Roman Koshkin

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My research aims to leverage bio-inspired backprop-free optimization to advance the state of the art in AI. I am experienced in developing NLP models in Pytorch. I use Python in most projects, but also C++ for performance-critical research code. I have long-standing interests in neuroscience, computational linguistics, NLP/NLU/SiMT, and cognitive science.

SKILLS

ML/DL frameworks/tools: *Pytorch (highest proficiency), HuggingFace, PyTorch Lightning, wandb, scikit-learn, JAX*
Infrastructure: *AWS, slurm*
Programming languages: *Python (highest proficiency), C++, Matlab, R, HTML, JavaScript*
Frontend development: *React/Next.js*
DevOps, CI/CD: *GitHub Actions, Docker, Singularity*
Databases: *Neo4j, Redis, MongoDB, Spark*
LLMOps: *LangSmith, LangChain*

EDUCATION

09/2019 - present **Okinawa Institute of Science and Technology,** ***Neural Coding and Brain Computing Unit****, Japan*
PhD in Computational Neuroscience *Expected graduation*: **06/2025**

06/2017 **National Research University HSE,** *Moscow, Russia*
Master of Science, Psychology (**with distinction**, GPA: 8.9/10)

06/2002 **VUMO University,** *Moscow, Russia*
Specialist, Linguistics (**with honors**, GPA: 4.9/5)

EMPLOYMENT IN RESEARCH ORGANIZATIONS

07/2023 – 10/2023 **Special Research Student**, ***NLP Group****, AHC Lab, Nara Institute of Science and Technology, Japan*
- Developed speech-to-text and speech-to-speech SiMT models leveraging open-source causal LLMs.
- MLOps/LLMOps: set up multiple parallel experiments to identify best design and HP choices.

07/2022 – 11/2022 **Research Intern**, ***Araya****, Reinforcement Learning Research Team, Tokyo, Japan*
- Conduct research towards using EEG for robot control with a brain-machine interface
- Compiled a sensor-aligned motor imagery EEG dataset on which I
- Trained a self-supervised EEG feature extractor with a contrastive loss and
- Achieved competitive performance in downstream tasks (incl. MI imagery classification).
- Reimplemented and open-sourced META AI's M/EEG speech-decoding model. The replication achieved results comparable to the original paper.

09/2017 – 07/2019 **Junior Research Fellow**, ***Center for Bioelectric Interfaces****, Institute of Cognitive Neuroscience, National Research University HSE, Moscow, Russia*
- Coordinated a research team of 3 people for 2 years
- Conceptualized and conducted neuromarketing and consumer behavior research experiments
- Designed and implemented EEG data collection and pre-processing pipelines
- Wrote and maintained data acquisition software (Python front- & backend)
- Designed and trained DL models for estimating respondents' opinion of advertised products
- Taught EEG data pre-processing techniques, Python and MATLAB to junior lab members
- Provided oral status updates and written progress reports to the funding company (Neurotrend)
- Co-authored one patent (RF Patent 2747571)

PATENTS

RF Patent 2747571. Electroencephalographic method and system of objective estimation of listeners' reaction to audio content based on a range of voluntary affective categories. https://bit.ly/EEGpatent2

GRANTS AND FELLOWSHIPS

2023 **KAKENHI Grant-in-Aid (¥ 1.8M)** (https://cir.nii.ac.jp/crid/1040577431243576704)
2023 **Japan Society for the Promotion of Science Fellowship** (http://bit.ly/3PjzL7y)
2021 **Google PhD Fellowship ($ 10K)** (https://research.google/outreach/phd-fellowship/recipients/?category=2021)

PREPRINTS & PEER-REVIEWED PUBLICATIONS

Koshkin, R., Sudoh, K., Nakamura, S. (2024). TransLLaMa: LLM-based Simultaneous Translation System. *arXiv.* https://arxiv.org/abs/2402.04636

Koshkin, R., Fukai, T. (2024). convSeq: Fast and Scalable Method for Detecting Patterns in Spike Data. *arXiv.* https://arxiv.org/abs/2402.01130

Koshkin, R., Fukai, T. (2023). Unsupervised Detection of Cell Assemblies with Graph Neural Networks. *In ICLR 2023 Tiny Papers Track.* https://openreview.net/pdf?id=Tbzv_BbjjO8

Koshkin, R., Shtyrov, Y. , Myachykov, A, & Ossadtchi, A. (2018). Testing the Efforts Model of Simultaneous Interpreting. *PLoS ONE 13*(10): e0206129. https://doi.org/10.1371/ journal.pone.0206129

Koshkin, R., & Ossadtchi, A. (2017). Commentary: Functional Connectivity in the Left Dorsal Stream Facilitates Simultaneous Language Translation: An EEG Study. *Frontiers in Human Neuroscience, 11*(2), 273. http://doi.org/10.3389/fnhum.2017.00064

Koshkin, R., Ossadtchi, A. & Shtyrov, Y. (2017). Attention, Working Memory And Listening In Simultaneous Interpreting. *Russian Journal of Cognitive Science, 4*(4). http://cogjournal.org/eng/4/4/index.html

Koshkin R. (2016). Comparative Analysis of Quantitative Dynamics of English-Russian and Russian-English Simultaneous Interpreting. *Bulletin of Moscow University, Series 22: Theory of Translation. Vol. 2*, 28-43 https://elibrary.ru/item.asp?id=27125259

