Samantha Lune Magid

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Research Interests

Complex, adaptive, and feedback-aware stochastic and dynamical systems; optimization under uncertainty; emergent behavior in ecological and social systems; geometric and latent representations of data; causal inference and quasi-experimental identification in systems; adversarial and game-theoretic models of policy and behavior; ethical considerations in mathematical modeling; computational decision-making in sustainability and conservation; mathematical education and systems thinking.

Education

University of Vermont | *Burlington, VT*
M.S. Complex Systems & Data Science
- UVM Graduate Merit Scholar
- Research areas: metaresearch, science-of-science

Boston University | *Boston, MA*
B.S. Data Science (Applied and Mathematical Focus) | *Minor:* Environmental Science
- Lara Vincent Undergraduate Research Awardee
- Specialization*:* Stochastic modeling and complex systems, with attention to impact anticipation, feedback effects, and system-aware model construction across ecological and social domains.

Mathematical & Computational Modeling Skills

Complex Systems & Stochastic Modeling: Stochastic processes • Monte Carlo methods • Feedback-aware dynamical systems • Advection-diffusion PDEs • Emergence and nonlinearity • Stochastic biological systems • Latent state-space models
Optimization & Learning: Discrete and continuous optimization • Kernel methods • Geometric representation • Adversarial and game-theoretic models • Black-box optimization • Simulated annealing • Representation learning
Causal & Policy Modeling: Quasi-experimental causal inference • Robustness analysis • Sensitivity to modeling assumptions • Policy- and market-constrained optimization • Market and behavioral feedback
Programming: Python (NumPy, SciPy, pandas, scikit-learn, PyTorch, TensorFlow, matplotlib) • R (dplyr, ggplot2, modelr, Shiny, Plotly) • Rust
Scientific & Computational Tools: LaTeX, NetCDF, QGIS, MySQL, Marxan, PowerBI, Tableau, Azure Data Factory
Laboratory & Field: Animal Handling • Wet Lab Techniques • Lab Safety • IACUC Certification

Research Experience

Scientific Productivity Research | *Vermont Complex Systems Institute* **May 2026 -**
- Developed scholar-agnostic stochastic models of scientific productivity, testing whether career trajectories can emerge from dynamic processes rather than fixed individual traits.
- Analyzed longitudinal publication data using autoregressive and self-exciting models; evaluated fit through rank persistence and held-out generative diagnostics.

- Identified separate extensive and intensive margins of productivity and evidence that recent publication history predicts both continued activity and future output.
- Built a reproducible Python research pipeline for model fitting, simulation, bootstrap inference, adversarial null testing, and publication-quality visualization.
- Contributed to an interdisciplinary follow-up to Zhang et al.'s work on scientific productivity, connecting methods from complex systems, computational social science, and stochastic-process modeling.

Fiddler Crab Bioturbation Study (Phase I) | *BUMP Labs* **Sept. 2022 - March 2023**
Boston University Lara Vincent Research Award (October 2022)

- Proposed and led an independent study of crab overpopulation as a complex biophysical system, examining how stochastic bioturbation feedback cycles drive marsh erosion
- Designed and fabricated a custom intertidal tidal-forcing generator, enabling controlled simulation of periodic boundary conditions and feedback-driven intertidal dynamics without in-situ disruption.
- Collaborated with field experts as one of BUMP's youngest principal investigators; completed Phase I and produced reusable tools for future estuarine modeling research.

Selected Projects

Support Vector Melanomas **Fall 2025**
Independent course project | https://github.com/samlune/support-vector-melanomas

- Formulated sequence classification as a geometric margin-based optimization problem, comparing linear and kernelized SVMs under varying representational assumptions.
- Designed a reproducible pipeline with explicit data construction, deduplication, and audit constraints to study stability and failure modes of learned decision boundaries.
- Interpreted model behavior through the lens of geometric structure, inductive bias, and high-dimensional learning stability.

Parcel Purchasing Portfolio Policy **Fall 2025**
Independent course project | Full report: Google Drive

- Formulated conservation parcel acquisition as a complex decision system under budget, market, behavioral, and uncertainty constraints, balancing emissions avoidance objectives against cost and market constraints.
- Analyzed how heuristic and algorithmic choice induces emergent allocation and prioritization patterns under controlled and stochastic pricing and transaction frictions.
- Evaluated robustness to modeling assumptions (transaction fees, stochastic pricing noise) and improved solutions via local 1-for-1 swap search.