



Aleksandr I. Panov

Curriculum Vitae

Educational Background

- 2025 **Dr.Sc. in Artificial Intelligence and Machine Learning**, *Moscow Institute of Physics and Technology*, Moscow, Russia
Specialized in cognitive robotics and model-based reinforcement learning. Thesis title: "Methods and algorithms of neurosymbolic learning and behavior planning for cognitive agents".
- 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
- 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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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

Research Experience

- 2021–Present **Head of laboratory**, ARTIFICIAL INTELLIGENCE RESEARCH INSTITUTE, Cognitive AI Systems Laboratory, Moscow, Russia
Leading non-profit organization in the field of Artificial Intelligence – www.airi.net.
- Cognitive robotics:
 - PlanFormer: pretrained multimodal architecture .
 - LLM-based planners for mobile robots and manipulators.
 - 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.
- 2018–Present **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.

- 2010–2024 **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 – [www.frccsc.ru](http://frccsc.ru).
- Reinforcement learning:
 - Object-centric world models for reinforcement learning.
 - Model-based reinforcement learning with heuristic planning.
 - 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 - www.hse.ru.
- Investigation of learning mechanisms based on sign representations in the problem of collective behavior planning.

Research Grants

As a head

- 2020–2025 **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

- Reinforcement Learning
- Cognitive Robotics
- LLM-based agents
- Behavior planning
- Multi-agent systems

Committees and Councils

- 2019–Present Member of the Editorial Board of the *Cognitive Systems Research*, www.sciencedirect.com/journal/cognitive-systems-research
- 2022–Present Member of the Association for the Advancement of Artificial Intelligence: AAAI, www.aaai.org
- 2020–Present Member of Institute of Electrical and Electronics Engineers, Russian Section: IEEE, www.ieee.org
- 2016–Present Executive Chair of the Organizing Committee of several international conferences and schools: BICA (school.bicasociety.org), RAAI, RAAI School
- 2016–2019 Member of the Editorial Board of the *Biologically Inspired Cognitive Architectures*: BICA Journal, www.journals.elsevier.com/biologically-inspired-cognitive-architectures
- 2016–2019 Member of The Biologically Inspired Cognitive Architectures Society: BICA Society, bicasociety.org
- 2015–2022 Member of Scientific Board of the Russian Association for Artificial Intelligence: RAAI, www.raai.org

Selected Recent Publications

- [1] Anton Andreychuk, Konstantin Yakovlev, Aleksandr Panov, and Alexey Skrynnik. “MAPF-GPT: Imitation Learning for Multi-Agent Pathfinding at Scale”. In: *AAAI 2025*. 2025.
- [2] Evgenii Dzhivelikian, Petr Kuderov, and Aleksandr Panov. “Learning Successor Features with Distributed Hebbian Temporal Memory”. In: *ICLR 2025*. 2025.
- [3] Daniil Kirilenko, Anton Andreychuk, Aleksandr I Panov, and Konstantin Yakovlev. “Generative Models for Grid-Based and Image-Based Pathfinding”. In: *Artificial Intelligence* 338 (2025), p. 104238.

- [4] Alexey Skrynnik, Anton Andreychuk, Anatolii Borzilov, Alexander Chernyavskiy, Konstantin Yakovlev, and Aleksandr Panov. "POGEMA: A Benchmark Platform for Cooperative Multi-Agent Navigation". In: *ICLR 2025*. 2025.
- [5] Muhammad Alhaddad, Konstantin Mironov, Aleksey Staroverov, and Aleksandr Panov. "Neural Potential Field for Obstacle-Aware Local Motion Planning". In: *2024 IEEE International Conference on Robotics and Automation (ICRA)*. Yokohama, Japan: IEEE, 2024, pp. 9313–9320.
- [6] Andrey Gorodetskiy, Konstantin Mironov, and Aleksandr Panov. "Model-based Policy Optimization using Symbolic World Model". In: *2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2024, pp. 664–669.
- [7] Mais Jamal and Aleksandr Panov. "FFStreams: Fast Search with Streams for Autonomous Maneuver Planning". In: *IEEE Robotics and Automation Letters* 9.7 (2024), pp. 6752–6759.
- [8] Daniil Kirilenko, Vitaliy Vorobyov, Alexey Kovalev, and Aleksandr Panov. "Object-Centric Learning with Slot Mixture Module". In: *The Twelfth International Conference on Learning Representations*. 2024.
- [9] Alexey Skrynnik, Anton Andreychuk, Maria Nesterova, Konstantin Yakovlev, and Aleksandr Panov. "Learn to Follow: Decentralized Lifelong Multi-Agent Pathfinding via Planning and Learning". In: *Proceedings of the AAAI Conference on Artificial Intelligence*. Vol. 38. 2024, pp. 17541–17549.
- [10] Alexey Skrynnik, Anton Andreychuk, Konstantin Yakovlev, and Aleksandr Panov. "Decentralized Monte Carlo Tree Search for Partially Observable Multi-agent Pathfinding". In: *Proceedings of the AAAI Conference on Artificial Intelligence*. Vol. 38. 2024, pp. 17531–17540.
- [11] Alexey Skrynnik, Anton Andreychuk, Konstantin Yakovlev, and Aleksandr Panov. "When to Switch: Planning and Learning For Partially Observable Multi-Agent Pathfinding". In: *IEEE Transactions on Neural Networks and Learning Systems* 35.12 (2024), pp. 17411–17424.
- [12] Artem Tsypin, Leonid Ugadiarov, Kuzma Khrabrov, Alexander Telepov, Egor Rumiantsev, Alexey Skrynnik, Aleksandr Panov, Dmitry Vetrov, Elena Tutubalina, and Artur Kadurin. "Gradual Optimization Learning for Conformational Energy Minimization". In: *The Twelfth International Conference on Learning Representations*. 2024.
- [13] Zoya Volovikova, Alexey Skrynnik, Petr Kuderov, and Aleksandr I Panov. "Instruction Following with Goal-Conditioned Reinforcement Learning in Virtual Environments". In: *Frontiers in Artificial Intelligence and Applications*. Vol. 392. 2024, pp. 650–657.
- [14] Dmitry Yudin, Nikita Zakharenko, Artem Smetanin, Roman Filonov, Margarita Kichik, Vladislav Kuznetsov, Dmitry Larichev, Evgeny Gudov, Semen Budennyy, and Aleksandr Panov. "Hierarchical waste detection with weakly supervised segmentation in images from recycling plants". In: *Engineering Applications of Artificial Intelligence* 128 (2024), p. 107542.
- [15] Brian Angulo, Aleksandr Panov, and Konstantin Yakovlev. "Policy Optimization to Learn Adaptive Motion Primitives in Path Planning With Dynamic Obstacles". In: *IEEE Robotics and Automation Letters* 8.2 (2023), pp. 824–831.
- [16] Daniil Kirilenko, Anton Andreychuk, Aleksandr Panov, and Konstantin Yakovlev. "TransPath: Learning Heuristics For Grid-Based Pathfinding via Transformers". In: *Proceedings of the AAAI Conference on Artificial Intelligence*. Vol. 37. 2023, pp. 12436–12443.

- [17] Aleksei Staroverov, Kirill Muravyev, Konstantin Yakovlev, and Aleksandr I Panov. "Skill Fusion in Hybrid Robotic Framework for Visual Object Goal Navigation". In: *Robotics* 12 (2023).
- [18] 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.