenge and Workshop AVEC'19, co-located with ACM Multimedia 2019. pp. 27–35. DOI: https://doi.org/10.1145/3347320.3357691. (Scopus).
3. *Ryumin D., Ivanko D., Kagirov I., Axyonov A., Karpov A., Zelezny M.* Human-Robot Interaction with Smart Shopping Trolley using Sign Language: Data Collection // Proceedings of the 2019 IEEE International Conference on Pervasive Computing and Communications Workshops. pp. 949–954. DOI: https://doi.org/10.1109/PERCOMW.2019.8730886. (WoS, Scopus).
4. *Akhtiamov O., Siegert I., Karpov A., Minker W.* Cross-Corpus Data Augmentation for Acoustic Addressee Detection // Proceedings of the 20th ACL International Conference on Discourse and Dialogue SIGDial-2019. pp. 274–283. DOI: https://www.aclweb.org/anthology/W19-5933 (Scopus).
5. *Fedotov D., Kim B., Karpov A., Minker W.* Time-Continuous Emotion Recognition Using Spectrogram Based CNN-RNN Modelling // Lecture Notes in Computer Science. 2019. pp. 93–102. DOI: https://doi.org/10.1007/978-3-030-26061-3_10 (Scopus, SJR = 0,28, Q2).
6. *Yu J., Markov K., Karpov A.* Speaking Style Based Apparent Personality Recognition // Lecture Notes in Computer Science. 2019. pp. 540–548. DOI: https://doi.org/10.1007/978-3-030-26061-3_55 (Scopus, SJR = 0,28, Q2).
7. *Verkholyak O.V., Kaya H., Karpov A.A.* Modeling short-term and long-term dependencies of the speech signal for paralinguistic emotion classification // Труды СПИИРАН. 2019. Вып. 62(1). С. 30–56. DOI: https://doi.org/10.15622/sp.18.1.30-56 (Scopus, SJR = 0,17, Q3).
8. *Ivanko D.V., Ryumin D.A., Karpov A.A., Zhelezny M.* Investigation of the influence of high-speed video data on the recognition accuracy of audiovisual speech // [Information and Control Systems]. 2019. vol. 2. pp. 26–34. DOI: https://doi.org/10.31799/1684-8853-2019-2-26-34. (Scopus). (In Russ.).

Papers published in editions, indexed by WoS, Scopus:

9. *Ryumin D., Kagirov I., Ivanko D., Axyonov A., Karpov A.* Automatic detection and recognition of 3D manual gestures for human-machine interaction // International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. 2019. pp. 179–183. DOI: https://doi.org/10.5194/isprs-archives-XLII-2-W12-179-2019 (Scopus, SJR = 0,31).
10. *Ivanko D., Ryumin D., Karpov A.* Automatic lip-reading of hearing impaired people // International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. 2019. pp. 97–101. DOI: https://doi.org/10.5194/isprs-archives-XLII-2-W12-97-2019 (Scopus, SJR = 0,31).
11. *Kipyatkova I.* LSTM-Based Language Models for Very Large Vocabulary Continuous Russian Speech Recognition System // Lecture Notes in Computer Science (SPECOM 2019). 2019. pp. 219–226. (Scopus, SJR = 0,28, Q2)
12. *Markovnikov N., Kipyatkova I.* Investigating Joint CTC-Attention Models for End-to-End Russian Speech Recognition // Lecture Notes in Computer Science (SPECOM 2019). 2019. pp. 337–347. (Scopus, SJR = 0,28, Q2).
13. *Markitantov M., Verkholyak O.* Automatic Recognition of Speaker Age and Gender Based on Deep Neural Networks // Lecture Notes in Computer Science (SPECOM 2019). 2019. pp. 327–336. (Scopus, SJR = 0,28, Q2).
14. *Kagirov I., Ryumin D., Axyonov A.* Method for Multimodal Recognition of One-Handed Sign Language Gestures Through 3D Convolution and LSTM Neural Networks // Lecture Notes in Computer Science (SPECOM 2019). 2019. pp. 191–200. (Q2, Scopus, SJR = 0,28).
15. *Velichko A., Budkov V., Kagirov I., Karpov A.* Applying Ensemble Learning Techniques and Neural Networks to Deceptive and Truthful Information Detection Task in the Flow of Speech // Studies in Computational Intelligence. 2019. pp. 457–466. DOI: https://doi.org/10.1007/978-3-030-32258-8_56 (Scopus, SJR = 0,183).
16. *Kagirov I., Karpov A., Kipyatkova I., Klyuzhev K., Kudryavcev A., Kudryavcev I., Ryumin D.* Lower Limbs Exoskeleton Control System

Based on Intelligent Human-Machine Interface // Studies in Computational Intelligence. 2019. pp. 477–482. DOI: https://doi.org/10.1007/978-3-030-32258-8_54 (Scopus, SJR = 0,183).

17. *Ivanko D., Ryumin D., Kipyatkova I., Axyonov A., Karpov A.* Lip-reading Using Pixel-based and Geometry-based Features for Multimodal Human-Robot Interfaces // Smart Innovation, Systems and Technologies. vol. 154. pp. 477–486. DOI: https://doi.org/10.1007/978-981-13-9267-2_39 (Scopus, SJR = 0,156).
18. *Ryumin D., Ivanko D., Kagirov I., Axyonov A., Karpov A.* Vision-Based Assistive Systems for Deaf and Hearing Impaired People // Computer Vision in Advanced Control Systems-5. 2020. vol. 175. pp. 197–223. DOI: https://doi.org/10.1007/978-3-030-33795-7_7 (Scopus, SJR = 0,163, Q3).
19. *Markovnikov N.M., Kipyatkova I.S.* The study of methods for constructing coder-decoder models for recognizing Russian speech // Information Management Systems. 2019. vol. 4. pp. 45–53. DOI: https://doi.org/10.31799/1684-8853-2019-4-45-53 (Scopus). (In Russ.).
20. *Kagirov I.A., Karpov A.A., Kipyatkova I.S., Klyuzhev K.S., Kudryavtsev A.I., Kudryavtsev I.A., Ryumin D.A.* Intelligent interface for controlling the robotic medical exoskeleton of the lower extremities Remotion // Aerospace and Environmental Medicine. 2019. vol. 5. pp. 92–98. DOI: https://doi.org/10.21687/0233-528X-2019-53-5-92-98 (Scopus, SJR = 0.23, Q3). (In Russ.).

Papers published in editions, indexed by Russian Science Citation Index (RSCI):

21. *Kagirov I.A., Tolstoy I.M., Savelyev A.I., Karpov A.A.* Gesture control of a collaborative robot // Robotics and technical cybernetics. 2019. Issue 7. vol. 2. pp. 139–144. DOI: https://doi.org/10.31776/RTCJ.7208. (In Russ.). (VAK, impact factor – 0,524).
22. *Kagirov I.A., Manueva Yu.S.* Development of a predicate model for the selection of lexical meanings when translating into Russian sign language based on the semantic dictionary of VA Aces and automatic dialing systems “Dialing” // Scientific Bulletin of Nizhny

Novgorod State Technical University. 2019. vol. 1(74). pp. 41–60. DOI: https://doi.org/10.17212/1814-1196-2019-1-41-60. (In Russ.). (VAK, impact factor – 0,355).
23. *Markitantov M.V., Karpov A.A.* Automatic recognition of age and gender by voice based on deep neural networks // Information-measuring and control systems. 2019. Issue 17. vol. 5. pp. 76–83. DOI: https://doi.org/10.18127/j20700814-201905-10 (In Russ.). (VAK, impact factor – 0,263).
24. *Aksenov A.A., Ryumin D.A., Kagirov I.A.* The method of multimodal recognition of one-handed gestures // Information-measuring and control systems. 2019. Issuew 17. vol. 5. pp. 84–92. DOI: https://doi.org/10.18127/j20700814-201905-11. (In Russ.). (VAK, impact factor – 0,263).
25. *Karpov A.A., Sergeev S.F., Lakhin O.I., Mikhaylyuk M.V., Kryuchkov B.I., Usov V.M.* The interaction of man and robot in a manned flight: an ontological approach // Manned Space Flights, 2019. vol. 4. 9 (in press). (In Russ.). (VAK, impact factor – 0,289).
26. *Markovnikov N.M., Kipyatkova I.S.* The study of methods for constructing integrated recognition systems for Russian speech without extracting features // Proceedings of the 8th interdisciplinary seminar “Analysis of spoken Russian speech” AR3-2019. 2019. pp. 71–77. (In Russ.).
27. *Kagirov I.A.* The project of the specialized corpora of the Russian sign language for use in human-machine interfaces // Proceedings of the 8th Interdisciplinary Seminar “Analysis of Conversational Russian Speech” AR3-2019. 2019. pp. 39–45. (In Russ.).
28. *Velichko A.N., Budkov V.Yu.* Development of a prototype system for the automatic determination of false and true information in speech // Proceedings of the 8th interdisciplinary seminar “Analysis of spoken Russian speech” AR3-2019. 2019. pp. 17–20. (In Russ.).
29. *Kagirov I.A., Karpov A.A., Kipyatkova I.S., Klyuzhev K.S., Kudryavtsev A.I., Kudryavtsev I.A., Ryumin D.A.* Control of a robotic medical exoskeleton through an intelligent interface // Proceedings of the international scientific and technical conference "Extreme Robotics". 2019. pp. 462–468. DOI: https://doi.org/10.31776/ConfER.30.2019. (In Russ.).

30. *Markitantov M.* An analytical review of systems for automatic speaker's age recognition by voice // Proceedings of the VIII Congress of Young Scientists. 2019. vol. 3. pp. 246–251. (In Russ.).
31. *Ryumin D., Aksenov A.* Method for the automatic detection and recognition of 3D one-handed gestures // Proceedings of the VIII Congress of Young Scientists. 2019. vol. 4. pp. 64–69. (In Russ.).
32. *Fedotov D.V., Verkholyak O.V., Karpov A.A.* Contextual continuous recognition of emotions in Russian speech using recurrent neural networks // Proceedings of the 8th Interdisciplinary Seminar “Analysis of Conversational Russian Speech”. 2019. pp. 96–99. (RSCI).

Laboratory of Research Automation

Head of laboratory: Dr. Sci. (Tech.), Sergey V. Kuleshov – associative-ontological approach to Internet-content analysis, data processing and compression, digital software-defined infocommunication systems, kuleshov@iias.spb.su.

Laboratory staff: 9 members.

Research activities – semantic analysis of audio-, video data and texts within the framework of digital programmed infocommunication theory. Software-defined reconfigurable infocommunication systems. The methods of energy effective optimization for program defined digital data transmission channels. Active data, distributed virtual machines. Associative-ontological approach to Internet content analysis, information analysis systems developing, automated monitoring of Internet environment. The basis for theory and methods of digital technologies for cognitive programming of complex spatial forms and their 3D prototyping. The application of mathematical methods for digital signal processing.

Research fellows and brief information of the research-work direction

Chief researcher, Dr. Sci. (Tech.), Honored Scientist of Russian Federation, Laureate of John von Neumann prize, laureate of Russian Federation government prize in science and technology field Prof. – Victor V. Alexandrov – algorithmic models, digital programmed infocommunication, informatics, infology, epistemology of growing infocommunication systems, NBICS technologies, alexandr@iias.spb.su

Leading Researcher, Dr. Sci. (Tech.), – Sergey F. Svinyin – application of modern mathematical methods in digital processing of multidimensional signals, svinyins@mail.ru.

Senior Researcher, Cand. Sci. (Tech.) – Alexandra A. Zaytseva – big data processing methods and technology, cher@iias.spb.su.

Researcher, Cand. Sci. (Tech.) – Pavel P. Kokorin – infology information systems, kokorin@list.ru.

Senior Researcher, Cand. Sci. (Tech.)– Alexey J. Aksenov – digital signal processing, methods of scanned 3D data processing and compression, a_aksenov@iias.spb.su.

Post graduated students and competitors

Nenausnikov K.V. Development of methods and algorithms of semantic text analysis for the application in question answering systems. Supervisor – Kuleshov S.V.

Shalnev I.O. The development of the distributed virtual machine for reconfigurable systems design. Supervisor – Kuleshov S.V.

Grants and projects

Kuleshov S.V. – Scientific research contract No.122/18, FSUE "State Research Institute of Applied Problems", 2018-2019.

Kuleshov S.V. – Scientific research contract, FSUE "State Research Institute of Applied Problems", 2019-2020.

Alexandrov V.V. – RFBR project N 16-29-09482-ofi_m "Prediction of the network-based terrorist threats appearance and elaboration of counter measures in metropolises", 2016–2018.

Kuleshov S.V. – RFBR project N 16-29-12965-ofi_m "Methodology and Algorithmic Tools Elaboration for Creation of Empirical Model of Strategic Management of Innovation Activity of Russian Economy Based on Technologies of Big Data Intelligent Processing and Machine Learning", 2016-2018.

Scientific and organizational activity

International Conference Cyber-Physical Systems and Control (CPS&C'2019), June 10-12, 2019, St. Petersburg, Russia – Zaytseva A.A., Kuleshov S.V.

5-th International Scientific and Practical Conference “Technological perspective within the framework of the Eurasian space: new markets and points of economic growth”, November 7-8, 2019, St. Petersburg, Russia – Zaytseva A.A., Kuleshov S.V.

Participation in conferences and exhibitions

XIV Russian Science and Practical Conference "Perspective systems and control tasks", April 1-5, 2019, Terskol, Kabardino-Balkar Republic – Kuleshov S.V., Zaytseva A.A.

International Conference Cyber-Physical Systems and Control (CPS&C'2019), June 10-12, 2019, St. Petersburg, –Aksenov A.Yu, Zaytseva A.A., Kuleshov S.V.

International Military-Technical Forum “ARMY-2019”, 25-30 June, 2019, Moscow, Russia –Kuleshov S.V.

Computational Methods in Systems and Software (CoMeSySo 2019), on-line Conference, Czech Republic, Zlin, September 10-12, 2019 –Aksenov A.Yu., Zaytseva A.A., Kuleshov S.V.

5-th International Scientific and Practical Conference “Technological perspective within the framework of the Eurasian space: new markets and points of economic growth”, Saint-Petersburg, November 7-8, 2019 – Alexandrov V.V, Aksenov A.Yu, Zaytseva A.A., Kuleshov S.V., Nenausnikov K.V.

Membership in Russian and International societies, editorial boards, etc.

Alexandrov V.V. – active member of Russian Academy of Natural Sciences. Editorial board member of "Scientific instrumentation" journal.

Svinyin S.F. – member of Saint-Petersburg Assotiation of Scientists scientific council, chairman of Saint-Petersburg department of Lomonosov’s foundation, member of international scientific society “Euroscience”.

Kuleshov S.V. – Expert of RAS, member of program committee of MICSECS 2018 International Conference, CPS&C'2019 International Conference.

Intellectual property

Certificate on Software Registration “The software module for determining trends in the analysis of news flows in natural language”, registration date 24.05.2019, N 2019616542 – Kuleshov S.V., Zaytseva A.A., Korableva O.N.

Certificate on Software Registration “The software module for visualization of trends in natural language texts”, registration date 30.05.2019, N 2019616846 – Kuleshov S.V., Zaytseva A.A., Aksenov A.Yu.

Certificate on Software Registration «Program for automatically highlighting collocations in natural language texts », registration date 18.06.2019, N 2019617650 – Kuleshov S., Alexandrov V., Nenausnikov K.

Recent results

1. The principles of active data distributed virtual machines system design were developed to create architecture allowing reconfigurability of

end devices and system stability in general. The proposed principles provide ability to control energy consumption of distributed software reconfigurable network nodes and data transmission rate [3, 5, 7, 10].

2. The method for automatic word meaning determination based on associative-ontological approach was proposed which is equally applicable to small and big text corpuses without preliminary processing. The method allows automatic detection of objects (subjects, facts) depending on context, which ensures stability invariant to input data [2, 11].

3. The methods and algorithms for comparison and generalization of associative ontologies was developed, which allow solving practical problems of semantic search, retrospective analysis of news flows and the formation of event trends, characterized by an optimized representation of associative ontology graphs [1, 2, 16].

4. The methodology and algorithms was developed for causal relationship detection on set of pairs <ontology notion – goal indicators> based on semantic data model including comparison and generalization of associative ontologies and mechanism for ontology notion list creation based on selection filters to be applied in external analytical systems [1, 2, 13].

5. Methods to reduce the risk of implementing active data technology in digital software-defined systems were proposed when constructing a distributed system of virtual machines through the integrated use of technologies for protecting executable code and initiation device reconfiguration classes [5, 6, 8].

References

Papers published in editions, indexed by WoS, Scopus:

1. *Kuleshov S.V., Zaytseva A.A., Aksenov A.J.* The tool for the innovation activity ontology creation and visualization // Advances in Intelligent Systems and Computing. 2019. vol. 763. pp. 292–301. DOI: 10.1007/978-3-319-91186-1_30 (Scopus, SJR = 0,174).
2. *Kuleshov S.V., Zaytseva A.A., Aksenov A.J.* Natural Language Search and Associative-Ontology Matching Algorithms Based on Graph Representation of Texts // Advances in Intelligent Systems and Computing. 2019. vol. 1046. DOI: 10.1007/978-3-030-30329-7_26 (Scopus, SJR = 0,174).
3. *Kuleshov S. V., Zaytseva A. A., Shalnev I. O.* Distributed system of virtual machines for self-organized networks. Informatsionno-upravliaiushchie sistemy // Information and Control Systems. 2019.

vol. 5. pp. 30–37. DOI:10.31799/1684- 8853-2019-5-30-37. (In Russ.). (Scopus).

4. *Svinyin S.F., Trigubovich G.M., Chernyshev A.V., Svinyin V.F.* Method for assessing the rational density of samples of multidimensional geophysical signals with finite energy // Geology and Mineral Resources of Siberia. 2019. vol. 3(39). pp. 72–79. DOI: 10.20403/2078-0575-2019-3-72-79. (In Russ.). (Scopus).
5. *Kuleshov S.V., Zaytseva A.A., Ronzhin A.L.* The Development of Soft Defined Distributed Infocommunication Systems Architecture Based on the Active Data Technology // Lecture Notes in Networks and Systems. 2020. vol. 95. pp. 257–265. DOI: https://doi.org/10.1007/978-3-030-34983-7_25 (Scopus).
6. *Kuleshov S.V., Aksenov A.Y., Viksnin I.I., Laskus E.O., Belyaev V.V.* The Analysis of Cybersecurity Problems in Distributed Infocommunication Networks Based on the Active Data Conception // Lecture Notes in Networks and Systems. 2020. vol. 95. pp. 491–499. DOI: https://doi.org/10.1007/978-3-030-34983-7_48 (Scopus).

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

7. *Podkorytov D.A., Floka A.B., Kuleshov S.V.* Cross-platform DNS Proxy service architecture // T-Comm: Teleccommunications and transport. 2019. Issue 13. vol. 5. pp. 35–40. DOI: 10.24411/2072-8735-2018-10269. (In Russ.). (VAK, impact factor – 0,854).
8. *Livshic I.I., Zaytseva A.A.* The problems of ensuring the security of the cloud component of information technology // Automation in Industry. 2019. vol. 7. pp. 10–16. (In Russ.). (VAK, impact factor – 0,282).
9. *Kuleshov S.V., Zaytseva A.A.* The approach to instrumental estimation of the digital compressed video data stream, formed with the video codecs // Information-measuring and Control Systems. 2019. vol. 17. no. 5. pp. 21–29. DOI: 10.18127/j20700814-201905-04. (In Russ.). (VAK, impact factor – 0,292).
10. *Shalnev I.O., Aksenov A.Y.* User interface generation based on distributed virtual environment technology // Information-measuring and Control Systems. 2019. vol. 17. no. 5. pp. 44–50. DOI: 10.18127/j20700814-201905-06 (In Russ.). (VAK, impact factor – 0,292).

11. *Nenausnikov K.V., Alexandrov V.V.* Approach to the description of the meaning of a word based on an associative-ontological approach // Information-measuring and Control Systems. 2019. Issue 17. vol. 5. pp. 92–99. DOI: 10.18127/j20700814-201905-12. (In Russ.). (VAK, impact factor – 0,292).
12. *Livshic I.I., Zaytseva A.A.* Methodology of IT security risk assessment for critical industrial facilities in distributed cyberphysical systems // Information-measuring and Control Systems. 2019. Issue 17. vol. 5. 2019. pp. 51–60. DOI: 10.18127/j20700814-201905-07 (IF = 0,292). (In Russ.). (VAK, impact factor – 0,292).
13. *Nenausnikov K.V., Kuleshov S.V.* Approaches to automatically extracting collocations from the text // Journal of Instrument Engineering. 2019. vol. 11. pp. 976–981. DOI 10.17586/0021-3454-2019-62-11-976-981. (In Russ.). (VAK, impact factor – 0,540).
14. *Nenausnikov K.V.* An approach to specify the meaning of a word using topic text segmentation // Proceedings of the Fifth International Scientific and Practical Conference “Technological perspective within the framework of the Eurasian space: new markets and points of economic growth”. 2019. pp. 165–169. (In Russ.).
15. *Alexandrov V.V., Kuleshov S.V., Aksenov A.Y.* The approach to user terminal identification in the anonymization environment. Proceedings of the Fifth International Scientific and Practical Conference “Technological perspective within the framework of the Eurasian space: new markets and points of economic growth”. 2019. pp. 161–165. (In Russ.).
16. *Zaytseva A.A., Kuleshov S.V.* To the question of creating a technology for visualization the dynamics of the significance of concepts changing over time based on the associative-ontological approach. Proceedings of the Fifth International Scientific and Practical Conference “Technological perspective within the framework of the Eurasian space: new markets and points of economic growth”. 2019. pp. 169–173. (In Russ.).
17. *Kuleshov S.V., Zaytseva A.A.* The concept of building active data transmission networks for UAVs // Transactions of the XIV All-Russian Scientific and Practical Conference "Perspective Systems and Control Problems". 2019. pp. 404–415. (In Russ.).

Laboratory of Computer Security Problems

Head of Laboratory: Dr. Sci. (Tech.), Prof. Igor V. Kotenko – information security, artificial intelligence, information and telecommunication systems. ivkote@comsec.spb.ru, http://comsec.spb.ru/kotenko.

Laboratory Staff: 19 members, 9 postgraduate students.

Research Activities – information security, including security information and event management systems, security policy management, access control, authentication, network security analysis, intrusion detection, firewalls, deception systems, malware protection, analysis and verification of security protocols and systems, software protection against VAKking and digital right management, modeling, simulation and visualization technologies for counteraction to cyber terrorism, intellectualization of services for protection of critical infrastructures, modeling and attacks impact analysis on cyber-physical systems.

Artificial intelligence, including multi-agent systems, soft and evolutionary computing, machine learning, data mining, data and information fusion, intellectual decision support systems, processing of incomplete and contradictory information.

Telecommunication systems and Internet of things, including decision making and planning for telecommunication systems, analysis and synthesis of protected multiservice networks. Modeling of the processes of the industrial systems of the Internet of things in the application to the cyber security systems, energy and water supply systems, railway transport systems, mobile self-organizing networks systems, etc.

Research fellows and brief information of the research-work direction

Leading Researcher, Dr. Sci. (Tech.), Professor –Igor B. Saenko – computer-based systems, information security, data processing and communications, modeling theory and mathematical statistics, information theory. ibsaen@comsec.spb.ru, http://comsec.spb.ru/saenko.

Leading Researcher, Dr. Sci. (Tech.), Professor – Igor B. Parashchuk – computer network security, automated information systems, data storage and processing, control theory, simulation theory and mathematical statistics, information theory, methods for quality and effectiveness

analyzing of network information security systems. parashchuk@comsec.spb.ru, http://comsec.spb.ru/ru/staff/parashchuk.

Leading Researcher, Cand. Sci. (Tech.) – Andrey A. Chechulin – computer network security, intrusion detection, virus, security analysis, network worm protection, programming. chechulin@iias.spb.su, http://comsec.spb.ru/chechulin/.

Senior Researcher, Cand. Sci. (Tech.) – Alexander A. Branitskiy – computer network security, intrusion detection systems, neural networks, immune system and interpolation polynomials. branits-kiy@comsec.spb.ru, http://comsec.spb.ru/branitskiy/.

Senior Researcher, Cand. Sci. (Tech.) – Vasily A. Desnitsky – computer network security, anti-tamper techniques, security policies, Internet of Things, modeling and analysis of computer attacks. desnitsky@comsec.spb.ru, http://comsec.spb.ru/desnitsky/.

Senior Researcher, Cand. Sci. (Tech.) – Elena V. Doynikova – computer network security, information security risk analysis methods, risk management. doyniko-va@comsec.spb.ru, http://comsec.spb.ru/doynikova/.

Senior Researer Cand. Sci. (Tech.) – Evgenia S. Novikova – computer network security, cryptography, authentication, visualization of security information, programming. novikova@comsec.spb.ru, http://comsec.spb.ru/novikova/.

Senior Researcher, Cand. Sci. (Tech.) – Olga V. Tushkanova – data mining, ontologies, computer network security. tushkanova@comsec.spb.ru, http://comsec.spb.ru/tushkanova.

Researcher – Lidia A. Vitkova – information security, analysis of social networks, big data, artificial intelligence systems. vitkova@comsec.spb.ru.

Junior Researcher, Cand. Sci. (Tech.) student – Kseniia N. Zhernova – visualization of the security data, human-computer interaction, cryptography, block ciphers, research advisor – Andrey A. Chechulin. zhernova@comsec.spb.ru, http://comsec.spb.ru/zhernova/.

Junior Researcher – Maxim V. Kolomeec – distributed system security, security visualisation, kolomeec@comsec.spb.ru, http://comsec.spb.ru/kolomeec/.

