DREW MCNEELY

Philadelphia, PA | drew@drewmcneely.net | github.com/drewmcneely

---

PUBLICATIONS

Hidden Markov Models and the Bayes Filter in Categorical Probability T. Fritz, A. Klingler, D. McNeely, A. Shah Mohammed and Y. Wang *IEEE Transactions on Information Theory*, vol. 71, no. 9, pp. 7052-7075, Sept. 2025 doi: 10.1109/TIT.2025.3584695

- Equal contributor among 5 authors
- Developed categorical recursive formulations for the Bayes filter, forward-backward algorithm, and fixed-interval smoother
- Showed that this specializes to Kalman filter, RTS smoother, and other classical algorithms when applied to Gaussian and FinStoch Markov categories
- Actively working on implementation with markovcats.jl

TECHNICAL PROJECTS

markovcats.jl | Julia DSL for Categorical Probability | Oct 2025–Present

- A Julia DSL with discrete probability syntax and Markov category semantics
- Built on GATLab.jl and Catlab.jl within the AlgebraicJulia ecosystem

girypy | Python Library for Categorical Estimation | 2022

- Categorical Kalman filter implementation using Gaussian Markov categories
- Abstract base class interface for Markov categories with pseudo-DSL using infix operators
- Precursor to markovcats.jl

photometry | Satellite Photometry Visualization | 2020

- Interactive 3D visualization of photometric output from satellites in orbit
- Maps real-valued functions on spherical domains to HTML-based globe rendering

---

RESEARCH EXPERIENCE

Independent Researcher | 2023–2024

- Co-authored IEEE publication on categorical probability and Bayesian filtering (accepted Sept. 2025)
- Attended Applied Category Theory Conference 2023 (College Park, MD)

Student: **Adjoint School 2024** | Jan–June 2024 | Project: Modeling Uncertainty with Markov Categories

- Investigated monads for imprecise probability including Dempster-Shafer theory and inner/outer probability measures
- Presented preliminary findings at ACT 2024, Oxford, UK

Graduate Researcher | University of Texas at Austin | 2017–2023

Categorical Probability (Advisor: Efstathios Bakolas, 2020–2023)

- Developed polymorphic categorical formulation of recursive Bayesian filters
- Created novel framework merging category theory with dynamical systems estimation
- Resulted in IEEE Transactions on Information Theory publication

Geometric Estimation (Advisor: Moriba Jah, 2017–2020)

- Recursive estimation for dynamical systems with Riemannian state spaces
- Clustering analysis of resident space objects

COMMUNITY LEADERSHIP

Adjoint School Organizing Committee | July 2024–July 2026

- Two-year position organizing international applied category theory research program
- Responsibilities: admissions review, mentor recruitment, sponsor outreach, website maintenance, liaison between Steering Committee and ACT Conference Organizing Committee
- 2025: Organized school at University of Florida, Gainesville
- 2026: Organizing school at Tallinn University of Technology, Estonia

---

EDUCATION

MS, Aerospace Engineering | University of Texas at Austin | May 2023

Thesis: *Categorical Probability for Abstracting Filtering Algorithms on Stochastic Dynamical Systems*

Advisor: Efstathios Bakolas

BS, Aerospace Engineering | Missouri University of Science & Technology | Dec 2015

BS, Mechanical Engineering | Missouri University of Science & Technology | Dec 2015

TEACHING EXPERIENCE

Mathematics Teacher | Uncommon Schools, Camden Prep High School | Aug 2024–Present

Algebra 2, Accelerated Precalculus, AP Calculus AB

Teaching Assistant | UT Austin, University of Arizona | 2017–2022

Calculus 2, Calculus 3, Linear Algebra, Differential Equations, Intro to Computer Programming

Private Tutor | 2016–2023

Math (4th grade through college), SAT/ACT/ISEE test prep

EARLIER EXPERIENCE

NASA Ames Research Center | Research Intern | Summer 2017

Constrained optimal control for Variable Camber Continuous Trailing Edge Flap aircraft

Missouri S&T Formula SAE | Controls & Data Acquisition Lead | 2014–2016

1st place overall Formula North 2016; 4th overall FSAE Lincoln 2016

SKILLS

Programming: Julia, Python, MATLAB, Java

Languages: English (native), Dutch (B2)