Drew McNeely

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Publications

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

technical projects

markovcats.jl Oct 2025–Present
Julia DSL for Categorical Probability
- A Julia DSL with discrete probability syntax and Markov category semantics
- Built on GATLab.jl and Catlab.jl within the AlgebraicJulia ecosystem

girypy Jan 2022
Python Library for Categorical Estimation
- 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 Jan 2020
Satellite Photometry Visualization
- 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, 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)

Adjoint School 2024, Student — Project: Modeling Uncertainty with Markov Categories Jan 2024 – June 2024
- Investigated monads for imprecise probability including Dempster-Shafer theory and inner/outer probability measures
- Presented preliminary findings at ACT 2024, Oxford, UK

University of Texas at Austin, Graduate Researcher — Categorical Probability (Advisor: Efstathios Bakolas) Austin, TX 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

University of Texas at Austin, Graduate Researcher — Geometric Estimation (Advisor: Moriba Jah) Austin, TX 2017 – 2020
- Recursive estimation for dynamical systems with Riemannian state spaces
- Clustering analysis of resident space objects

community leadership

Adjoint School Organizing Committee, Organizing Committee Member — 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 **University of Texas at Austin**, Aerospace Engineering — May 2023

- Thesis: *Categorical Probability for Abstracting Filtering Algorithms on Stochastic Dynamical Systems*
- Advisor: Efstathios Bakolas

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

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

teaching experience

Uncommon Schools, Camden Prep High School, Mathematics Teacher — Aug 2024 – present

- Algebra 2, Accelerated Precalculus, AP Calculus AB

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

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

Self-Employed, 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)