Junior Researcher – Dmitry S. Levshun – distributed system security, embedded devices, event correlation, levshun@comsec.spb.ru, http://comsec.spb.ru/levshun/.

Junior Researcher – Andrey V. Fedorchenko – computer network security, methods of correlation of security events, vulnerability analysis of computer networks. fedorchen-ko@comsec.spb.ru, http://comsec.spb.ru/fedorchenko/.

Junior Researcher – Anton A. Pronoza – computer network security, big data, visualization techniques. pronoza@comsec.spb.ru, http://www.comsec.spb.ru/pronoza/.

Junior Researcher – Igor A. Ushakov – computer network security, insider detection methods, big data.

Postgraduate students and research directions

Diana A. Gaifulina. Computer network security, intrusion detection, security event correlation methods, network vulnerability analysis. Research advisor – Kotenko I.V. gaifulina@comsec.spb.ru, http://www.comsec.spb.ru/gaifulina/.

Denis A. Kleverov. Computer network security, intrusion detection, machine learning. Research advisor –Kotenko I.V.

Maksim A. Kleverov. Computer network security, intrusion detection, machine learning. Research advisor –Kotenko I.V.

Nickolay A. Komashinsky. Computer network security, intrusion detection, malware. Research advisor – Kotenko I.V. komashinsky@comsec.spb.ru, http://www.comsec.spb.ru/komashinsky/.

Alexei G. Kushnerevich. Big data, data analysis, research advisor – Saenko I.B. kushnerevich@comsec.spb.ru, http://comsec.spb.ru/kushnerevich/.

Alexey V. Meleshko. Information security, anomaly search, machine learning, cyber-physical systems, hardware platform. Research advisor – Vasily Desnitsky. meleshko@comsec.spb.ru, http://www.comsec.spb.ru/ meleshko/.

Aleksei P. Pronichev. Computer network security, big data, intrusion detection. Research advisor – Kotenko I.V. pronichev@comsec.spb.ru, http://www.comsec.spb.ru/ pronichev/.

Yurii E. Bakhtin. Cyberphysical system security, industrial network communication protocols, semi-natural modeling, research advisor – Chechulin A.A. bakhtin@comsec.spb.ru, http://comsec.spb.ru/bakhtin/.

Grants and projects

Kotenko I.V. – Government contract # 05.607.21.0322 “Development of methods, models, algorithms and software based on the detection of deviations in heuristics of ultra-high volume traffic to detect network attacks and protect against them”. Project of Russian Ministry of Education and Science in scope of the Program “Research and development in priority directions of evolution of the scientific and technological complex of Russia on 2014-2020”, 2019-2020.

Saenko I.B. – Grant of Russian Science Foundation № 18-11-00302 "Intelligent digital network content processing for effective detection and counteraction of inappropriate, dubious and harmful information", 2018-2020.

Chechulin A.A. – Grant of Russian Science Foundation № 18-71-10094 “Monitoring and counteraction to malicious influence in the information space of social networks”, 2018-2021.

Kotenko I.V. – Research grant # 18-29-22034 of Russian Foundation of Basic Research "Monitoring and identification of destructive information impacts and negative personal tendencies of the younger generation when interacting with the Internet space on the basis of methods of neurocomputer and neural network processing of Internet content", 2018-2021.

Kotenko I.V. – Research grant # 18-07-01488-a of Russian Foundation of Basic Research “Models, methods, techniques and algorithms of human-machine interaction to support visual analytics of network security of critical infrastructures using multitouch screens”, 2018-2020.

Saenko I.B. – Research grant # 18-07-01369-a of Russian Foundation of Basic Research “Models and methods of analysis, structural optimization and verification of access control systems for cloud infrastructures of critical information systems, based on the creation and application of artificial intelligence means”, 2018-2020.

Chechulin A.A. – Research grant # 18-37-20047 of Russian Foundation of Basic Research “Research, development and application of Augmented Reality technology for cyber and cyberphysical systems security data visualization”, 2018-2020.

Chechulin A.A. – Research grant # 19-29-06099 of Russian Foundation of Basic Research “Development of methods for vulnerabilities detection for human-computer interaction interfaces of the Smart City transport infrastructure”, 2019-2021.

Doynikova E.V. – Research grant # 19-07-01246 A of Russian Foundation of Basic Research “Techniques of security assessment and response to cyber attacks in the industrial Internet of Things based on the ontology of security metrics and methods of intellectual analysis of big data”, 2019-2021.

Doynikova E.V. – Scholarship of the President of the Russian Federation to young scientists and graduate students in the direction “Strategic information technologies, including the creation of supercomputers and software development” (SP-2018) “Development of models, methods and algorithms for automatic response to cyber attacks in systems of the industrial Internet of things based on a combination of neuro-fuzzy networks and genetic algorithms”, No. SP-751.2018.5, 2018-2020.

Desnitsky V.A. – Research grant # 19-07-00953 A of Russian Foundation of Basic Research “Models, techniques and algorithms for security analysis of software and hardware components of wireless sensor networks”, 2019-2021.

Desnitsky V.A. – Russian Federation Presidential Grant № MK-5848.2018.9 “Modeling and analysis of cyber-physical energy exhaustion attacks on Internet of Things devices”, 2018-2019.

Kotenko I.V. – NIR-FUND of ITMO University № 717075 “Methods, Models, Methods, Algorithms, Protocols and Applications for ensuring Information Security of Cyber-Physical Systems”, 2017-2019.

Kotenko I.V. – Project of Innovation Research Laboratory in the Field of Cybersecurity of SPIIRAS, 2019-2021.

Kotenko I.V. – “Models, techniques and methodology for design and verification of secure cyber-physical systems”. Research grant # 19-37-90082 “Postgraduate students” of Russian Foundation of Basic Research, 2019-2022.

Chechulin A.A. – Research grant # 19-17-50205 of Russian Foundation of Basic Research “Security Aspects of Cyberphysical Systems”, 2019-2020.

Kotenko I.V. – “Visual analytics for information security: methods, models and applications”. Research grant # 19-17-50173 of Russian Foundation of Basic Research “Expansion”, 2019-2020.

University courses

SCS, SUT: Cloud computing and telecommunication security (lectures) – Kotenko I.V.

SCS, SUT: - Information security technology (lectures and practice); Big data security (lectures and practice); Digital forensics (lectures and practice) – Chechulin A.A.

SCS, SUT: Building secure architecture of cloud computing information security (lectures) – Desnitsky V.A.

CIT, ICST, SPbPU: Intellectual data analysis (lectures and practice); Information systems design (lectures and practice); Methods and algorithms for data analysis (lectures and practice) – Tushkanova O.N.

SCS, SUT: Information security risk management (practice and labs); Basics of Information Security Management (practice and labs); Technology for big data information security (practice and labs). – Vitkova L.A.

ISIS, SPbSUITD: Basics of Information Security Management (lectures and practice); Organizational and legal support of information security (lectures and practice); Technical information security (lectures and practice); Complex information security in the enterprise (lectures and practice) –Vitkova L.A.

SCS, SUT: Digital forensics (lectures and practice) – Doynikova E.V.

SCS, SUT: Exploiting software vulnerabilities (lectures and practice) – Branitskiy A.A.

Scientific and organizational activities

Special Session Security in Parallel, Distributed and Network-Based Computing (SPDNS 2019) on 27th Euromicro International Conference on Parallel, Distributed and network-based Processing (PDP 2019). Pavia, Italy, February 13-15, 2019. http://www.comsec.spb.ru/spdns19/ (Kotenko I.V. – chair of the special session).

Special Session “Advanced research in cybersecurity”, The 21th Conference “RusCrypto 2019” on Cryptology, Steganography, Digital Signature and Security Systems. March 19-22, 2019. (Kotenko I.V. – session moderator).

The 11th International Symposium on Intelligent Distributed Computing (IDC 2019), St. Petersburg, Russia, October 7-9, 2019. https://idc2019.ru/ (Kotenko I.V. – co-chair of the conference).

The 6th International scientific school “Incident management and countering targeted cyber-physical attacks in distributed large-scale critical

systems" (IM&CTCPA 2020). October 9-10, 2019 (Kotenko I.V. – chair of the program and organizing committee).

Session «Security of information technologies», XI St. Petersburg Interregional Conference «Information Security of Russian Regions (ISRR-2019)», October 23-25, 2019, St. Petersburg, Russia (Kotenko I.V., Saenko I.B. – co-chairs of the session).

International cooperation

International Cooperation with the following organizations: Fraunhofer Institute for Secure Information Technology (Fraunhofer-Institut für Sichere Informations-Technologie in Darmstadt) (Germany), Blekinge Institute of Technology (BTH) (Karlskrona, Sweden), Almaty University of Energy and Communications (Almaty, Kazakhstan), Paul Sabatier University, Toulouse III (France), Euromicro Association (Germany), Huawei, etc.

Participation in conferences and exhibitions

The 2019 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus). January 28-31, 2019, St. Petersburg – Vasily Desnitsky, Igor Kotenko, Nikolay Rudavin.

The 27th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP-2019). Pavia, Italy, February 13-15, 2019 – Igor Kotenko.

8th International Conference on Advanced Infotelecommunications(ICAIT 2019). February 27-28, 2019. Conference proceedings. Russia, St. Petersburg – Yurii Bakhtin, Alexander Branitskiy, Lidia Vitkova, Vasily Desnitsky, Elena Doynikova, Kseniia Zhernova, Maxim Kolomeec, Igor Kotenko, Alexei Kushnerevich, Dmitry Levshun, Igor Parashchuk, Nikolay Rudavin, Igor Saenko, Olga Tushkanova, Andrey Fedorchenko, Andrey Chechulin.

The 21th Conference "RusCrypto 2019" on Cryptology, Steganography, Digital Signature and Security Systems. March 19-22, 2019. Russia, Solnechnogorsk – Lidia Vitkova, Vasily Desnitsky, Igor Kotenko, Alexei Kushnerevich, Andrey Chechulin.

Scientific session "Information Technologies in Robotics" of the Department of Nanotechnology and Information Technology of the Russian Academy of Sciences. 27 March, 2019, Russia, Moscow – Andrey Chechulin.

IEEE International Conference on Computer Communications (IEEE INFOCOM 2019). 28 April – 03 May, 2019, France, Paris – Igor Kotenko.

III International conference «Science of the future» and IV All-Russian Forum «Science of the future – science of the young». May 14-17, 2019, Russia, Sochi – Andrey Chechulin, Vasily Desnitsky, Elena Doynikova.

XXII International Conference on Soft Computing and Measurements (SCM-2019). May 23-25, 2019, Russia, St. Petersburg – Igor Parashchuk, Vasily Desnitsky, Igor Kotenko.

International Youth Forum "Youth. Science. Security". May 28-29, 2019, Russia, Moscow – Andrey Chechulin.

International scientific conference «Cyber-physical systems design and modelling» (CyberPhy-2019), June 3-7, 2019, Russia, St. Petersburg – Igor Kotenko, Igor Parashchuk.

International Youth Economic Forum at the St. Petersburg International Economic Forum, 8 June, 2019, Russia, St. Petersburg – Andrey Chechulin, Vasily Desnitsky, Elena Doynikova.

10th IFIP International Conference on New Technologies, Mobility and Security (IEEE IFIP NTMS 2019), June 24-26, 2019, Spain, Gran Canaria – Igor Kotenko.

Genetic and Evolutionary Computation Conference Companion (GECCO 2019), July 13-17, 2019, Czech Republic, Prague – Igor Kotenko, Igor Saenko.

The 14th International Conference on Availability, Reliability and Security (ARES 2019), August 26-29, 2019, UK, Canterbury – Elena Doynikova, Igor Kotenko.

The 2019 International Russian Automation Conference (RusAutoCon), September 8-14, 2019, Russia, Sochi – Igor Kotenko, Igor Parashchuk.

The International Conference on Modern Trends in Manufacturing Technologies and Equipment 2019 (ICMTME 2019), September 9-13, 2019. Russia, Sevastopol – Igor Kotenko, Igor Parashchuk, Vasily Desnitsky, Alexey Meleshko.

The 12th International Conference on Security of Information and Networks (SIN 2019), September 12-15, 2019, Russia, Sochi – Igor Kotenko, Igor Saenko, Nickolay Komashinsky.

The 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and

Applications (IDAACS 2019). September 18-21, 2019, France, Metz – Igor Kotenko, Igor Saenko, Alexander Branitskiy, Andrey Fedorchenko, Diana Gaifulina.

The 18th International Conference on Intelligent Software Methodologies, Tools, and Techniques (SOMET 19), September 23-25, 2019, Malaysia, Kuching – Igor Kotenko, Igor Saenko.

The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". September 24-28, 2019, Russia, Sevastopol – Yurii Bakhtin, Alexander Branitskiy, Lidia Vitkova, Vasily Desnitsky, Elena Doynikova, Kseniia Zhernova, Maxim Kolomeec, Nickolay Komashinsky, Igor Kotenko, Dmitry Levshun, Igor Parashchuk, Igor Saenko, Olga Tushkanova, Andrey Chechulin.

The 13th International Symposium on Intelligent Distributed Computing (IDC'2019), October 7-9, Russia, St. Petersburg – Yurii Bakhtin, Alexander Branitskiy, Lidia Vitkova, Diana Gaifulina, Vasily Desnitsky, Elena Doynikova, Kseniia Zhernova, Maxim Kolomeec, Igor Kotenko, Alexei Kushnerevich, Dmitry Levshun, Igor Parashchuk, Nikolay Rudavin, Igor Saenko, Olga Tushkanova, Andrey Chechulin.

The Fifth International scientific school "Incident management and countering targeted cyber-physical attacks in distributed large-scale critical systems" (IM&CTCPA 2019). October 9-10, 2019, Russia, St. Petersburg – Igor Kotenko, Elena Doynikova, Vasily Desnitsky, Andrey Chechulin, Olga Tushkanova, Igor Ushakov.

The 4rd International Symposium on Mobile Internet Security (MobiSec 2019), October 17-19, 2019, Taiwan, Taichung – Yurii Bakhtin, Kseniia Zhernova, Maxim Kolomeec, Igor Kotenko, Dmitry Levshun, Andrey Chechulin.

XI St. Petersburg Interregional Conference «Information Security of Russian Regions (ISRR-2019)», October 23-25, 2019, Russia, St. Petersburg – Igor Saenko, Andrey Fedorchenko, Igor Parashchuk, Igor Kotenko, Andrey Chechulin, Elena Doynikova, Alexander Branitskiy, Maxim Kolomeec, Dmitry Levshun, Lidia Vitkova, Vasily Desnitsky, Nikolay Rudavin, Alexei Kushnerevich.

The 4th International Scientific Conference «Intelligent Information Technologies For Industry» (IITI 2019), December 2-7, 2019, Czech Republic, Ostrava-Prague – Igor Kotenko, Maxim Kolomeec, Dmitry Levshun, Igor Saenko, Lidia Vitkova, Olga Tushkanova, Andrey Chechulin.

Trustworthy Software Technology Forum, 28-29 November, 2019, Russia, St. Petersburg – Igor Kotenko, Andrey Chechulin.

Membership in International Societies, Editorial Boards

Kotenko I.V. – Member of Russian and European Associations of Artificial Intelligence, Senior member of IEEE and Computer Society, member of Association for Computing Machinery (ACM), Institute for Systems and Technologies of Information, Control and Communication (INSTICC), the Series Editor of Springer's Communications in Computer and information Science; member of board of directors of International scientific, engineering and educational organization dedicated to advancing the arts, sciences and applications of Information Technology and Microelectronics (Euromicro); member of editorial board of scientific journals: "Problems of Informatics", "Vestnik RGUPS", "Artificial Intelligence Research Journal", "International Journal of Computing", "The Open Bioinformatics Journal", "The Open Automation and Control Systems Journal", "The FTRA Journal of Convergence", "International Journal of u- and e- Service, Science and Technology"; the reviewer of the scientific journals: "Information technologies and computer systems", "ACM Transactions on Internet Technology", "ACM Transactions on Multimedia Computing, Communications, and Applications", "IEEE Software", "IEEE Access", "IEEE Computer", "IEEE Transactions on Dependable and Secure Computing", "Security and Communication Networks", "Transactions on Systems, Man, and Cybernetics", "Computer Standards & Interfaces", "Recent Patents on Computer Science", "The International Journal for the Computer and Telecommunications Industry", "Data Mining and Knowledge Discovery", "International Journal of Computer Science Applications", "Informatica", "Security and Communication Networks", "Telecommunication Systems Journal", "Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications", etc.; chair of the program committees of the 26th Euromicro International Conference on Parallel, Distributed and network-based Processing (PDP 2018) and the 5th International scientific school "Incident management and countering targeted cyber-physical attacks in distributed large-scale critical systems" (IM&CTCPA 2019), chair of the section of 1st IEEE International Conference on industrial Cyber-Physical Systems (ICPS-2019); member of the program committees of 28 international conferences and workshops.

Saenko I.B. – Member of Arctic Academy of Sciences, Section of Information Technologies; Corresponding Member of Russian Academy of Natural Sciences; the member of editorial board of scientific journals “Information and space” and “Telecommunication technologies”; the member of program committee of 27th Euromicro International Conference on Parallel, Distributed and network-based Processing (PDP 2019), the 5th International scientific school "Incident management and countering targeted cyber-physical attacks in distributed large-scale critical systems" (IM&CTCPA 2019).

Parashchuk I.B. – the member of Scientific council on informatization at the Government of Saint Petersburg; the member of the Joint educational and methodical Council for the direction 09.02.04 – "Information systems" of Federal educational and methodical association in the higher education system of the Ministry of Education and Science of the Russian Federation on the enlarged groups of specialties and the directions of preparation 09.00.00 "Informatics and computer facilities", the full member of the International academy of authors of discoveries and inventions (IAADI).

Chechulin A.A. – Advisory Board member of EU Horizon 2020 research project Yaksha; chair of the special session of the the 11th International Symposium on Intelligent Distributed Computing (IDC 2019), member of program committees of the Special Session on Security in Parallel, Distributed And Network-Based Computing of the 26th Euromicro International Conference on Parallel, Distributed and Network-Based Computing (SPDNS-2018), the international symposium on security of the mobile Internet (MobiSec 2018), the 4th International scientific school "Incident management and countering targeted cyber-physical attacks in distributed large-scale critical systems" (IM&CTCPA 2018), the 1st IEEE International Conference on industrial Cyber-Physical Systems (ICPS-2018).

Desnitsky V.A. – chair of the special session of the the 11th International Symposium on Intelligent Distributed Computing (IDC 2019), the member of program committee of 27th Euromicro International Conference on Parallel, Distributed and network-based Processing (PDP 2019) and the 5th International scientific school "Incident management and countering targeted cyber-physical attacks in distributed large-scale critical systems" (IM&CTCPA 2019).

Doynikova E.V. – chair of the special session of the the 11th International Symposium on Intelligent Distributed Computing (IDC 2019),

the member of program committee of the 5th International scientific school "Incident management and countering targeted cyber-physical attacks in distributed large-scale critical systems" (IM&CTCPA 2019).

Novikova E.S. – chair of the special session of the the 11th International Symposium on Intelligent Distributed Computing (IDC 2019), the member of program committee of the special session "Security in Parallel, Distributed and Network-Based Computing" (SNDS2019), 27th Euromicro International Conference on Parallel, Distributed and network-based Processing (PDP 2019) and the international symposium on security of the mobile Internet (MobiSec 2019).

Intellectual property

Patent No. 2705010, registered in the State Register of Inventions of the Russian Federation on 01.11.2019. Random event prediction device – Desnitsky V.A., Kotenko I.V., Parashchuk I.B., Saenko I.B., Chechulin A.A.

Certificate No 2019663976, registered in the Computer Program Registry on 29.10.2019. The component for comments collection in the VKontakte social network – Levshun D.S., Chechulin A.A.

Certificate No 2019663984, registered in the Computer Program Registry on 29.10.2019. The component of the uncertainty of assessment and categorization removal for the semantic content of information objects based on the use of processing methods for incomplete, contradictory and fuzzy knowledge –Vitkova L.A., Paraschuk I.B.

Certificate No 2019664050, registered in the Computer Program Registry on 30.10.2019. Component of multidimensional assessment and categorization of semantic content of information objects –Branitskiy A.A., Saenko I.B.

Certificate No 2019664059, registered in the Computer Program Registry on 30.10.2019. Application for the analysis of the constructive, destructive and deficit components of the user's I-functions based on Ammon’s I-structural test –Levshun D.S., Chechulin A.A., Kotenko I.V.

Certificate No 2019664065, registered in the Computer Program Registry on 30.10.2019. The system for the evaluation of user's visual perception in virtual reality – Kolomeets M.V., Chechulin A.A., Zhernova K.N.

Certificate No 2019664066, registered in the Computer Program Registry on 30.10.2019. Component for visualization of graph structures in virtual reality –Kolomeets M.V., Chechulin A.A.

Certificate No 2019664067, registered in the Computer Program Registry on 30.10.2019. The search component of the connected core of social groups in social networks –Kolomeets M.V., Chechulin A.A.

Certificate No 2019664198, registered in the Computer Program Registry on 01.11.2019. A component for calculating metrics to support decision making on countering inappropriate information on the Internet. Doynikova E.V., Kotenko I.V.

Certificate No 2019664301, registered in the Computer Program Registry on 05.11.2019. The visualization component for the results of a psychological tests based on Ammon's I-structural test – Levshun D.S., Chechulin A.A.

Certificate No 2019664309, registered in the Computer Program Registry on 05.11.2019. Component for visual analysis of social network user activity in 2D and 3D – Kolomeets M.V., Chechulin A.A.

Certificate No 2019664410, registered in the Computer Program Registry on 06.11.2019. Neural network module for users of a social network classification according to the psychological scales of the Ammon's test. Branitskiy A.A., Doynikova E.V., Kotenko I.V.

Certificate No 2019664733, registered in the Computer Program Registry on 13.11.2019. A component of user segmentation by their activity on social networks –Vitkova L.A., Chechulin A.A., Kotenko I.V.

Certificate No 2019665204, registered in the Computer Program Registry on 20.11.2019. Modeling normal and abnormal wireless sensor network traffic to evaluate and increase protection against Denial-of-Sleep attacks –Desnitsky V.A.

Certificate No 2019665088, registered in the Computer Program Registry on 19.11.2019. Modeling protection of Digital City network nodes against Denial-of-Sleep attacks –Desnitsky V.A.

Certificate No 2019664768, registered in the Computer Program Registry on 13.11.2019. Modeling protection of unmanned aerial vehicles from energy depletion attacks –Meleshko A.V., Desnitsky V.A.

Certificate No 2019664767, registered in the Computer Program Registry on 13.11.2019. Modeling components of a Digital City system to counter energy depletion attacks –Meleshko A.V., Desnitsky V.A.

Certificate No 2019665584, registered in the Computer Program Registry on 26.11.2019. Assessment of feasibility of energy depletion attacks on an unmanned aerial vehicle through modification of flight performance –Desnitsky V.A., Meleshko A.V.

Recent results

1. A set of models, algorithms and methods for collecting and pre-processing network information objects based on the use of distributed intelligent scanners, their multi-aspect assessment, categorization and visual analysis, which differ in their ability to detect unwanted, dubious and harmful information on the Internet in the conditions of incompleteness and inconsistency of network content and allow the development and selection of countermeasures through the use of a multi-level system of security metrics (Grant of Russian Science Foundation № 18-11-00302) [23, 24, 25, 29, 53].

2. New models, algorithms and methods for ensuring the timeliness of multi-level and multi-module analysis of information objects based on the use of parallel computing, which are distinguished by their ability to support stable distributed data storage and parallelization of methods and algorithms of multi-level classification and allow integrating heterogeneous components of network content processing into a single intelligent analytical detection system and countering unwanted, dubious and harmful second information on the Internet (Grant of Russian Science Foundation № 18-11-00302) [8, 11, 16, 22].

3. General approach to the analysis of large connected graphs based on algorithms of filtering, aggregation, preprocessing, transformation, verification, analysis and display of graph structures. When using a social network for data analysis, this approach will increase the effectiveness of countering sociocultural threats, terrorism and ideological extremism in the information space of the Internet (Grant of Russian Science Foundation № 18-71-10094) [39, 60].

4. A set of data models and classification algorithms for data from social networks, based on a distributed processing system using methods of artificial intelligence, machine learning and parallel processing. When using a social network for data analysis, this approach will increase the effectiveness of countering sociocultural threats, terrorism and ideological extremism in the information space of the Internet (Grant of Russian Science Foundation № 18-71-10094) [16, 41].

5. New models, algorithms, and methods of analysis, structural optimization, and verification of schemes for differentiating access to information in cloud infrastructures of critical information systems, which differ in matching target criteria with requirements for differentiating

access, using proximity measures of required and real schemes, are available based on the application of bio-inspired optimization methods (in particular, genetic algorithms), and allowing to obtain flexible and consistent access schemes to information resources based on attribute-oriented security policy (Research grant # 18-07-01369-a of Russian Foundation of Basic Research) [10, 74, 79].

6. A technique for visualizing information security processes using augmented reality technology, forming a visualization model, a metric pair – a visualization component, a pair of a visualization interaction model - a management model, and a systematic methodological approach to augmented data visualization based on a developed approach to protect information, which based on the integration of visualization models, methods of human-machine interaction, approaches to using cognitively th graphics and data structures of certain classes of information security tasks has been developed (Research grant # 18-37-20047 of Russian Foundation of Basic Research) [5, 10].

7. Conceptual framework for the construction and functioning of mechanisms for ensuring cyberphysical security in wireless sensor networks (WSN) using analytical modeling methods. The proposed WSN presentation model and the combined intruder model are focused on the classification of attacking effects on the WSN, verification of specifications and identification of anomalies in the WSN (Research grant # 19-07-00953 A of Russian Foundation of Basic Research) [9, 13].

