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 Machine Learning, 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

Principal RnD Researcher (15+ years of experience), RnD Technical Leader (10+ years of experience), and RnD Manager (7+ years of experience). Running and managing industrial research and academic collaboration (35+ publications, 30+ patents). 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, plus 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) and Planning (including Diffusion-based)
- Motion Selection (RL-based)
- Agent-centric and scene-centric encoders
- Scaling laws in Behavior
- Robustness and Uncertainty of Autonomy Stack
- Reward and issue predictor models
- LLM and VLM

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

Sep 2021

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

Sep 2014

May 2014

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

Nov 2008

Software Engineer   RIRC of Briansk region, Russia, Briansk

Creating and supporting of a large DB ($\sim$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.

Feb 2007

Apr 2007

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.

Sep 2006

Jun 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.

Feb 2006

Jun 2006

Software Engineer   Neurocom, Russia, Moscow

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

Dec 2003

Apr 2006

Software Engineer   Optical and Electronic Technologies, Russia, Moscow

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

Jul 2005

Academia

Jul 2023 - ...	**Adjunct Professor**	**Sofia University**, USA/CA, Palo Alto

Machine Learning 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	**Postgraduate Student**	Lomonosov Moscow State University, Russia, Moscow
Sep 2009		

Postgraduate study at Lomonosov MSU, Department of Mechanics and Mathematics. Major 01.01.09 - Discrete Mathematics and Mathematical Cybernetics.

Jul 2006	**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).
Sep 2000   GPA 4.89/5, Diploma with honors.

Jul 2000	**High School**	Briansk Pushkin's Lycee, Russia, Briansk

High School, Briansk Pushkin's Lycee, Physics and Mathematics major.
Jan 1997   Gold medal.

Academic services

Apr 2023 - ...	**Conference Reviewer**	

Serving as a reviewer for publications at conferences NeurIPS, ICLR, CVPR, ICML.

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 Goggle Scholar or Personal Webpage.

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

2022   F. Pavutnitskiy, S. O. Ivanov, E. Abramov, V. Borovitskiy, A. Klochkov, V. Vyalov, A. Zaikovskii, and A. Petiushko. "Quadric Hypersurface Intersection for Manifold Learning in Feature Space". In: *Proceedings of The 25th International Conference on Artificial Intelligence and Statistics (AISTATS)*. vol. 151. 2022, pp. 10999–11013

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.

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
Feb 2021	*CNN Robustness research: Application to face detectors and face ID systems* Invited speaker at 2021 Open conference on Artificial Intelligence by OpenTalks.AI

Projects

Some projects that I'm proud of.

Jul 2023 - Nov 2023	**Nuro ML University (NMLU)** The main ideologist and the program owner of Nuro ML University: 100+ full-time employees involved, 3 parallel tracks (novice, average, and SotA).	Nuro, USA/CA, Mountain View
Apr 2023 - ...	**Nuro Tech Talks** 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.	Nuro, USA/CA, Mountain View
Sep 2019 - Dec 2021	**School of Huawei Advanced Research Education (SHARE)** 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.	Huawei Research, Russia, Moscow
Jul 2019	**Hackathon: Metric Learning for facial descriptors** 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.	Huawei Research, Russia, Moscow
Jan 2017	**Python's imresize()** 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.	Russia, Moscow
Jan 2008	**FTP Search Engine** 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.	Russia, Briansk

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.