

# Ilona Kulikovskikh

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 yukinoid



Reverse engineering, Behavioral cloning, Embodied cognition, Learning dynamics, Dynamic and control systems, Evolutionary computation

## Work Experience in Academia

- May 2020 – **Full Professor**,  
Present Department of Information Systems and Technologies,  
Institute of Informatics, Mathematics and Electronics,  
Samara National Research University, Samara, Russia.  
Teaching postgraduate and undergraduate courses. Supervising PhD's, Master's, and Bachelor's theses
- Nov 2018 – **Visiting Scholar**,  
Nov 2019 Centre of Research Excellence for Data Science and Advanced Cooperative Systems,  
Faculty of Electrical Engineering and Computing (FER), University of Zagreb, Croatia,  
Laboratory for Machine Learning and Knowledge Representation, Ruđer Bošković Institute, Croatia.  
Participated in the DATACROSS project of The Centre of Research Excellence for Data Science and Advanced Cooperative Systems (CRE ACROSS-DataScience) co-financed by the Croatian Government and the European Union through the European Regional Development Fund – the Competitiveness and Cohesion Operational Programme (KK.01.1.1.01.0009).
- Jan 2018 – **Senior Research Associate, Founder and Group Leader**,  
Present Department of Information Systems and Technologies,  
Institute of Informatics, Mathematics and Electronics,  
Samara National Research University, Samara.  
Founded the research group  $A \rightleftharpoons B$  for reverse-engineering AI technologies to build explainable and reliable AI systems with the focus on identifying, formulating, and solving safety and security problems. Led the research projects financed by the Russian Foundation for Basic Research (18-37-00219) and Russian Federation President Grant (MK-6218.2018.9).

## Work Experience in Industry

- Jan 2019 – **Chief Scientific Officer (CSO), Co-Founder**,  
2021 Team Chemistry LLC.  
Co-leading the start-up project financed by the National Program for Innovate Science START-1-18 (C1-51885).
- Jan 2012 – **Data Scientist**,  
Jul 2013 Centre for Neuropsychological Assessment, Samara.

## Qualifications

- 2013–2020 **Higher Attestation Commission (VAK), Moscow, Russia**,  
\*Doctor of Sciences (Dr.Sc., Habil.) in \*\*Theoretical Computer Science.  
Diploma DOK 001900 issued 26 Nov 2020  
\* A post-doctoral degree called Doctor of Sciences is given to reflect the second advanced research qualification or a higher doctorate in ISCED 2011. Less than 10 % of Candidate of Sciences holders earn Doctor of Sciences degree. It requires fundamental research or a new research direction, which is of significant scientific, industrial, or social value.

\*\* Built the learning theory on the exponential equation which describes dynamic processes in technical, social, and natural environments. It is principally directed towards creating explainable and reliable AI-based systems with the primary focus on identifying, formulating, and solving safety and security problems that emerge from bidirectional transitions between the environments.

2019 **Ministry of Education and Science, Russia,**  
Associate Professor Rank.  
Diploma DOC 000525 issued 11 Sep 2019

2008–2011 **Higher Attestation Commission (VAK), Moscow, Russia,**

\*Candidate of Sciences (Ph.D.) in \*\*Applied Mathematics and Computer Science.  
Diploma DKN 144158 issued 25 Nov 2011

\* According to the International Standard Classification of Education (ISCED) 2011, Candidate of Sciences belongs to ISCED level 8 - "doctoral or equivalent", together with PhD, DPhil, D.Lit, D.Sc, LL.D, Doctorate or similar. Candidate of Sciences allows its holders to reach the level of an Associate Professor.

\*\* Complemented the Fourier decomposition method with the extended orthogonality relations to ensure computationally efficient time series analysis, including real-time applications. The proposed method reveals a beneficial interplay between two key properties: orthogonality and generalisation capability.

2002–2008 **\*Samara State Aerospace University, Samara,**  
Specialist in Computer Science.

Diploma VSA 0712081 issued Feb 4, 2008 with an overall mark of 5.0/5.0

\* One of the leading centers of the aerospace industry, which is responsible for the development of space technology including strategic information technologies.

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## Projects

2019 – 2020 **Enabling efficient "human-human", "machine-machine", and "human-machine" interactions in business and the public sector, National Program for Innovate Science START-1-18 (project no. C1-51885),**  
Role: **Co-PI.**

Created a model of the ideal "human-human" interaction based on behavioral observations of successful interactions in dynamic questionnaires. Adopted the model to enable reliable "human-human", "machine-machine", and "human-machine" interactions in business and the public sector with controllable internal biases in decision making.