8. Models and hardware-software prototypes of solutions for protection against energy depletion attacks based on algorithms for detecting this class of attacks and increasing security against them using Digital City system devices as an example. Theoretical and experimental studies of energy depletion attacks have been carried out, estimates of their feasibility have been obtained (Russian Federation Presidential Grant № MK-5848.2018.9) [19, 36].

Awards, diplomas, scholarships

Desnitsky V.A., Doynikova E.V., Chechulin A.A. – I Place at the session “ Transportation Systems” of the III International Conference “Science of the Future” for the project "Self-learning Hardware and Software Robotics Complex for Emergency Situations".

Desnitsky V.A., Fedorchenko A.V. –Winners of the 2019 contest for subsidy's provisions to young scientists, young candidates of sciences at higher schools and academic institutions located in St. Petersburg.

Chechulin A.A. – Winner of the 2019 contest for the right to receive St. Petersburg grants in the sphere of scientific and scientific – technical activities.

Pronoza A.A. – Winner of the 2019 competitive selection for the right to receive grants for the students of higher schools located in St. Petersburg, post-graduate students of higher schools, branch and academic institutions located in St. Petersburg. Kotenko I., Saenko I. – best paper award for the paper "An Approach for Intelligent Evaluation of the State of Complex Autonomous Objects Based on the Wavelet Analysis" on the 18th International Conference on Intelligent Software Methodologies, Tools, and Techniques (SOMET 2019). Kuching, Sarawak, Malaysia, September 23-25, 2019.

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Monographies:

1. *Kotenko IV.., Saenko I.B., Chechulin A.A., Shorov A.V., Polubelova O.V., Novikova E.S., Doynikova E.V., Desnitsky V.A.* Intelligent information protection services in critical infrastructures // SPb.: BHV-Petersburg. 2019. 400 p. (In Russ.).
2. *Krasov A.V., Gelfand A.M., Korzhik V.I., Kotenko I.V., Petriv R.B., Sakharov D.V., Ushakov I.A., Sharikov P.I., Yurkin D.V.* Building a trusted computing environment // St. Petersburg: publisher Petriv Roman Bogdanovich. 2019. 108 p. ISBN 978-5-6043143-2-6. (In Russ.).

Papers prepared jointly with foreign organizations:

3. *Berger I., Rieke R., Kolomeets M., Chechulin A., Kotenko I.* Comparative study of machine learning methods for in-vehicle intrusion detection // Lecture Notes in Computer Science. 2019. pp. 85–101. DOI: https://doi.org/10.1007/978-3-030-12786-2_6 (WoS, Scopus, SJR=0,29, Q2).
4. *Fakih B., El Baz D., Kotenko I.* GRIDHPC: A Decentralized Environment for High Performance Computing // Concurrency and Computation: Practice and Experience. 2019.

DOI: 10.1002/cpe.5320, Internal Article ID: 16450736 (WoS, Scopus, SJR=0,31, Q2).

5. *Levshun D., Chechulin A., Kotenko I., Chevalier Y.* Design and Verification Methodology for Secure and Distributed Cyber-Physical Systems // 10th IFIP International Conference on New Technologies, Mobility and Security (NTMS). 2019. 5 p. DOI: 10.1109/NTMS.2019.8763814.
6. *Chevalier Y., Rieke R., Chechulin A., Kotenko I.* ECU-Secure: Characteristic Functions for Intrusion Detection in In-Vehicle Networks // Proceedings of the 13th International Symposium on Intelligent Distributed Computing (IDC 2019). pp. 495–504. DOI: https://doi.org/10.1007/978-3-030-32258-8_58. ISSN 1860-949X. (Scopus, WoS, SJR=0,18, Q4).
7. *Kolomeets M., Chechulin A., Kotenko I., Strecker M.* Voronoi maps for planar sensor networks visualization // 2017 International Symposium on Mobile Internet Security. 2019. pp. 96–109. DOI: https://doi.org/10.1007/978-981-13-3732-1_7 (Scopus, WoS, SJR=0,162).

Papers published in publications indexed in WoS, Scopus:

8. *Kotenko I., Saenko I., Branitskiy A.* Improving the Performance of Manufacturing Technologies for Advanced Material Processing Using a Big Data and Machine Learning Framework // Materials Today: Proceedings. 2019. vol. 11. pp. 380–385. DOI: 10.1016/j.matpr.2018.12.162 (Scopus, WoS, SJR=0,31).
9. *Desnitsky V., Kotenko I.* Monitoring the State of Materials in Cyberphysical Systems: Water Supply Case Study // Materials Today: Proceedings. 2019. vol. 11. pp. 410–416. (Scopus, WoS). DOI: 10.1016/j.matpr.2019.01.005 (Scopus, WoS, SJR:0.31).
10. *Kotenko I., Saenko I.* Generation of access control schemes in computer networks based on genetic algorithms // Nature-inspired Cyber Security and Resiliency: Fundamentals, Techniques, and Applications. 2019. (WoS, Scopus).
11. *Kotenko I., Saenko I., Kushnerevich A., Branitskiy A.* Attack detection in IoT critical infrastructures: a machine learning and big data processing approach // The 27th Euromicro International Conference on Parallel, Distributed and network-based

Processing (PDP 2019). 2019. pp. 340–347. DOI: 10.1109/PDP.2019.00057. (WoS, Scopus).
12. *Kolomeets M., Chechulin A., Kotenko I., Saenko I.* Access control visualization using triangular matrices // The 27th Euromicro International Conference on Parallel, Distributed and network-based Processing (PDP 2019). 2019. pp. 348–355. DOI: 10.1109/PDP.2019.00058. (WoS, Scopus).
13. *Desnitsky V.A., Kotenko I.V., Rudavin N.N.* Protection mechanisms against Energy Depletion Attacks in Cyber-Physical Systems // 2019 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering, (2019 ElConRus). 2019. pp. 214–219. DOI: 10.1109/EIConRus.2019.8656795. (WoS, Scopus).
14. *Kotenko I., Parashchuk I.* An approach to modeling the decision support process of the security event and incident management based on Markov chains // The 9th IFAC/IFIP/IFORS/IISE/INFORMS Conference "Manufacturing Modelling, Management and Control" (MIM 2019). 2019. (WoS and Scopus).
15. *Vitkova L., Desnitsky V., Chechulin A., Kotenko I.* Approach to organizing of a heterogeneous swarm of cyber-physical devices to detect intruders // The 9th IFAC/IFIP/IFORS/IISE/INFORMS Conference "Manufacturing Modelling, Management and Control" (MIM 2019). 2019. (WoS and Scopus).
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17. *Kim I., Viksnin I., Kotenko I.* Automated centroid tuning based on particle swarm optimization in the image clustering process // International Journal of Computer Science & Applications (IJCSA). 2019. vol. 16. no. 1. pp. 17–37. (WoS, Scopus, SJR=0,13, Q4).
18. *Kotenko I., Parashchuk I.* Analysis of the Sensitivity of Algorithms for Assessing the Harmful Information Indicators in the Interests of Cyber-Physical Security // Electronics. 2019. vol. 8. no. 3. 15 p. DOI: 10.3390/electronics8030284 (WoS, Scopus, SJR=0,46, Q1).
19. *Desnitsky V., Kotenko I., Zakoldaev D.* Evaluation of Resource Exhaustion Attacks against Wireless Mobile Devices // Electronics. 2019. vol. 8. no. 5. 16 p. DOI:

https://doi.org/10.3390/electronics8050500. (WoS and Scopus, SJR=0,46, Q1).
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21. *Branitskiy A., Fedorchenko A., Kotenko I., Saenko I.* An Approach to Intelligent Distributed Scanning and Analytical Processing of the Internet Inappropriate Information // The 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS 2019). 2019. pp. 146–151. (WoS, Scopus).
22. *Kotenko I., Saenko I., Ageev S.* Hierarchical fuzzy situational networks for online decision-making: Application to telecommunication systems // Knowledge Based Systems (KBSs). 2019. vol 185. pp. 1–16. DOI: https://doi.org/10.1016/j.knosys.2019.104935 (WoS, Scopus, SJR=1,46, Q1).
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25. *Desnitsky V.A., Kotenko I.V., Parashchuk I.B.* Methods of Assessing the Effectiveness of Network Content Processing Systems for Detecting Malicious Information Taking into Account the Elimination of Uncertainty in the Semantic Content of Information Objects // 2019 XXII International Conference on Soft Computing and Measurements (SCM). 2019. pp. 41–44. DOI: 10.1109/SCM.2019.8903670 (WoS, Scopus).

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28. *Kotenko I., Budko P., Vinogradenko A., Saenko I.* An Approach for Intelligent Evaluation of the State of Complex Autonomous Objects Based on the Wavelet Analysis // The 18th International Conference on Intelligent Software Methodologies, Tools, and Techniques (SOMET 2019). Advancing Technology Industrialization Through Intelligent Software Methodologies, Tools and Techniques. 2019. pp. 25–38. DOI: 10.3233/FAIA190036 (Scopus, SJR=0,177, Q4).
29. *Parashchuk I., Kotenko I.* Formulation of a system of indicators of information protection quality in automatic systems of numerical control machines for advanced material processing // Materials Today: Proceedings. 2019. pp. 1–8. DOI: 10.1016/j.matpr.2019.07.023 (Scopus, WoS, SJR=0,3).
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the 2019 10th IFIP International Conference on New Technologies, Mobility and Security (NTMS). 2019. pp. 1–5. DOI: 10.1109/NTMS.2019.8763843 (Scopus).
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139. *Vitkova L.A., Chechulin A.A., Naumenko K.A.* Architecture of distributed data collection and processing in monitoring systems social networking // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 323–325. (In Russ.).
140. *Kotenko I.V., Chechulin A.A., Zhernova K.N.* Comparison of realizations of gestural interfaces for network security management // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 329–330. (In Russ.).
141. *Zhernova K.N., Chechulin A.A.* Data visualization models and algorithms for identification and counteraction of inappropriate information // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 325–327. (In Russ.).
142. *Doynikova E.V.* The technique and algorithms for the cyber attack forecasting based on neuro-fuzzy networks // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 308–310. (In Russ.).

143. *Doynikova E.V., Fedorchenko A.V.* Classification of interfaces and types of events used in the industrial internet of things for analysis of their weakness to cyberatacs // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 306–308. (In Russ.).
144. *Krasilnikova N.V., Doynikova E.V., Vanchakova N.P*. The seven level scale of destructive manifestations of behavior in social networks for monitoring destructive effects by neural network methods // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 304–306. (In Russ.).
145. *Desnitsky V.A.*, *Fedorchenko A.V*. Modeling processes of protection against attacks of energy exhaustion in cyberphysical systems // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 282–284.
146. *Pronichev A.P., Vitkova L.A.* Development of a decentralized network traffic analysis system architecture // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 546–548. (In Russ.).
147. *Pronichev A.P., Kotenko I.V*. Promising areas of application of multi-agent systems // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 464–466. (In Russ.).
148. *Branitskiy A.A., Saenko I.B*. Methods of adaptation and retraining of the system of analysis of information objects in the internet network // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 310–312. (In Russ.).
149. *Branitskiy A.A., Desnitsky V.A.* Approach to adaptation and retraining of system for analyzing the information objects // The V interregional scientific and practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 62–64. (In Russ.).
150. *Doynikova E.V*. Classification and analysis of cyber attacks goals in the industrial internet of things // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 116–117. (In Russ.).

151. *Saenko I.B., Ivanov A.Yu., Komashinsky V.I., Pantyukhin O.I.* Method of attribute-based access control policy optimization for cloud storage // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 148–150. (In Russ.).
152. *Saenko I.B., Levshun D.S., Ageev S.A., Komashinsky V.I.* Model of ensuring consistency of the access control policies of cloud storage on the basis of the ABAC model // XI Saint-Petersburg Interregional conference "Information security of regions of Russia (IBRR-2019)". 2019. pp. 150–152. (In Russ.).
153. *Tushkanova O.N., Saenko I.B*. The Technique of ensuring timeliness of multiclass classification of inappropriate information on the Internet using parallel computing // XI St. Petersburg Interregional Conference “Information Security of Russian Regions”. 2019. pp. 153–155. (In Russ.).
154. *Fedorchenko A.V., Saenko I.B*. Algorithms for collecting and pre-processing network information objects based on the use of distributed intelligent scanners // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 155–156. (In Russ.).
155. *Saenko I.B., Parashchuk I.B., Bushuev S.N.* Model and algorithm of detection of need of reconfiguring the access control policies in crucial cloudy infrastructures // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. C. 304–305. (In Russ.).
156. *Meleshko A.V., Desnitsky V.A.* Identification of data anomalies in cyberphysical water management systems // XI St. Petersburg Interregional Conference “Information Security of Russian Regions (ISRR-2019)”. 2019. pp. 136–137. (In Russ.).
157. *Desnitsky V.A.* Modeling and analysis of cyber-physical attacks of the depletion of energy resources of the devices of the Internet of Things systems // Collection of abstracts of the participants of the II International Scientific Conference "Science of the Future – Science of the Young" IV All-Russian Forum "Science of the Future – Science of the Young". 2019. p. 115.

Laboratory of Computing and Information Systems and Software Engineering

Head of laboratory: Chief Researcher, Dr. Sci. (Tech.), Prof. Vasiliy Yu. Osipov – mathematical modeling, intelligent systems, neural networks, information security, osipov_vasiliy@mail.ru.

Laboratory staff: 8 members, 2 postgraduate students.

Research activities – corporate user systems; parallel and distributed data processing; high performance computer systems; GRID technologies; cloud computing; neural networks; computer modeling; mathematical modeling; information security; network security monitoring; object oriented programming; software engineering; artificial intelligence; cognitive technologies; software design automation.

Research fellows and brief information of the research-work direction

Chief Researcher, Dr. Sci. (Tech.), Prof. – Victor V. Nikiforov – real-time operating systems, embedded real-time software systems, nik@iias.spb.su.

Senior researcher, Cand. Sci. (Tech) – Rosa R. Fatkieva – information security, information systems modeling, rrf@iias.spb.su.

Senior researcher, Cand. Sci. (Tech) – Elena L. Evnevich – cloud and distributed computations, cognitive technologies, eva@iias.spb.su.

Senior researcher, Cand. Sci. (Tech) – Natalia A. Zhukova cognitive monitoring, automated synthesis of observed objects models, software engineering, nazhukova@mail.ru.

Postgraduate students

Miloserdov D.I. “Optimization of Soft-Hardware Implementation for Cognitive Machine Intelligent Cores on Neural Network Basis”, research advisor – Osipov V.Yu.

Kolesnikov K.E. “Modeling of Conflicting Systems Dynamics for Solution of Interaction Control Problems”, research advisor – Osipov V.Yu.

Grants and projects

Osipov V.Yu., Fatkieva R.R., Shishkin V.M. – RFBR grant 16-29-09482 “Forecasting of Information Network Terrorist Threats and Substantiation of Respective Countermeasures in Megapolises”, 2017-2019.

University courses

St.Petersburg State Electrical Engineering University (LETI), department of Information Security: “Protection of Computer Networks and Telecommunications” – Fatkieva R.R.

St.Petersburg State Electrical Engineering University (LETI), department of Computer Software and Applications, “Artificial Neural Networks” – Zhukova N.A.

ITMO University, department of Software Engineering and Computer Systems, “Intelligent Systems Development” – Zhukova N.A.

Scientific and organizational activities

City seminar “Informatics and Automation” attached to Scientific Council on Saint Petersburg Informatization, http://conference.spiiras.nw.ru/seminar_ICT – deputy supervisor OsipovV.Yu.

Fifth International Workshop on Experimental Economics and Machine Learning (EEML 2019), https://eeml.hse.ru/2019/ – member of Program Committee Zhukova N.A.

International cooperation

Joint activities with Bulgarian Academy of Sciences on the issues of the theory of information security monitoring for computer networks.

Conferences

V All-Russian (with international participation) Scientific and Practical Conference “Problems of Information Security”, February 14-16, 2019, Simferopol-Gurzuf – Shishkin V.M., Kolesnikov K.E.

19-th International Conference Computational Science and Its Applications – ICCSA 2019, July 1–4, 2019, St. Petersburg, Russia – Osipov V.Yu., Zhukova N.A.

16-th International Symposium on Neural Networks, ISNN 2019, July 10-12, 2019, Moscow, Russia – Osipov V.Yu., Nikiforov V.V.

Fifth International Workshop on Experimental Economics and Machine Learning (EEML 2019), September 25-26, 2019, Perm', Russia – Osipov V.Yu., Zhukova N.A., Miloserdov D.I.

XI Saint Petersburg Interregional Conference "Information Security of Regions of Russia (IBRR-2019)", St. Petersburg, Russia, October 23-25, 2019 – Zhukova N.A., Fatkieva R.R., Evnevich E.L.

V Interregional Scientific-Practical Conference "Advanced national information systems and technologies", October 24-28, 2019, Sevastopol – Shishkin V.M., Kolesnikov K.E., Fatkieva R.R.

Fifth International Scientific and Practical Conference "Technological Perspective within the Framework of the Eurasian Space: New Markets and Points of Economic Growth", November 7-8, 2019, St. Petersburg, Russia – Zhukova N.A., Miloserdov D.I.

Membership in Russian and International Societies, Editorial Boards, etc.

Zhukova N.A. – reviwer of Fruct books "Tools and Technologies for the Development of Cyber-Physical Systems", https://www.igi-global.com/books/.

Recent Results

1. Methods and models of controlled associative information processing by means of recurrent neural networks with enhanced capabilities for forecasting and restoring of distorted signals [7, 11, 13]. Distinction from existing solutions consists in taking into account the changes in behavioral laws of processed signals due to the continuous learning of neural networks. Besides associative call of signals from network memory is controlled by means of new rules enabling accuracy and forecasting horizon to increase. The solutions proposed can contribute to the development of promising self-learning autonomous robots.

2. The fundamentals of the theory of multilevel automatic synthesis of automaton models of monitoring objects, which differs in the original ones: a conceptual model for the synthesis of multilevel tunable automaton models, a system of indicators and performance criteria, which provides an assessment of the completeness of models and the complexity of their construction, formalisms of the mathematical description of hierarchical relatively finite automata, mathematical formulations of problems multi-

level synthesis. Theoretical theses make it possible to reduce the complexity of automatic synthesis of models of monitoring objects [1, 6].

3. A software package for predicting terrorist threats, analyzing the structural dynamics of social networks, assessing possible risks and substantiating protection measures based on automatic complex intellectual analysis of poorly structured content, consisting of three software components: event monitoring for predicting terrorist threats, automatic multi-level synthesis of object models monitoring, forecasting events based on recurrent neural networks with control emymi elements.

Intellectual Property

1. Computer program package for the solution of the tasks of event monitoring for terrorist threats forecasting. Certificate № 2019660739 of computer program state registration. Date of registration 13.08.2019. Levonevskiy D.K., Osipov V.Yu., Fatkieva R.R.
2. Computer program for event forecasting on the basis of recurrent neural networks with controlled elements. Certificate № 2019662053 of computer program state registration. Date of registration 16.09.2019. Osipov V.Yu., Miloserdov D.I.
3. Computer program for automated multilevel synthesis of models for the objects of monitoring. Certificate № 2019663233 of computer program state registration. Date of registration 14.10.2019. Osipov V.Yu., Zhukova N.A., Klimov N.V.

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Papers prepared in cooperation with foreign institutions:

1. *Tianxing M., Osipov V., Vodyaho A., Lebedev S., Zhukova N.* Distributed Technical Object Model Synthesis Based on Monitoring Data // International Journal of Knowledge and Systems Science. 2019. vol. 10(3). pp. 27–43. (Scopus, SJR=0,12, Q4).
2. *Tianxing M., Baimuratov I.R., Zhukova N.A.* A Knowledge-Oriented Recommendation System for Machine Learning Algorithm Finding and Data Processing // International Journal of Embedded and Real-Time Communication Systems. 2019. vol. 10(4). pp. 19–38. (Scopus, SJR=0,25, Q2).

3. *Tianxing, M., Zhukova, N., Meltsov, V., Shichkina, Y. A* Knowledge-Based Computational Environment for Real-World Data Processing // Lecture Notes in Computer Science. 2019. pp. 257–269. (Scopus, SJR=0,28, Q2).
4. *Baimuratov I., Shichkina Y., Stankova E., Zhukova N., Than N.* A Bayesian Information Criterion for Unsupervised Learning Based on an Objective Prior // Proceedings of International Conference on Computational Science and Its Applications. (ICCSA 2019). 2019. pp. 707–716. (Scopus).

Papers published in editions, indexed by WoS, Scopus:

5. *Fatkieva R.R.* Systems of information security indicators for industrial enterprises // Automatic documentation and mathematical linguistics. 2019. vol. 53(4). pp. 216–224. (WoS).
6. *Vodyaho A., Postnikov E., Ekalo A., Osipov V., Zhukova N., Chervontsev M.* Cognitive Systems for Monitoring: Architectural View // Advances in Science, Technology and Engineering Systems Journal. 2019. vol. 4(3). pp. 117–125. (Scopus)
7. *Osipov V.Yu., Nikiforov V.V.* Recurrent neural networks with controlled elements in restoring frame flows // Information and Control systems. 2019. vol. 5(102). pp. 10–17. DOI:10.31799/1684-8853-2019-5-10-17 (In Russ.) (Scopus)
8. *Vodyaho A., Postnikov E., Osipov V., Zhukova N., Chervontsev M., Klimov N.* Computational and Technological Models of Cognitive Monitoring Systems // Advances in Science, Technology and Engineering Systems Journal. 2019. vol. 4(2). pp. 197–202. (Scopus)
9. *Zhukova N.A., Andriyanova N.R.* Cognitive Monitoring of Distributed Objects // Automatic documentation and mathematical linguistics. 2019. vol. 53(1). pp. 32–43. (WoS).
10. *Vodyaho A.I., Osipov V.Yu., Zhukova N.A., Chervontsev M.A.* Cognitive Technologies in Monitoring Management // Automatic documentation and mathematical linguistics. 2019. vol. 53(2). pp. 71–80. (WoS).
11. *Osipov V., Nikiforov V.* Functional and Structural Features of Recurrent Neural Networks with Controlled Elements. // Lecture Notes in Computer Science. 2019. pp. 133–140. (Scopus, SJR=0,28, Q2)

12. *Osipov V., Stankova E., Vodyaho A., Lushnov M., Shichkina Yu., Zhukova N.* Automatic Synthesis of Multilevel Automata Models of Biological Objects // Lecture Notes in Computer Science. 2019. pp. 441–456. (Scopus, SJR=0,28, Q2).
13. *Osipov V., Zhukova N., Miloserdov D.* Neural Network Associative Forecasting of Demand for Goods // Proceedings of the Fifth International Workshop on Experimental Economics and Machine Learning (EEML 2019). 2019. pp. 1–9. (Scopus).

Papers published in editions, indexed by Russian Science Citation Index (RSCI):

14. *Sergeev V.D., Fatkieva R.R.* Method of Two-Factor Authentication in a Cloud Service // Izvestiya SPbGETU "LETI". 2019. vol. 1. pp. 22-31. (Impact factor – 0, 162). (In Russ.)
15. *Fatkieva R.R.* Systems of Information Security Indicators for Industrial Enterprises // Nauchno-Tekhnicheskaya Informatsiya, Seriya 2: Informatsionnye Protsessy i Sistemy. 2019. vol. 8. pp. 18–27. (In Russ.). (VAK, Impact factor – 0,406).
16. *Zhukova N.F., Andriyanova N.R.* Cognitive Monitoring of Distributed Objects // Nauchno-Tekhnicheskaya Informatsiya, Seriya 2: Informatsionnye Protsessy i Sistemy. 2019. vol. 2. pp. 18–29. (In Russ.). (Impact factor – 0,406).
17. *Vodyaho A.I. Osipov, V.Yu., Zhukova N.A., Chervontsev, M.A.* Cognitive Technologies in Monitoring Management // Nauchno-Tekhnicheskaya Informatsiya, Seriya 2: Informatsionnye Protsessy i Sistemy. 2019. vol. 4. pp. 1–12. (In Russ.). (Impact factor – 0,406)
18. *Zhukova N.A.* Ontology Models for Transformation of Data about the State of Technical Objects // Ontology of Designing. 2019. vol. 9. no. 3(33), pp. 345–360. (In Russ.).
19. *Zhukova N.A.* General and Concrete Tasks of Multi-Level Synthesis of Monitoring Objects Models // Nauchno-Tekhnicheskaya Informatsiya, Seriya 2: Informatsionnye Protsessy i Sistemy. 2019. vol. 11. pp. 16-22. (In Russ.). (Impact factor – 0,406)
20. *Zhukova N.A.* About the Possibilities of Synthesis of Multilevel Models of Objects // Izvestiya SPbGETU "LETI". 2019. vol. 10. pp. 16–21. (In Russ.). (Impact factor – 0, 162).

21. *Vodyaho A.I., Zhukova N.A., Abbas S.A., Chervontsev M.A.* Multimodel Approach to Building of Monitoring Systems // Izvestiya SPbGETU “LETI”. 2019. vol. 7. pp. 5–13. (In Russ.). (Impact factor – 0, 162).
22. *Shishkin V.M., Kolesnikov K.E.* Dynamic Model of Confrontation in Physical Interpretation // Problems of Information Security. V All-Russian (with international participation) Scientific and Practical Conference. 2019. pp. 39–41. (In Russ.).
23. *Miloserdov D.I.* Software Complex for Neural Network Time Series Forecasting // Technological Perspective within the Framework of the Eurasian Space: New Markets and Points of Economic Growth. Fifth International Scientific and Practical Conference. 2019. (In Russ.). (In Press).
24. *Baimuratov I.R., Zhukova N.A.* The Robust and Efficient Method of Automatic Clustering // Technological Perspective within the Framework of the Eurasian Space: New Markets and Points of Economic Growth. Fifth International Scientific and Practical Conference. 2019. (In Russ.). (In Press).
25. *Lebedev S.V., Nguen N.T., Baimuratov I.R., Zhukova N.A.* Analysis of OWL Ontology Visualization Tools // Technological Perspective within the Framework of the Eurasian Space: New Markets and Points of Economic Growth. Fifth International Scientific and Practical Conference. 2019. (In Russ.). (In Press).

