

Aleksandr I. Panov

Curriculum Vitae

Educational Background

- 2011–2015 **Ph.D. in Theoretical Bases of Computer Science**, *Institute for Systems Analysis*, Moscow, Russia.
Specialized in modeling of goal-oriented behavior of intelligent agents and their coalitions. Thesis title: “Investigation of methods, development of models and algorithms for formation of elements of sign-based worldview of the actor”.
- 2009–2011 **Master of Applied Mathematics and Physics**, *Moscow Institute of Physics and Technology*, Department of Applied Mathematics and Management, Moscow, Russia.
Majors: technologies of active databases, computer graphics, game theory and decision making, effective algorithms, decomposition in optimization. Specialized in logical methods (AQ, JSM) of data mining and multi-agent systems. Thesis title: “Investigation and modeling of group behavior for multifunctional agents”.
- 2005–2009 **Bachelor of Physics**, *Novosibirsk State University*, Department of Physics, Novosibirsk, Russia.
Majors: operational systems, digital integrated circuits, introduction to CAD, microprocessors, information networks and systems, object-oriented analysis and design. Specialized in semantic integration of databases. Thesis title: “Semantic integration of biological databases”.

Teaching Experience

- 2011–Present **Head of AI Master Program**, *Moscow Institute of Physics and Technology*, Phystech School of Applied Mathematics and Informatics, Moscow, Russia.
Seminars on Basis of Operation Systems and Basis of Object-Oriented Programming, Lectures on Introduction in AI and Reinforcement Learning
- 2011–2016 **Assistant Lecturer**, *Peoples' Friendship University of Russia*, Department of Computer Science, Moscow, Russia.
Lectures on Intelligent Dynamic Systems, Theoretical Computer Science and Intelligent Data Analysis
- 2015–2019 **Associate Professor**, *National Research University Higher School of Economics*, Faculty of Computer Science, Moscow, Russia.
Seminar on Intelligent Data Mining

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Research Experience

- 2010–Present **Head of Laboratory**, FEDERAL RESEARCH CENTER “COMPUTER SCIENCE AND CONTROL” OF RUSSIAN ACADEMY OF SCIENCES, Institute for Artificial Intelligence Research, Moscow, Russia.
Leading academic institute in Computer Science and High-performance computing – <http://frccsc.ru>.
- Cognitive modeling:
 - Psychologically inspired models of human behavior based on theory of sign-based world model.
 - Biologically inspired models of sign components: image, significance and personal meaning.
 - Algorithms of behavior planning and goal setting procedures.
 - Machine learning and multi-agent systems:
 - The composite logical method to extract cause-effect relationships.
 - Algorithms of planning and role distribution in coalition of cognitive agents.
 - Cognitive Robotics:
 - Multi-layer control system for coalition of cognitive robots.
- 2015–2018 **Research Fellow**, NATIONAL RESEARCH UNIVERSITY HIGHER SCHOOL OF ECONOMICS, Laboratory of Process-Aware Information Systems (PAIS Lab), Moscow, Russia.
Leading University in Russia in Economics and Computer Science - <http://hse.ru>.
- Investigation of learning mechanisms based on sign representations in the problem of collective behavior planning.
- 2018–
presence **Director**, MOSCOW INSTITUTE OF PHYSICS AND TECHNOLOGY, Center for Cognitive Modeling, Moscow, Russia.
Leading University in Russia in Physics and Computer Science – <http://cogmodel.mipt.ru>.
- Applied research in self-driving cars and mobile robotics:
 - New framework for behavior planning of self-driven cars based on Apollo-auto.
 - Original methods of neural-based object segmentation, detection, tracking for mobile robots.
 - Reinforcement learning:
 - Hierarchical reinforcement learning and learning from demonstrations.
 - Learning-based methods for visual navigation in indoor scenes.
 - Neuromorphic computing:
 - Architecture of the hierarchical intrinsically motivated agent (HIMA).
 - Improved variants of hierarchical temporal memory.
- 2021–
presence **Principal Research Fellow**, ARTIFICIAL INTELLIGENCE RESEARCH INSTITUTE, Neural-symbolic team, Moscow, Russia.
Leading non-profit organization in the field of Artificial Intelligence – <http://airi.net>.
- Reinforcement learning in multi-agent systems:
 - Switching algorithms of planning-based and learning-based multi-agent path finding methods.
 - Monte-Carlo approach in multi-agent systems.
 - Neural-symbolic integration:
 - Disentangled representations and object-oriented world models.
 - Vector symbolic architectures in VQA and robot navigation setting.

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Research Grants

As a head

- 2020–2023 **Grant for young head of scientific group**, *Russian Science Foundation (RSF)*.
Reinforcement learning using network vector-symbolic representations in the task of smart navigation of cognitive agents.
- 2018–2020 **Grant for postdocs**, *Russian Science Foundation (RSF)*.
Hierarchical reinforcement learning in the task of acquiring conceptual procedural knowledge by cognitive agents.
- 2016–2019 **Grant for postdocs**, *Russian Foundation for Basic Research (RFBR)*.
Investigation of learning mechanisms based on sign representations in the problem of collective behavior planning.
- 2016–2018 **Grant for postdocs**, *Russian Foundation for Basic Research (RFBR)*.
Investigation of learning mechanisms based on sign representations in the problem of collective behavior planning.
- 2016–2018 **Oriented basic research**, *Russian Foundation for Basic Research (RFBR)*.
Development of new methods for knowledge base construction, search and adaptation of cases for scientific-technical solutions and technologies using their text descriptions based on semantic networks.

