Luke Rast

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Experience

Independent Postdoctoral work 2024 - present

- Active learning approaches for machine learning explainability and domain adaptation, by studying the adaptation behavior of neural networks during fine-tuning. [ongoing]
- Inferring individual-scale disease transmission and recovery dynamics from population epidemic trajectories [1].

Graduate Researcher, Drugowitsch Lab 2016 - 2022
Harvard Medical School

Developed statistical and machine learning methods to describe and analyze neural activity data.

- Developed methods for fitting the function of brain regions, as described by an optimization problem. This resulted in a novel adaptive experimental design to characterize brain regions through active learning. Published in NeurIPS. [3]
- Developed statistical filtering models to describe orientation sensation in fruit flies. This allowed for comparison of certainty representation in the model with neural activity correlates. [2]

Research Associate 2013 - 2015
Gladstone Institute of Virology and Immunology, UCSF

Mathematical modeling and development of experimental systems to study evolution of virus populations.

- Mathematical modeling of viral evolution under different biological interventions, elucidated key design considerations for interventions that are robust to viral co-evolution. [5]
- Developed bioreactor systems for long-term virus culture. Produced a culture system that enabled study of viral population dynamics and production of high-titer virus supplies. Published protocol. [4]

Education

Ph.D. Harvard University, *Systems, Synthetic and Quantitative Biology* 2021
B.A. University of California, Berkeley, *Mathematics, Physics* 2012

Portfolios

- Google Scholar: completed research projects
- github.com/lrast: development, data science, and working research projects
- lrast.github.io: portfolio projects and ongoing research work

Skills:

- Statistics, Machine learning, Mathematical modeling, Stochastic modeling, Neural networks, Deep Learning, Data Science, Bayesian statistics, Information theory, Reinforcement learning, Control theory
- Python (pytorch, tensorflow, sklearn, huggingface, pandas, flask), SQL, R, git, cloud services, JavaScript (ReactJS)
- Sterile technique, mammalian cell culture, virus culture, flow cytometry, PCR, viral titer assays

Publications

1. M. P. Rast & **L. I. Rast**, "Determining disease attributes from epidemic trajectories," *Infectious Disease Modelling*, (2025).
2. Kutschireiter, **Rast** & Drugowitsch, "Projection Filtering with Observed State Increments with Applications in Continuous-Time Circular Filtering," *IEEE Transactions on Signal Processing*, (2022).
3. **Rast** & Drugowitsch, "Adaptation Properties Allow Identification of Optimized Neural Codes," *Advances in Neural Information Processing Systems*, (2020).
4. Saykally, **Rast**, et al., "A Bioreactor Method to Generate High-titer, Genetically Stable, Clinical-isolate Human Cytomegalovirus," *Bioprotocol*, (2017).
5. **Rast**, Rouzine, et al., "Conflicting Selection Pressures Will Constrain Viral Escape from Interfering Particles: Principles for Designing Resistance-Proof Antivirals," *PLoS Computational Biology*, (2016).