Other publications:

26. *Evnevich E.L., Zhukova N.A., Fatkieva R.R.* Problem of Cognitive Technologies Application to Information Security // Information Security of Russian regions (ISRR-2019). XI St. Petersburg Interregional Conference. 2019. pp. 177–178. (In Russ.).
27. *Shishkin V.M., Kolesnikov K.E.* 2019. Dynamic Model of Confrontation in Informational and Physical Interpretation // pp. 280–282. (In Russ.).
28. *Fatkieva R.R., Evsyukov A.S.* Software Package for Displaying Incidents of Information Security Breaches on Geographic Map // 2019. pp. 284–287. (In Russ.).

Laboratory of Cybersecurity and Post-Quantum Cryptosystems

Head of Laboratory: Cand. Sci. (Tech.), Roman Sh. Fahrutdinov – research and development of the algorithms and means for information protection, certificate testing, computer-technical expertise. E-mail: fahr@cobra.ru.

Department staff: 15 members.

Research areas of the laboratory – information and computer security, applied cryptography, post-quantum cryptosystems with the public-key, finite non-commutative algebras.

Research Fellows and work directions

Chief Researcher, Dr. Sci. (Tech.) – Alexander A. Moldovyan – cryptographic protocols, hardware and software means for information protection, maa1305@yandex.ru

Chief Researcher, Dr. Sci. (Tech.) – Nikolay A. Moldovyan – protocols of the digital signature and authentication, algorithms of the public and pseudo-probabilistic encryption, block and stream ciphers, finite algebras as carriers of the public-key crypto-schemes, post-quantum cryptography, nmold@mail.ru

Senior Researcher, Cand. Sci. (Tech.) – Anatoliy Yu. Mirin – research and development of the algorithms and means for information protection, certificate testing, computer- technical expertise, mirin@cobra.ru.

Researcher, Cand. Sci. (Tech.) – Dmitriy N. Moldovyan – digital signature algorithms and protocols, finite algebras as carriers of public-key cryptoschemes, post-quantum cryptography, mdn.spectr@mail.ru.

Researcher – Alexey I. Galanov – digital signature algorithms and protocols, research and development of algorithms and information security tools, case studies on information security requirements, computer-technical expertise, daiver@cobra.ru

Researcher – Anna A. Kostina – research and development of the algorithms and means for information protection, certificate testing, computer-technical expertise, anya@hotbox.ru

Junior Researcher – Ivan K. Abrosimov– digital signature algorithms and protocols, finite algebras as carriers of cryptographic schemes with a public key, post-quantum cryptography, ivnabr@yandex.ru.

Junior Researcher – Iana N. Berezina–study of the linguistic and technical aspects of information security, computer linguistics, work with

technical literature in Russian, English, French, German and Spanish.yana.berezina, french@mail.ru.

Junior Researcher – Diana Al. Gayfulina –statistical data analysis, network traffic analysis, identification of network anomalies, classification of web pages, diana-lina95@yandex.ru.

Junior Researcher – Alexey V. Meleshko – security of cyber-physical systems, detection of abnormal data, machine learning, lexa.0710@gmail.com.

Junior Researcher – Anastasia V. Balueva – security of cyber-physical systems, energy depletion attacks, machine learning, _tonys_@mail.ru.

Junior Researcher – Aleksey P. Pronichev – software development, software engineering, pronichev@comsec.spb.ru.

Junior Researcher – Denis A. Kleverov – stream data analysis for security, statistical data analysis, reinforcement learning, genetic algorithms, machine learning, deep learning, denklewer@gmail.com.

Junior Researcher – Maxim A. Kleverov – data clustering, statistical data analysis, bioinformatics, machine learning, deep learning, klevermx@gmail.com.

Grants and Projects

Moldovyan N.A. – RFFR grant № 18-07-00932-a «New types of finite algebras and post-quantum-cryptography protocols on their base», 2018-2020.

Moldovyan N.A. – RFFR grant № 18-57-54002-Viet_a «Method for pseudoprobabilistic encryption, algorithm and protocols for providing information security of the information-telecommunication systems», 2018-2019.

Balueva A.V. – RFFR grant № 19-07-00953 “Models, techniques and algorithms for security analysis of software and hardware components of wireless sensor networks”, 2019-2021, (science supervisor Desnitsky V.A.)

Moldovyan A.A. – serial software supply contracts of Information Security System «Aura 1.2.4», «Aura» и «SGU-2».

University courses

A.F. Mozhaysky's MSA: Cryptographic protocols – Moldovyan N.A., Cryptographic protocols – Abrosimov I.K.,

Theoretical and numerical methods in cryptography – Abrosimov I.K.,

Admiral Makarov State University of Maritime and Inland Shipping: Cryptographic methods for information protection. Foundations of Cryptography – Moldovyan N.A.

International collaboration

Institute of Mathematics and Computer Science of the Academy of Sciences of Moldova, Academy of Cryptography Technique, Hanoi, Vietnam.

Participation in conferences and exhibitions

XLVIII Scientific and Educational Conference of ITMO University, St. Petersburg, January 29 - February 1, 2019 – Gayfulina D.A.

International scientific-technical and scientific-methodical conference Actual problems of information and telecommunications in science and education (APINO-2019), St. Petersburg, Russia, February 27-28, 2019 – Gayfulina D.A., Kuzmina V.I., Starodubova D.D., Balueva A.V., Meleshko A.V.

XXI RusCrypto'2019 Conference, Moscow Region, March 19-22, 2019 (1 section report) – Gayfulina D.

The 10th IFIP International Conference on New Technologies, Mobility & Security (NTMS'19), June 24-26, 2019, Canary Islands, Spain – Moldovyan A.A., Moldovyan D.N. (sectional report).

The 5-th Conference on Mathematical Foundations of Informatics, MFOI 2019, July 3-6, 2019, Iasi, Romania – Moldovyan A.A., Moldovyan D.N.

The 4th International Conference on Research in Intelligent and Computing in Engineering 2019 (RICE 2019) August 8-9, 2019, Hanoi University of Industry, Vietnam – Moldovyan N.A.

International Conference on Modern Trends in Manufacturing Technologies and Equipment 2019, September 9-13, 2019, Sevastopol – Meleshko A.V.

The 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, September 18-21, 2019, Metz, France – Gayfulina D.A.

The 5th International Conference of Mathematical Society of the Republic of Moldova, dedicated to the 55th anniversary of the foundation

of Vladimir Andrunachievici Institute of Mathematics and Computer Science ("IMCS-55"), September 28 - October 01, 2019, Romania – A. Moldovyan (invited plenary report), D. Moldovyan.

13th International Symposium on Intelligent Distributed Computing (IDC 2019), October 7-10, 2019, Saint-Petersburg, Russia – Gayfulina D.A., Balueva A.V.

All-Russian Workshop “Informatics, Management and System Analysis” Scientific report: “Algebraic carriers of the hidden problem of discrete logarithm and post-quantum cryptoschemes” – Moldovyan N.A.

XI St. Petersburg Interregional Conference "Information Security of the Regions of Russia (IBRR-2019)", October 23-25, 2019. St. Petersburg, Russia – Moldovyan N., Moldovyan A.A., Moldovyan D.N., Kostina A.A., Mirin A.Yu., Abrosimov I.K., Galanov A.I., Fahrutdinov R.Sh., Meleshko A. V., Pronichev A.P., Gayfulina D.A.

Membership in Russian and international organizations, editorial boards of journals

Moldovyan N.A. – member of the editorial board of the journals “SPIIRAS Proceedings” and “Journal of Computer Science and Cybernetics” (Hanoi, Vietnam).

Recent Results

1. Method for generalizing the classes of algebraic carriers of public-key crypto-schemes based on the computational difficulty of the hidden discrete logarithm problem - finite non-commutative associative algebras characterized by defining multiplication tables of basis vectors in the form of a mathematical formula, parameterized by the dimension value of the algebras is developed. The method expands the family of algebras promising for the search for practical post-quantum commutative ciphers and protocols for electronic digital signature and public key distribution [8, 10].

2. New forms of defining the computationally difficult problem of discrete logarithm in finite non-commutative algebras with the associative multiplication operation, which represents interest as the base cryptographic primitive for developing the post-quantum public-key algorithms and protocols [12] and electronic digital signature are proposed [13].

3. New type of commutative ciphers - probabilistic commutative encryption algorithms is proposed, [11] the first-time post-quantum keyless encryption protocols based on the hidden discrete logarithm problem[11] and new types of modes for using block cipher [1]: 1) encryption in error correction mode; 2) pseudo-probabilistic encryption.

4. New approach to detecting anomalous data from sensors of cyber-physical water supply control systems, characterized by the possibility of detecting in the dynamics of deviations of indications from a previously unrecorded set of sensors, taking into account the accumulated statistics of the correct operation of the system is developed [18, 26]. The data of normal and abnormal behavior of the system accumulated during the modeling process made it possible to obtain data samples from sensors used for generalization using machine learning methods. The implementation of the prototype allowed to confirm the correctness of the developed approach and its applicability in solving the problems of monitoring the security of cyber-physical systems.

References:

Papers prepared jointly with foreign organizations:

1. *Moldovyan N.A., Moldovyan A.A., Nguyen D.T., Nguyen N.H., Nguyen H.M.* Pseudo-probabilistic block ciphers and their randomization // Journal of Ambient Intelligence and Humanized Computing. 2019. vol. 10. no. 5. pp. 1977–1984. DOI: https://doi.org/10.1007/s12652-018-0791-6 (Scopus, SJR=0,35, Q2).
2. *Nguyen H.N., Nguyen D.T., Nguyen M.H., Moldovyan N.A.* New Blind Signature Protocols Based on Finite Subgroups with Two-Dimensional Cyclicity // Iranian Journal of Science and Technology, Transactions of Electrical Engineering. 2019. vol. 43. pp. 277–287. DOI: https://doi.org/10.1007/s40998-018-0129-6 (Scopus, SJR=0,12, Q4).
3. *Moldovyan D.N., Moldovyan A.A., Sklavos N.* Post-Quantum Signature Schemes for Efficient Hardware Implementation // Proceedings of 10th IFIP International Conference on New Technologies, Mobility & Security (NTMS'19). 2019. (Scopus)
4. *Moldovyan A.A., Moldovyan D.N., Shcherbacov V.A.* On Defining 4-Dimensional Finite Non-Commutative Associative Algebras Over

GF(2^s) // Proceedings of the 5th International Conference of Mathematical Society of the Republic of Moldova. 2019. pp. 101–108.

5. *Moldovyan A.A., Moldovyan D.N., Shcherbacov V.A.* Four-dimensional Non-commutative Associative Algebra and its Application // Proceedings of the 5-th Conference on Mathematical Foundations of Informatics. 2019. pp. 59–74.
6. *Moldovyan N.A., Moldovyan D.N., Le Q.M., Nguyen L.G., Ho S.T., Nguyen H.M.* Stream Pseudo-probabilistic Ciphers // Context-Aware Systems and Applications, and Nature of Computation and Communication. pp. 36–47. DOI: 10.1007/978-3-030-06152-4_4 (Scopus).
7. *Nguyen H.M., Nguyen N.H., Phieu N.H., Moldovyan N.A., Moldovyan A.A., Tran C.M.* Post-quantum Cryptoschemes: New Finite Non-commutative Algebras for Defining Hidden Logarithm Problem // Context-Aware Systems and Applications, and Nature of Computation and Communication. 2019. pp. 183–194. DOI: 10.1007/978-3-030-06152-4_16 (Scopus).

Papers Published in Editions Indexed by WoS, Scopus:

8. *Moldovyan N.A., Moldovyan A.A.* Finite Non-commutative Associative Algebras as carriers of Hidden Discrete Logarithm Problem // Вестник ЮУрГУ. Серия «Математическое моделирование и программирование». 2019. vol. 12. no. 1. pp. 66–81. DOI: 10.14529/mmp190106 (Scopus, SJR=0,3, Q3).
9. *Moldovyan N.A., Abrosimov I.K.* A post-quantum electronic digital signature scheme based on the reinforced form of the hidden discrete logarithm problem // Bulletin of St. Petersburg University. Applied math. Computer science. Management processes. 2019. vol. 15. no. 2. pp. 212–220. (In Russ.). (Scopus, SJR=0,21, Q3).
10. *Moldovyan A.A., Moldovyan N.A.* New forms of specifying the hidden discrete logarithm task // Transactions of SPIIRAS. 2019.No 2 (18). C. 504–529. doi: 10.15622 / sp.18.2.504-529 (Scopus, SJR = 0.17, Q3).
11. *Moldovyan A.A., Moldovyan D.N., Moldovyan N.A.* Post-quantum commutative encryption algorithm // Computer Science Journal of Moldova. 2019. vol. 27. no. 3(81). pp. XXX. (WoS, Scopus).

12. *Moldovyan D.N.* Post-quantum public key-agreement scheme based on a new form of the hidden logarithm problem // Computer Science Journal of Moldova. 2019. vol.27. no. 1(79). pp. 56–72. (WoS, Scopus).
13. *Moldovyan N.A.* Finite Non-commutative Associative Algebras for Setting the Hidden Discrete Logarithm Problem and Post-quantum Cryptoschemes on Its Base // Buletinul Academiei de Stiinte a Republicii Moldova. Matematica. 2019. vol. 1. no. 89. pp. 71–78. (Scopus, SJR=0,32, Q4).
14. *Moldovyan D.N.* A unified method for setting finite non-commutative associative algebras and their properties // Quasigroups and Related Systems. 2019. vol. 27. no. 2. pp. 293–308. (Scopus, SJR=0,25, Q4).
15. *Gaifulina D.A., Chechulin A.A.* Development of the complex algorithm for web pages classification to detection inappropriate information on the Internet // 13TH International Symposium on Intelligent Distributed Computing (IDC 2019). 2019. vol. 868. pp. 278–284 (Scopus, WoS).

Papers in journals indexing by Russian Science Citation Index:

16. *Moldovyan A.A., Moldovyan D.N.* Post-quantum EDS scheme based on the hidden discrete logarithm problem in four-dimensional finite algebra // Information Security Issues. 2019. vol. 2. pp. 18–22. (In Russ.). (VAK, Impact factor 0.328).
17. *Moldovyan N.A., Abrosimov I.K.* Post-quantum digital signature protocols based on a hidden discrete logarithm task // Information Security Issues. 2019. vol. 2. pp. 23–32. (In Russ.). (VAK, impact factor 0.328).
18. *Moldovyan D.N.* Keyless encryption protocol based on the hidden discrete logarithm task // Information Security Issues. 2019. vol. 3. pp. 26–32. (In Russ.). (VAK, impact factor 0.278).
19. *Moldovyan A.A., Moldovyan D.N.* Post-quantum blind signature protocol on non-commutative algebras // Issues of information security. 2019. vol. 4. pp. 18–22. (In Russ.). (VAK, impact factor 0.328).
20. *Desnitsky V.A., Meleshko A.V.* Analysis of the security of software and hardware components in wireless sensor networks // Information Technologies and Telecommunications". 2019. vol. 7, no. 1. pp. 75–83. (In Russ.). (Impact factor 0.30).

21. *Gayfulina D.A. Khakimova E.R. Chechulin A.A.* Development of a comprehensive algorithm for the classification of web sites to detect unwanted information on the Internet // VIII International Scientific-Technical and Scientific-Methodological Conference "Actual Problems of Information Telecommunications in Science and Education". 2019. Vol. 1. S. 312–317. (In Russ.).
22. *Balueva A.V., Desnitsky V.A.* An approach to the detection of Denial-of-Sleep attacks in cyberphysical systems based on machine learning methods // VIII International Scientific-Technical and Scientific-Methodical Conference "Actual Problems of Infotelecommunications in Science and Education". 2019. vol. 1. pp. 97–102. (In Russ.).
23. *Meleshko A.V., Savkov S.V.* Threat model and risk assessment methodology for a water supply management system // VIII International Scientific-Technical and Scientific-Methodological Conference "Actual problems of information and telecommunications in science and education". 2019 (In Russ.). (accepted for publication).

Other publications:

24. *Gayfulina D.A.* Development and research of a composite algorithm for classifying web pages to detect inappropriate content on the Internet // XI St. Petersburg Interregional Conference Information Security of Russian Regions (IBRR-2019). 2019. pp. 110–112. (In Russ.).
25. *Gayfulina D.A.* The use of binary network traffic data analysis techniques to identify anomalies in the face of uncertain specifications of data transfer protocols // XI St. Petersburg Interregional Conference Information Security of Russian Regions (IBRR-2019). 2019. pp. 108–110. (In Russ.).
26. *Kostina A.A., Moldovyan N.A., Morozova E.V.* The method of cryptocoding using two independent redundancy labels // III scientific and technical. conf. "Scientific and technical problems in industry: scientific, engineering and production problems of creating technical means for monitoring the electromagnetic field using innovative technologies". 2019. pp. 219–222. (In Russ.).
27. *Moldovyan A., Moldovyan N.* Finite Non-commutative Algebras as Carriers of Post-quantum Public-key Cryptoschemes // Proceedings of the Fifth Conference of Mathematical Society of Moldova (IMCS-55). 2019. pp. 109–114

Laboratory of Autonomous Robotic Systems

Head of laboratory: Cand. Sci. (Tech.) Anton I. Saveliev – development of mathematical models, cross-platform software and mobile services for the surrounding cyber-physical space, saveliev.ais@yandex.ru.

Laboratory staff: 19 members.

Research activities – development of mathematical models, software and hardware for autonomous robotic systems, including methods of modular, swarm, cloud and anthropomorphic robotics, and prototyping of robots, cyber-physical modules and specialized calculators.

Research fellows and brief information of the research-work direction

Principal researcher, Dr. Sci. (Tech.), Prof., Professor of the Russian academy of sciences – Andrey L. Ronzhin – interaction of autonomous robotic systems and users in a cyber-physical environment, ronzhin@iias.spb.su.

Researcher – Nikita A. Pavliuk – construction of groundbased robotic systems and individual mechatronic nodes, antei.hasgard@gmail.com.

Junior researcher – Alexander V. Denisov – models and algorithms of software engineering for wireless informational interactions of distributed sensor assemblies, sdenisov93@mail.ru.

Junior researcher – Dmitriy A. Malov – methods for organizing the transmission of data between devices in IoT-networks, machine learning methods, malovdmitrij@gmail.com.

Junior researcher – Petr A. Smirnov – algorithm design and software development for control of n-link mechanisms based on machine learning solutions, petruha.smirnov.1994@gmail.com.

Junior researcher – Irina V. Vatamaniuk – methods, algorithms and architectures of robotic and information control systems, vatamaniuk@iias.spb.su.

Junior researcher – Artem D. Kovalev – development of synchronous workflow, including three-dimensional mapping, object segmentation and their localization in environment, aided by computer vision approaches, artem.kovalev1992@gmail.com.

Junior researcher – Konstantin D. Krestovnikov – development of model and algorithms for power resource distribution in a swarm of robotic devices via two-way wireless energy transfer, open56it@gmail.com.

Junior researcher –Ivan M. Tolstoy – technical vision algorithms, machine learning methods for image processing, tolstoy.i.m@yandex.ru.

Junior researcher – Olga O. Shumskaya – algorithmic models and software for digital data processing on onboard compuiting units of robotic systems, shumskaya.oo@gmail.com.

Junior researcher – Roman N. Yakovlev – architecture of big data models and cyber-physical systems, iakovlev.r@mail.ru.

Postgraduate students

Pavliuk N.A. – Programming assets and pilot models of connections and interactions of robotic devices and modules (research advisor – A. Ronzhin), antei.hasgard@gmail.com.

Denisov A.V. – Models and algorithms of software system design for wireless informational interaction of distributed sensor suites (research advisor – A. Ronzhin), denisov@iias.spb.su.

Malov D.A. – Architectures, algorithms and software of selforganizing technical systems (research advisor – A. Ronzhin), malovdmitrij@gmail.com.

Ivin A.G. – Mathematical models, algorithms and software for implementing combined movements of anthropomorphic robots (research advisor – V. Budkov), arssivka@yandex.ru.

Michalchenko D.I. – Algorithms and software for decision making based on sensory systems data of anthropomorphic robots (research advisor – A. Ronzhin), tekatodsham@gmail.com.

Smirnov P.A. – Development of algorithms and software based on machine learning approaches for control of n-link mechanisms (research advisor – A. Ronzhin), petruha.smirnov.1994@gmail.com.

Shumskaya O.O. – Algorithmic models and software for digital data processing in the onboard computer of robotic systems (research advisor – A. Ronzhin), shumskaya.oo@gmail.com.

Zaharov K.S. – Development of methods and algorithms for dynamic planning of ground-based robotic vehicle motion in outdoor environment (research advisor – A. Saveliev), kon7666007@yandex.ru.

Kovalev A.D. – development of synchronous workflow, including three-dimensional mapping, object segmentation and their localization in

environment, aided by computer vision approaches (research advisor – A. Saveliev), artem.kovalev1992@gmail.com.

Krestovnikov K.D. – development of model and algorithms for power resource distribution in a swarm of robotic devices via two-way wireless energy transfer (research advisor – A. Saveliev), open56it@gmail.com.

Grants and projects

Saveliev A. – Grant of the President of the Russian Federation MK383.2018.9 "Development of a system for user localization and navigation in cyber-physical space, based on probabilistic machine learning methods", 2018-2019.

Ronzhin A.– Project of RFBR No. 18-58-76001 ERA_a "Strategies for joint activities of heterogeneous robots, controlled by intuitive humanmachine interfaces, when solving agricultural tasks", 2018-2021.

Budkov V. – Project of RFBR No. 17-58-04110_Bel_mol_a Modeling and development of energy-efficient solutions for kinematics and dynamics of walking robots, 2017-2019.

Ronzhin A. – Project of RFBR No. 16-29-04101_ofi Techniques for controlling pairwise linkages of homogeneous robots when configuring a robotic swarm into three-dimensional forms, 2016-2019.

Ronzhin A. – RFBR project №19-08-01215_A, Theoretical foundations of two-way wireless energy transfer and algorithms for establishment of automatic energy resource redistribution in a robotic group. 2019-2021.

Saveliev A. – RFBR project №18-29-22061_мк, Development of a complex approach to analyze audio, video and text content in Russian to discover violent behavior of users in informational environment based on neural network technologies, 2018-2022.

Ronzhin A. – RSCF 16-19-00044П, Patterns of task distribution among service robots and cyberphysical smart environment devices in context of multimodal customer service, 2019-2020.

University courses

SUAI: Robots, mechatronics and robotic systems, Technology and software for creating intelligent systems, Management of robots and robotic systems – Ronzhin A.

SUAI: "Design of robots and robotic systems"; "Electric drives of aerospace robotic systems"; "Sensor systems in mechatronics and robotics"; "Fuzzy controls in robotic systems"; "Computer technology modeling and design of electro-mechanical devices"; "Neural networks and neurocontrollers"; "Control robots and robotic systems"; "Optimal systems"; "Application Programming"; "Local control systems"; “Educational practice” – Saveliev A.

SUAI: "Control robots and robotic systems"; "Optimal systems"; "Local control systems"; "Neural networks and neurocontrollers"; Microchip technology in mechatronics and robotics. "Fuzzy controls in robotic systems"; Internship. “Educational practice”; "Electromechatronica" – N. Pavliuk.

Scientific and organizational activities

Organization of the 14th International Scientific-Technical Conference on Electromechanics and Robotics "Zavalishin’s Readings – 2019" (ER(ZR)-2019), http://confs.guap.ru/zav-read. Kursk, Russia, Aplril 17-20, 2019. Proceedings published online: Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”, ER(ZR) 2019, Kursk, Russia, 17 - 20 April 2019 – Springer Singapore. A. Ronzhin and V. Shishlakov (Eds.): eBook ISBN 978-981-13-9267-2, ISSN 2190-3018, 2019. vol. 154. 791 p. DOI: 10.1007/978-981-13-9267-2.

Organization of the 4rd International Conference "Interactive Collaborative Robotics’ ICR-2019. http://specom.nw.ru/icr2019. Istanbul, Turkey, August 20-25, 2019. Proceedings published: Interactive Collaborative Robotics, 4th International Conference, ICR 2019, Istanbul, Turkey, August 20–25, 2019, Proceedings – Springer Nature Switzerland AG 2019. A. Ronzhin, G. Rigoll, R. Meshcheryakov (Eds.): ISSN 0302-9743, ISBN 978-3-030-26117-7, LNCS 11659, LNAI, 11659, 2019, DOI: 10.1007/978-3-030-26118-4.

International cooperation

Joint research and organization of scientific events in collaboration with the University of West Bohemia in Pilsen (Czech Republic), Bogazici University in Istanbul (Turkey), Dresden University of Technology, Karlsruhe Institute of Technology (Germany), Belarusian State University ofInformatics and Radioelectronics (Belarus), United

Institute of Information Problems of the National Academy of Sciences of Belarus, Universidad Nacional Autonoma de Mexico (Mexico).

Participation in conferences and exhibitions

2nd International Conference "Business Management in the Digital Economy", March 21-22, 2019, St. Petersburg, Russia – Yakovlev R., Vatamaniuk I.

2019 International Conference on Industrial Engineering, Applications and Manufacturing (ICIEAM), March 25–29, 2019, Sochi, Russia – Malov D., Saveliev A.

Proceedings «Modern robotics problems» In Memory of E. P. Popov, Academician of RAS, March 26, 2019, Moscow, Russia – Ronzhin A., Saveliev A., Krestovnikov K.

