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Ilona Kulikovskikh

Senior Research Associate

Research Interests

Machine learning; Statistical data processing; Signal processing; Cognitive science; Artificial Intelligence; Human-robot relation and collaboration; Robotic cognition and communication; Robotics and automation control; Behavior science; Evolution of mind and cognitive functions, animal communication; Bio-inspired computing; Life long learning

Academic positions

Nov 2018 - present, Research Associate
Faculty of Electrical Engineering and Computing (FER),
University of Zagreb, Zagreb, Croatia;
Laboratory for Machine Learning and Knowledge Representation,
Rudjer Boskovic Institute, Zagreb, Croatia

- Participated in the 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 Program-me (KK.01.1.1.01.0009): Advanced Methods and Technologies in Data Science and Cooperative Systems (DATACROSS)
- Created bio-inspired gradient methods with greater sustainability (stability and adaptability) to the variations in the input data
- Implemented the sustainable to adversarial attacks deep learning models based on the bio-inspired gradient methods
- Developed future collaborations
- Wrote up research work for publication and presentation

Jan 2018 - present, Senior Research Associate, Group Leader
Department of Information Systems and Technologies,
Institute of Computer Science, Mathematics and Electronics,
Samara National Research University, Samara, Russia

- Led the following research projects:
  Russian Foundation for Basic Research (18-37-00219): A model of deep learning based on the phenomena of retrieval-induced forgetting (RIF)
  Russian Federation President Grant (MK-6218.2018.9): Individual and group machine learning based on the phenomena of retrieval-induced forgetting (RIF)
- Gained funding, managed budgets
- Built a research group, set personal and research priorities
- Developed effective plans to support research delivery, managed internal and external group relationships to deliver impact

- Coached group members to support development of independence, ensured their career progression - built reputation, profile and esteem
- Developed future collaborations
- Conducted research, wrote up research work for publication and presentation

Sep 2017 - present, Associate Professor
Department of Information Systems and Technologies,
Institute of Computer Science, Mathematics and Electronics,
Samara National Research University, Samara, Russia

- Taught the following courses:
  Mathematical Modelling, postgraduate study,
  PhD's programme in Applied Mathematics and Computer Science
  Digital Signal and Image Processing, postgraduate study,
  Master's programme in Informatics and Computing Tools
  Data Mining and Big Data, postgraduate study,
  Master's programme in Data Analysis and Software Quality Assurance
  Automated Software Testing, postgraduate study,
  Master's programme in Data Analysis and Software Quality Assurance
  Programming in Modern Fortran, postgraduate study,
  Master's programme in Programming Technologies for Intel Computing Platforms
  Software Testing and Debugging, postgraduate study,
  Master's programme in Programming Technologies for Intel Computing Platforms
  Performance Engineering of Software Systems, postgraduate study,
  Master's programme in Programming Technologies for Intel Computing Platforms
- Supervised Master's theses and students research

May 2014 - Jun 2016, Research Associate
Laboratory of Automated Research Systems,
Samara State Aerospace University, Samara, Russia

- Produced computational models using machine learning techniques to describe students' behaviour in multiple-choice testing
- Provided programming support to validate these models on modelled data and in a real-world environment
- Created computational models to classify learners' partial knowledge according to Bloom's cognitive levels
- Wrote up research work for publication and presentation

- Created computational models to classify learners' partial knowledge according to Bloom's cognitive levels
- Wrote up research work for publication and presentation

Sep 2011 - Sep 2017, Associate Professor
Department of Information Systems and Technologies,
Samara State Aerospace University, Samara, Russia

- Taught the following courses:
  Mathematical Modelling, postgraduate study
  Digital Signal and Image Processing, postgraduate study
  Data Mining and Big Data, postgraduate study
  Model-Driven Software Engineering, postgraduate study
  Complex Systems Modelling, undergraduate study
  Computer Graphics, undergraduate study
  Numerical Methods, undergraduate study
  Information Technologies, undergraduate study
- Supervised Master's theses and students research

Sep 2008 - Sep 2011, Assistant Professor
Department of Information Systems and Technologies,
Samara State Aerospace University, Samara, Russia

- Taught the following courses:
  Automated Research Systems Engineering, postgraduate study
- Supervised students research

May 2007 - Dec 2007, Research Assistant
Department of Biomedical and Laser Systems,
Samara State Aerospace University, Samara, Russia

- Created a model of a photoplethysmographic signal to detect hidden venous pulsations in case of arterial stiffness
- Carried out spectral analysis of photoplethysmographic signals to classify patients into biological age groups
- Wrote up research work for publication and presentation

