Aleksandr Petiushko, PhD

Industry and Academia

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Bio

Dr. Aleksandr Petiushko is a Director, Head of Machine Learning Research at Autonomous Driving company Nuro (Mountain View, California), an Adjunct Professor at Sofia University (Palo Alto, California) giving courses on ML and AI, and a lecturer at Lomonosov MSU and MIPT, giving lectures on the Theory of Deep Learning. Before Nuro, worked as a Team Lead / Scientific Expert, Chief Scientist at Huawei, as a Managing Director / Leading Scientific Researcher at Artificial Intelligence Research Institute. The Ph.D. dissertation is at the intersection of Discrete Mathematics and Computer Linguistics. Research interests lie in the applications of empirical and theoretical robustness (publications at ECCV, IJCAI, AAAI, CVPR, NeurIPS).

Education

- PhD in Theoretical CS · 2016
- MSc in Mathematics · 2006

Interests

- Autonomous Driving
- Deep Learning
- Robustness Theory
- Discrete Mathematics

Skills

- Research
- Leadership
- Lecturing

Summary || Last Update: July 2024

Principal RnD Researcher (15+ years of experience), RnD Technical Leader (10+ years of experience), and RnD Manager (8+ years of experience). Running and managing industrial research and academic collaboration (35+ publications, 30+ patents). Hiring and transforming AI/ML teams. Inspired by theoretical computer science and how it changes the world.

Experience

Present — Feb 2022

Director, Head of ML Research Nuro, USA/CA, Mountain View

Responsibilities:

- Managing and hiring the team of highly skilled diverse talents in ML (10+ FTEs, dotted line reports, consultants, interns)
- Internal cross-collaboration and ideas brainstorming with other Behavior and Perception teams
- Technical Roadmaps
- State-of-the-Art frontier research
- Academia collaboration

Technical Directions:

- Prediction (including conditional and joint), Planning (including Diffusion-based), and Motion Selection (RL-based)
- Closed-loop Reasoning
- Synthetic Data Generation
- Reward and Issue Predictor models
- Agent-centric and scene-centric encoders
- Scaling laws in Behavior
- Robustness and Uncertainty of Autonomy Stack
- LLM, VLM, Perception-Behavior interface

Other achievements:

- Internal FTEs ML education through a series of Deep Learning Theory lectures
- Main ideologist and program owner of Nuro ML University (100+ FTEs involved)
- Created Nuro Tech Talks series (top robotics researchers share their ideas for Nuro)
- Made SotA exploration a working internal pipeline
- Constantly increasing Nuro's visibility (participation at conferences, workshops, seminars, etc)

Feb 2022 — Sep 2021

Managing Director, Leading Scientific Researcher Artificial Intelligence Research Institute, Russia, Moscow

Fusion Brain Research Director.

Responsibilities:

- Research roadmap formulation
- Research team hiring
- Leading the research team (6 people)
- Academia collaboration

Technical Directions:

- Multi-modality
- Multi-tasking
- Retrieval-based systems

Sep 2021 — Sep 2014

Chief Scientist, Team Leader Huawei Research, Russia, Moscow

Technical Lead and Research Manager.

Responsibilities:

- Video Intelligence direct management (∼15 people, plus interns)
- Fundamental Research (∼25 experts from different groups) team leadership
- Academia collaboration projects on Fundamental Research in AI
- Interviewing young talents
- Mentoring interns
- Remote work coordination

Sep 2021 – Sep 2014

Chief Scientist, Team Leader — Huawei Research, Russia, Moscow

Technical Directions:

- Video Recognition and Retrieval (MML, MDMMT, top place on smth2smth)
- Trajectory Prediction (top places on Argoverse and Apolloscape benchmarks)
- Face Recognition (Detection and Identification)
- Domain Adaptation (computer vision)
- Multi-task end2end (keypoints, detection, segmentation)
- Storage (cold storage, erasure coding, object distribution, file type recognition with ML)
- NeuralNets for Computer Vision (Super Resolution, DeBlur, Compression)
- Robustness in DL
- Geometrical DL

Other achievements:

- Organized and maintained the Fundamental Research team (with publishing activity)
- Organized and initially led the first Neural Net direction at Huawei MRC
- Proposed and prepared the multi-year funding project Fundamental Research in AI at Huawei MRC

May 2014 – Nov 2008

Senior Software Engineer — LSI Corporation (now Broadcom), USA/CA, San Jose (remote)

Engineering responsibilities:

- Media gateway (DSP for audio)
- WCDMA protocol (preamble detection)
- LDPC (trapping set analysis)
- Gesture recongintion (classical ML in CV)
- Flash controller (wear leveler, garbage collector)

Other achievements:

- 30+ patents on storage systems, ML and Computer Vision
- Some demo videos: 1, 2, 3

Nov 2008 – Feb 2007

Software Engineer — RIRC of Briansk region, Russia, Briansk

Creating and supporting of a large DB (∼1-10M records) on Oracle, implementing its functionality using PL/SQL; a number of client interfaces (Perl – CGI/Tk, AJAX (prototype, jQuery), Delphi) for interconnection with DB; Windows SVN server administration.