Scientific session of Department for Nanotechnology and Information Technology of the Russian Academy of Sciences (DNIT RAS), March 27, 2019, Moscow, Russia – Saveliev A., Ronzhin A.

VIII National congress of young scientists, IFMO University, Russia, April 15-19, 2019, St. Petersburg, Russia – Saveliev A.

2019 International Siberian Conference on Control and Communications (SIBCON), April 18-20, 2019, Tomsk, Russia – Shumskaya O.

14th International Conference "Zavalishin's Readings – 2019" (ER(ZR)-2019) – April 17-20, 2019, Kursk, Russia – Saveliev A., Pavliuk N., Denisov A., Malov D., Vatamaniuk I., Kovalev A., Krestovnikov K., Shumskaya O., Yakovlev R., Tolstoy I., Ronzhin A.

V national science-and-practice workshop «Unmanned vehicles with AI-powered systems», May 22-24, 2019, St. Petersburg, Russia – Saveliev A., Tolstoy I.

International Conference Cyber-Physical Systems and Control (CPS & C'2019) – St. Petersburg, Russia, June 10-12, 2019 – Saveliev A., Malov D., Shumskaya O.

30th International Scientific and Technological Conference "Extreme Robotics", June 13-15, 2019, St. Petersburg, Russia – Shumskaya O.

XIII National council on management problems (ICS RAS), June 17-20, 2019, Moscow, Russia – Shumskaya O., Ronzhin A.

Conference «Russian Science to the Army», June 26, 2019, Town of Kubinka, Moscow Oblast, Russia – Ronzhin A.

18th IEEE International Conference on Smart Technologies IEEE (EUROCON-2019), July 1-4, 2019, Novi Sad, Serbia – Krestovnikov K., Pavliuk N.

4th International Conference on Interactive Collaborative Robotics (ICR 2019), August 20-25, 2019, Istanbul, Turkey – Ronzhin A., Saveliev A., Pavliuk N., Denisov A., Mallov D., Smirnov P., Kovalev A., Krestovnikov K., Yakovlev R.

21st International Conference on Speech and Computer (SPECOM-2019), August 20-25, 2019, Istanbul, Turkey – Malov D., Vatamaniuk I., Ronzhin A.

International Conference on Marine Robotics in Ocean Exploration, September 17-19, 2019, St. Petersburg, Russia – Ronzhin A.

12-th Multiconference on management problems (MMP-2019) – September 23-28, 2019, Divnomorskoe, Gelendzhik, Russia – Ronzhin A., Saveliev A., Pavliuk N., Kovalev A.

19th Conference «IFAC Conference on Technology, Culture and International Stability» (TECIS-2019), September 26-28, 2019, Sozopol, Bulgaria – Kovalev A.

12th International Conference «IEEE Developments in e-Systems Engineering» (DeSE2019), October 7-10, 2019, Kazan, Russia – Saveliev A., Krestovnikov K., Vatamaniuk I., Yakovlev R., Malov D.

Workshop session №27 of Scientific Technological Council of Military-Industrial Commission of Russia concerning development of military and specialized robotic systems – October 16, 2019, Magnitogorsk, Russia – Ronzhin A.

1st International Conference on Control Systems, Mathematical Modeling, Automation and Energy Efficiency SUMMA2019, November 20-22, 2019, Lipetsk, Russia – Pavliuk N., Mallov D., Shumskaya O.

Membership in Russian and International societies, editorial boards, etc.

Ronzhin A. – RAS expert, Member of the Scientific Council on Robotics and Mechatronics of the Russian Academy of Sciences, Member of the subcommittee on Eastern Europe of the International Speech Communication Association (ISCA), Member of the Academy of Navigation and Motion Control, General Conference Co-Chair of the International Conference "Speech and Computer" SPECOM, Co-Chair of

the international conference "Interactive Collaborative Robotics" ICR, Associate Editor of the International Journal of Intelligent Unmanned Systems, member of the editorial board of the scientific journal System Engineering and Information Technologies, member of the editorial board of the scientific journal Speech Technologies, deputy chief editor of the journal Trudy SPIIRAN, member of the expert council of the Higher Attestation Commission on Computer Science and computing.

Saveliev A. – Member of the Committee of the Semifinal of the Contest "Participant of the Youth Scientific and Innovation Contest" ("UMNIK") of the Foundation for Assistance to the Development of Small Forms of Enterprises in the Scientific and Technical Sphere, Member of National Board of International Competition «RoboCup».

Intellectual property

Invention patent № 2704048 of 28.02.2019: «Mobile autonomous robotic platform with reconfigurable unit structure». Application № 2019105802. Saveliev A., Kharkov I., Pavliuk N., Karpov A.

Invention patent № 2698307 from 26.08.2019: A. Saveliev, K. Krestovnikov, N. Pavliuk, «Wireless charging system». Application № №2018132577/07(053309).

Certificate of state registration of computer programs № 2019662000 of 13.09.2019: «Program of multi-criteria assessment of required robotic system device fleet for treatment of selected farmlands, AgrobotModeling». Application №2019660951. Saveliev A. (RU), Ngo K. (VN), Nguyen V. (VN).

Certificate of registration № 2019664935 of 15.11.2019: «System for testing of modern machine learning algorithms, used for prediction of user locations in smart cyber-physical environment». Application № 2019664064 of 07.11.2019. Malov D., Saveliev A., Edemskii A.

Recent results

1. A methodology was developed to calculate time and energy, required for the units of mobile autonomous reconfigurable system (MARS) to complete their tasks, particularly, to determine transmitted energy volume with regard to power losses in the transmission channel between homogeneous modular robotic devices.

2. A modular robotic system (chainlike) reconfiguration algorithm is designed, enabling assembly of a unified modular structure for fully functional motion, based on suboptimal reconfiguration plan GreedyCM, where all kinematic chains are transformed into closed ones via virtual links addition.

The presented algorithm provides for application of closed loop analysis kinematic methods, related to establishment of formations, based on actuators, connectors and motion mechanisms [1–6].

3. Algorithms and architecture for proactive user detection in cyber-physical environment are designed, ensuring user action classification and prediction of user behavior [7–11].

4. An algorithm is developed for mesh network establishment, which consists of data transnission modules, leveraging the LoRa technology and ensuring robust two-way communication between a mobile robotic platform or unmanned aerial vehicle (UAV) [12, 13].

5. A mathematical model for controlling the engines of robotic platforms for autonomous operation as a part of a multi-agent robotic navigation system based on ArUco-markers using classical path planning algorithms has been developed [14].

6. Mathematical, model-algorithmic, and software have been developed to automate the maintenance and interaction of heterogeneous agricultural robotic systems, providing numerical and simulation modeling of the number of unmanned aerial vehicles and ground-based robotic service platforms, visualizing their functioning, as well as choosing the optimal composition and number of heterogeneous robots [15–19].

Awards, diplomas, scholarships

Pavliuk N. – The winner of competitive selection for obtaining scholarships of the Government of the Russian Federation in priority areas of training for the 2018/2019 academic year.

Malov D. – The winner of competitive selection for obtaining scholarships of the Government of the Russian Federation in priority areas of training for the 2019/2020 academic year.

References

Monography:

1. *Vatamanyuk I.V., Levonevsky D.K., Malov D.A., Yakovlev R.N., Savelyev A.I.* Models and methods of user interaction with cyber-physical intellectual space: monograph // Lan'. 2019. 212 p.

Articles prepared jointly with foreign organizations:

2. *Iakovlev R., Denisov A., Prakapovich R.* Iterative Method for Solving the Inverse Kinematics Problem of Multi-link Robotic Systems with Rotational Joints // Proceedings of 14th International

Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 237–251. DOI: 10.1007/978-981-13-9267-2_20 (Scopus, SJR=0.16, Q3).

3. *Jokisch O., Siegert I., Maruschke M., Strutz T., Ronzhin A.* Don’t Talk to Noisy Drones–Acoustic Interaction with Unmanned Aerial Vehicles // International Conference on Speech and Computer. 2019. pp. 180–190. DOI: 10.1007/978-3-030-26061-3_19 (Scopus).
4. *Guzey N., Guzey M., Ronzhin A.* Consensus-based Localization by Using Array of Antennas on a Fixed-Wing UAV // 27th Telecommunications forum TELFOR 2019. 2019. pp. 4. (Scopus).
5. *Denisov A., Usina E., Iakovlev R., Shtrutz T., Narandzhich M., Guzej M., Jokish O.* Algorithms for radio beacon mesh network establishment for navigation of robotic systems in agriculture // Vestnik of MSTU “Stankin”. 2019. (In Russ.). (Impact factor – 0,802).

Papers published in editions, indexed by WoS, Scopus:

6. *Malov D., Edemskii A., Saveliev A.* Proactive Localization System as a Part of a CyberPhysical Smart Environment // 2019 International Conference on Industrial Engineering, Applications and Manufacturing (ICIEAM). 2019. pp. 1–5. DOI: 10.1109/ICIEAM.2019.8742988 (WoS, Scopus).
7. *Krestovnikov K., Cherskikh E., Pavliuk N.* Concept of a synchronous rectifier for wireless power transfer system // IEEE EUROCON 2019 18th International Conference on Smart Technologies. 2019. 5 p. DOI: 10.1109/EUROCON.2019.8861856 (WoS, Scopus).
8. *Krestovnikov K., Saveliev A., Shabanova A., Vatamaniuk I.* Comparative Study of Synchronous and Non-Synchronous Rectifiers for Use in the Receiving Part of a Wireless Charging System // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. Springer, Singapore. 2020. pp. 675–685. DOI: 10.1007/978-981-13-9267-2_56 (Scopus, SJR = 0,16, Q3).
9. *Gorbach N., Usina E., Shabanova A., Yakovlev R.* Calculation methodology for power characteristics of electroadhesive contact for gripping conductive and dielectric objects // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 697–705. DOI: 10.1007/978-981-13-9267-2_58 (Scopus, SJR = 0,16, Q3).

10. *Tsybulskaya J., Permiakov N., Drugov P., Denisov A.* Sound Source Localization Based on the Simple Cross-correlation Method and Probabilistic Neural Networks // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 525–536. DOI: 10.1007/978-981-13-9267-2_43 (Scopus, SJR = 0,16, Q3).
11. *Vu Q., Ronzhin A.* A Model of Four-Finger Gripper with a Built-in Vacuum Suction Nozzle for Harvesting Tomatoes // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 149–160. DOI: 10.1007/978-981-13-9267-2_13 (Scopus, SJR = 0,16, Q3).
12. *Malov D., Letenkov M.* Synthetic Data Generation Approach for Face Recognition System // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 501–510. DOI: 10.1007/978-981-13-9267-2_41 (Scopus, SJR = 0,16, Q3).
13. *Levonevskii D., Shumskaya O., Velichko A., Uzdiaev M., Malov D.* Methods for Determination of Psychophysiological Condition of User Within Smart Environment Based on Complex Analysis of Heterogeneous Data // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 511–523. DOI: 10.1007/978-981-13-9267-2_42 (Scopus, SJR = 0,16, Q3).
14. *Pavliuk N., Saveliev A., Cherskikh E., Pykhov D.* Formation of Modular Structures with Mobile Autonomous Reconfigurable System // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. 2020. pp. 383–395. DOI: 10.1007/978-981-13-9267-2_31 (Scopus, SJR = 0.16, Q3).
15. *Pavliuk N., Kharkov I., Zimuldinov E., Saprychev V.* Development of Multipurpose Mobile Platform with a Modular Structure // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. pp. 137–147. DOI: https://doi.org/10.1007/978-981-13-9267-2_12 (Scopus, SJR = 0.16, Q3).
16. *Krestovnikov K., Cherskikh E., Saveliev A.* Investigation of the influence of the length of the intermediate magnetic circuit on the characteristics of magnetic capture for robotic complexes of the mining industry // Journal of Mining Institute. 2019. (WoS, Scopus). (In Russ.).
17. *Krestovnikov K., Cherskikh E., Smirnov P.* Wireless Power Transmission System Based on Coreless Coils for Resource

Reallocation Within Robot Group // International Conference on Interactive Collaborative Robotics. 2019. pp. 193–203. DOI: 10.1007/978-3-030-26118-4_19 (Scopus).
18. *Levonevskiy D., Malov D., Vatamaniuk I.* Estimating Aggressiveness of Russian Texts by Means of Machine Learning // International Conference on Speech and Computer. Springer, Cham. 2019. pp. 270–279. DOI: 10.1007/978-3-030-26061-3_28 (Scopus).
19. *Pavliuk N., Smirnov P., Kondratkov A., Ronzhin A.* Connecting Gripping Mechanism Based on Iris Diaphragm for Modular Autonomous Robots // International Conference on Interactive Collaborative Robotics. 2019. pp. 260–269. DOI: 10.1007/978-3-030-26118-4_25 (Scopus).
20. *Kovalev A., Pavliuk N., Krestovnikov K., Saveliev A.* Generation of Walking Patterns for Biped Robots Based on Dynamics of 3D Linear Inverted Pendulum // International Conference on Interactive Collaborative Robotics. 2019. pp. 170–181. DOI: 10.1007/978-3-030-26118-4_17 (Scopus).
21. *Denisov A., Iakovlev R., Lebedev I.* Mathematical and Algorithmic Model for Local Navigation of Mobile Platform and UAV Using Radio Beacons // International Conference on Interactive Collaborative Robotics. 2019. pp. 53–62. DOI: 10.1007/978-3-030-26118-4_6 (Scopus).
22. *Malov D., Edemskii A., Saveliev A.* Architecture of Proactive Localization Service for Cyber-Physical System's Users // International Conference on Interactive Collaborative Robotics. 2019. pp. 10–18. DOI: 10.1007/978-3-030-26118-4_2 (Scopus).
23. *Saveliev A., Pshchelko N., Krestovnikov K.* Method of Sensitivity Calculation for Electrete Diaphragm Capacitive Sensors // 12th International Conference on the Developments in eSystems Engineering. 2019. (WoS, Scopus).
24. *Iakovlev R., Vatamaniuk I., Malov D.* Architecture Transformation of the Corporate Information Providing System for a Scientific Organization // 12th International Conference on the Developments in eSystems Engineering. 2019. (WoS, Scopus).
25. *Uzdyaev M., Saveliev A., Malov D.* Aggressive Behavior Detection in Video Stream // 12th International Conference on the Developments in eSystems Engineering. 2019. (WoS, Scopus).

26. *Shumskaya O.O., Iskhakova A.O.* Application of digital watermarks in the problem of operating signal hidden transfer in multi-agent robotic system // 2019 International Siberian Conference on Control and Communications (SIBCON). 2019. pp. 1–5. DOI: 10.1109/SIBCON.2019.8729669 (WoS).

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

27. *Iakovlev R.* A simulation model for estimating the computational load on the central server of a videoconferencing system // Science Bulletin of the NSTU. 2019. vol. 1(74). pp. 125–140. DOI: 10.17212/1814-1196-2019-1-125-140. (In Russ.). (Impact factor – 0,355).
28. *Ronzhin A.* Cold Start Strategies for New Academic Laboratories // Management Consulting. 2019. vol. 5 (125). pp. 68–79. DOI: 10.22394 / 1726-1139-2019-5-68-79. (In Russ.). (Impact factor – 0,532).
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45. *Iakovlev R., Lezina T., Vatamaniuk I.* Management of the architecture of the cyberphysical system // The Second International Conference “Business Management in the Digital Economy”. 2019. pp. 255–259. (In Russ.).
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47. *Kovalev A., Pavliuk N., Ronzhin A., Saveliev A.* The method of suboptimal search for reconfiguration of a modular robotic system // 12th Multiconference on Control Problems (MKPU-2019) - Scientific and Technical Conference “ROBOTICS AND MECHATRONICS” (ROME-2019). 2019. pp. 155–158 (In Russ.).
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50. *Shumskaya O., Iskhakova A.* Problems of masking control signals of agents of mobile robotic groups // XII All-Russian meeting on control problems. 2019. pp. 3086–3091. (In Russ.).
51. *Shumskaya O., Iskhakova A.*, *Iskhakov A.* Masking control signals of agents in mobile robotic groups with network-centric control // Abstract of the 30th international scientific and technical conference “Extreme Robotics-2019”. – St. Petersburg: LLC "Publishing and Printing Complex" Gangut". 2019. pp. 303–304. (In Russ.).
52. *Shumskaya O., Iskhakova A.*, *Iskhakov A.* Masking control signals of agents in mobile robotic groups with network-centric control // 30th International Scientific and Technical Conference "Extreme Robotics-2019". 2019. (In Russ.).

Intelligent Systems Laboratory

Head of Laboratory: Dr. Sci. (Tech.), Prof. Ilya S. Lebedev – multi-agent modeling, intelligent data analysis and applied big data models, methods and models of information and computer security of transport systems, semantic data models. isl_box@mail.ru

Laboratory Staff – 5 researchers.

Research Activities – multi-agent system technology, Multi-agent logistics, Self-organized B2B Networks, Distributed and P2P Data Mining and Machine Learning, Intelligent Data Analysis, Data and Information Fusion, Knowledge Discovery from Data, Intelligent Transportation Systems, Big Data Analysis, Teamwork of agents, 3G Recommending Systems, Mobile document images enhancement.

Research fellows and brief information of the research-work direction

Senior Researcher, Cand. Sci. (Tech.) – Mikhail E. Sukhoparov – intelligent planning systems and scheduling in tasks of project management and transportation logistics, P2P architectures and protocols for mobile services. mikhailsukhoparov@yandex.ru.

Junior Researcher – Viktor V. Semenov – information security, machine learning, decision making methods, recommending systems, intelligent methods for processing and analyzing multidimensional data. v.semenov@iias.spb.su.

Junior Researcher – Kseniya I. Salakhutdinova – information security, data processing, theory of probability and mathematical statistics, machine learning. kainagr@mail.ru.

Postgraduate Students

Salakhutdinova K.I. – Method of identifying software versions based on statistical criteria (research supervisor – Ilya Lebedev)

Semenov V.V. – Methods for assessing the state of information security of computing tools based on side electromagnetic radiation (research supervisor – Ilya Lebedev)

Grants and Projects

Lebedev I.S. – Project no. 0073-2018-0007 of the RAS Presidium Program «Development of scalable sustainable algorithms for constructing

semantic models of big data and their use for solving applied problems of clustering and machine learning», 2018-2020.

Lebedev I.S. – Project no. 0073-2018-0008 of the RAS Presidium Program «Theory and distributed algorithms of self-organization of group behavior of agents in an autonomous mission», 2018-2020.

University Courses

Saint Petersburg State University (SPbU): «Object oriented programming» (Ilya Lebedev);

National Research University "Higher School of Economics" (SPb): «Information support of logistics business processes in supply chains» (Ilya Lebedev); «Research seminar» (Ilya Lebedev); «Vocational orientation workshop» (Ilya Lebedev);

ITMO University: «Organization and management of information security service» (Kseniya Salakhutdinova); «Digital video processing methods» (Kseniya Salakhutdinova).

Participation in conferences and exhibitions

VIII Congress of Young Scientists (status: All-Russian), April 15-19, 2019, St. Petersburg, Russia – Salakhutdinova K.

28th Scientific and Technical Conference “Methods and Technical Tools of Information Security” (MTTIS 2019), St. Petersburg, Russia, June 24-27, 2019 – Salakhutdinova K., Semenov V.

The 4th International Conference on Interactive Collaborative Robotics, August 20-25, 2019, Istanbul, Turkey – Semenov V.

The 12th conference on Internet of Things and Smart Spaces ruSMART 2019, August 26-28, 2019. St. Petersburg, Russia – Semenov V.

XI St. Petersburg Interregional Conference "Information Security of Russian Regions (IBRR-2019)", St. Petersburg, Russia, October 23-25, 2019 – Semenov V.

Intellectual property

Official registration of the computer program "Comparison of executable file signatures". State registration certificate No. 2019619363. Salakhutdinova K.I.

Official registration of the computer program "The program for determining the state of information security of individual components of computing systems". State registration certificate No. 2019618203. Semenov V.V.

Recent Results

1. A method based on a static approach to analyzing the characteristics of disassembled program codes for generating reference signatures of identifiable executable files was proposed. This method provides the creation of frequency distributions that are unique in form and amplitude. Distributions are based on the use of a number of selected most informative assembler commands that are steadily manifested in various programs [9].

2. A method for comparing the signatures of identifiable executable files with previously generated reference program signatures using the combined approach of using the machine learning algorithm — gradient boosting of decision trees and the additive Fishburn criterion was proposed [2, 5].

3. An algorithm for clustering domain text was developed. It differs from the known ones by using semantic-syntactic vectors describing the types of connections between words, which allows one to take into account the semantic role of natural language constructions in the text [10, 11].

References

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1. *Semenov V., Sukhoparov M., Lebedev I.* Approach to side channel-based cybersecurity monitoring for autonomous unmanned objects // Interactive Collaborative Robotics. 2019. pp. 278–286. DOI: https://doi.org/10.1007/978-3-030-26118-4_27 (Scopus).
2. *Semenov V.V., Lebedev I.S., Sukhoparov M.E., Salakhutdinova K.I.* Application of an Autonomous Object Behavior Model to Classify the Cybersecurity State // Internet of Things, Smart Spaces, and Next Generation Networks and Systems (ruSMART 2019). 2019. pp. 104–112. DOI: https://doi.org/10.1007/978-3-030-30859-9_9 (Scopus).
3. *Leyfer K., Spivak A.* Continuous User Authentication by the Classification Method Based on the Dynamic Touchscreen Biometrics // 24th Conference of Open Innovations Association (FRUCT). 2019. pp. 228–234. DOI: https://doi.org/10.23919/FRUCT.2019.8711941 (Scopus).

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

4. *Salakhutdinova K.I., Malkov V.V., Krivtsova I.E.* Comparative analysis of approaches to software identification // Security of Information Technologies. 2019. vol. 26. no. 2. pp. 58–66. DOI: https://doi.org/10.26583/bit.2019.2.04 (VAK, Impact factor – 0.308).
5. *Semenov V.V., Lebedev I.S.* Signal information processing in the tasks of monitoring information security of autonomous objects of unmanned systems // Scientific and Technical Journal of Information Technologies, Mechanics and Optics. 2019. vol. 19. no. 3. pp. 492–498. DOI: https://doi.org/10.17586/2226-1494-2019-19-3-492-498 (VAK, impact factor 0.466).
6. *Salakhutdinova K.I., Lebedev I.S., Krivtsova I.E., Anisimov A.S.* Software identification in the audit of electronic storage media // Aerospace Instrumentation. 2019. no 9. pp. 20–28. DOI: 10.25791 / aviakosmos.09.099.865 (VAK, impact factor - 0.442).
7. *Salakhutdinova K.I.* Improving the accuracy of software identification by using the additive criterion // Information technology. 2019. vol. 25. no. 10. pp. 609–614. DOI: 10.17587 / it.25.609-614 (VAK, impact factor 0.466).
8. *Sukhoparov M.E., Semenov VV, Lebedev I.S.* Behavior model for classifying the state of information security of an autonomous object // Problems of information security. Computer systems. 2019, no. 3 (in print). (VAK, impact factor - 0.547).
9. *Sukhoparov M.E., Salakhutdinova K.I., Lebedev I.S.* Software identification using standard machine learning tools // Problems of information security. Computer systems. 2019, no. 4 (in print). (VAK, impact factor – 0.547).
10. *Spivak A.I., Lebedev I.S., Lapshin S.V.* Classification of short messages using vectorization based on ELMo // Bulletin of Tula State University. Technical Sciences. 2019, no. 10. (VAK, Impact factor – 0.240). (In the press).
11. *Lapshin S.V., Lebedev I.S., Spivak A.I.* Text clustering using semantic-syntactic word relationships // Scientific and Technical Journal of Information Technologies, Mechanics and Optics 2019. vol. 19. no. 6. pp. 1058–1064. (VAK, impact factor - 0.466). (In the press).

Other Publications

12. *Semenov V.V., Lebedev I.S., Sukhoparov M.E.* Identification of the information security state of unmanned vehicles using artificial neural networks // Methods and technical means of ensuring information security: materials of the 28th scientific and technical conference. 2019. pp. 46–47.
13. *Salakhutdinova K.I., Sukhoparov M.E.* Software identification technique based on the static characteristics of the program code of the file // Methods and technical means of information security: materials of the 28th scientific and technical conference. 2019. pp. 31–32.
14. Semenov V.V. Method for monitoring the state of information security of unmanned vehicles // Materials of the XI St. Petersburg Interregional Conference "Information Security of Russian Regions (IBRR-2019)." 2019. pp. 323–324.

Laboratory of Big Data in Socio-Cyberphysical Systems

Head of laboratory: Cand. Sci. (Tech.) Viktor Yu. Budkov – methods and models of audio-visual signal processing in embedded cyber-physical modules, budkov@iias.spb.su

Laboratory staff: 18 members.

Research activities – foundations and technologies of big data for socio-cyberphysical systems.

Research fellows and brief information of the research-work direction

Senior researcher, Cand. Sci. (Tech.). – Mikhail V. Kharinov – the model of detection of images of objects in terms of a network formed by dynamic Sleator-Tarjan trees and address cycles; the development of the apparatus of hypercomplex numbers (quaternions and octaves) for the application in science and technology, khar@iias.spb.su.

Researcher – Dmitriy K. Levonevskiy – information security, corporate information systems, mathematical and computer modeling, dlewonewski.8781@gmail.com.

Junior researcher – Egor A. Aksamentov – software development and computer vision algorithm design for automated segmentation and classification of objects in the environment, egor.aksamentov.96@mail.ru.

Junior researcher – Aleksandr N. Bykov – robotics engineering solutions for cyber-physical environment, 124alex.96@mail.ru.

Junior researcher – Pavel S. Drugov – software development and computer vision algorithm design for automated detection of cyber-physical system users, pah53k@gmail.com.