Industry positions

May 2019 - present, Chief Scientific Officer (CSO), Co-Founder
Team Chemistry LLC, Samara, Russia

- Co-led the start-up project:
  National Programme START-1-18 (C1-51885): Creating a web platform for building the most efficient teams in business and government using machine learning techniques based on cognitive maps
- Created computational models and algorithms for supporting and improving the adaptivity of social and environmental human-human, machine-machine and human-machine interactions
- Implemented the prototype of a platform for controlled human-human and machine-machine behavioral experiments
- Wrote up research work for publication and presentation

Jan 2012 - Jul 2013, Data Scientist, Software Engineer
Centre for Neuropsychological Assessment, Samara, Russia

- Modelled data sets from large structured and unstructured data repositories
- Created programs to gather statistics and analyse the data sets using machine learning techniques
- Administrated VMware EsXi: Debian and Windows

Feb 2008 - Jun 2010, Data Scientist
Laboratory of Catalytic Converter Analysis,
JSC RosEco, VAZ Car Factory, Tolyatti, Russia

- Developed algorithms and wrote programs to predict the level of future emissions
- Provided assistance within the pre-processing effort to analyse experimental data sets

Education

2013 - 2018, Samara National Research University, Samara, Russia
***Doctor of Sciences** in Theoretical Computer Science
(submitted, expected an official defence and diploma)
* A post-doctoral degree called Doctor of Sciences is given to reflect second advanced research qualifications or higher doctorates in ISCED 2011.

2008 - 2011, Samara State Aerospace University, Samara, Russia
***Candidate of Sciences (PhD)** in Signal Processing, Data Processing and Automation Control
(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 the Associate Professor.

2002 - 2008, Samara State Aerospace University, Samara, Russia
Computer Engineer, Computer Science and Engineering
(diploma BCA 0712081 issued Feb 4, 2008, with distinction)

Training

Online courses
Machine Learning
(certificate issued Mar 30, 2016 by **Stanford University**)

Introduction to Machine Learning
(certificate issued Mar 14, 2016 by **Higher School of Economics**)

The Data Scientist's Toolbox
R Programming
Getting and Cleaning Data
(certificate issued Nov 6, 2014 by **Johns Hopkins University**)

Principles of Written English. Part III
(certificate issued Mar 8, 2014 by **University of California at Berkeley**)

Principles of Written English. Part II
(certificate issued Feb 28, 2014 by **University of California at Berkeley**)

Introduction to Computer Science and Programming (Python)
(certificate issued Jan 1, 2014 by **MIT**)

Digital Signal Processing
(certificate issued Dec 26, 2013 by **Ecole Polytechnique Federale de Lausanne**)

Computing for Data Analysis
(certificate issued Dec 20, 2013 by **Johns Hopkins University**)

Principles of Written English. Part I
(certificate issued Dec 15, 2013 by **University of California at Berkeley**)

Crafting an Effective Writer: Tools of the Trade (Fundamental English Writing)
(certificate issued Dec 2, 2013 by **Mt. San Jacinto College**)

Functional Programming Principles in Scala
(certificate issued Dec 1, 2013 by **Ecole Polytechnique Federale de Lausanne**)

Introduction to Mathematical Thinking
(certificate issued Nov 11, 2013 by **Stanford University**)

Quantum Mechanics and Quantum Computation
(certificate issued Oct 24, 2013 by **University of California at Berkeley**)

Coding the Matrix: Linear Algebra Through Computer Science Application
(certificate issued Oct 10, 2013 by **Brown University**)

Summer and language schools

2019: 4th International Summer School on Data Science.
Split, Croatia, Sep 9-13.

- Introductory Statistics I, II
  Ivo Ugrina, University of Split, Croatia
- Regression: Some Principles and Cautions
  Lynne Billard, University of Georgia, USA
- Analysis of Variance: Covariance and Repeated Measures
  Lynne Billard, University of Georgia, USA
- Dimension Reduction I: Principal Component and Factor Analysis
  Nancy Flournoy, University of Missouri, USA
- Dimension Reduction II : Sliced Inverse Regression and Correspondence Analysis
  Nancy Flournoy, University of Missouri, USA
- Computational Statistics I: Simulating Univariate and Multivariate Data
  Vesna Lužar-Stiffler, CAIR Center and University of Zagreb, Croatia
- Computational Statistics II: Using Simulation to Evaluate Statistical Techniques and Models
  Vesna Lužar-Stiffler, CAIR Center and University of Zagreb, Croatia
- Symbolic Data Analysis
  Lynne Billard, University of Georgia, USA

