# Sergey V. Kovalchuk

Curriculum Vitae

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## Summary

Senior researcher (PhD, predictive modeling and simulation of complex systems, AI-solutions in various domains, NLP) with experience in scientific software development, high-performance and distributed computing (Python as a primary language). Working in the area since 2006. Currently, assistant professor (ITMO University) and principal engineer (Huawei). Latest domains for AI, modeling, and simulation application are healthcare and software development. Latest research interests are in human-AI interaction, hybrid and collective intelligence.

## Work History

***ITMO University*, St. Petersburg, Russia** ***Nov 2006 – Present***

Senior researcher at National Center for Cognitive Research, associate professor at Faculty of Digital Transformations, head of Digital Healthcare Lab. Responsible for conducting and organizing research and development projects for modelling and simulation of complex systems, AI solutions, decision support systems including design and performing experimental studies in various problem domains, development of high-performance computational infrastructure.

- Design and development of models of complex systems in various domains (examples: hydrometeorology, city science, medicine, healthcare)
- Design and development of intelligent (AI) solutions for analytics, optimization, decision support
- Design and development of scientific software for modelling and simulation for science and industry
- Design and conducting of numerical experimental studies for modeling and simulation of complex systems
- Work with domain experts for development of domain-specific and knowledge-based solutions
- Design and development of architecture and intelligent software for high-performance and distributed computing
- Proposing, participation in competition and work conducting in original research projects and grants with teamwork
- Organization of interaction and collaborative work with other groups, sub-groups, industry partners, experts
- Collaboration in national and international academic and educational partnership
- Writing software documentation, scientific reports, journal, and conference papers
- Disseminate outcomes of research via scientific conferences, journals other publications
- Supervising PhD, MSc, BSc research projects

***Huawei*, St. Petersburg, Russia** ***Jul 2022 – Present***

Principal engineer at Russian Research Institute (St. Petersburg Research Center). Responsible for planning and conducting research in the area of natural language generation (question-answering, search, code generation for software development), development of multi-model text processing pipelines, improvement of model performance, evaluation of models and pipelines (model-based evaluation, human evaluation), human-AI interaction. Activities in interaction with academic partners.

***Almazov National Medical Research Center*, St. Petersburg, Russia** ***Apr 2017 – Feb 2022***

Senior researcher. Responsible for planning, preparation, conducting and publishing of research and development in data-driven predictive modelling and simulation, AI solutions and decision support systems for medicine and healthcare within a series of projects (including projects in collaboration with ITMO University).

***Kurchatov Institute*, Moscow, Russia** ***Oct 2017 – Dec 2018***

Researcher. Responsible for design and development of concepts and technologies for intelligent and knowledge-based support of composite models' construction, identification, running, and application in complex computational and data-processing high-performance environment.

***Embl, web development company, Orenburg, Russia*** ***May 2005 – Nov 2006***

Software architect, senior software developer. Responsible for development of architecture of server-side applications (data modeling, services architecture, high-level structure), implementation of server-side core services.

***X-Plat, payment system, Orenburg, Russia*** ***Sep 2005 – Aug 2006***

Senior software developer. Responsible for development of architecture with following implementation of software system for automatic public payment terminals (kiosks) for self-served payment for various services with remote access to payment server. In a team of two persons developed the system from architecture design to final deployment.

## Education

***ITMO University, St. Petersburg, Russia*** ***Nov 2006 – Dec 2008***

*PhD, Mathematical modeling, numerical calculation and software systems*

Thesis title "High-performance software system for metocean extreme events simulation"

***Orenburg State University, Orenburg, Russia*** ***Sep 2001 – Jun 2006***

*Engineer, software engineering*

Thesis title "Design and development of computation tasks processing within peer-to-peer distributed computational environment "DistAnt"