POSTER PRESENTATIONS AND TALKS

Koshkin, R, Fukai, T. (2022). Astrocytes facilitate self-organization and remodeling of cell assemblies under STP-coupled STDP. SfN Conference, Nov 14-16, San Diego. Abstract: https://bit.ly/SfN_nov_2022

Koshkin, R., Fukai, T (2021). Leveraging Self-organized Structure for Memory Encoding in Binary Networks. RIKEN-OIST Symposium, Oct. 6-7, 2021, Japan Poster: https://bit.ly/3lgsqGO

Koshkin, R., Shtyrov, Y. & Ossadtchi, A. (2017). Testing One Aspect of the Efforts Model of Simultaneous Interpreting: An ERP Study. In *Proceedings of the Workshop "Neurobiology Of Speech And Language"*, Oct. 27-29, 2017, SPb, Russia Abstract: http://bit.ly/2y52Hu3 Poster: http://bit.ly/2ljEytV

Koshkin, R., Ossadtchi, A. & Shtyrov, Y.(2016). N1 ERP As an Index of Depth of Processing In Simultaneous Interpreting. In *Proceedings of Communication, Computation, and Cognitive Processes*, Sept. 28-29, 2016, Moscow, Russia Abstract: http://bit.ly/2lhyWjP

Koshkin, R., Ossadtchi, A. & Shtyrov, Y.(2017). Working Memory Load In Simultaneous Language Interpretation: An ERP Study. *IEEE International Symposium «Video and Audio Signal Processing in the Context of Neurotechnologies»*, Jun. 26-30, 2017, SPb, Russia Abstract: http://bit.ly/2ANhSVD

Kuznetsova A., **Koshkin R.**, Ossadtchi A. (2017). Localizing Hidden Regularities With Known Temporal Structure in the EEG Evoked Response Data. *IEEE International Symposium «Video and Audio Signal Processing in the Context of Neurotechnologies»*, Jun. 26-30, 2017, SPb, Russia Abstract: http://bit.ly/2ANhSVD

Does High WM load Disrupt Listening in Simultaneous Interpreting? Higher School of Economics, April 27, 2017. Slides: http://bit.ly/2yKSjqN

CONFERENCE PROCEEDINGS AND BOOK CHAPTERS

Koshkin, R., Ossadtchi, A. (2017). Working Memory Load in Simultaneous Language Interpretation: An ERP Study. In *Proc. of the 4th Conference "Cognitive Science in Moscow: New Research"*. July 15, 2017, Moscow, Russia. p. 434 http://virtualcoglab.ru/MoscowCogSci2017Proceedings.pdf

Garcia, A., **Koshkin, R.**, Paiva, T. (2023). EEG. In *Cognitive Translation and Interpreting Studies. Amsterdam: John Benjamins.* (In review)

RESEARCH PROJECTS

09/2020 – 09/2021 **Self-organization in a Recurrent Network of Binary Neurons**
OIST Neural Coding and Brain Computing Unit
Implemented a recurrent network of binary neurons whose connections self-organize over time. Wrote a high-performance implementation in C++ with an easy-to-use Python API that enables faster hypothesis testing and parameter search.

04/2020 – 09/2020 **Tutoring Object Manipulation Skills in a Human-Robot Interaction Paradigm**
OIST Cognitive Neurorobotics Unit
Trained a humanoid robot to perform a reach-and-grasp task by combining a limited set of learned motor primitives into novel motion trajectories. This work was inspired by the stochastic PV-RNN architecture.

1/2020 – 4/2020 **Spike-Timing Dependent Plasticity in Image Classification Tasks**
OIST Neural Coding and Brain Computing Unit
Built an STDP-based spiking neural network for image classification. I built on recent work and aimed to enhance the performance of published models trained on high dimensional image data.

09/2019 – 12/2019 **Extended Ca^{2+} Buffer and Dynamics Model of the Rat Hippocampal Presynapse**
OIST Computational Neuroscience Unit
Implemented a reaction-diffusion model of Ca2+ dynamics in the rat hippocampal presynapse. Modeled local and global Ca2+ profiles in an extended buffer model with voltage-dependent calcium channels.

10/2017 – 07/2019 **Neurobarometer,** *Center for Bioelectric Interfaces, Higher School of Economics*
Led software & algorithm development towards building a portable EEG-based device for neuromarketing and consumer behavior research.

09/2016 – 04/2017 **Finding Weak Effects with Known Temporal Structure in Evoked Response Data,** *NRU HSE*
Contributed to designing a novel projection-based method for identifying weak effects in noisy ERP data

09/2015 – 09/2016 **Attention and Working Memory in Simultaneous Interpreting,** *Higher School of Economics*
Tested the Efforts Model of simultaneous interpreting using the ERP technique

COURSES AND SUMMER SCHOOLS

09/2014 Neurolinguistics Summer School, National Research University Higher School of Economics
09/2005 Advanced English Course, St. John College of the University of Leeds, York, UK

TEACHING, MENTORSHIP AND OTHER EXPERIENCE

11/2021 **Science Mentor**, *Okinawa, Japan*
Taught Introduction to Deep Learning with Python to high-school students.