- Methods of Inference to Follow Adaptive Designs
  Nancy Flournoy, University of Missouri, USA

2014: International Language School EF Educational First. Cambridge, UK, Nov 1-30.
- General English classes at B2.2-C1.1 CEFR levels
- Professional English classes on negotiation

Workshops
2018: International Workshop on EU and Business R&D Project Management organized by project "DATACROSS - Advanced methods and technologies in Data Science and Cooperative Systems" of Centre of Research Excellence for Data Science and Cooperative Systems, H2020 project "Twinning coordination action for spreading excellence in Aerial Robotics - AeRoTwin" and H2020 project "EXCELLABUST - Excelling LABUST in marine robotics". Zagreb, Croatia, Dec 5-7.
- H2020 programme
- Enterprise Europe Network
- Identifying the right call
- Training on writing EU proposals
- Overview on Management of H2020 projects
- Fiscal responsibility and management of budgets
- Research results, deliverables management, and lean/agile methods

Grants

2018-present: The Centre of Research Excellence for Data Science and Advanced Cooperative Systems (CREACROSS-Data-Science) co-financed by the Croatian Governmentand the European Union through the European Regional Development Fund - the Competitiveness and Cohesion Operational Programme (KK.01.1.1.01.0009)
Project title: Advanced Methods and Technologies in Data Science and Cooperative Systems (DATACROSS)
Role: Research Associate

2019-2020: National Programme START-1-18 (C1-51885)
Project title: Creating a web platform for building the most efficient teams in business and government using machine learning techniques based on cognitive maps
Role: Co-Principal Investigator

2018-2019: Russian Foundation for Basic Research (18-37-00219)
Project title: A model of deep learning based on the phenomena of retrieval-induced forgetting (RIF)
Role: Principal Investigator

2018-2019: Russian Federation President Grant (MK-6218.2018.9)
Project title: Individual and group machine learning based on the phenomena of retrieval-induced forgetting (RIF)
Role: Principal Investigator

2016-2017: National Program for Supporting Fundamental and Applied Science
Project title: ”Real-time intelligent systems for space sounding and hyperspectral image processing”
Role: Research Assistant

2015-2016: National Program for Supporting Fundamental and Applied Science
Project title: ”Mathematical modelling complex processes in high-performance computing systems and artificial intelligence systems”
Role: Research Assistant

2010-2011: U.M.N.I.K.: National Program for Innovate Science
Project title: ”Effective data mining algorithms based on an analytical decomposition method”
Role: Principal Investigator

Awards

2018:
Winner of Region Contest for young scientists and engineers

2013:
Winner of Region Contest “Best Young Scientist”,
nomination “PhD”

2009:
Winner of Region Contest “Best Young Scientist”,
nomination “PhD Student”

2009:
Winner of National Contest “Best Book in Russian Education”

2009:
Winner of National Youth Contest for Innovate Science
“U.M.N.I.K.”

Media

Interview: Robots are at the desk: Machines also need to study. POISK: The official newspaper of the Russian Academy of Sciences (RAS). May 24, 2019. Moscow, Russia.

Professional Duties

2012-present: Junior Member of Academy
International Academy of Navigation and Motion Control, Saint-Petersburg, Russia

Programme and/or Reviewer Committee Member

2015-present:

- Mathematical Modelling and Analysis (Taylor & Franis Group)
- International Journal of Adaptive Control and Signal Processing (Taylor & Franis Group)
- Digital Signal Processing (Elsevier)
- Pattern Recognition and Image Processing (Springer)
- Computer Optics (Institution of Russian Academy of Sciences (RAS), Image Processing Systems Institute of RAS)
- Journal of Difference Equations and Applications (Taylor & Franis Group)
- Computers in Human Behavior (Elsevier)

2019: European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (Wurzburg, Germany)
2018: International Conference on Advances in Signal Processing and Artificial Intelligence (Barcelona, Spain)
2014-present: International Conference on Advanced Information Technologies (Samara, Russia)

Projects Evaluation Committee Member

2018-present: EU-H2020 projects
2012-2014: National Programme START projects

Data Science Competitions Participant

2015-present: Kaggle
2015-present: InnoCentive

Skills

Languages

- English - C1
- Chinese - B1
- Japanese - A2
- Korean - A2
- Croatian - A2
- Russian - mother tongue

Programming Languages

- C/C++, C#
- Java, JavaScript
- HTML, CSS, PHP
- MATLAB, Octave
- LabView
- R
- Python
- Fortran
- Prolog, Erlang
- Scala
- Haskell
- Julia
- Swift
- Go
- SQL