2018 – 2019 **DATA CROSS project: Robust Machine learning, The Centre of Research Excellence for Data Science and Advanced Cooperative Systems (CREACROSS-Data-Science) co-financed by the Croatian Government and the European Union through the European Regional Development Fund - the Competitiveness and Cohesion Operational Program (KK.01.1.1.01.0009),**  
Role: **Visiting Scholar.**

Modelled safe and explainable machine learning environments with the principles of population dynamics.

2018 – 2019 **Building explainable deep learning models with the phenomenon of retrieval-induced forgetting (RIF), Russian Foundation for Basic Research (project no. 18-37-00219),**  
Role: **PI.**

Modelled a memory phenomenon where remembering causes forgetting (retrieval-induced forgetting, RIF) inside neural networks, which allowed to explain and regulate the dynamics of a learning process.

2018 – 2019 **Modelling principles of machines cognition and communication with the phenomenon of retrieval-induced forgetting (RIF), Russian Federation President Grant (project no. MK-6218.2018.9),**  
Role: **PI.**

Created a model of shared memory with the phenomenon of retrieval-induced forgetting (RIF), where remembering causes forgetting. Formulated novel principles of machine cognition and communication based on the proposed memory model. Adopted these principles to regulate convergence rate/generalization error trade-off in neural networks.

2010 – 2011 **Reducing data redundancy and models complexity with analytical decomposition method, National Program for Innovate Science U.M.N.I.K.,**  
Role: **PI.**

## Skills

Programming languages	C/C++, C#, Java, JavaScript, MATLAB, Octave, LabView, R, Python, Prolog, Erlang, Scala, Haskell, Julia
Frameworks	Keras, PyTorch, Tensorflow, MXNet, Gluon, ONNX
Languages	English, Russian (native)
Training	Deep Learning Lecture Series by DeepMind x UCL (2020), Fast AI by Fast.ai (2019), Reinforcement Learning Lecture Series by DeepMind x UCL (2018), Machine Learning by Stanford University (Mar 30th, 2016; with distinction), Introduction to Machine Learning by Higher School of Economics (Mar 14th, 2016; with distinction), R Programming by Johns Hopkins University (Nov 6th, 2014; with distinction), Introduction to Computer Science and Programming (Python) by MIT (Jan 1st, 2014; with distinction), Writing in Sciences by Stanford University (Nov 22nd, 2013), Digital Signal Processing by Ecole Polytechnique Federale de Lausanne (Dec 26th, 2013; with distinction), Computing for Data Analysis by Johns Hopkins University (Dec 20th, 2013; with distinction), Functional Programming Principles in Scala by Ecole Polytechnique Federale de Lausanne (Dec 1st, 2013; with distinction), Introduction to Mathematical Thinking by Stanford University (Nov 11th, 2013; with distinction), Quantum Mechanics and Quantum Computation by University of California at Berkeley (Oct 24th, 2013; with distinction), Coding the Matrix: Linear Algebra Through Computer Science Application by Brown University (Oct 10th, 2013; with distinction)

## Scientific Community Activities

Academy membership	<b>Full Member of Academy</b> , International Academy of Navigation and Motion Control, Saint-Petersburg
Journal reviewing	Pattern Recognition and Image Processing, Computer Optics, Computers in Human Behavior, IEEE Industrial Electronics, Electronics, Entropy, Machine Learning
Conference proceedings reviewing	ECML PKDD 2019; DS 2019-2020, NeurIPS 2020
Program Committee membership	ECML PKDD 2020

## Academic Honors

2020	<b>Outstanding Teaching Award</b> , Samara National Research University.
2018 – 2020	<b>National Award for Outstanding Research</b> , Ministry of Education and Science of the Russian Federation.
2018	<b>Winner of Science Innovation Competition</b> , National Innovation Promotion Fund, START.
2018	<b>Russian Federation President Grant</b> , President Grant Committee.
2013	<b>Best Young Researcher</b> , Ministry of Education and Science of the Russian Federation.
2010 – 2011	<b>Best PhD Student Scholarship Award</b> , Government of the Russian Federation.
2009	<b>Best Book in Russian Education</b> , National Education Development Fund.
2009	<b>Best PhD student</b> , Ministry of Education and Science of the Russian Federation.
2009	<b>Winner of Youth Science and Innovation Competition</b> , National Innovation Promotion Fund, U.M.N.I.K.