Junior researcher – Ilya V. Duboyskii – algorithms for processing and transfer of multimedia data to assess user condition within cyber-physical systems, acreedr@yandex.ru.

Junior researcher – Dmitry M. Dudarenko – Architecture and algorithm design for CPS features, ensuring representation of physical objects in cyber-environment, dmitry@dudarenko.net.

Junior researcher – Igor V. Lebedev – development of UAV control systems to complete flight tasks within cyberphysical systems, igorlevedev@gmail.com.

Junior researcher – Maksim A. Letenkov – development of machine learning models for data generation and analysis in socio-cyberphysical systems, o1prime@yandex.ru.

Junior researcher – Yuliya I. Rubtsova – development of cyber-physical environment layout methods, based on neural network technologies, julia_rubik@mail.ru.

Junior researcher – Mikhail Yu. Uzdiaev – methods of multimodal identification of human activity within video stream using meta-learning approaches , m.y.uzdiaev@gmail.com.

Junior researcher – Elizaveta E. Usina – analysis of production cycle functioning for cyber-physical system implementation, lizzzi96@mail.ru.

Junior researcher – Igor G. Khanykov – the development of image segmentation algorithms with a hierarchical data structure, igorioniak@mail.ru, igk@iias.spb.su.

Junior researcher – Ekaterina O. Cherskikh – research and development of electrical machinery for cyber-physical systems, katy0419@mail.ru.

Junior researcher – Aleksandra R. Shabanova – development of methods and algorithms for control of physical modules of cyber-physical systems, shabanova_ar@mail.ru.

Postgraduate students

Uzdiaev M.Yu. – methods of multimodal identification of human activity within video stream using meta-learning approaches (research advisor – A. Saveliev), m.y.uzdiaev@gmail.com.

Letenkov M.A. – development of machine learning models for data generation and analysis in socio-cyberphysical systems (research advisor – A. Saveliev), o1prime@yandex.ru.

International cooperation

Joint research and organization of scientific events in collaboration with the University of West Bohemia in Pilsen (Czech Republic), Karlsruhe Institute of Technology (Germany).

Participation in conferences and exhibitions

Proceedings «Modern robotics problems» In Memory of E. P. Popov, Academician of RAS, March 26, 2019, Moscow, Russia – Cherskikh E.

14th International Conference "Zavalishin's Readings – 2019" (ER(ZR)-2019), April 17-20, 2019, Kursk, Russia – Shabanova A., Usina E., Drugov P., Dudarenko D., Letenkov M., Levonevskiy D., Uzdiaev M., Cherskikh E.

14th International Conference on Pattern Recognition and Information Processing (PRIP'2019) – May 21-23, 2019, Minsk, Republic of Belarus – Kharinov M.

The International scientific conference for Bachelor, Master and Cand. Sci. (Tech.) students TUSUR», May 22-24, 2019, – Tomsk, Russia – Kharinov M., Khanykov I.

International Conference Cyber-Physical Systems and Control (CPS & C'2019), June 10-12, 2019, St. Petersburg, Russia – Levonevskiy D., Duboyskii I., Drugov P.

18th IEEE International Conference on Smart Technologies IEEE (EUROCON-2019), July 1-4, 2019, Novi Sad, Serbia – Cherskikh E.

4th International Conference on Interactive Collaborative Robotics (ICR 2019), August 20-25, 2019, Istanbul, Turkey – Cherskikh E., Lebedev I., Dudarenko D.

21st International Conference on Speech and Computer (SPECOM-2019), August 20-25, 2019, Istanbul, Turkey – Levonevskiy D.

International Russian Automation Conference (RusAutoCon), September 8-14, 2019, Sochi, Russia – Kharinov M., Khanykov I., Bykov A.

XXVII International scientific conference «Modern technologies in problems of control, automation and information processing», September 14-20, 2019, Alushta, Republic of Crimea, Russia – Khanykov I.

7th NEICON International Conference «Electronic Resources for Research and Education: Development, Promotion and Use», September 22-29, 2019, Rethymno, Crete, Greece – Levonevskiy D.

19th Conference «IFAC Conference on Technology, Culture and International Stability» (TECIS-2019), September 26-28, 2019, Sozopol, Bulgaria – Dudarenko D., Rubtsova Yu.

1st International Conference on Control Systems, Mathematical Modeling, Automation and Energy Efficiency SUMMA2019, November 20-22, 2019, Lipetsk, Russia – Cherskikh E., Shabanova A.

12th International Conference «IEEE Developments in e-Systems Engineering» (DeSE2019), October 7-10, 2019, Kazan, Russia – Uzdiaev M.

XV International Conference on Finsler Extensions of Relativity Theory-2019 (FERT-2019), October 24-27, 2019, Moscow, Russia – Kharinov M.

19th Conference «Mathematical Methods of Pattern Recognition» (MMPR-2019), November 26-29, 2019, Moscow, Russia – Khanykov I., Kharinov M.

4th International Scientific and Practical Conference "Technological perspective within the framework of the Eurasian space: new markets and points of economic growth", December 13-15, 2019, St. Petersburg, Russia – Levonevskiy D.

The Annual International conference on Polynomial Computer Algebra (PCA'2019), December 15-20 2019, St. Petersburg, Russia – Kharinov M.

Recent results

1. A non-blocking routing approach is developed for information exchange control in data transmission network of a cyber-physical system of a critical facility (CF), based on operative assessment of channel resource to maintain data flows, generated by technical vision subsystem units in CF's cyber-physical systems. A new mathematical model of a mass service system (MSS) is proposed, providing for solution of optimization tasks, related to definition of most promising access strategies (schemas) and managed parameter values by data transmission network modeling in remote control system of governmental distributed CFs, accounting for prioritization of incoming request streams, as well for load source number and gradient provisioning of channel resources.

2. Topological model of audio-recording subsystem is proposed, which is implemented in constrained physical environments (rooms), based on which user speech activity within socio-cyberphysical system is developed, optimizing the quality of perceived audio-signals, when the user moves around the room, bearing on microphone location coordinates [27].

3. An algorithm for improvement of noise immunity of speech pitch signal is developed together with jitter determination approach, based on averaging of pitch period change related to the current value, as well an algorithm for separation of periodic and random pitch jitter components using discrete Fourier transform over pitch period sequence, featuring unknown values in unvoiced speech frames [8].

4. A rapid pixel clustering approach using Ward method-like piecewise constant approximations is developed, featuring three-part sequential color image processing workflow, allowing to decrease image approximation error. The three steps of this workflow are as follows: superpixel establishment,

superpixel refinement and subsequent hierarchy composition using the original Ward method [6, 15,16, 19, 24]. Additionally, a system approach to new image segmentation algorithm design is proposed, accounting for the number of segmentations at algorithm output [3, 17].

5. A least-error approximation model of hierarchical approximation sequence for object detection automation is proposed, in terms of which precise definition of superpixels (unit pixel sets) is given, composing image and objects, explains and helps overcoming complications, related to a priori unknown image analysis via modernization of classic cluster analysis methods: Ward method, k-means, split/merge methods, etc. [2,10,12,14,20,28,32]. For generalization of color image transforms, as well physics-related applications an explicit solution is obtained for eigenvectors for rotation composition and Lorentz boost and a solution condition is formulated, particularly, an eigenvector quartet is established for a composition of Lorentz boosts [9,11,25,31].

6. An overall architecture of multimedia content distribution system in cyber-physical systems is proposed with detailed description of content distribution process participants; their typical actions are outlined on use case diagrams; also, an object-oriented model is developed, describing types and properties of program entities, belonging to content distribution system [4].

7. A neural network model is developed for user behavior analysis in video stream, allowing to detect violent human behavior, based only on RGB frame analysis, without extracting information about optical flow on these frames. The developed model is based on application of three-dimensional convolutional neural networks (3D CNN) and transfer learning approach for training period shortening, retaining recognition outcomes [29].

8. A system architecture is proposed, ensuring optimal neural network configuration establishment for the developed methodology of artificial data sample generation, based on GAN approach (Generative adversarial network), which allows creating datasets, particularly suitable for user face synthetic image generation under different head rotation angles and lighting conditions [11, 34].

References

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Reinforcement Learning on Lidar Data // Proceedings of 14th International Conference on Electromechanics and Robotics “Zavalishin's Readings”. Springer, Singapore. 2020. pp. 537–547. DOI: 10.1007/978-981-13-9267-2_44 (Scopus, SJR=0,16, Q3).
2. *Kharinov M.V., Bykov A.N.* Data Structure for Multimodal Signal Processing // 2019 International Russian Automation Conference RusAutoCon. 2019. pp. 6. DOI: 10.1109/RUSAUTOCON.2019.8867769. (WoS, Scopus).
3. *Khanykov I.G.* Technique for Acceleration of Classical Ward's Method for Clustering of Image Pixels // 2019 International Russian Automation Conference (RusAutoCon). 2019. pp. 6. DOI: 10.1109/RUSAUTOCON.2019.8867747. (WoS, Scopus).
4. *Levonevskiy D., Saveliev A., Duboiskii I., Drugov P.* Cloud system for distributing multimedia content in cyber-physical systems // International Conference Cyber-Physical Systems and Control. 2019. pp. 266–274. (Scopus).
5. *Dudarenko D., Rubtsova Yu., Kovalev A., Sivchenko O.* Reinforcement Learning Approach for Navigation of Ground Robotic Platform inStatically and Dynamically Generated Environments // IFAC-PapersOnLine. 2019. vol. 52. no. 25. pp. 445–450. (Scopus).
6. *Khanykov I., Tolstoy I. M., Levonevskiy D.* The classification of the image segmentation algorithms // International Journal of Intelligent Unmanned Systems. 2019. (Scopus, SJR = 0.27, Q3).
7. *Shabanova A., Tolstoy I., Lebedev I.* Method for Overhead Power Line Monitoring Using Unmanned Aerial Vehicles // Problemele energeticii regionale. 2019. vol. 3. no. 44. pp. 17–30. (WoS). (In Russ.). (Impact factor – 0,101).
8. *Pakulova E., Vatamaniuk I., Budkov V., Iakovlev R., Nosov M.* Assessment of the user current state of the Socio-Cyber-Physical System based on the analysis of the jitter of the speech pitch period // TELFOR Journal. 2019. vol. 2. (Scopus, SJR = 0,13, Q3).
9. *Kharinov M.V.* The Quartet of Eigenvectors for Quaternionic Lorentz Transformations // Advances in Applied Clifford Algebras. 2019. (Scopus, SJR = 0,4, Q3).
10. *Kharinov M.V., Buslavsky A.N.* Object Detection in Color Image // Proceedings of the 14th International Conference on Pattern

Recognition and Information Processing. 2019. pp. 43–47. (Scopus).

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13. *Mikhalchenko D., Ivin A., Sivchenko O., Aksamentov E.* Application of deep neural networks for obtaining a depth map from a two-dimensional image // Proceedings of Southwest State University, 2019. vol. 23. no. 3. pp. 113–134. (In Russ.). (Impact factor – 0,370).
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16. *Miroshnikova E., Levonevskiy D., Motienko A.* Import/export and data analytics modules in the electronic edition of the journal SPIIRAS Proceedings for automated interaction with global indices and aggregators // Problems of Artificial Intelligence. 2019. (In Russ.).
17. *Levonevskiy D., Miroshnikova E., Motienko A., Ronzhin A.* Integration of software modules for interacting with external systems, export, import and data analytics into the OJS 3 platform using the example of the journal SPIIRAS // 7th NEICON International Conference “Electronic Scientific and Educational Resources: Creation, Promotion and Use”. 2019. (In Russ.).
18. *Khanykov I.* Application of the model of high-speed clustering of pixels in the tasks of preprocessing images of remote sensing of the Earth // Proceedings of Southwest State University. 2019 (In Russ.). (Impact factor – 0,370). (In Russ.).

19. *Kharinov M.* The Eigenvector Quartet for the Composition of Lorentz Boosts in the Quaternionic Space // 15-th Int. Conf. on Finsler Extensions of Relativity Theory-2019 (FERT-2019). 2019. pp. 195–200. DOI: 10.13140/RG.2.2.11847.04001. (In Russ.).
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23. *Uzdiaev M.* Violent action recognition using 3D CNN neural network architectures // Izvestiya Tula State University (Izvestiya TulGU). Technical sciences. vol. 12. 2019. (In Russ.). (Impact factor – 0,226).
24. *Levonevskiy D.* Possibilities and problems of aggressive user behavior recognition in the WEB // 4-я International Scientific and Practical Conference "Technological perspective within the framework of the Eurasian space: new markets and points of economic growth". 2019. pp. 177–180. (In Russ.).
25. *Velichko A., Budkov V.* Development of a prototype system for the automatic determination of false and true information in speech // Analysis of spoken Russian speech (AR3-2019): Proceedings of the eighth interdisciplinary seminar. - SPb.: Polytechnicprint. pp. 17–20. (In Russ.).
26. *Khanykov I.* The program of multi-level threshold segmentation of grayscale images using the Arifin method // Modern technologies in the problems of control, automation and information processing: Sat. tr XXVIII Int. scientific and technical conf. 2019. pp. 150. (In Russ.).
27. *Buslavsky A., Kharinov M.* Computer pre-processing of audio signals and images // Collection of selected articles of the scientific session of TUSUR. Tomsk: V-Spectrum. 2019. vol. 2. pp. 44–47. (In Russ.).

28. *Khanykov I.* A model of high-speed clustering of pixels based on the Ward method for highlighting traffic signs and pedestrians in a video stream // Collection of selected articles of the TUSUR scientific session. Tomsk: V-Spectrum. 2019. vol. 2. pp. 60–62. (In Russ.).
29. *Khanykov I.* Application of the model of high-speed clustering of pixels based on the Ward method in the problems of highlighting road signs and pedestrians in a video stream // Collection of selected articles of the TUSUR scientific session. Tomsk: V-Spectrum. 2019. vol. 2. pp. 63–65. (In Russ.).
30. *Khanykov I.* Development of a generalized classification scheme for image segmentation algorithms // 19th Conference «Mathematical Methods of Pattern Recognition» (MMPR-2019). pp. 182–183.
31. *Kharinov M.* Sketch on quaternionic Lorentz transformations // International Conference on Polynomial Computer Algebra (PCA'2019). pp. 71–74. (In Russ.).
32. *Kharinov M.* Minimization of the approximation error of a structured image by piecewise-constant approximations // Mathematical Methods of Pattern Recognition (MMPR-2019) / Abstracts of the 19th All-Russian Conference with International Participation, Moscow: Russian Academy of Sciences. pp. 159–164. (In Russ.).

Department of Robotic and Embedded Systems Prototyping

Head of department: Cand. Sci. (Tech.) Vladimir P. Dashevsky – concepts and prototypes of embedded computers for autonomous robotic systems based on SMARC system modules, vladimir.dashevsky@gmail.com.

Department staff: 4 members.

Research areas: embedded computers and their applications. System-on-modules. Digital signal processing. Real-time systems. Embedded system applications. Software as a service (SaaS).

Research fellows and brief information of the research-work direction

Senior programmer – Alexander V. Myskin – Developing software for distributed computer systems with dynamic architecture, mys@iias.spb.su.

Senior programmer – Vasiliy G. Rzhimsky – Developing software for distributed computer systems with dynamic architecture. rzhimskiy.vasiliy@gmail.com.

Senior engineer – Maxim M. Bizin – application of embedded systems for smart control of complex objects, bizin@iias.spb.su.

Grants and projects

Dashevsky V. – "Poseidon MFAT" Contract No. 5 / SP-R / 2015 with LLC Ravelin Ltd., 2018 - 2019.

Dashevsky V. – License agreement No. 1-LD / SP-R / 19 with Ravelin Ltd. to use the software “Service for integrating Gate controllers into the VideoNet access control system”.

Participation in conferences and exhibitions

XXI International scientific conferences “Complex Systems: Control and Modeling Problems” (CSCMP-2019) – September 3-6, 2019 Samara, Russia – Dashevsky V.

Membership in Russian and international organizations, editorial boards etc

Dashevsky V. – board member of TB141, representative of SPIIRAS in standardization of Robotics branch. In 2019 review comment forms concerning first versions of 16 new standards have been submitted; voting procedures have been fulfilled concerning amended and final revisions of 18

standards, developed earlier. 3 papers have been reviewed for International Journal of Embedded and Real-Time Communication Systems.

Recent Results

1. Some features of software suite for door phone switch IAC-PMUX are upgraded, based on previously developed SMARC unit: a subsystem for network event logging (syslog) has been added, a real-time synchronization service (ntp), subscriber line diagnostic tools, special API implemented for automated remote control.

2. The characteristics of the software "Gate Controller Integration Service into the VideoNet Access Control System" software have been improved by expanding support for VIZIT doorphone control units and Gate-parking controllers, under license agreement No. 1-LD / SP-R / 19 between SPIIRAS and Ravelin Ltd LLC. Transferred to commercial operation.

3. An IAC-SIP hardware platform based on the SMARC module for operating as a SIP intercom server has been developed, which allows equipping complex multi-apartment house complexes in conjunction with IAC PMUX intercom handset switches, in which the server is equipped with a real-time clock, on its basis the entire network of switches can work in a single time using the NTP protocol.

References

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

1. Dashevsky V. Comparative analysis of modern standards of single-board computers // Industrial ACS and controllers. 2019. vol 1. pp. 3–14. (In Russ.). (Impact factor – 0,239).
2. Bogomolov A., Alyokhin M., Dashevsky V. Information technology for monitoring professionally determined health risks // In the collection: Problems of management and modeling in complex systems Proceedings of the XXI International Conference. 2019. pp. 211–216. (In Russ.).
3. Dashevsky V., Budkov V. Delay Spectroscopy in Real-Time Systems // Electrical and information systems and systems (USPTU). 2019. vol. 15. no. 3. pp. 92–100. DOI: 10.17122/1999-5458-2019-15-3-92-100. (In Russ.). (Impact factor – 0,389).

Laboratory of Information Technologies in System Analysis and Modeling

Head of Laboratory: Professor, Dr. Sci. (Tech.), honored scientist, Laureate of the Russian Government in the field of science and technology, Boris V. Sokolov – fundamental and applied investigations in system modeling and in the theory of optimal control, development of mathematical models and methods for multi-objective decision making in complex technical-organizational systems under conditions of uncertainty, sokolv_boris@inbox.ru.

Laboratory Staff – 28 members and 8 post-graduate students.

Research activities – development, research and implementation of methodological, methodical and technological bases of automation and intellectualization of processes of integrated modeling and simulation, proactive monitoring, control for complex objects at different stages of their life cycle.

Research fellows and brief information of the research-work direction

Leading Researcher, Professor, Dr. Sci. (Tech.), Honored scientist – Yury I. Ryzhikov – numerical approximation, queuing theory and simulation, inventory theory, educator of scientists, ryzhbox@yandex.ru.

Leading Researcher, Professor, Dr. Sci. (Tech.) – Vladimir V. Mihailov – Modeling of populational, ecological, and ecological-economical systems, modeling of bioclimatic fields for ranges of populations, mwwcari@gmail.com.

Leading Researcher, Professor, Dr. Sci. (Tech.) – Vyacheslav A. Zelentsov – decision support systems; methods, technologies and systems of integrated processing of aerospace information in monitoring and control systems servicing organizational-technical complexes, the theory of hierarchical systems, reliability and maintenance of complex systems, v.a.zelentsov@gmail.com.

Leading Researcher, Professor, Dr. Sci. (Tech.) – Mikhail Yu. Okhtilev – fundamental approaches to structure-functional synthesis of intellectual information technologies and real-time monitoring systems as applied to complex technical objects in dynamic environment, oxt@email.ru.

Leading researcher, Professor, Dr. Sci. (Tech.) – Mikoni Stanislav V. – system analysis, intelligent technologies, decision-making theory, smikoni@mail.ru.

Senior Researcher, Associate professor, Dr. Sci. (Tech.) – Alexander N. Pavlov – system analysis and decision making in conditions of significant uncertainty, the theory of controlling the structural dynamics of complex organizational and technical complexes, pavlov62@list.ru.

Leading Researcher, Professor, Dr. Sci. (Econom.) – Dmitry N. Verzilin – modeling socio-economic systems and processes, modusponens@mail.ru.

Leading Researcher, Professor, Dr. Sci. (Tech.) – Vyacheslav I. Mironov – fundamental and applied investigations in system modeling, in the theory of optimal observation and dynamic-processes control, in calculus mathematics, in space-flight ballistics, and in statistical analysis as applied to characteristics of complex technical systems, mironuv@yandex.ru.

Leading Researcher, Professor, Dr. Sci. (Tech.) – Alexander A. Musaev – forecasting and control in non-stationary and chaotic environments, cognitive decision support systems, amusaev@technolog.edu.ru.

Leading Researcher, Associate professor, Dr. Sci. (Tech.) – Vadim V. Burakov – methodology of software quality evaluation, refactoring of software, v.v.burakov@gmail.com.

Leading Researcher, Professor, Dr. Sci. (Tech.), Honored scientist – Alexander P. Kovalev – system analysis and modeling of complex space-rocket systems at different stages of their life cycle.

Senior Researcher, Ph.D. – Semen A. Potriasaev – applied research in the field of mathematical modeling; mathematical models and methods of support and decision-making in complex organizational and technical systems, taking into account factors of uncertainty and multi-criteria; qualimetry of models; foggy computing on the industrial internet of things, semp@mail.ru.

Junior Researcher, Cand. Sci. (Tech.) – Alexander Y. Kulakov– management of the structural dynamics of technical systems, control algorithms for the functioning of spacecraft. russ69@yandex.ru

Senior Researcher, Cand. Sci. (Tech.) — Alexander V. Spesivtsev — artificial intelligence, models and methods for making multi-criteria decisions in conditions of uncertainty, based on knowledge, sav250@gmail.com.

Senior Researcher, Cand. Sci. (Tech.) – Oleg V. Karsaev – multi-agent systems, planning, simulation, decision support systems, distributed systems, routing, DTN networks, satellite constellation, karsaev@ips-logistic.com.

Junior Researcher – Ilia Y. Pimanov – geographic information systems, web-cartography, remote sensing of the Earth from space, pimen@list.ru.

Senior Researcher, Cand. Sci. (Tech.) – Inna V. Trofimova – Research and development of models and methods for real-time correction of plans defining the use of information systems, isolovyeva@mail.ru

Junior Researcher – Maria R. Ponomarenro – Earth remote sensing from space, space-based radar sounding, synthetic aperture radars, pnmry@yandex.ru.

Junior Researcher – Valerii V. Zakharov – development of logical-dynamic models and algorithms for solving network planning problems in complex organizational and technical systems, valeriov@yandex.ru.

Junior Researcher – Aleksandr E. Semenov – pedestrian navigation, analysis and visualization of spatial data, development of mobile web applications, geoinformation services, visualization and analysis of data, processing of Earth remote sensing data, sasfeat@mail.ru.

Postgraduate students

Krylov A.V. The topic of the thesis is “Models and algorithms for the representation and processing of knowledge in the proactive management of complex organizational and technical objects” (research advisor – Sokolov B.V.).

Ohtilev P.A. The topic of the thesis is “Models and algorithms for monitoring the structural states of complex organizational and technical objects in conditions of uncertainty” (research advisor – Sokolov B.V.).

Gnidenko A.S. The topic of the thesis is “Models, algorithms and software for proactive control of complex technical objects with a tunable structure” (research advisor – Sokolov B.V.).

Zakharov V.V. The topic of the thesis is “Logic-dynamic models and algorithms for solving problems of network planning in zotz” (research advisor – Sokolov B.V.).

Sobolevsky V.A. The topic of the thesis is “Methods and technologies of automated development of neural networks” (research advisor – Sokolov B.V.).

Ushakov V.A. The topic of the thesis is “Methods and algorithms of operational multi-criteria evaluation and analysis of quality indicators of automated control systems for moving objects based on the construction of domains of attainability” (research advisor – Sokolov B.V.).

Rostova E.N. The topic of the thesis is “Synthesis of algorithms and analysis of dynamic processes in biotechnical remote control systems for manipulating robots” (research advisor – Zelencov V.A.).

Semenov A.E. The thesis of the thesis is “software tools for integrated processing of spatial data in the tasks of managing the development of territories” (research advisor – Sokolov B.V.).

Kuzmin D.V. “Development and research of algorithms for controlling the movement of an adaptive system in an anisatropic environment” (research advisor – Mikhailov V.V.).

Grants and Projects

Yusupov R.M – RFBR Project #16-29-09482-ofi_m “Prediction of the network-based terrorist threats appearance and elaboration of countermeasures in metropolises” (Executors: Sokolov B.V., Pavlov A.N.).

Burakov V.V. – RFBR Project #17-08-00797 “Research and development of methodological basis and technology of integrated modelling and simulation of complex technical objects proactive control system”.

Verzilin D.N. – RFBR Project #17-06-00108 “Research and development of scientific and methodological basis of multi-criteria evaluation and forecasting of socio-economic indicators of the ecological and economic objects in the Baltic Sea coastal zone”.

Mikoni S.V. – RFBR Project #17-01-00139 “Development of a methodology of structuring and analyzing the properties of complex technical systems”.

Sokolov B.V. – RFBR Project #17-29-07073-ofi_m_ “Theoretical and technological foundations of the formation and decentralized planning of the intellectual robots coalition behavior based on socio-inspired self-organization and smart contracts”. (Together with the laboratory Smirnov A.V.)

Sokolov B.V. – RSF Project №#17-11-01254 “Methodology and service-oriented technology for the development and implementation of the system for integrated automated modeling of natural and natural-technological objects and its application for the operational forecasting of river floods”. (2017-2019).

Sokolov B.V. – RFBR Project #18-07-01272 “Development of theoretical and technological foundations of intelligent decision support in the area of integrated urban arterial transportation planning in metropolitan areas taking into account preferences of passengers of various social groups” (2018-2020).