Deep Learning Frameworks

- TensorFlow
- Keras
- PyTorch
- MXNet
- Gluon
- ONNX

Publications

Journal papers

Kulikovskikh, I.M. (2019). Reducing computational costs in deep learning on almost linearly separable training data. Computer Optics. (submitted)

Kulikovskikh, I., Prokhorov, S., Legović, T., Šmuc, T. (2019). An SGD-based meta-learner with "growing" descent. Journal of Physics: Conference Series. (accepted)

Kulikovskikh, I., Prokhorov, S., Lipić, T., Legović, T., Šmuc, T. (2019). BioGD: Bio-inspired robust gradient descent. PLoS ONE. 14(7): e0219004.

Kulikovskikh, I.M., Prokhorov, S.A. (2018). Psychological perspectives on implicit regularization: A model of retrieval-induced forgetting. Journal of Physics: Conference Series. 1096(1): 012079.

Kulikovskikh, I.M. (2018). Meixner nonorthogonal filters. Automation and Remote Control. 79(8): 1458-1473.

Kulikovskikh, I.M. (2017). Cognitive validation maps for early occupancy detection in environmental sensing. Engineering Applications of Artificial Intelligence. 65: 330-335.

Kulikovskikh, I.M. (2017). Anomaly detection in an ecological feature space to improve the accuracy of human activity identification in buildings. Computer Optics. 41(1): 126-133.

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.

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.

Prokhorov, S.A. **Kulikovskikh, I.M.** (2016). Pole position problem for Meixner filters. Signal Processing. 120: 8-12.

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

Kulikovskikh, I., Prokhorov, S., Legovic, T., Smuc, T. Growing descent of stochastic gradient with the generalized logistic map. In: Proceedings of the 5th Conference on Information Technology and Nanotechnology (ITNT-2019). May 21-24, 2019. Samara, Russia. pp. 338-344.

Kulikovskikh, I.M., Prokhorov, S.A. A method of implicit regularization based on the phenomena of retrieval-induced forgetting (RIF). In: Proceedings of the 4th Conference on Information Technology and Nanotechnology (ITNT-2018). May 21-24, 2018. Samara, Russia. pp. 2132-2137.

Kulikovskikh, I.M., Prokhorov, S.A. Modifications of log-likelihood to measure floor and ceiling effects. In: Proceedings of the 3rd Conference on Information Technology and Nanotechnology (ITNT-2017). April 25-27, 2017. Samara, Russia. pp. 1849-1853.

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). September 24-25, 2015. Colchester, UK. pp. 65-70.

Prokhorov, S.A., **Kulikovskikh, I.M.**, Tselishev, D.V. Solving recurrences for Laguerre functions to provide scientific computing in mobile technologies. In: Proceedings of the International Conference on Advanced Information Technologies and Scientific Computing. June 30-July 2, 2014. Samara, Russia. pp. 3-6.

Prokhorov, S.A. **Kulikovskikh, I.M.** New handbook on orthogonal functions of exponential type and its applications to create small memory programs in mobile technologies. In: Proceedings of the International Conference on Advanced Information Technologies and Scientific Computing. December 4-6, 2013. Samara, Russia. pp. 8-9.

Kulikovskikh, I.M., Prokhorov, S.A. Some lightweight algorithms for scientific computing in mobile technologies. In: Proceedings of the 8th International Conference on Applied Mathematics and Scientific Computing. June 10-14, 2013. Šibenik, Croatia. pp. 40-41.

Prokhorov, S.A. , **Kulikovskikh, I.M.** SCAN: Software package of spectral-correlation analysis. In: Proceedings of the International Conference on Advanced Information Technologies and Scientific Computing. September 29-October 1, 2010. Samara, Russia. pp. 3-8.

other 97 papers, including six co-authored monographs and study books, published in Russian
Available upon request.

Conference presentations

Kulikovskikh, I., Šmuc, T.
Machines in a classroom: Towards human-like active learning.
22nd Conference on Discovery Science (DS 2019). October 28-30, 2019. Split, Croatia.

Kulikovskikh, I., Šmuc, T.
Bio-inspired robust machine learning.
4th Workshop on Data Science (IWDS 2019). October 15, 2019. Zagreb, Croatia.

Kulikovskikh, I., Prokhorov, S., Legović, T., Šmuc, T.
Growing descent of stochastic gradient with the generalized logistic map.
5th Conference on Information Technology and Nanotechnology (ITNT-2019). May 21-24, 2019. Samara, Russia.

