

# Alex Baranski

PhD Candidate · Cognitive Neurorobotics

Research: Theory of Autonomous Adaptation, Neural Graphs, Harmonic Representations

Okinawa Institute of Science and Technology, 1919-1 Tancha, Onna-son, Kunigami-gun, Okinawa, Japan

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## Education

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### Okinawa Institute of Science and Technology

Onna, Okinawa, Japan

PhD in Cognitive Neurorobotics

2021/01 - present

- Advised by Dr. Jun Tani in the Cognitive Neurorobotics Research Unit
- Passed with minor revisions as of 2026/03/09

#### Research Contributions:

- Proposed a new theory of fully autonomous adaptation by enumerating behaviors
- Created a new rapid online adaptation algorithm based on a self-organizing plan-graph
- Validated the algorithm on difficult maze and dynamic control tasks
- Developed a generalized neural graph representation supporting fast pathfinding
- Introduced a dynamic harmonic memory system that generalizes to higher dimensions

### University of Chicago

Chicago, Illinois, United States

Bachelor of Science in Mathematics, General Honors

2013/09 - 2017/06

## Professional Experience

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### Angelo Lab

Stanford, California, United States

Computational Research Scientist

2018/08 - 2021/01

- Created an algorithm for extracting local features of low-SNR imaging data.
- Engineered MAUI, a GUI for processing multiplexed ion-beam imaging (MIBI) data.
- Developed a hierarchical anomaly-detection system for brain tissue images.
- Created a metric of spatial heterogeneity for MIBI data.
- Made a mathematical model of field-intensity artifacts in MIBI data.
- Built a variational autoencoder for quantitative analysis of single cell morphology.

### 4th Law

San Jose, California, United States

Software Engineer

2017/07 - 2018/04

- Developed database model for efficient storage of geospatio-temporal data.
- Engineered modular control platform.
- Worked with control engineer to design adaptive control system.
- Wrote technical recommendations for the CTO and head engineer.

### MacLean Lab

Chicago, Illinois, United States

Undergraduate Researcher

2015/05 - 2015/08

- Created model of transient excitation in anesthetized mouse brain.

### Freedman Lab

Chicago, Illinois, United States

Student Technician

2014/05 - 2014/08

- Wrote acquisition software for neural and eye-tracking data from Rhesus macaques.

## Skills

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- **Research:** Project Management, Creative Problem-Finding, Creative Problem-Solving, Mathematical Thinking
- **Programming:** Python, PyTorch, Java, MATLAB, JavaScript, Bash, some C++ and C
- **Machine Learning:** Deep Learning, Generative Modeling, Genetic Algorithms, Reinforcement Learning
- **Mathematics:** Abstract Algebra, Function Approximation, Numerical Techniques, Harmonic Methods
- **Computer Science:** Theoretical CS, Algorithm Design, Data Structures, Software Engineering
- **Neuroscience:** Cognitive, Evolutionary, Developmental, Systems, Cellular
- **Tools:** MuJoCo, SymPy, Mathematica, Slurm, Git, Inkscape, LaTeX

## Publications (First-Author)

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- **Baranski, A.**, Jun, T. *Life, uh, Finds a Way: Hyperadaptability by Behavioral Search*. arXiv, 2025
- **Baranski, A.**, Froese, T. *Efficient Spike Timing Dependent Plasticity Rule for Complex-Valued Neurons*. ALIFE 2021: The 2021 Conference on Artificial Life

- **Baranski, A.**, Milo, I., Greenbaum, S., Oliveria, J., Mrdjen, D., Angelo, M., Keren, L. *MAUI (MBI Analysis User Interface)—An image processing pipeline for Multiplexed Mass Based Imaging*. PLoS Computational Biology, 2021

## Publications (Co-authored)

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- Risom, T., Rivero, B., Liu, C., **Baranski, A.**, Strand, S., Greenwald, N., McCaffrey, E., Varma, S., Keren, L., Srivastava, S., Zhu, C., Vennam, S., Hwang, S., Colditz, G., Bendall, S., West, R., Angelo, M. *Mapping the tumor and microenvironmental evolution underlying DCIS progression through multiplexed ion beam imaging*. Cancer Research, 2020
- Risom, T., Glass, D., Averbukh, I., Liu, C., **Baranski, A.**, Kagel, A., McCaffrey, E., Greenwald, N., Gutiérrez, B., Strand, S., Varma, S., Kong, A., Keren, L., Srivastava, S., Zhu, C., Khair, Z., Veis, D., Deschryver, K., Vennam, S., Maley, C., Hwang, E., Marks, J., Bendall, S., Colditz, G., West, R., Angelo, M. *Transition to invasive breast cancer is associated with progressive changes in the structure and composition of tumor stroma*. Cell, 2022
- Vijayaragavan, K., Cannon, B., Tebaykin, D., Bossé, M., **Baranski, A.**, Oliveria, J., Mrdjen, D., Corces, M., McCaffrey, E., Greenwald, N., Sigal, Y., Khair, Z., Bruce, T., Rajaraman, A., Bukhari, S., Montine, K., Angelo, R., Montine, T., Bendall, S. *Single-cell Spatial Proteomic Imaging for Human Neuropathology*. bioRxiv, 2022
- McCaffrey, E., Donato, M., Keren, L., Chen, Z., Delmastro, A., Fitzpatrick, M., Gupta, S., Greenwald, N., **Baranski, A.**, Graf, W., Kumar, R., Bosse, M., Fullaway, C., Ramdial, P., Forgó, E., Jojic, V., Valen, D., Mehra, S., Khader, S., Bendall, S., Rijn, M., Kalman, D., Kaushal, D., Hunter, R., Banaei, N., Steyn, A., Khatri, P., Angelo, M. *The immunoregulatory landscape of human tuberculosis granulomas*. Nature Immunology, 2022
- Ferrian, S., Liu, C., McCaffrey, E., Kumar, R., Nowicki, T., Dawson, D., **Baranski, A.**, Glaspy, J., Ribas, A., Bendall, S., Angelo, M. *Multiplexed imaging reveals an IFN- $\gamma$ -driven inflammatory state in nivolumab-associated gastritis*. Cell Reports Medicine, 2021
- Hartmann, F., Mrdjen, D., McCaffrey, E., Glass, D., Greenwald, N., Bharadwaj, A., Khair, Z., Verberk, S., **Baranski, A.**, Baskar, R., Graf, W., Valen, D., Bossche, J., Angelo, M., Bendall, S. *Single-cell metabolic profiling of human cytotoxic T cells*. Nature Biotechnology, 2021

## Presentations

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- **A Baranski**. *Generating Adaptive Behavior by a Self-Mutating Search Process*. Presented at Neuroscience 2024.
- **A Baranski**, J Tani. *Behavior-Model Coevolution with Working Memory*. Presented at the International Workshop on Cognitive Neurorobotics 2024.
- **A Baranski**, J Tani. *Quasiparametric Networks with Fast Weight Memory for Spatial Search*. Presented at the International Symposium on Artificial Intelligence and Brain Science 2022.
- **A Baranski**, D Mjurden, JP Oliveria, K Vijayaragavan, TJ Montine, SC Bendall and M Angelo. *Automatic pattern differentiation in multiplexed imaging data*. Presented at Biolmage Informatics 2019.
- B Cannon, **A Baranski**, K Vijayaragavan, D Mrdjen, J Oliveria, and S Bendall. *Capturing human brain tissue phenotypes with pixel-connected object identification in multiplexed ion beam imaging data*. Presented at Biolmage Informatics 2019.