Leo Kozachkov

Pronounced 'Cause-Itch-Cove'
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CURRENT AFFILIATION

Postdoctoral Associate   Dec 2022 – Present
McGovern Institute for Brain Research
MIT, Cambridge, MA
PI: Guangyu Robert Yang

EDUCATION

Doctor of Philosophy, Brain and Cognitive Sciences   Sept 2017 – Nov 2022
MIT, Cambridge, MA
Advisors: Earl K. Miller & Jean-Jacques Slotine

Bachelor of Science, Physics   Sept 2012 – May 2016
Rutgers University, New Brunswick, NJ
  ○ Minor in Mathematics

PAPERS

Kozachkov, L., Kastanenka, K.V., & Krotov, D. "Building Transformers from Neurons and Astrocytes".
To Appear: Proceedings of the National Academy of Sciences (2023). [Link]

Kozachkov, L., Wensing, P., & Slotine, J.-J. "Generalization as Dynamical Robustness: The Role of Riemannian Contraction in Supervised Learning".
Transactions of Machine Learning Research (2023). [Link]

Tauber, J., Brincat, S., Stephen, E., Donoghue, J., **Kozachkov, L.**, Brown, E., Miller, E.K. "Propofol mediated unconsciousness disrupts progression of sensory signals through the cortical hierarchy"
bioRxiv (2023). [Link]

Ostrow, M., Eisen, A., **Kozachkov, L.**, Fiete, I. "Beyond Geometry: Comparing the Temporal Structure of Computation in Neural Circuits with Dynamical Similarity Analysis"
arXiv (2023). [Link]

Kozachkov, L., Tauber, J., Brincat, S., Slotine, J.-J., & Miller, E.K. "Robust and Brain-Like Working Memory through Short-Term Synaptic Plasticity".
PLoS Computational Biology (2022). [Link]

Kozachkov, L., & Slotine, J.-J. "Matrix Measure Flows: A Novel Approach to Stable Plasticity in Neural Networks".
arXiv (2022). [Link]

Kozachkov, L., Ennis, M., Slotine, J.-J. "RNNs of RNNs: Recursive Construction of Stable Assemblies of Recurrent Neural Networks".
Neural Information Processing Systems (2022). [Link]

Kozachkov, L., Lundqvist, M., Slotine, J.-J., & Miller, E.K. "Achieving stable dynamics in neural circuits".

PLoS Computational Biology (2020). [Link]

Kozachkov, L., & Michmizos, K. "Sequence learning in Associative Neuronal-Astrocytic Networks".
13th International Conference on Brain Informatics (2020). [Link]

Kozachkov, L., & Michmizos, K. "The causal role of astrocytes in slow-wave rhythmogenesis: A computational modelling study".
arXiv (2017). [Link]

INVITED TALKS

October 26 2022: NeuroAI Lab, Stanford University, CA

October 20 2022: Francesco Bullo Group, University of Santa Barbara, CA

September 01 2022: Center for Computational Neuroscience, Flatiron Institute, New York

HONORS & AWARDS

NeurIPS Scholar Award	2022
Singleton Fellowship	2021-2022
Best Paper Award, 1st Runner Up, 13th International Conference on Brain Informatics	2020
Paul Robeson Scholar, School of Arts and Sciences	2016
Dean's List	$2013 - 2014 - 2015 - 2016$
Bronze Medal, University Physics Competition	2014
Research Assistant Award, Aresty Research Center	$2013 - 2014$

  ◦ 29% acceptance rate.

Writers Foundation Award   2012
  ◦ For "excellence in creative writing."

CONFERENCES

Kozachkov, L., et al. "Robust and Brain-Like Working Memory Through Short-Term Synaptic Plasticity" Gordon Conference on Neurobiology, 2022, ME.

Kozachkov, L., et al. "Dynamic stability underlies cortical computations during working memory" Society for Neuroscience 2021, Chicago, IL.

Eisen, A., **Kozachkov, L.**, et al. "Propofol anesthesia changes dynamic stability in cortex" Society for Neuroscience 2021, Chicago, IL.

Kozachkov, L., Michmizos, K. "Sequence learning in Associative Neuronal-Astrocytic Network" 13th International Conference on Brain Informatics, 2020.

