ALAN ERIC AKIL

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EDUCATION

University of Houston *August 2016 – May 2021*
Ph.D. in Mathematics
Advisor: Krešimir Josić
Dissertation: Dynamics of balanced neuronal networks under synaptic plasticity
Research Interests: Computational and mathematical neuroscience, data science, machine learning

University of Nebraska–Lincoln *August 2012 – August 2016*
Bachelor of Science in Chemical Engineering
Bachelor of Science in Mathematics

Computer Skills MATLAB, Python, R, Linux, Keras, TensorFlow, PyTorch, LaTeX, GitHub

PROFESSIONAL EXPERIENCE

UH Department of Mathematics *August 2017 – Present*
Graduate Research Assistant

· Mathematical analysis of synaptic plasticity and correlated activity in balanced neural networks.

UH Department of Mathematics *August 2016 – December 2019*
Teaching Assistant

· Taught recitation sections of various undergradute–level courses, and graded homeworks and exams for several advanced undergraduate courses.

PUBLICATIONS

1. **AE Akil**, R Rosenbaum, and K Josić. "Balanced Networks under Spike–Time Dependent Plasticity." In review (2020).
2. AR Andrei, **AE Akil**, N Kharas, S Pojoga, R Rosenbaum, R Janz, K Josić, V Dragoi. "Rapid, State–dependent, Compensatory Plasticity Revealed by Functional Connectivity Dynamics *in vivo*." In preparation (2020).

ACADEMIC PROJECTS

Balanced Networks under Spike–Time Dependent Plasticity
Thesis Project

· Developed a general theory of synaptic plasticity rules in balanced networks theory that relates correlated activity to changes in connectivity.
· This theory allows us to make analytical predictions about the dynamics of plastic, balanced networks that can be tested experimentally.

Rapid, State–dependent, Compensatory Plasticity Revealed by Functional Connectivity Dynamics in vivo
Thesis Project

· Demonstrated that optogenetic activation of excitatory neurons in macaque cortex induces a dynamic reduction in functional connectivity over the timescale of minutes during awake states, but not during rest.

· Replicated experimental results using a balanced network model undergoing inhibitory plasticity.
· Showed that network dynamics during wakefulness are mediated by rapid compensatory plasticity of inhibitory–excitatory connections.

RESEARCH INVOLVEMENT

Neuromatch Academy
Online, Interactive Track; July 13 – July 31, 2020

· *Topics:* Mathematical Modelling, Machine Learning, Dimensionality Reduction, Bayesian Statistics, Linear Systems, Decision Making, Optimal Control, Reinforcement Learning, Neurons and Networks, Network Causality, and Deep Learning.
· *Group Project:* Analyzed neural activity collected by *Steinmetz et al.* over different regions of mouse brain, and trained a Hidden Markov Model and Gaussian Process Factor Analysis to uncover hidden dynamical states. Showed that transitions between hidden states explain variance in task performance.

4th NIH Brain Initiative Summer Course on Models and Neurobiology
University of Missouri, July 14 – July 20, 2019

· *Topics:* Dynamics of individual neurons and neuronal circuits, modelling in Python using NEURON software.

Eighth Summer School of the Centre of Neural Dynamics
University of Ottawa, May 21 – June 1, 2018

· *Topics:* Introduction to Computational Neuroscience: single cell dynamics, neural data analysis, neural networks, and applications in medicine.

RELEVANT GRADUATE COURSES

- **Stochastic Models in Biology.** Markov processes with discrete and continuous space variables, diffusion processes, Wiener and Ornstein–Uhlenbeck processes, point processes, Gillespie's algorithm and applications in Biology.
- **Introduction to Deep Learning.** Hands-on course about training deep convolutional networks and recurrent networks using TensorFlow.
- **Introduction to Statistical Learning.** Linear Regression, Classification, Resampling Methods, Model Selection and Regularization, Tree–based Methods, Support Vector Machines, & Unsupervised Learning.
- **Automatic Learning, Data Mining, & Deep Learning.** Trained multi–layer perceptrons, auto–encoders, Boltzmann machines, and convolutional neural networks on popular Kaggle datasets.
- **Theoretical Neuroscience: Networks & Learning.** Introduction to the mathematical theories of learning and computation by neural systems.

ORAL AND POSTER PRESENTATIONS

- **Akil, A.**, Rosenbaum, R., Josić, K.: Balanced Networks under Spike–Time Dependent Plasticity. NeuroNex3: The Third Annual NeuroNex Investigator Meeting. October 28 – October 29, 2020. (Poster)
- **Akil, A.**, Andrei, A., Kharas, N., Pojoga, S., Janz, R., Rosenbaum, R., Josić, K., Dragoi, V.: Rapid, State–dependent, Compensatory Plasticity Revealed by Functional Connectivity Dynamics *in vivo*. COSYNE 20. February 26 – March 1, 2020. (Poster – peer reviewed)

- **Akil, A.**, Rosenbaum, R., Josić, K.: Balanced Networks under Spike–Time Dependent Plasticity. COSYNE 20. February 26 – March 1, 2020. (Poster – peer reviewed)
- **Akil, A.**, Rosenbaum, R., Josić, K.: Synaptic Plasticity in Correlated Balanced Networks. SIAM NS19. May 22 – May 23, 2019. (Lecture – peer reviewed)
- **Akil, A.**, Rosenbaum, R., Josić, K.: Synaptic Plasticity in Correlated Balanced Networks. SIAM DS19. May 19 – May 23, 2019. (Poster – peer reviewed)
- **Akil, A.**, Rosenbaum, R., Josić, K.: Synaptic Plasticity in Correlated Balanced Networks. COSYNE 19. February 28 – March 5, 2019. (Poster – peer reviewed)
- **Akil, A.**, Rosenbaum, R., Josić, K.: Synaptic Plasticity in Correlated Balanced Networks. Gulf Coast Consortium for Theoretical & Computational Neuroscience. February 1, 2019. (Poster)

HONORS AND ACTIVITIES

- Secretary of American Mathematical Society Graduate Chapter, August 2020 – Present
- President of American Mathematical Society Graduate Chapter, August 2019 – August 2020
- Treasurer of American Mathematical Society Graduate Chapter, August 2017 – August 2019
- Graduate Tuition Fellowship, August 2016 – Present

LANGUAGES

Spanish (mother tongue), English, Portuguese, and Italian

CONTACT

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- GitHub: github.com/alanakil
- LinkedIn: linkedin.com/in/alan-akil-725195b2/