## Selected publications

Journal papers in English	20. <b>Kulikovskikh I.</b> , Lipić T., Šmuc T. (2020). From knowledge transmission to knowledge construction: A step towards human-like active learning. Entropy. 22(8): 906.
	19. <b>Kulikovskikh I.</b> , Prokhorov S., Lipić T., Legović T., Šmuc T. (2019). BioGD: Bio-inspired robust gradient descent. PLoS ONE. 14(7): e0219004.

18. **Kulikovskikh I.**, Prokhorov S., Legović T., Šmuc T. (2019). An SGD-based meta-learner with "growing" descent. *Journal of Physics: Conference Series*. 1368: 052008.
17. **Kulikovskikh I.M.** (2018). Meixner nonorthogonal filters. *Automation and Remote Control*. 79(8): 1458-1473.
16. **Kulikovskikh I.M.** (2017). Cognitive validation maps for early occupancy detection in environmental sensing. *Engineering Applications of Artificial Intelligence*. 65: 330-335.
15. **Kulikovskikh I.M.**, Prokhorov S.A., Suchkova S.A. (2017). Promoting collaborative learning through regulation of guessing in clickers. *Computers in Human Behavior*. 75: 81-91.
14. **Kulikovskikh I.M.**, Prokhorov S.A. (2017). Minimizing the effects of floor and ceiling to improve the convergence of loglikelihood. *Procedia Engineering*. 201: 779–788.
13. Prokhorov S.A. **Kulikovskikh I.M.** (2016). Pole position problem for Meixner filters. *Signal Processing*. 120: 8-12.
12. Prokhorov S.A., **Kulikovskikh I.M.** (2015). Unique condition for generalized Laguerre functions to solve pole position problem. *Signal Processing*. 108: 25-29.
- Conference proceedings in English 11. **Kulikovskikh I.**, Legović T. Growth and harvest induce essential dynamics in neural networks. In: *ACM Companion proceedings of the Genetic and Evolutionary Computation Conference (GECCO'2021)*. July 10-14, 2021. @ Lille, France.
10. Prokhorov S.A., **Kulikovskikh I.M.** Fuzzy learning performance assessment based on decision making under internal uncertainty. In: *Proceedings of the 7th Computer Science and Electronic Engineering Conference (CEEC'15)*. Sep 24-25, 2015. Colchester, UK. pp. 65-70.
- Presentations in English 9. **Kulikovskikh I.**, Legović T. Classical versus quantum convergence dynamics in energy-based neural networks. *The Virtual Bristol Quantum Information Technologies Workshop (BQIT:21)*. Apr 26-28, 2021. Bristol, UK.
8. **Kulikovskikh I.**, Lipić T., Šmuc T. Neurons in 'active learning' learn less than they think. *5th Workshop on Data Science (IWDS 2020)*. Nov 24, 2020. Zagreb, Croatia.
7. **Kulikovskikh I.**, Šmuc T. Machines in a classroom: Towards human-like active learning. *22nd Conference on Discovery Science (DS 2019)*. Oct 28-30, 2019. Split, Croatia.
6. **Kulikovskikh I.**, Šmuc T. Bio-inspired robust machine learning. *4th Workshop on Data Science (IWDS 2019)*. Oct 15, 2019. Zagreb, Croatia.
5. **Kulikovskikh I.**, Šmuc T. Robust machine learning inspired by the models of population dynamics. *12th International Ljubljana-Zagreb Workshop on Knowledge Technologies and Data Science*. Oct 24-25, 2019. University of Zagreb, Zagreb, Croatia.
4. **Kulikovskikh I.** Modelling machine-machine interactions with the generalized logistic equation. *Seminar on Data Science*. Nov 8, 2018. Laboratory for Machine Learning and Knowledge Representation, Ruđer Bošković Institute, Zagreb, Croatia.
3. **Kulikovskikh I.** The exponential equation which describes learning processes in technical, social, and natural environments. *Seminar on Machine Learning*. Mar 29, 2018. Computational Center of Russian Academy of Sciences, Moscow.
2. **Kulikovskikh I.** Implicit regularization of regression models. *Seminar on Problems in Mathematics*. Dec 8, 2017. Department of Mathematics, Samara National Research University, Samara.
- Books in Russian 1. Prokhorov S.A., **Kulikovskikh I.M.** Classical orthogonal functions and its applications. Part I. Orthogonal functions of exponential type. Samara: Samara Scientific Center of the Russian Academy of Sciences, 2013. 200 p. [in Russian]