Okhtilev M.Y. RFBR Project #18-08-01505 “Development and research of methods and algorithms of pro-active control of maintenance of onboard systems of complex dynamic objects at emergency situations”, (2018-2020).

Karsaev O.V. RFBR Project #18-01-00840 “Development of a multi-agent model of team work of a group of small spacecraft in an autonomous mission” (2018-2020).

Yusupov R.M. — RFBR Project #19-08-00989 “Development and research of the scientific foundations of the theory of multicriteria assessment, analysis and quality management of models and polymodel complexes that describe complex technical objects” (Executors: Sokolov B.V., Pavlov A.N.).

Sokolov B.V. — RFBR Project #19-37-90112-Aspiranty “Development of methods, technology and software for automated generation and training of artificial neural networks based on service-oriented architecture” (Post graduate student Sobolevsky V.A.).

Sokolov B.V. — RFBR Project #19-38-90221-Aspiranty “Development and research of methods and algorithms of operational multi-criteria evaluation and analysis of quality indicators of automated control systems for moving objects based on the construction of attainable sets in the space of system-technical parameters” (Post graduate student Ushakov V.A.).

Sokolov B.V. — State research 0073-2019-0004 “Methodology and technologies of integration of existing and prospective state and commercial information-management and telecommunication systems and networks at various stages of their life cycle”.

SokolovB.V. — “Development and research of intellectual information technologies of monitoring, multi-profile forecasting and the guaranteed anticipatory safety management of critical infrastructures in emergency situations with use of land and aerospace systems of the Russian Federation”. he project is carried out with financial support of the Ministry of Education and Science of the Russian Federation, a state task № 2.3135.2017/K. (2017-2019) (Together with Volga State University of Technology.)

Sokolov B.V. — International project “Technology-US” – “Development of methodological issues and software for ground and onboard functional modules aimed at restoration of satellite up state in emergency and critical onboard situations”. Project customer: Space Systems Research and Development Institute (NII KS), Khrunichev State Research and Production Space Center.

Zelentsov V.A. – A component of the DW “Development of software for modeling, calculation and analysis of reliability indicators of spacecraft and its components”, customer - “Arsenal Design Bureau named after M.V. Frunze”, 2018-2020.

Zelentsov V.A. – The project “Implementation of work on the development of the spatial data fund of the Leningrad region”, the customer is JSC “Russian Research Center for Leningrad Region”, 2018-2019.

Sokolov B.V. “ERASMUS Mundus” - Innovative strategies for training engineers using simulation and open learning platforms (“Inmotion”). The international project is being implemented with the financial support of the European program ERASMUS Mundus, 2018-2019.

Zelentsov V.A. — Project KS1309 "InnoForestView" of the South-East Finland – Russia CBC 2014-2020 programme Innovative information technologies for analysis of negative impact on the cross-border region forests

Sobolevsky V.A. — Grant of the Committee on Science and Higher School of the Government of St. Petersburg for young scientists "Methodology, software and intellectual informational technologies for forecasting river floods during the spring ice drift in the North-West region."

University Courses

Higher School of Economics, Chair of logistics. Disciplines: Strategic planning for the development of logistics infrastructure – Sokolov B.V.

SUAI, Chair of computer mathematics and programming. Disciplines: Systems Analysis, Mathematical Methods and models of operations research – Sokolov B.V.

ITMO University: Faculty of Technology Management and Entrepreneurship. Disciplines: "Information technology in management" – Verzilin D.N.

Mojaisky MCA, Chair of computer-aided control systems. Disciplines: Methods and technologies of control decision making; Systems analysis and organization of computer-aided control systems. Inter-branch Institute for education and information. Disciplines : Basics of System approach and systems analysis; Processes control – Pavlov A.N.

Mojaisky MCA, Chair for aircraft autonomic control systems. Disciplines : Spacecrafts control systems – Mironov V.I.

Saint Petersburg State University, faculty of Applied Mathematics and Control Processes. Elective course Mathematical modeling of social and economic processes – Trofimova I.V.

St. Petersburg State Institute of Technology, Chair of System Analysis. Disciplines: "Theory of probabilities and mathematical statistics", "Methodology of dissertation research" (for postgraduate students) – Musaev A.A.

Scientific and organizational activities

Chairman of the Program Committee of the Ninth All-Russian Scientific and Practical Conference on Simulation and its Application in Science and Industry "Simulation. Theory and Practice "(IMMOD-2019) – Sokolov B.V.

Member of the program and organizational committees of the Fifth International Scientific and Practical Conference "Simulation and Integrated Modeling of Marine Engineering and Marine Transport Systems" (SIM MEMTS 2019) – Sokolov B.V.

International Collaboration

Cooperation with the Institute of Informatics Problems of the National Academy of Sciences of Belarus: the exchange of trainees, requirements specification for the joint international program "Monitoring-SG."

Collaboration with Global Chage Research Institute CAS, Brno, Czech Republic. Collaboration with Tomas Bata University, Zlin, Czech Republic. Collaboration with partner organizations of the InMotion project (ERASMUS + program).

Collaboration with partner organizations of the InMotion project (ERASMUS + program).

Collaboration with the project partner InnoForestView: Luke - Institute of Natural Resources of Finland.

Collaboration with partner organizations of the BalticSatApps project: University of Turku (Turku, Finland), Finnish Meteorological Institute (Helsinki, Finland), Turku Science Park (Turku, Finland), Tartu Technopark Union (Tartu, Estonia) , Technology Transfer Center of Krakow University of Technology (Krakow, Poland), Tartu Observatory (Tartu, Estonia), Institute of Geodesy and Cartography (Warsaw, Poland), Krakow Technopark (Krakow, Poland), State Administration of Space Research (Solna, Sweden).

Collaboration with Lappeenranta Technological University - organization of training courses for students, postgraduated students and lecturers of the State University of Aviation Instrumentation.

Participation in the CARMA International Project (Circum Arctic Rangifer Monitoring and Assessment).

Collaboration with the Center for Arctic Studies at the University of Northern Iowa within the framework of an agreement on scientific cooperation and the NSF grant “Taimyr Reindeer Migration Realaysis.

Collaboration with the Technical University of Dresden (Technische Universität Dresden) in the framework of joint research on the topic "Mathematical modeling and scientific and technological development of processes for the continuous production of biodiesel in microreactors" commissioned by the Ministry of Education and Science of the Russian Federation, reg. No. AAAA-A7-1170405 10276-6.

Participation in conferences and exhibitions

All-Russian scientific-practical conference "Modern problems of hydrometeorology and sustainable development of the Russian Federation", March 14-15, 2019, St. Petersburg, Russia — Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Ponomarenko M.R.

IX scientific and technical conference of students, graduate students and young scientists "Science Week", St. Petersburg State Institute of Technology, April 1-3, 2019, St. Petersburg, Russia – Musaev A.A.

14th All-Russian Scientific-Industrial Conference "Perspective Systems and Management Tasks", April 1-5, 2019, Kabardino-Balkarian Republic, Nalchik, Elbrus region. – Karsaev O.V.

8th Computer Science On-line Conference (CSOC 2019), April 24-27, 2019, Zlin, Czech Republic — Potryasaev S.A., Sokolov B.V., Pavlov A.N., Kulakov A.Yu., Zelentsov V.A., Mochalov V.F., Ushakov V.A.

XXII International Scientific and Practical Conference "Scientific Trends: Issues of Exact and Technical Sciences", May 12, 2019, St. Petersburg, Russia – Musaev A.A.

XXIV International Scientific and Practical Conference "Scientific Dialogue: A Young Scientist", May 22, 2019, St. Petersburg, Russia – Musaev A.A.

XXII International Scientific and Practical Conference "Scientific Dialogue: Economics and Management", June 8, 2019, St. Petersburg, Russia – Musaev A.A.

XXIII International Scientific and Practical Conference "System Analysis in Design and Management" (SAEC-2019), June 10-11, 2019, St. Petersburg. – Sokolov B.V., Mikoni S.V., Versilin D.N.

33rd International ECMS Conference on Modelling and Simulation ECMS 2019, June 11-14, 2019, Caserta, Italy — Zakharov V.V., Rostova E.N.

XIII All-Russian Meeting on Management Problems of VSPU-2019., IPU RAS, June 17-20, 2019, Moscow, Russia – Sokolov B.V., Zakharov V.V., Ushakov V.A.

The 4th International Conference Digital Transformation & Global Society (DTGS 2019), June 19-21, 2019, St. Petersburg, Russia – Verzilin D.N.

International Joint Conference "Internet and Modern Society" (Internet and Modern Society – IMS-2019). June 19-22, 2019, St. Petersburg, Russia – Mikoni S.V.

8th International Conference of young scientists in the field of computer technology - International Young Scientists Conference in Computational Science, June 24-28, 2019, Heraklion, Greece — Semenov A.E.

Round table "Modern problems of the creation and development of unified platforms for spacecraft for various purposes" in the framework of the International military-technical forum "Army 2019", June 25-30, 2019, Moscow region, pos. Kubinka - Karsaev O.V.

The Fifth International Scientific and Practical Conference " Simulation and Integrated Modeling of Marine Engineering and Marine Transport Systems" (SIM MEMTS-2019), July 10, 2019, St. Petersburg, Russia – Sokolov B.V., Pavlov A.N., Zakharov V.V.

9th IFAC MIM 2019 at Berlin School of Economics and Law on August 28-30, 2019, Berlin, Germany — Sokolov B.V., Pavlov A.N., Verzilin D.N., Zakharov V.V., Rostova E.N.

Problems of control and modeling in complex systems (PCMCS-2019), September 3-6, 2019, Samara, Russia – Mikhailov V.V.

GeoInformation for Disaster Conference (Gi4DM 2019), Prague, Czech Republic, September 3-6, 2019 – Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Ponomarenko M.R.

All-Russian Scientific Conference with International Participation "Scientific Problems of Russian River Remediation and Ways to Solve It", September 8-14, 2019, Nizhny Novgorod, Russia – Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Ponomarenko M. R.

Computational Statistics and Mathematical Modeling Methods in Intelligent Systems (CoMeSySo 2019) – Online Conference, September 10-12, 2019, Zlin, Czech Republic – Potryasaev S.A.

XII Multiconference on Control Problems (MCP-2019), September 23-28, 2019, Divnomorskoe, Russia – Sokolov B.V., Karsaev O.V.,Zelentsov V.A., Kulakov A.Yu, Pimanov I.Yu., Zakharov V.V., Semenov A.E.

V Interregional Scientific and Practical Conference “Perspective Directions for the Development of Domestic Information Technologies” (PNROIT-2019), September 24-28, 2019, Sevastopol, Russia – Sokolov B.V., Mikoni S.V., Zakharov V.V.

11th International Symposium on Digital Earth (ISDE 11), September 24-27, 2019, Florence, Italy — Zelentsov V.A.

The Sixth National Scientific Conference with International Participation “Mathematical Modeling in Ecology” (ECOMATMOD-2019) September 26-29, 2019, Pushchino, Russia Mikhailov V.V.

International Scientific and Practical Conference "Global Climate Change: Regional Effects, Models, Forecasts", October 3–5, 2019, Voronezhб, Russia – Mikhailov V.V., Ponomarenko M.R., Sobolevsky V.A.

3th International Symposium on Intelligent Distributed Computing IDC2019, October 7-10, 2019, St. Petersburg, Russia – Sokolov B.V., Pavlov A.N., Verzilin D.N., Zakharov V.V., Mikhailov V.V., Spesivtsev A.V.

2nd Euro-Mediterranean Conference for Environmental Integration (EMCEI) 10-13 October, 2019, Sousse, Tunisia — Mikhailov V.V., Ponomarenko M.R., Sobolevsky V.A.

The Ninth All-Russian Scientific and Practical Conference on Simulation and its Application in Science and Industry “Simulation. Theory

and Practice ” (IMMOD-2019), October 16-18, 2019, Ekaterinburg, Russia – Sokolov B.V., Mikoni S.V., Burakov V.V.

Interdepartmental workshop on the conservation of the Taimyr population of wild reindeer, October 17-18, 2019, Krasnoyarsk, Russia – Mikhailov V.V.

The 13th IEEE International conference on application of information and communication technologies (AICT2019), 23-25 October, 2019, Baku, Azerbaijan — Mikhailov V.V., Spesivtsev A.V., Sobolevsky V.A.

IV Interdepartmental Scientific and Technical Conference "Problems of Development and Improvement of Automated Control Systems for Special Purpose", October 30, 2019, St. Petersburg, Russia – Sokolov B.V., Okhtilev M.Yu.

56th Moscow International Conference “Digital Transformation of Transport Logistics at Airports: Effective Solutions and Practices” October 30-31, 2019, Moscow, Russia – Zakharov V.V.

V All-Russian Student Forum "Engineering personnel - the future of the innovative economy of Russia", November 5-8, 2019, St. Petersburg – Sokolov B.V., Zakharov V.V., Pimanov I.Yu.

5th International Inter-University Scientific and Practical Conference "Technological Perspective in the Eurasian Space: New Markets and Points of Economic Growth" November 07-08, 2019, St. Petersburg, Russia – Mikoni S.V., Zakharov V.V.

IV conference “Behavior and behavioral ecology of mammals. November 11-15, 2019, Chernogolovka, Russia – Mikhailov V.V.

Participation in the conference of the XVII All-Russian Open Conference "Modern Problems of Remote Sensing of the Earth from Space", November 11-15, 2019, Moscow, IKI RAS. – Mochalov V.F., Zelentsov V.A., Grigoryeva O.V., Potryasaev S.A., Verzilin D.N.

4th International Scientific Conference "Intelligent Information Technologies in Engineering and Production", December 2-7, 2019, Ostrava-Prague, Czech Republic – Mikoni S.V., Zakharov V.V.

Membership in Domestic and International societies, editorial boards, etc.

Sokolov B.V. – Chairman of the program committee of the conference “Simulation. Theory and Practice”, member of the organizational and program committees of the scientific school“ Modeling and analysis of safety and risk in complex systems”, conferences“ Cybernetics and High

Technologies of the 21st Century", "Regional Informatics","Information Security of Russian Regions","Perspective Development Trends" domestic information technologies, "Information technologies in management", IFAC MIM, DR-LOG, member of the editorial board of the journals "Izvestiya VUZov. Instrument-making","Information Technologies","Informatization and Communication", "Reliability","Questions of Radio Electronics", a member of the Cosmonautics Federation of the Russian Federation, a full member of the International Academy of Navigation and Motion Control, a member of the Association "North-West", chairman of the section"Cybernetics" named after Academician A. Berg at the House of Scientists named after M. Gorky of the Russian Academy of Sciences, member of the scientific and technical committee for the implementation of the project for the creation of the International Aerospace Global Monitoring System (MAKSM), member of the scientific and dissertation councils of SPIIRAS, Military - kosmicheskoy im.A.F.Mozhayskogo Academy, Library Science; expert of the Russian Academy of Sciences, expert of the RFBR, member of the Scientific Council for Informatization of St. Petersburg, member of the Presidium of the National Society of Simulation Modeling.

Zelentsov V.A. – Member of the Program Committee of the 8th Computer Science On-line Conference 2019.

Ohtilev M.Yu. – The member of editors of the journal "Aerospace instrument-making"; The full member of the International Academy of navigation and motion control.

Mikoni S.V. – Member of the Russian Association of Artificial Intelligence.

Mironov V.I. – Academician of International Academy of Integrated Security.

Mikhailov V.V. – Member of the national society of simulation modeling, Member of the society "Russian scientists of socialist orientation (RUSO)". Chairman of SAC GUMRF, specialty 230400.65, 230400.62. Participant in NSF grant 1594934 "Taimyr Reindeer Migration Realaysis (TAMARA)" funded by the National Science Foundation (NSF). Participation in CARMA's "Circum Arctic Rangifer Monitoring and Assessment" Program Member of the WWF Wild Reindeer Working Group.

Musaev A.A. – Member of the American Mathematical Society (AMS), Member of the Institute of Electrical and Electronics Engineers (IEEE).

Semenov A.E. – Member of the Program Committee of the 8th Computer Science On-line Conference 2019.

Intellectual Property

Web application for information support of work management on the territory of KartoMetka. Certificate No. 20169664291. Registered in the registry of computer programs 05.11.2019 – Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Semenov A.E.

Web application for fixing the spatial position of address objects “Address Pro”. Certificate No. 2019664431. Registered in the registry of computer programs on 11/06/2019 – Zelentsov V.A, Potryasaev S.A, Pimanov I.Yu., Semenov A.E.

Web application for building walking routes "Tikhokhod". Certificate No. 2019664457. Registered in the registry of computer programs on 11/7/2019 – Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Semenov A.E.

Web application for viewing multi-temporal spatial data “Quartz Pro”. Certificate No. 2019664458. Registered in the registry of computer programs on 11/7/2019 – Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Semenov A.E.

Patent for the invention "Device for the destruction of potentially dangerous space objects." Patent No. 219.017.62A5, registration date May 29, 2019 – Penkov M.M., Aleksandrov M.A., Shaldaev S.E., Minakov E.P., Sokolov B.V.

Research results

1. Methodology and service-oriented technology for creating and using a complex of automated modeling and proactive forecasting of the state of natural and natural-technological objects. The methodology consists in the development of a fundamentally new scientific direction in interdisciplinary research - the qualimetry of models and polymodel complexes, which provides theoretical and technological justification for the comprehensive automation of the creation and use of intelligent monitoring systems and proactive (proactive) management of natural and natural-technological objects. The developed software package provides automatic monitoring and high-precision operational forecasting of floods based on the use of heterogeneous ground-based aerospace data for the river basin, as well as explicit and implicit expert data specified in a

linguistic-production form. (Sokolov B.V., Zelentsov V.A., Potryasaev S.A. Semenov A.E.) [10, 24].

2. A polymodel complex for proactive control of the movement, channels, resources, complexes and parameters of target, supporting and auxiliary operations, flows and structures of both individual small-sized spacecraft (SSS) and their groups has been developed. The novelty consists in a uniform description (using the same mathematical structures) of the tasks of complex modeling of proactive management processes of SSS and their groups, tasks of planning their actions, tasks of operational management and monitoring of their state, which allows to increase the efficiency of planning processes by 15-20% in comparison with traditional technologies for automating these processes (Kulakov A.Yu., Pavlov A.N., Sobolevsky V.A. Potryasaev S.A., Sokolov B.V., Zakharov V.V.) [7, 10, 11, 13].

3. The expansion of notations of the business process modeling language BPMN (Business Process Modeling Notation) was expanded, which allows for solving problems of configuration and reconfiguration of on-board equipment (OBE) in parallel with the problems of analysis and synthesis of interaction technologies of both individual SSS and their groups, as well as programs (plans) of proactive management of operations, flows, resources of robots and their coalitions. Using the modernized BPMN business process modeling language allowed us to increase the throughput of space-based systems for collecting and processing and transmitting space information by 20-30% compared to traditional approaches to solving these problems (Kulakov A.Yu., Potryasaev S.A., Sokolov B.V.) [1, 4–9, 12, 16, 19].

4. Software and mathematical support has been developed for the complex solution of the problems of representing, formalizing and using explicit and implicit expert knowledge to assess the state of complex objects (SCO) based on the further development of the fuzzy-possible approach proposed by L.Zade. New forms of representing fuzzy numbers have been developed, using the methods of symbolic mathematics and supplemented by arithmetic operations on them to preserve the initial level of fuzziness of the explicit and implicit knowledge of experts in the application of experimental design theory. A combined method has been developed for constructing models for assessing the state of the Arctic Ocean, combining the method of fuzzy-production description of expert knowledge and the method of theory of experimental design, which made it

possible to increase the efficiency and validity of managerial decisions by 15-20% compared to traditional approaches to solving these problems by involving explicit and implicit expert knowledge (Spesivtsev A.V.) [22, 31].

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82. *Yusupov R.M., Mikoni S.V., Sokolov B.V.* The methodology for assessing the quality of models and polymodel complexes // Materials of the 5th interregional scientific-practical conference "Prospective directions for the development of domestic information technologies." 2019. pp. 13–14. (In Russ.).
83. *Burakov VV, Mustafin N.G., Okhtilev M.Yu., Sokolov B.V.* Methodology and technology for solving the problems of proactive monitoring and management of complex technical objects // Materials of the 5th inter-regional scientific-practical conference "Perspective

directions of development of domestic information technologies". 2019. pp. 112–114. (In Russ.).
84. *Burakov VV, Mustafin N.G., Okhtilev M.Yu.* Tools and intellectual technologies of decision support systems in situational centers // Materials of the 5th interregional scientific-practical conference “Perspective directions of development of domestic information technologies”. 2019. pp. 114–116. (In Russ.).
85. *Zakharov V.V., Sokolov B.V., Kulakov A.Yu.* Methods and algorithms for planning the modernization of a corporate information system based on technologies of the industrial Internet of things // Materials of the V inter-regional scientific-practical conference “Perspective directions of development of domestic information technologies”. 2019. pp. 209–210. (In Russ.).
86. *Zakharov V.V., Kulakov F.M., Sokolov B.V.* Models and algorithms for the synthesis of technologies and control programs for robotic systems // Materials of the V interregional scientific-practical conference "Perspective directions of development of domestic information technologies". 2019. pp. 211–212. (In Russ.).
87. *Zelentsov V.A., Kovalev A.P., Potryasaev S.A., Pimanov I.Yu.* Hardware-software complex and intelligent technologies for operational forecasting of river floods // Materials of the V interregional scientific and practical conference “Perspective directions of development of domestic information technologies”. 2019. pp. 381–382. (In Russ.).
88. *Yusupov R.M., Sokolov B.V., Volkov V.F., Minakov E.P.* Development of the theory and applied methods for analyzing the effectiveness of information management systems providing processes for collecting and processing data and information, modeling and evaluating the effectiveness of the use of RCTs // Development of Russian rocket and space science and technology. 2019. Issue 6. pp. 483–498. (In Russ.).
89. *Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Ponomarenko M.R.* A system for monitoring and forecasting the hydrological situation on the Severnaya Dvina River based on the integrated use of a complex of models and ground-space data // Abstracts of the All-Russian Scientific and Practical Conference “Modern Problems of Hydrometeorology and Sustainable Development of the Russian Federation”. 2019. pp. 459–461. (In Russ.).

90. *Zelentsov V.A., Potryasaev S.A., Pimanov I.Yu., Ponomarenko M.R.* Experience in the development and testing of information technologies for the automation of integrated modeling of river floods // Scientific problems of Russian rivers recovery and ways to solve them. 2019. pp. 140–144. (In Russ.).
91. *Ryzhikov Yu.I.* Calculation and optimization of networks with queues // Fifth International Scientific and Practical Conference. “Simulation and integrated modeling of marine equipment and marine transport systems” (PCM MTMTS-2019). 2019. pp. 150–155. (In Russ.).
92. *Semenov A.E., Zhukov D.V., Mochalov V.F., Grigoryeva O.V.* Intelligent system for assessing the environmental situation of water areas of naval bases based on data processing from aerospace surveys // Fifth International Scientific and Practical Conference. “Simulation and integrated modeling of marine equipment and marine transport systems” (PCM MTMTS-2019). 2019. pp. 156–160. (In Russ.).
93. *Sokolov B.V., Okhtilev M.Yu., Potryasaev S.A., Yusupov R.M.* Methods and algorithms for adapting industrial production planning models // Fifth International Scientific and Practical Conference. “Simulation and integrated modeling of marine equipment and marine transport systems” (PCM MTMTS-2019). 2019. pp. 166–172. (In Russ.).
94. *Pavlov A.N., Zakharov V.V.* Model and algorithmic support for planning the modernization of shipbuilding // The Fifth International Scientific and Practical Conference "Simulation and Complex Modeling of Marine Equipment and Marine Transport Systems" (PCM MTMTS-2019). 2019. pp. 133–137. (In Russ.).
95. *Mikhailov V.V., Ponomarenko M.R., Sobolevsky V.A.* Modeling the influence of climatic factors on the dynamics of the above-ground phytomass of plant communities of the tundra // Materials of the international scientific-practical conference "Global climate change: regional effects, models, forecasts." 2019. vol. 2. pp. 106–109. (In Russ.).
96. *Mikhailov V.V.* About one approach to constructing the bioclimatic field of the range // Materials of the international scientific-practical conference "Global Climate Change: Regional Effects, Models, Forecasts". 2019. Issue 2. pp. 101–106. (In Russ.).
97. *Kolpashchikov L.A., Bondar M.G., Mikhailov V.V.* Features of the modern spatio-temporal structure of wild reindeer of the Taimyr

population // Materials of the 4th scientific conference “Behavior and Behavioral Ecology of Mammals”. 2019. pp. 34. (In Russ.).
98. *Verzilin D.N., Maksimova T.G.* Multi-criteria assessment, analysis and forecasting of socio-economic indicators of the state of ecological and economic objects // Ecological and economic foundations of sustainable development of territories. 2019. 27 p. (In Russ.).
99. *Yusupov R.M., Sokolov B.V., Volkov V.F., Minakov E.P.* Development of the theory and applied methods for analyzing the effectiveness of information management systems providing processes for collecting and processing data and information, modeling and evaluating the effectiveness of the use of RCTs // Development of Russian rocket and space science and technology. 2019. Issue 6. pp. 483–498. (In Russ.).

Laboratory of Information Technologies in Transport

Head of laboratory – Dr. Sci. (Tech.) Yury M. Iskanderov, automation and informatization of large complex dynamic systems, system analysis and integration of information resources, formalization of decision-making processes, knowledge engineering, intelligent transport systems, iskanderov_y_m@mail.ru

Laboratory staff: 6 members.