Apr 2007 – Sep 2006

Software Engineer — Computer Technologies, Russia, Briansk

Creating and supporting of bundled software to automate Internet provider tasks (accounting systems, billings, client and server-side for payment systems CyberPlat and OSMP using MySQL, PostgreSQL and Perl); implementing different web-interfaces and admin scripts (Perl, bash + sed, grep, awk) on demands for the administration department.

Jun 2006 – Feb 2006

Integration and testing department specialist — Auriga, Russia, Moscow

RTOS lynxOS testing in different environments, different scripts for testing (Perl, bash + sed, grep, awk); participating in porting utilities, OS code bug fixing (C); using CVS, RCS.

Jun 2006 – Dec 2003

Software Engineer — Neurocom, Russia, Moscow

Speech experiments, algorithms development (Matlab, C) and speech recognition in noisy conditions.

Apr 2006 – Jul 2005

Software Engineer — Optical and Electronic Technologies, Russia, Moscow

Statistical experiments, algorithms development using Matlab for observation and tracing problem (video data from infrared imager).

Academia

Jul 2023 - ...

Adjunct Professor — Sofia University, USA/CA, Palo Alto

Machine Learning and Artificial Intelligence courses.

Feb 2023 - ...

Visiting Professor — Moscow Institute of Physics and Technology, Russia, Moscow

Theory of Deep Learning courses.

Feb 2019 - ...

Visiting Professor — Lomonosov Moscow State University, Russia, Moscow

Python, Computer Vision, Machine Learning, Theory of Deep Learning courses.

Education

Mar 2016 — **Doctor of Philosophy (Ph.D.)** — Lomonosov Moscow State University, Russia, Moscow
Russian name - "Candidate of Physical and Mathematical Sciences", defended at Lomonosov MSU, Department of Mechanics and Mathematics.
Dissertation "Bigram Languages", major 01.01.09 - Discrete Mathematics and Mathematical Cybernetics. Abstract. Youtube recording (all links are in Russian).

Nov 2012 – Sep 2009 — **Postgraduate Student** — Lomonosov Moscow State University, Russia, Moscow
Postgraduate study at Lomonosov MSU, Department of Mechanics and Mathematics. Major 01.01.09 - Discrete Mathematics and Mathematical Cybernetics.

Jul 2006 – Sep 2000 — **Master of Science (M.Sc.)** — Lomonosov Moscow State University, Russia, Moscow
Russian name - "specialist" (theoretical and applied mathematics), major in the discrete mathematics at Lomonosov MSU, Department of Mechanics and Mathematics.
Thesis "Dynamic adjustment of signals". Incomplete (but the best that I could find) text (in Russian).
GPA 4.89/5, Diploma with honors.

Jul 2000 – Jan 1997 — **High School** — Briansk Pushkin's Lycee, Russia, Briansk
High School, Briansk Pushkin's Lycee, Physics and Mathematics major.
Gold medal.

Academic services

Apr 2023 - ... — **Conference Reviewer**
Serving as a reviewer for publications at conferences CVPR, NeurIPS, ICLR, AAAI, ICML, WACV.

May 2021 - ... — **Journal Reviewer**
Serving as a reviewer for publications in Neurocomputing.

Publications

Selected conference/journal/patent publications. For the full list (35+ publications, 30+ patents, about 70 in total), please refer either to the Google Scholar or Personal Webpage.

2024 — J. Booher, K. Rohanimanesh, J. Xu, and A. Petiushko. *CIMRL: Combining IMitation and Reinforcement Learning for Safe Autonomous Driving*. 2024. arXiv Preprint: 2406.08878

2023 — Z. Zhou, J. Booher, W. Liu, A. Petiushko, and A. Garg. "Multi-Constraint Safe RL with Objective Suppression for Safety-Critical Applications". In: *Symposium Machine Learning for Autonomous Driving (ML4AD)*. 2023

2023 — D. Bakshandaeva, D. Dimitrov, V. Arkhipkin, A. Shonenkov, M. Potanin, D. Karachev, A. Kuznetsov, A. Voronov, V. Davydova, E. Tutubalina, and A. Petiushko. "Many heads but one brain: FusionBrain – a single multimodal multitask architecture and a competition". In: *Computer Optics* 47.1 (2023), pp. 185–195

2022 — M. Pautov, O. Kuznetsova, N. Tursynbek, A. Petiushko, and I. Oseledets. "Smoothed Embeddings for Certified Few-Shot Learning". In: *Advances in Neural Information Processing Systems (NeurIPS)*. vol. 35. 2022, pp. 24367–24379