Kulikovskikh, I.M., Prokhorov, S.A.
A method of implicit regularization based on the phenomena of retrieval-induced forgetting (RIF).
4th Conference on Information Technology and Nanotechnology (ITNT-2018). May 21-24, 2018. Samara, Russia.

Kulikovskikh, I.M., Prokhorov, S.A.
Modifications of log-likelihood to measure floor and ceiling effects.
3rd Conference on Information Technology and Nanotechnology (ITNT-2017). Apr 25-27, 2017. Samara, Russia.

Prokhorov, S.A., **Kulikovskikh, I.M.**
Fuzzy learning performance assessment based on decision making under internal uncertainty.
7th Computer Science and Electronic Engineering Conference (CEEC'15). Sep 24-25, 2015. Colchester, UK.

Prokhorov, S.A., **Kulikovskikh, I.M.**, Tselishev, D.V.
Solving recurrences for Laguerre functions to provide scientific computing in mobile technologies.
International Conference on Advanced Information Technologies and Scientific Computing. Jun 30-2 Jul 2, 2014. Samara, Russia.

Prokhorov, S.A. **Kulikovskikh, I.M.**
New handbook on orthogonal functions of exponential type and its applications to create small memory programs in mobile technologies.
International Conference on Advanced Information Technologies and Scientific Computing. Dec 4-6, 2013. Samara, Russia.

Kulikovskikh, I.M., Prokhorov, S.A.
Some lightweight algorithms for scientific computing in mobile technologies.
8th International Conference on Applied Mathematics and Scientific Computing. Jun 10-14, 2013. Šibenik, Croatia.

Prokhorov, S.A. , **Kulikovskikh, I.M.**
SCAN: Software package of spectral-correlation analysis.
International Conference on Advanced Information Technologies and Scientific Computing. Sep 29-Oct 1, 2010. Samara, Russia.

other 25 presentations given in Russian
Available upon request.

Software patents

granted by Federal Institute for Industrial Property

Software Implementation of Long-Term Memory for CNN
I.M. Kulikovskikh, D.V. Bezrukov
Pat. No. 2018664362 issued Oct 30, 2018

Software Implementation of Fuzzy Machine Learning Algorithms
I.M. Kulikovskikh, E.A. Nazarova
Pat. No. 2018664363 issued Oct 30, 2018

Software Implementation of Grouped Machine Learning Algorithms Based on the Phenomenon of Retrieval-Induced Forgetting
I.M. Kulikovskikh, E.A. Ponomarev
Pat. No. 2018665162 issued Nov 6, 2018

Fuzzy Learning Assessment System to Assess Leaning Performance with Partial Knowledge
I.M. Kulikovskikh, S.A. Prokhorov, S.A. Suchkova
Pat. No. 2015660296 issued Dec 16, 2015

Machine Learning System For Teaching English Prepositions
I.M. Kulikovskikh, S.A. Prokhorov, S.A. Suchkova
Pat. No. 2015618129 issued Jul 31, 2015

Mobile Application for Analysing Fourier Coefficients in Demanding Computational Tasks
I.M. Kulikovskikh, S.A. Prokhorov, D.V. Tselishev
Pat. No. 2014619047 issued Sep 8, 2014

Mobile Android-Based Handbook of Basic Orthogonal Exponential Functions
I.M. Kulikovskikh, S.A. Prokhorov, A.P. Mayorov
Pat. No. 2013660124 issued Oct 24, 2013

Analyser of Incomplete Data for iOS
Pat. No. 2013611627 issued Jan 30, 2013
I.M. Kulikovskikh, S.A. Prokhorov, Ya.Yu. Bogdanova

Software for Data Mining in Photoplethysmographic Signals
I.M. Kulikovskikh, S.A. Prokhorov, N.S. Phillippova
Pat. No. 2013611625 issued Jan 30, 2013

Software for Catalytic Data Analysis
V.V. Grebnev, G.D. Malchikov, V.I. Zarazhevskij, I.E. Kravchenko, S.A. Prokhorov, **I.M. Kulikovskikh**
Pat. No. 2010616641 issued Oct 6, 2010

Software for Analysis of Jacobi Generalized Orthogonal Polynomials
I.M. Kulikovskikh, S.A. Prokhorov
Pat. No. 2009614285 issued Aug 14, 2009

SCAN: Research Software for Spectral-Correlation Analysis with Analytical Fourier Decomposition Method
I.M. Kulikovskikh, S.A. Prokhorov
Pat. No. 2009613943 issued Jul 24, 2009

References

References upon request.