Research activities – integration of information resources of transport systems, global information transport systems, intelligent support for transport management processes, system analysis and structuring of information resources of transport systems, informatization and automation of transport systems of regions and urban agglomerations, information and computer security of transport systems, specialized information retrieval systems, informatization and automation of transport infrastructure, Information processing systems in transport systems, Intelligent data analysis, systems for collecting, receiving and presenting spatial data on the state and functioning of transport systems, including using geoinformation technologies.

Research fellows and brief information of the research-work direction

Leading Researcher, Dr. Sci. (Tech.), Prof. – Yan A. Ivakin – methods and models for the collection and presentation of spatial data on the state and functioning of transport systems, the intellectualization of geoinformation systems, the qualification of software and information systems, the automation of substantive humanitarian research, yan_a_ivakin@mail.ru

Senior Researcher, Cand. Sci. (Tech.), Assoc. Prof. – Michael B. Laskin – methods and models of information processing in transport systems, data mining, methods of strategic planning of the development of transport and logistics infrastructure, laskinmb@yahoo.com

Senior Researcher, Cand. Sci. (Tech.) – Sergey N. Potapychev – intellectual geoinformation systems, modern methods of visualization of complex spatial objects in three-dimensional form, modeling of transport-logistical processes with the use of geoinformation systems, s.potapychev@mail.ru

Research Fellow, Cand. Sci. (Tech.) – Alexander A. Ershov - automation of control of dynamic systems, methods for optimizing network

structures, modeling of transport and logistics processes using machine learning methods, ershets@mail.ru

Junior Research Fellow – Alexandra S. Svistunova - system analysis, intelligent decision support systems, knowledge engineering in transport systems, svistunova_alexandra@bk.ru

Grants and projects

Ivakin Ya. – RFBR project № 19-07-00006-A "Theoretical foundations of intellectual decision support in geochronological tracking of historical and geographical processes", 2019-2021.

Potapychev S. – RFBR project № 18-07-00437-A "Theoretical and technological bases of intellectual decision support in the dispatching of geospatial processes", 2018-2020.

Iskanderov Yu. – Development work under a contract with the company Transoil LLC “Development of an information system for optimizing technological processes”, January-December 2019.

University courses

National Research University "Higher School of Economics" (SPb): "Information support of logistics business processes in supply chains", "Innovative transport technologies in logistics", "Research seminar", – Iskanderov Yu.

National Research University "Higher School of Economics" (SPb): Scientific practical seminar "Strategic Planning of Logistics Infrastructure Development" –Laskin M.

St Petersburg University: “Economic Data Analysis Tools”, “Mathematical and statistical methods in the analysis of complexly organized data” –Laskin M.

State University of Aerospace Instrumentation (SPb): “Computer technologies in quality management”, “Computer technologies in innovative sphere”, “Information technology in quality management, information security” –Ivakin Ya.

Peter the Great St. Petersburg Polytechnic University: “Informatics and engineering and scientific graphics” –Svistunova A.

Scientific and organizational activity

Yu. Iskanderov – Member of the Program Committee, co-chair of the section "Information Technologies in Transport" of the International Conference "Regional Informatics (RI-2018)".

M. Laskin – Member of the Program Committee, Scientific Secretary of the section "Information Technologies in Transport" of the International Conference "Regional Informatics (RI-2018)".

Ya. Ivakin – Member of the Program Committee, chair of the section "GIS" of the International Conference "Regional Informatics (RI-2018)".

International cooperation

Cyprus University of Technology (Cyprus, Limassol) – agreement on scientific and technical cooperation and exchange of young researchers.

Participation in conferences and exhibitions

XVIII International Scientific and Practical Conference "Logistics: Modern Development Trends", April 4-5, 2019, St. Petersburg, Russia – Iskanderov Yu., Laskin M., Ershov A., Svistunova A.

IV International Scientific and Practical Conference "Transport Planning and Modeling", April 11-12, 2019, St. Petersburg, Russia – Iskanderov Yu., Svistunova A.

24th International Exhibition of Transport and Logistics Services, Warehousing Equipment and Technologies TransRussia, April 15-17, 2019, Moscow, Russia – Iskanderov Yu.

IX International Forum "Transport Security", May 30-31, 2019, St. Petersburg, Russia – Iskanderov Yu.

XXII International Scientific and Practical Conference "System Analysis in Design and Management" (SAEC-2019), June 10-11, 2019, Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia – Iskanderov Yu., Svistunova A.

International Conference “Cyberphysical Systems and Management” (CPS & C'2019), June 10-12, 2019, St. Petersburg, Russia – Iskanderov Yu., Svistunova A.

International scientific-practical conference "Modern problems of training specialists in the field of information technology and digitalization of water transport enterprises", September 5, 2019, St. Petersburg, Russia – Iskanderov Yu., Svistunova A.

V Interregional Scientific and Practical Conference “Perspective Directions for the Development of Domestic Information Technologies” (PDDDIT-2019), September 24-28, 2019, Sevastopol, Russia – Iskanderov Y., Ivakin Y., Potapychev S., Laskin M., Ershov A., Svistunova A.

13th International Symposium on Intelligent Distributed Computing (IDC-2019), October 7-10, 2019, St. Petersburg, Russia – Iskanderov Yu.

9th All-Russian Scientific and Practical Conference on Simulation and its Application in Science and Industry “Simulation. Theory and Practice ” (IMMOD-2019), October 16-18, 2019, Russia – Laskin M., Svistunova A.

Conference in memory of E.S. Ozerov, October 22, 2019, St. Petersburg, Russia – Laskin M.

XI St. Petersburg Interregional Conference "Information Security of Russian Regions (ISRR-2019)", October 23-25, 2019, St. Petersburg, Russia – Iskanderov Yu., Ivakin Ya., Potapychev S., Laskin M., Ershov A., Svistunova A.

XVII International Conference of the History and Computer Association, October 25-27, 2018, Moscow-Zvenigorod, Russia – Ivakin Y., Potapychev S.

19th International Conference "Hybrid Intelligent Systems" (HIS - 2019), December 10-12, 2019, Bhopal, India – Iskanderov Yu.

VI International Scientific Conference "Information Technologies in Science, Management, Social Sphere and Medicine", December 14-19, 2019, Tomsk, Russia – Ivakin Y., Potapychev S.

Membership in International Societies, Editorial Boards

Iskanderov Yu. – Chairman of the Board of the main educational programs of the baccalaureate "Business Informatics" and the Master’s Degree "Information Business Analytics" of the St. Petersburg State University; Head of the basic department "Information Technologies in Logistics" SPIIRAS in the Higher School of Economics (St. Petersburg); Member of the editorial board of the scientific journal "Bulletin of the Admiral Makarov State University of Maritime and Inland Shipping "; Full Member of the Russian Transport Academy; Member of the Program Committees of Scientific Conferences IDC-2019, ISRR-2019.

Laskin M. – Member of the Scientific and Methodological Council of the Self-Regulating Organization of Appraisers "Community of Assessment Professionals", St. Petersburg, Russia.

Ivakin Ya. – Member of the editorial board of the journals "Vestnik of the St. Petersburg University of Technology and Design. Natural and technical sciences" and “Hydroacoustics”.

Recent Results

1. A new approach to formalizing the integrated information systems of transport logistics based on the synthesis of the multi-agent

technology methodology and the theory of actor networks has been developed. The novelty of the approach is to unify and standardize the rules and procedures for the formation of a set of heterogeneous sources and consumers of information into a single information space that ensures the functioning of collective decision-making processes, taking into account individual preferences. Application of this approach allows you to create promising relevant methods and models for the rational management of transport and logistics systems [1, 2, 5-9].

2. An algorithm for solving the problem of geochronological tracking for heterogeneous sets of cartographic data on retrospective geospatial processes has been developed and optimized. A feature of this algorithm is a comprehensive assessment of the collection of processes of accumulation and integration of data on the geographical movement of artifacts for a specified period of time with the presentation of the results in the form of a generalizing graph. A computer interpretation of the statistical significance of the isomorphism of the corresponding graphs based on geochronological tracking allows to provide a new quality of interdisciplinary research using modern GIS tools [10, 11, 13, 32, 34].

References

Papers prepared jointly with foreign organizations:

1. *Iskanderov Y., Pautov M.* Actor-Network Approach to Self-organisation in Global Logistics Networks // Inetrnational Symposium on Intelligent Distributed Computing. 2019. pp. 117–127. DOI: https://doi.org/10.1007/978-3-030-32258-8_14. (Scopus).
2. *Iskanderov Y., Pautov M.* Heterogeneous Engineering in Intelligent Logistics // 19th International Conference on Hybrid Intelligent Systems. 2019. (Scopus).

Papers published in editions, indexed by WoS, Scopus:

3. *Potapychev S.N., Ivakin Y.A.* Method of intelligent support ofdecision-making at dispatching the geospatial processes // Journal of Experimental & Theoretical Artificial Intelligence. 2019. DOI: https://doi.org/10.1080/0952813X.2019.1592237 (WoS, Scopus, SJR=0,39, Q2).
4. *Seliverstov Y.A., Chigur V.I., Sazanov A.M., Seliverstov S.A., Svistunova A.S.* Sentiment analysis of «AUTOSTRADA.INFO/RU»

users'comments. SPIIRAS Proceedings. 2019. vol. 18. no. 2, pp. 354–389. DOI 10.15622/sp.18.2.354-389 (Scopus, SJR=0,17, Q3).

Papers published in editions, indexed by Russian Science Citation Index (RCSI):

5. *Iskanderov Y.M., Gaskarov V.D., Doroshenko V.I.* Multi-agent model of the integrated ship control system// Vestnik Gosudarstvennogo universiteta morskogo i rechnogo flota im. admirala S.O. Makarova. 2019. vol. 5(57). pp. 831–841. DOI: 10.21821/2309-5180-2019-11-5-831-841 (In Russ.). (Impact factor – 0,512).
6. *Iskanderov Y.M., Rudykh S.V., Vasin A.V.* The approach to the formation of an intelligent system of transport and logistics information // Vestnik Gosudarstvennogo universiteta morskogo i rechnogo flota im. admirala S.O. Makarova. 2019. vol. 6(58). DOI: 10.21821/2309-5180-2019-11-6-XXX-XXX (In Russ.). (Impact factor – 0,512).
7. *Iskanderov Y.M., Gaskarov V.D., SmolentsevS.V.* Development of transport and technological processes based on integrated information systems // Transport business of Russia. 2019. vol. 5. (In Russ.). (Impact factor – 0,315).
8. *Iskanderov Y.M., Gaskarov V. D., Doroshenko V. I.* Improving river transport management processes based on integrated information systems. M., River transport (XXIst century).2019. vol. 4(92). (In Russ.). (Impact factor – 0,076).
9. *Iskanderov Y.M.* Features of informatization of transport and technological processes in supply chains. Informatization and communication. vol. 4. 2019, pp. 31–37. DOI: 10.34219/2078-8320-2019-10-4-31-37 (Impact factor – 0,282).
10. *Ivakin Y.A., Potapychev S.N., Ivakin V.Y.* Optimal algorithm of hypotheses testing at the ship use research based on the geochronological tracking // Vestnik Gosudarstvennogo universiteta morskogo i rechnogo flota im. admirala S.O. Makarova. 2019. vol. 3(55). DOI: 10.21821/2309-5180-2019-11-3-448-460 (In Russ.) (Impact factor – 0,512).
11. *Ivakin Y.A., Potapychev S.N., Ivakin V.Y.* A rational algorithm for testing hypotheses of spatial historical research based on geochronological tracking in GIS // Historical Informatics. 2019. vol. 2. pp. 147–158. DOI: 10.7256 / 2585-7797.2019.2.28612 (In Russ.) (Impact factor – 0,478).

12. *Ivakin Y.A., Potapychev S.N.* A model of the information and maintenance network for products of domestic sonar weapons // Scientific and Technical Collection of Hydroacoustics. 2019. vol. 39(3). 103 p. (In Russ.). (Impact factor - 0.470).
13. *Ivakin Y.A., Potapychev S.N., Ivakin V.Y.* A model for supporting the scheduling of geospatial processes of the water transport based on the situational management //Vestnik Gosudarstvennogo universiteta morskogo i rechnogo flota im. admirala S.O. Makarova. 2019. vol. 5(57). pp. 842–855. DOI: 10.21821/2309-5180-2019-11-5-842-855 (In Russ.). (Impact factor – 0,512)
14. *Laskin M.B., Talavirya A.U.* Assessment of changes in the market value of residential real estate in the area of the commissioned transport interchange of the urban toll road // Statistics and Economics. 2019. vol. 16(5). pp. 57–69. https://doi.org/10.21686/2500-3925-2019-5-57-69 (InRuss.). (Impact factor – 0,282).
15. *Laskin M.B., Morina Y.I.,Svistunova A.S.* Simulation of passenger service processes in the airport complex. // The Ninth All-Russian Scientific and Practical Conference on Simulation and its Application in Science and Industry "Simulation. Theory and Practice" (IMMOD-2019). 2019. pp. 520–524. (In Russ.)
16. *Adrianova A.V., Laskin M.B.,Svistunova A.S.* Simulation modeling of the route network section of the Pulkovo and Domodedovo airports in AnyLogic environment // Ninth All-Russian Scientific and Practical Conference on Simulation and its Application in Science and Industry "Simulation. Theory and Practice" (IMMOD-2019). 2019. pp. 347–351. (In Russ.)

Other publications:

17. *Iskanderov Y.M.* Multi-agent systems for logistics functions management in the supply chains // "Logistics: current development trends". Materials of the XVII International Scientific and Practical conf. SPb, 2019. 344 p. (In Russ.).
18. *Ershov A.A.* Formation of the knowledge base of the intellectual system of proactive management of transport and logistics processes // "Logistics: current development trends". Materials of the XVII International Scientific and Practical conf. 2019. pp. 189–191. (In Russ.).

19. *Svistunova A.S., ChumakA.S.* The intellectual decision support system for oversize cargo transportation. // "Logistics: current development trends". Materials of the XVII International Scientific and Practical conf. 2019. pp. 100–103. (In Russ.).
20. *Iskanderov Y.M., Svistunova A.S., Chumak A.S.* System analysis of quality indicators integrated logistics technologies for cargo transportasion. // System analysis in the design and management: Collection of scientific papers XXIII International scientific and practical conf. 2019 pp. 251–262. (In Russ.).
21. *Iskanderov Yu.M., Svistunova A.S., Chumak A.S.* Developing of knowledge base for the decision support system of the transportation of the oversized cargoes // Abstracts International Conference Cyber-Physical Systems and Control. 2019. pp. 9.
22. *Iskanderov Y.M., Svistunova A.S., ChumakA.S.* The intellectual decision support system for oversize cargo transportation // Proceedings of the V Interregional Scientific and Practical Conference "Perspective Directions for the Development of Domestic Information Technologies" (PDDDIT-2019). 2019. pp. 67–71. (In Russ.).
23. *Iskanderov Y.M., Laskin M.B.* Modeling of transport and technological processes in the supply chains based on multiagent technologies // Proceedings of the V Interregional Scientific and Practical Conference "Perspective Directions for the Development of Domestic Information Technologies" (PDDDIT-2019). 2019. pp. 71–74. (In Russ.).
24. *Iskanderov Y.M., Ershov A.A.* The knowledge base for intellectual system of the proactive management transport and logistics processes // Proceedings of the V Interregional Scientific and Practical Conference "Perspective Directions for the Development of Domestic Information Technologies" (PDDDIT-2019). 2019 pp. 74–78. (In Russ.).
25. *Iskanderov Y.M., Pautov M.D.* Intelligent information security support system for supply chain management // Proceedings of the V Interregional Scientific and Practical Conference "Perspective Directions for the Development of Domestic Information Technologies" (PDDDIT-2019). 2019. pp. 277–280. (In Russ.).
26. *Iskanderov Y.M., Svistunova A.S., ChumakA.S.* The safe intellectual decision support system for oversize cargo transportation // Proceedings of the Conference "Information Security of Russian Regions (ISRR-2019)". 2019. pp. 319–320. (In Russ.).

27. *Iskanderov Y.M., Pautov M.D.* Ensuring information security in the management of supply chains based on the intelligent system // Proceedings of the Conference "Information Security of Russian Regions (ISRR-2019)". 2019. pp. 318–319. (In Russ.).
28. *Iskanderov Y.M., Ershov A.A.* The safe knowledge base of intellectual system of the proactive management transport and logistics processes // Proceedings of the Conference "Information Security of Russian Regions (ISRR-2019)". 2019. pp. 315–316. (In Russ.).
29. *Iskanderov Y.M., Laskin M.B.* Modeling of information security of transport and technological processes in the supply chains based on multiagent technologies // Proceedings of the Conference "Information Security of Russian Regions (ISRR-2019)". 2019. pp. 316-317. (In Russ.).
30. *Ivakin Y.A., Potapychev S.N.* A rational algorithm for statistical testing of hypotheses of humanitarian research in GIS based on the geochronotracking // Proceedings of the Conf. "Information Security of Russian Regions (ISRR-2019)". 2019. pp. 431–434 (In Russ.).
31. *Ivakin Y.A., Potapychev S.N.* Intelligent support for dispatching geospatial processes of maritime transport based on situational management. // Proceedings of the V Interregional Scientific and Practical Conference “Perspective Directions for the Development of Domestic Information Technologies” (PDDDIT-2019). 2019. pp. 203–204. (In Russ.).
32. *Ivakin Y.A., Potapychev S.N.* The optimal algorithm for testing hypotheses of interdisciplinary research based on the geochronotracking // Proceedings of the V Interregional Scientific and Practical Conference “Perspective Directions for the Development of Domestic Information Technologies” (PDDDIT-2019). 2019. pp.125–126. (In Russ.).
33. *Ivakin Y.A., Potapychev S.N.* A model for supporting dispatching of geospatial processes of maritime transport based on situational management // Proceedings of the International Scientific Conference "Information Technologies in Science, Management, Social Sphere and Medicine". 2019. pp. 239–246. (In Russ.).
34. *Ivakin Y.A., Potapychev S.N.* Algorithm for testing hypotheses of retrospective studies based on geochronological tracking // Proceedings of the International Scientific Conference "Information Technologies in Science, Management, Social Sphere and Medicine". 2019. pp. 497–503. (In Russ.).

Department of Postgraduate Studies, Information and Educational Technologies and Services

Head of department: Cand. Sci. (Tech.), Assoc. Prof. Salukhov Vladimir Ivanovich. Research areas — information technologies in education, life cycle management of infotelecommunication systems, analysis and development of support and decision-making systems based on modern information technologies, methodology of distributed situation centers and competence centers; visal@iias.spb.su.

Laboratory Staff: 15 members.

Research Activities – information technologies in education and development of the joint training center for processing space information of remote sensing of the Earth (ERS), as well as the computer scientific and educational center SPIIRAS. Analysis of free software and its use in scientific and educational centers. Development of methodology for the application of the system of distributed situation centers and competence centers. Modeling and automation of management processes of infotelecommunication systems. Application of methods of multi-criteria statistical analysis and for building corporate expert systems, including for medical institutions.

Research fellows and brief information of the research-work direction

Senior Researcher, Cand. Sci. (Tech.), Assoc. Prof. – Kasatkin Viktor V. – information technologies in education; information systems and technologies, v.v.kasatkin@mail.ru

Senior Researcher, Motienko Anna I., Cand. Sci. (Tech.). – emergency rescue robots, human-machine interaction, first aid, emergency rescue, emergency situation, infocommunication systems for medical purposes, collection and analysis of statistical medical data, public health monitoring,, anna.gunchenko@gmail.com.

Associate Professor, Cand. Sci. (Tech.) – Tatyanina Lyudmila G. – fundamental problems of pedagogy and psychology, applied aspects of social psychology and psychosomatics, l.g.tatyanina@mail.ru.

Professor, Dr. Sci. (Phil), Prof. – Plebanek Olga V. – philosophy of science, post-non-classical cognitive practices, philosophy of culture, civilizational research, nonlinear processes in social dynamics, plebanek@mail.ru.

Associate Professor, Cand. Sci. (Tech.), Assoc. Prof. – Salye Tatyana E. – research of modern trends of pedagogy and psychology in various social environments, tatiana_sallier@mail.ru.

Grants and projects

Motienko A.I. – RFBR Project No. 19-07-00832 A "Infocommunication system for data acquisition on the health status of the population", 2018-2020.

Motienko A.I. – Project for the implementation of the development program of the scientific journal "SPIIRAS Proceedings" no. Mon2018/2 (NP "NEIKON"), 2018-2019.

University Courses

SPbGMU: Informatics – Motienko A.I.
SPIIRAS: Pedagogy of higher education – Tatyanina L.G.
SPIIRAS: History and philosophy of science – Plebanek O.V.
NSU im. P. F. Lesgaft: Special psychology – Tatyanina L.G.

Conferences

XV St. Petersburg Scientific and Practical Conference "Problems of Training in the Field of Infocommunication Technologies", St. Petersburg, March 19, 2019 – Kasatkin V.V.

XXV International scientific and methodological conference "Modern education: content, technology, quality", St. Petersburg, April 23, 2019 – Kasatkin V.V.

V Interregional scientific and practical conference "Perspective directions of development of domestic information technologies", September 24-28, 2019, Sevastopol, Russia – Kasatkin V.V., Salukhov V.I., Motienko A. I.

XI St. Petersburg interregional conference "Information security of Russian regions (IBRR-2019)", St. Petersburg, October 23-25, 2019 – Kasatkin V.V.

Membership in Russian international organizations, editorial boards, etc.

Salukhov V.I. – member of the editorial Board of MIR TELECOM magazine;

Kasatkin V.V. – member of the Federal educational-methodical Association in the system of higher education in the Enlarged group of specialties and areas of higher education 09.00.00 "Computer science", Deputy Chairman of Educational-methodical Council in "Information systems and technologies"; scientific Secretary of the Scientific Council for Informatization of St. Petersburg the Government of St. Petersburg; Deputy Chairman of the St. Petersburg Society of Computer Science, Computer Engineering, Communication Systems and Controls, Chairman of the Commission on Energy, Communications and Information Technologies of the Department of the Scientific and Expert Council for the North-Western Federal district under the Working group of the Federation Council of the Federal Assembly of the Russian Federation.

Recent result

1. A method of increasing the duration of opening the structure of a broadband signal from 2 to 10 times, allowing on the basis of original approaches to improve the correlation properties and structural secrecy of pseudorandom sequences and increase the noise immunity of digital information transmission systems [22, 23].
2. The algorithm of stochastic dynamic programming for operational management of resources of information support systems of the region is developed, which allows to minimize losses from correction of plans of introduction of information technologies in various spheres of activity [24].
3. The developed method of synthesis of the topological structure of distributed terminal systems that will be implemented in two phases: the first defines the minimum set of communication nodes and their placement based on the availability requirements of communications nodes for different categories of users and the global distributed terminal system, second options build nodes of communication and relationships between them which provide the functions of automonitoring users local information spaces while ensuring continuity of communication for different categories of users [3].
4. Developed proposals for projects of approximate basic professional educational programs in the direction of "Information systems and technologies" levels of bachelor's degree 09.03.02 and master's degree 09.04.02 on the basis of Federal State Educational Standard 3++, updated with Professional standards [1, 29].

5. Proposals for advanced training programs for developers of basic professional educational programs have been developed on the example of bachelor's and master's courses 09.03.02 and 09.04.02 "Information systems and technologies" [1, 28].

6. The platform of electronic edition of scientific publications has been developed, which provides automation of routine operations of publishers and editors of scientific journals – keeping records of articles and their status, writing letters, timing control, loading versions of articles, generating statistics on citation, import and export of data to global indexes, successfully tested on several journals and allowed SPIIRAS's Works to enter Scopus (Q3) and take first places in thematic groups among journals in the RSCI [16].

References

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1. *Astakhova T.N., Verzun N.A., Kasatkin V.V., Kolbanev M.O., Shamin A.A.* Research of models of connectivity of sensory networks. Information and control systems. 2019. vol. 5. pp. 38–50. DOI:10.31799/1684-8853-2019-5-38-50. (In Russ.).
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Abbreviations

ASRT	Academy of Sciences of the Republic of Tatarstan
BSTU	Baltic State Technical University "Voenmeh" D.F. Ustinov
A.F. Mozhaysky's MSA	A.F. Mozhaysky's Military-Space Academy
IL RAS	Institute of Limnology of the Russian Academy of Sciences
DNTIT RAS	Department of Nano Technologies and Information Technologies of RAS
MAPE, Minobrnauki	Medical Academy of Postgraduate Education Minobrnauki of Russia
SRCES RAS	Saint-Petersburg Scientific-Research Centre for Ecological Safety of the Russian Academy of Sciences
NSRAI	Novgorod Scientific Research Agriculture Institute
PSTU	Petersburg State Transport University
PetrSU	Petrozavodsk State University
FRP	Fundamental Research Program
Herzen University	Herzen State Pedagogical University of Russia
SZNIESH	Northwest Research Institute Economy and Organization of Agriculture
N-W CIRPFM	North-West Centre of Interdisciplinary Researches of Problems of Food Maintenance
SPSUACE	St. Petersburg State University of Architecture and Civil Engineering
SPbMU	St. Petersburg Mining University
SPbSMTU	St. Petersburg State Marine Technical University
PFSPSMU	Pavlov First St. Petersburg State Medical University
SPbPU	Peter the Great St. Petersburg Polytechnic University
SPbU	Saint Petersburg State University
SUAI	Saint Petersburg State University of Aerospace Instrumentation
SPbUWC	St.Petersburg Water Communications University
UMTE	St. Petersburg University of Management Technologies and Economics
ITMO	St.Petersburg State University of Information Technologies, Mechanics and Optics

LETI	St.Petersburg State Electrical Engineering University
SPSC RAS	St. Petersburg Scientific Center of the Russian Academy of Sciences
SPC RAS	St. Petersburg Federal Research Center of the Russian Academy of Sciences
SPIIRAS	St.Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences
FTP	Federal Target Program

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