***Certification***

- Model Thinking, University of Michigan – Coursera (2022)
- Game Theory, Higher School of Economics – Coursera (2022)
- Probabilistic Graphical Models 1: Representation, Stanford – Coursera (2020)
- Welcome to Game Theory, University of Tokyo – Coursera (2020)
- English as a Medium of Instruction (EMI) for ITMO Academics, ITMO University (2018)
- Culture and Technologies of Modern Management, ITMO University (2018)
- Modern Technologies for Project Management and Fundraising in University, ITMO University (2009)
- Intel Cluster Toolkit Training, Intel (2008)
- Programming for Multi-core for Academia, Intel (2007)
- Microsoft Certified Technology Specialist, Microsoft (2007)

## Skills

Experience in modeling and simulation (design, implementation, experiments, validation, verification)
Experience in software engineering (software architecture, design, development, testing, documentation)
Familiar concepts: AI, XAI, cognitive computing, predictive modeling, eScience, cloud computing, high-performance computing, workflows, decision support systems, BigData, V&V
Programming languages: Python, C#, C/C++, familiar with Java, R
Strong analytical skills, ability to design original systems and approaches
Ability to work in team and within multi-team environment
Ability to work under strict deadlines
Ability and will to learn new skills and get new knowledge
Languages: Russian (native), English (professional work), German (basic)

## Notable Projects and Funding

*Research grants (as primary investigator)*

- "Intelligent technologies for decision support based on modeling and control of human-AI interaction", Russian Scientific Foundation, 2024-2026, 21.000.000 RUB
- "Intelligent technologies for chronic disease health service quality improvement in large-scale distributed telemedicine systems", Ministry of Science and Education (international collaboration project), 2021, 10.000.000 RUB
- "Intelligent technologies for building, investigation and application of digital entities based on composite models for complex systems", Russian Scientific Foundation, 2019-2021, 18.000.000 RUB
- "Personalized recommending technology for chronic disease patients using hybrid predictive modeling of life and health processes", Ministry of Science and Education, 2017-2019, 60.000.000 RUB

- “Big data management for computationally intensive applications”, Ministry of Science and Education, 2014-2016, 10.000.000 RUB
- “Technologies for system-level design and development of inter-disciplinary applications in cloud environment”, Ministry of Science and Education, 2009-2013, 3.900.000 RUB
- “Instrumental environment for composite applications building for complex system modeling”, Federal Agency for Education, 2009-2011, 2.400.000 RUB

*Projects for industry (as primary investigator)*

- GazpromNeft, 2021-2022
- GazpromNeft STC, 2019-2021
- PMT-Online, 2018-2020

*Personal grants*

- “Methods and technologies for complex model management using surrogate approach”, Grant by President of Russia, 2018-2019
- “Technology for brain-computer virtual reality systems using cloud computing environment”, Scholarship by President of Russia, 2018-2019
- “Methods for prediction and planning of high-performance modular software parallel execution”, Grant by Government of St. Petersburg, 2009
- “Methods for design of eScience software for high-performance computing using service-oriented architecture”, Grant by Government of St. Petersburg, 2008
- “Parallel software for statistical modelling of sea wave spectrum”, Grant by Government of St. Petersburg, 2007

*Other notable projects (as participant)*

- CLAVIRE: cloud computing environment. A series of projects started by the project “Multi-profile instrumental platform for building and management of distributed cloud computing environment: CLAVIRE” (supported by Ministry of Science and Education, 2010-2012) and followed by multitude projects on the development, extension and application of CLAVIRE. *Personal role:* development of intelligent and knowledge-based technologies for composite application design, building and execution.
- “High performance data assimilation technologies for complex system forecasting using hybrid dynamical models” (supported by Russian Scientific Foundation, 2014-2018). *Personal role:* development of intelligent methods and technologies for complex model building, identification, application with a focus on data assimilation.
- A series of project for BCC Company during the development of a Water Level Forecasting and Flood Prevention Systems for Flood Prevention Facility Complex in Saint Petersburg (in operation since 2011 with no flood events during operation period). *Personal role:* design and development of ensemble water level forecasting solution; design and development of data assimilation solution; participation in the development of plan elaboration and decision support system.