2022 — N. Muravev and A. Petiushko. "Certified Robustness via Randomized Smoothing over Multiplicative Parameters of Input Transformations". In: *Proceedings of the Thirty-First International Joint Conference on Artificial Intelligence, (IJCAI)*. 2022, pp. 3366–3372

2022 — M. Pautov, N. Tursynbek, M. Munkhoeva, N. Muravev, A. Petiushko, and I. Oseledets. "CC-Cert: A probabilistic approach to certify general robustness of neural networks". In: *Proceedings of the AAAI Conference on Artificial Intelligence (AAAI)*. vol. 36. 7. 2022, pp. 7975–7983

2021 — M. Dzabraev, M. Kalashnikov, S. Komkov, and A. Petiushko. "MDMMT: Multidomain Multimodal Transformer for Video Retrieval". In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*. 2021, pp. 3354–3363

2021 — S. Komkov and A. Petiushko. "AdvHat: Real-World Adversarial Attack on ArcFace Face ID System". In: *2020 25th International Conference on Pattern Recognition (ICPR)*. 2021, pp. 819–826

2016 — A. Petiushko, D. Parfenov, I. Mazurenko, and A. Kholodenko. *Methods and apparatus for merging depth images generated using distinct depth imaging techniques*. US Patent App. 14/233,943. 2016

2015 — A. Petiushko. "On context-free bigram languages". In: *Intelligent Systems* 19.2 (2015), pp. 187–208

2010 — A. Petiushko. "On Markov Random Fields and Their Relationship with Markov Chains". In: *Intelligent Systems* 14.1-4 (2010), pp. 225–236

Public Tech Talks

Selected technical talks. For the full list (35+ talks in total), please refer to the Personal Webpage.

Jun 2024 — *Combining IMitation and Reinforcement Learning for Safe Autonomous Driving*
Invited speaker at 2024 DDADS Workshop

Dec 2023 — *Scaling Laws for Autonomous Driving Models*
Invited speaker at 2023 ML4AD Symposium

Jun 2023 — *Behavior Modeling and Learned Motion Selection for Safe Driving*
Invited speaker at 2023 CVPR SSAD Workshop

Oct 2022 — *Autonomy Challenges*
A Berkeley Deep Drive Lecture

Nov 2021 — *Effective Multi-modal Multi-task models*
Invited speaker at Machine Learning and Artificial Intelligence Technologies Workshop, Sirius Educational Center

Oct 2021 — *Certified Robustness, High Dimensions and Computer Vision*
Invited speaker at SAMPLE - Statistics, Artificial Intelligence, Machine Learning, Probability, Learning Theory Event

Projects

Some projects that I'm proud of.

Jul 2023 - Nov 2023 — **Nuro ML University (NMLU)** — Nuro, USA/CA, Mountain View
The main ideologist and the program owner of Nuro ML University: 100+ full-time employees involved, 3 parallel tracks (novice, average, and SotA).

Apr 2023 - ... — **Nuro Tech Talks** — Nuro, USA/CA, Mountain View
The creator of Nuro Tech Talks series where top robotics researchers share their research ideas for Nuro: 20+ talks with speakers from multiple countries, universities, and companies.

Sep 2019 - Dec 2021 — **School of Huawei Advanced Research Education (SHARE)** — Huawei Research, Russia, Moscow
The main technical coordinator and the owner of Machine Learning and Computer Vision specialization of the School of Huawei Advanced Research Education (briefly SHARE) at Lomonosov Moscow State University, the biggest Russian University.

Jul 2019 — **Hackathon: Metric Learning for facial descriptors** — Huawei Research, Russia, Moscow
I was invited by the Russian Association for Artificial Intelligence to organize and run a hackathon to find the best similarity metric for the FaceID system.

Jan 2017 — **Python's imresize()** — Russia, Moscow
I wrote a Python code mimicking the MatLab imresize() function which is often used for super-resolution challenges. Project has apprx 150 stars on github.

Jan 2008 — **FTP Search Engine** — Russia, Briansk
I wrote two versions of the ftpsearch engine: one running on the ftp server itself, another for scanning ftp servers remotely. All versions include an indexer and a web-interface for the search itself. These two versions were deployed on two main Briansk Internet providers of that time: BryanskTel and BKS-TV.

Professional Awards

Moscow Institute of Physics and Technology, Russia, Moscow

2022 — Top-10 MIPT Publishing Scientists

Huawei Research, Russia, Moscow

2020 — Best Mentor, Fundamental Research Incentive, Team Golden Medal, Future Star
2019 — Outstanding Individual, Future Star, Team Golden Medal, Top Selling Point Delivery
2018 — Technology Innovation and Breakthrough, Quality Star, Golden Luban, Excellent Delivery and Customer Success
2017 — Outstanding Contractor

Hobbies

Traveling, biking, modern physics, math puzzles, adventure games, family.