Kozachkov, L., et al. "Achieving and using stability in neural circuits" Society for Neuroscience 2019, Chicago, IL.

Kozachkov, L., et al. "Combination and Stability Properties of Echo-State Net-

works" Society for Neuroscience 2018, San Diego, CA.

Kozachkov, L., Michmizos, K. "A Biomimetic Neural-Astrocytic Network: Adding a Slow Layer for Fast Information Processing" NICE 2017, Dayton, Ohio.

Shinbrot T, **Kozachkov, L.**, Siu T. "A nonlinear feedback model for granular and surface charging." Applied Physics Society Meeting, 2015, San Antonio, TX.

TECHNICAL SKILLS	**Languages**: Python, MATLAB
	Packages: PyTorch, PyTorch Lightning, scikit-learn, NumPy, SciPy, LaTeX
	Developer Tools: Git, Windows Subsystem for Linux (WSL)
	Mathematics (Selected Topics): Nonlinear Control Theory, Dynamical Systems Theory, Linear Algebra, Calculus, ODEs, PDEs, Mathematical Theory of Statistics & Probability, Statistical Learning Theory

TEACHING EXPERIENCE

Teaching Assistant   Spring 2019, 2020
MIT 9.53
Emergent Computations in Distributed Neural Circuits

Part-Time Lecturer   Sept 2015 – Dec 2015
Rutgers Physics 206
General Physics Lab

RESEARCH EXPERIENCE

Miller Lab + Nonlinear Systems Lab   Sept 2018 – Present
Department of Brain and Cognitive Sciences
Graduate Student
Research Advisor(s): Prof. Earl K. Miller & Jean-Jacques Slotine
  ○ Developing theoretical framework using tools from control theory to understand the role of dynamic stability in neural computations.

  ○ Helping conduct/analyze electrophysiological experiments with non-human primates to understand the role of stability in cortical computations underlying working memory.

Laboratory for Computational Brain   April 2016 – August 2017
Department of Computer Science
Research Assistant
Research Advisor: Prof. Konstantinos Michmizos
  ○ Designed simulations to elucidate the role of low-frequency glial calcium waves in modulating large neural populations.

  ○ Developed minimal, neurophysiologically plausible models of glia-neuron and glia-synapse interactions.

Sengupta Lab   Sept 2015 – May 2016
Department of Physics and Astronomy
Senior Honors Thesis Student
Thesis Advisor: Prof. Anirvan Sengupta
  ○ Modeled and analyzed the effects of epigenetic chromatin silencing on *Neurospora Crassa* circadian rhythm.

Computational Vision and Psychophysics Lab   Sept 2015 – Feb 2016
Department of Psychology, Center for Cognitive Science
Research Assistant
Research Advisor: Prof. Melchi Michel
  ○ Studied the effects of intrinsic position uncertainty on search times in object
    identification tasks for natural, cluttered images.

Shinbrot Lab   Summer 2014
Department of Biomedical Engineering
Research Assistant
Research Advisor: Prof. Troy Shinbrot
  ○ Developed an Ising-like model to simulate spontaneous tribocharging of similar
    materials. Research was presented at American Physical Society, 2015.

Laboratory of Vision Research   Sept 2013 – May 2014
Rutgers Center for Cognitive Science
Aresty Research Assistant
Research Advisor: Prof. Thomas V. Papathomas
  ○ Studied the 3-D perception of faces and scenes. Research presented at the
    Aresty Undergraduate Research Symposium. Poster.

EXTRA-CURRICULAR ACTIVITES

Research Intern   2022 – 2022
MIT-IBM Watson AI Lab
IBM Research

Lifeguard   2012 – 2013 – 2014 – 2015
Candlewood Management Service Inc

Custodian   Jan 2011 – June 2011
Raritan Valley YMCA East Brunswick, NJ

Staff Writer   2013 – 2015
Applied Sentience
Rutgers University
  ○ Published monthly articles on science, philosophy, mathematics, and literature.

Lifeguard   2012 – 2013 – 2014 – 2015
Candlewood Management Service Inc

Custodian   Jan 2011 – June 2011
Raritan Valley YMCA East Brunswick, NJ