## Chairing and Judging

- Editor of Journal of Computational Science
- Guest editor of annual special issue of Journal of Computational Science after International Conference of Computational Science, ICCS (since 2016)
- Chair of Computational Health track in ICCS (since 2020)
- PC member of conferences and tracks (ICCS, DSRS, YSC, DTGS, etc.)
- Reviewing for journals (Future Generation Computer Systems, Journal of Biomedical Informatics, Journal of Computation Science, etc.) and conferences (ICCS, IEEE eScience, DSRS, YSC, DTGS, etc.)
- Reviewing grant proposals for Russian Scientific Foundation in the area of mathematics and informatics (since 2018)

## Teaching (ITMO University)

- Supervising 2 PhD, 35 MSc, 4 BSc projects defended in 2010-2024 including 4 double-degree MSc students (ITMO University + University of Amsterdam)
- Supervising MSc education programs: “Computational Biomedicine” (2016-2020), “Digital Healthcare” (2019-2021), “Intelligent big data technologies in medicine and healthcare” (2020-2022, specialization in MSc program "Big data and machine learning")
- Giving courses for MSc students: “Agent based modeling and simulation”, “Mathematical models of complex software”, “Introduction to eScience and eEngineering”, “Medical statistics”

- Organizing and giving a course for educated professionals “Data Analysis and Processing in Medicine and Healthcare” (provided for Almazov National Medical Research Center, Nov-Dec 2019, official certification)
- Giving technological training classes: OpenMP, WCF, Python for Scientists

## Service (ITMO University)

- Member of Academic Council (2019-2024, university-level, faculty-level)
- External expert in IT (for courts, for companies)

## List of 20 Key Publications

h-index 16 (Scopus), more than 200 publications in English and Russian, 27 registered intellectual properties in Russian