As a senior researcher

- 2017–2020 **Grant in priority thematic research areas**, *Russian Foundation for Basic Research (RFBR)*, research adviser: Nataliya Chudova.
Network approach for construction of sign based world model and sign realization of cognitive functions.
- 2016–2018 **Grant in priority thematic research areas**, *Russian Science Foundation (RSF)*, research adviser: Prof. Gennady S. Osipov.
Creation of theory, methods and models for distributed control of behavior of cognitive robotic systems and their coalitions in nondeterministic environment.
- 2015–2017 **Individual grant**, *Russian Foundation for Basic Research (RFBR)*, research adviser: Prof. Gennady S. Osipov.
Neurophysiological and psychological foundations of sign models of the world and cognitive functions.

Research Interests

- Computer Cognitive Modeling
- Semiotics
- Cognitive Robotics
- Multi-agent systems
- Behavior planning
- Reinforcement Learning

Committees and Councils

- 2015–2022 Member of Scientific Board of the Russian Association for Artificial Intelligence: RAAI, www.raai.org
- 2022–Present Member of the Association for the Advancement of Artificial Intelligence: AAAI, aaai.org/

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- 2016–2019 Member of the Editorial Board of the *Biologically Inspired Cognitive Architectures*: BICA Journal, www.journals.elsevier.com/biologically-inspired-cognitive-architectures/
- 2019–Present Member of the Editorial Board of the *Cognitive Systems Research*, www.sciencedirect.com/journal/cognitive-systems-research
- 2016–2019 Member of The Biologically Inspired Cognitive Architectures Society: BICA Society, bicasociety.org
- 2016–Present Executive Chair of the Organizing Committee of several international conferences and schools: BICA (school.bicasociety.org), RAAI (rncai.ru), RAAI School

Selected Publications

- [1] Aleksey Staroverov, Dmitry A. Yudin, Ilya Belkin, Vasily Adeshkin, Yaroslav K. Solomentsev, and Aleksandr I. Panov. “Real-Time Object Navigation with Deep Neural Networks and Hierarchical Reinforcement Learning”. In: *IEEE Access* 8 (2020), pp. 195608–195621.
- [2] Alexey Skrynnik, Aleksey Staroverov, Ermek Aitygulov, Kirill Aksenov, Vasilii Davydov, and Aleksandr I. Panov. “Forgetful experience replay in hierarchical reinforcement learning from expert demonstrations”. In: *Knowledge-Based Systems* 218 (2021), p. 106844.
- [3] Alexey Skrynnik, Aleksey Staroverov, Ermek Aitygulov, Kirill Aksenov, Vasilii Davydov, and Aleksandr I. Panov. “Hierarchical Deep Q-Network from imperfect demonstrations in Minecraft”. In: *Cognitive Systems Research* 65 (2021), pp. 74–78. arXiv: arXiv:1912.08664v2.
- [4] Evgenii Dzhivelikian, Artem Latyshev, Petr Kuderov, and Aleksandr I Panov. “Hierarchical intrinsically motivated agent planning behavior with dreaming in grid environments”. In: *Brain Informatics* 9.1 (2022), p. 8.
- [5] Daniil Kirilenko, Alexey K. Kovalev, Yaroslav Solomentsev, Alexander Melekhin, Dmitry A. Yudin, and Aleksandr I. Panov. “Vector Symbolic Scene Representation for Semantic Place Recognition”. In: *2022 International Joint Conference on Neural Networks (IJCNN)*. 2022, pp. 1–8.
- [6] Alexey K. Kovalev, Makhmud Shaban, Evgeny Osipov, and Aleksandr I. Panov. “Vector Semiotic Model for Visual Question Answering”. In: *Cognitive Systems Research* 71 (2022), pp. 52–63.
- [7] Aleksei Staroverov and Aleksandr Panov. “Hierarchical Landmark Policy Optimization for Visual Indoor Navigation”. In: *IEEE Access* 10 (2022), pp. 70447–70455.
- [8] Brian Angulo, Alexander Panov, and Konstantin Yakovlev. “Policy Optimization to Learn Adaptive Motion Primitives in Path Planning with Dynamic Obstacles”. In: *IEEE Robotics and Automation Letters* 8 (2023), (In Press).
- [9] Daniil Kirilenko, Anton Andreychuk, Aleksandr Panov, and Konstantin Yakovlev. “TransPath: Learning Heuristics For Grid-Based Pathfinding via Transformers”. In: *AAAI* (2023), (In Press). arXiv: 2212.11730.
- [10] Dmitry Yudin, Ruslan Musaev, Aleksei Staroverov, and Aleksandr I Panov. “HPointLoc: Point-based Indoor Place Recognition based on Synthetic RGB-D Images”. In: *ICONIP*. 2023, (In Press).

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