

# Leo Kozachkov

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Pronounced ‘Cause-Itch-Cove’  
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<b>CURRENT AFFILIATION</b>	Postdoctoral Fellow K. Lisa Yang Integrative Computational Neuroscience (ICoN) Center MIT, Cambridge, MA Advisor: Ila Fiete	Dec 2022 – Present
<b>EDUCATION</b>	Doctor of Philosophy, Brain and Cognitive Sciences MIT, Cambridge, MA Advisors: Earl K. Miller & Jean-Jacques Slotine	Sept 2017 – Nov 2022
	Bachelor of Science, Physics Rutgers University, New Brunswick, NJ ◦ Minor in Mathematics	Sept 2012 – May 2016
<b>PAPERS</b>	<p><b>Kozachkov, L.</b>, Wensing, P., &amp; Slotine, J.-J. (2023). Generalization as Dynamical Robustness: The Role of Riemannian Contraction in Supervised Learning. <i>Transactions of Machine Learning Research</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, Tauber, J., Brincat, S., Slotine, J.-J., &amp; Miller, E.K. (2022). Robust and Brain-Like Working Memory through Short-Term Synaptic Plasticity. <i>PLoS Computational Biology</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, &amp; Slotine, J.-J. (2022). A Note on Matrix Measure Flows, With Applications to the Contraction Analysis of Plastic Neural Networks. <i>arXiv</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, Kastanenka, K.V., &amp; Krotov, D. (2022). Building Transformers from Neurons and Astrocytes. <i>bioRxiv</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, Ennis, M., Slotine, J.-J. (2022). RNNs of RNNs: Recursive Construction of Stable Assemblies of Recurrent Neural Networks. <i>Neural Information Processing Systems, 2022</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, Lundqvist, M., Slotine, J.-J., &amp; Miller, E.K. (2020). Achieving stable dynamics in neural circuits. <i>PLoS Computational Biology</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, &amp; Michmizos, K. (2020). Sequence learning in Associative Neuronal-Astrocytic Networks. <i>13th International Conference on Brain Informatics</i>. <a href="#">[Link]</a></p> <p><b>Kozachkov, L.</b>, &amp; Michmizos, K. (2017). The causal role of astrocytes in slow-wave rhythmogenesis: A computational modelling study. <i>arXiv</i>. <a href="#">[Link]</a></p>	

## 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 Networks” 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, L<sup>A</sup>T<sub>E</sub>X

**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  
ACTIVITIES**

*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