1. A. Gorbatovski, S. Kovalchuk Reinforcement Learning for Question Answering in Programming Domain using Public Community Scoring as a Human Feedback // Proceedings of the 23rd International Conference on Autonomous Agents and Multiagent Systems, 2024, pp. 2294-2296.
2. *S. Kovalchuk*, *V. Lomshakov*, *A. Aliev* Human perceiving behavior modeling in evaluation of code generation models // Proceedings of the 2nd Workshop on Natural Language Generation, Evaluation, and Metrics (GEM), 2022, pp. 287-294.
3. *S.V. Kovalchuk*, *G.D. Kopanitsa*, *I.V. Derevitskii*, *G.A. Matveev*, *D.A. Savitskaya* Three-stage intelligent support of clinical decision making for higher trust, validity, and explainability // Journal of Biomedical Informatics, Vol. 127, 2022, pp. 104013.
4. *A.A. Funkner*, *A.N. Yakovlev*, *S.V. Kovalchuk* Surrogate-assisted performance prediction for data-driven knowledge discovery algorithms: Application to evolutionary modeling of clinical pathways // J. of Computational Science, Vol. 59, 2022, pp. 101562.
5. *O. Metsker*, *K. Magoev*, *A. Yakovlev*, *S. Yanishevskiy*, *G. Kopanitsa*, *S. Kovalchuk*, *V.V. Krzhizhanovskaya* Identification of risk factors for patients with diabetes: diabetic polyneuropathy case study // BMC Medical Informatics and Decision Making, Vol. 20, 2020, pp. 201.
6. *E.V. Bolgova*, *S.V. Kovalchuk*, *M.A. Balakhontceva*, *N.E. Zvartau*, *O.G. Metsker* Human Computer Interaction During Clinical Decision Support With Electronic Health Records Improvement // International Journal of E-Health and Medical Communications, Vol. 11, Issue 1, 2020, pp. 93-106.
7. *S.V. Kovalchuk*, *A.A. Funkner*, *O.G. Metsker*, *A.N. Yakovlev* Simulation of Patient Flow in Multiple Healthcare Units using Process and Data Mining Techniques for Model Identification // Journal of Biomedical Informatics, Vol. 82, 2018, pp. 128-142.
8. *S.V. Kovalchuk*, *O.G. Metsker*, *A.A. Funkner*, *I.O. Kisliakovskii*, *N.O. Nikitin*, *A.V. Kalyuzhnaya*, *D.A. Vaganov*, *K.O. Bochenina* A Conceptual Approach to Complex Model Management with Generalized Modelling Patterns and Evolutionary Identification // Complexity, Vol. 2018, Article ID 5870987, 15 p.
9. *N. Butakov*, *M. Petrov*, *K. Mukhina*, *D. Nasonov*, *S. Kovalchuk* Unified domain-specific language for collecting and processing data of social media // Journal of Intelligent Information Systems, Vol. 51, Issue 2, 2018, pp. 389-414.
10. *T.M. Abuhay*, *S.V. Kovalchuk*, *K. Bochenina*, *G.-K. Mbogo*, *A.A. Visheratin*, *G. Kampis*, *V. V. Krzhizhanovskaya*, *M.H. Lees* Analysis of Publication Activity of Computational Science Society in 2001-2017 Using Topic Modeling and Graph Theory // Journal of Computational Science, Vol. 26, 2018, pp. 193-204.
11. *S.V. Kovalchuk*, *E. Krotov*, *P.A. Smirnov*, *D.A. Nasonov*, *A.N. Yakovlev* Distributed Data-Driven Platform for Urgent Decision Making in Cardiological Ambulance Control // Future Generation Computer Systems, Vol. 79, Part 1, 2018, pp. 144-154.
12. *S.V. Kovalchuk*, *T.M. Abuhay*, *I. Altintas*, *M.L. Norman*, *M.H. Lees*, *V.V. Krzhizhanovskaya*, *J. Dongarra*, *P.M.A. Sloot* Data through the Computational Lens // Journal of Computational Science, Vol. 20, 2017, pp. 81-84.
13. *A.M. Chirkin*, *A.S.Z. Belloum*, *S.V. Kovalchuk*, *M.X. Makkes*, *M.A. Melnik*, *A.A. Visheratin*, *D.A. Nasonov* Execution Time Estimation for Workflow Scheduling // Future Generation Computer Systems, Vol. 75, 2017, pp. 376-387.
14. *S.V. Kovalchuk*, *A.V. Krikunov*, *K.V. Knyazkov*, *A.V. Boukhanovsky* Classification issues within ensemble-based simulation: application to surge floods forecasting // Stochastic Environmental Research and Risk Assessment, Vol. 31, Issue 5, 2017, pp. 1183-1197.
15. *V.V. Kashirin*, *A.A. Lantseva*, *S.V. Ivanov*, *S.V. Kovalchuk*, *A.V. Boukhanovsky* Evolutionary simulation of complex networks’ structures with specific functional properties // Journal of Applied Logic, Volume 24, Part A, 2017, pp. 39-49.
16. *A.V. Kiselev*, *V.A. Karbovsky*, *S.V. Kovalchuk* Agent-based modelling using ensemble approach with spatial and temporal composition // Procedia Computer Science, Vol. 80, 2016, pp. 530-541.
17. *A. Karsakov*, *A. Moiseev*, *K. Mukhina*, *I.N. Ankudinova*, *M.A. Ignatieva*, *E. Krotov*, *V. Karbovskii*, *S.V. Kovalchuk*, *A.O. Konradi* Toolbox for Visual Explorative Analysis of Complex Temporal Multiscale Contact Networks Dynamics in Healthcare // Procedia Computer Science, Vol. 80, 2016, pp. 2107-2118.
18. *S.V. Kovalchuk*, *A.V. Boukhanovsky* Towards Ensemble Simulation of Complex Systems // Procedia Computer Science, Vol. 51, 2015, pp. 532-541.
19. *S.V. Ivanov*, *S.V. Kovalchuk*, *A.V. Boukhanovsky* Workflow-Based Collaborative Decision Support for Flood Management Systems // Procedia Computer Science, Vol. 18, 2013, pp. 2213-2222.
20. *K.V. Knyazkov*, *S.V. Kovalchuk*, *T.N. Tchurov*, *S.V. Maryin*, *A.V. Boukhanovsky* CLAVIRE: e-Science Infrastructure for Data-driven Computing // Journal of Computational Science, Vol. 3, Issue 6, 2012, pp. 504–510.

## Personal Information and Family

Birth date: 1984-01-30 (41 y/o)

Citizenship: Russia

Marital status: married

Children: 10 y/o, 8 y/o

2025-03-07