Leo Kozachkov

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Cambridge, MA

Current Affiliation

PhD Candidate Sept 2017 – Present (Expected End of 2022)
Massachusetts Institute of Technology
Department of Brain and Cognitive Sciences
Research Adviser(s): Prof. Earl K. Miller, Prof. Jean-Jacques Slotine

Education

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

Papers

Kozachkov, L.*,Wensing, P, Slotine, J-J. (2022) "Generalization in Supervised Learning Through Riemannian Contraction" arXiv [Link]

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

Kozachkov, L.*,Ennis, M*., Slotine, J-J. (2021)"RNNs of RNNs: Recursive Construction of Stable Assemblies of Recurrent Neural Networks" arXiv [Link]

Kozachkov, L.*., Lundqvist, M*., Slotine, J-J. & Miller, E.K. (2020) "Achieving stable dynamics in neural circuits" PLoS Computational Biology [Link]

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

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

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.

Invited Talks

Center for Computational Neuroscience, Flatiron Institute, September 2022

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

Honors & Awards

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."

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