

Michael C. Burkhardt

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Education

Brown University Providence, RI	Ph.D. Applied Mathematics	2013–2019
Rutgers University New Brunswick, NJ	M.Sc. Mathematics	2011–2013
Purdue University West Lafayette, IN	B.Sc.'s Mathematics, Statistics, & Economics	2007–2011

Experience

University of Chicago Chicago, IL	Sr. Data Scientist <ul style="list-style-type: none">joined the Beaulieu-Jones lab to develop machine learning solutions for healthcare applications	2024–
University of Cambridge Cambridge, UK	Research Associate (Visiting Researcher in 2024) <ul style="list-style-type: none">developed multimodal trajectory models for the early diagnosis of neurodegenerative diseaseworked with research engineers at the Alan Turing Institute to automate the detection of covariate shift	2021–2024
Adobe, Inc. San Jose, CA	Machine Learning Scientist (Sr. in 2021) <ul style="list-style-type: none">built and validated predictive models to personalize user experience (PySpark/LightGBM/Airflow)designed and tested personalized pricing interventions within the cancellation flow (causal forests)supervised intern projects in representation learning for causal inference and semi-supervised learning (Keras/Tensorflow)	2018–2021
Brown University Providence, RI	Graduate Research Assistant <ul style="list-style-type: none">developed a novel nonlinear filter for online neural decoding (Matlab/Python)collaborated with the BrainGate Clinical Trail to test this filter in a brain–computer interfaceexperimented with Bayesian solutions to provide robustness against common non-stationarities	2014–2018

Summer research internships at **Spotify, U.S.A.** (Data Research Intern in New York, NY, 2017) & **Argonne National Laboratory** (Graduate Research Aide in Lemont, IL, 2012)

Publications

- M. Burkhart, **Actions of nilpotent groups on nilpotent groups**, Glasgow Mathematical Journal 67 (2025)
- M. Burkhart, **Fixed point conditions for non-coprime actions**, Proceedings of the Royal Society of Edinburgh Section A: Mathematics 155 (2025)
- E. G. Woo, M. Burkhart, E. Alsentzer, & B. Beaulieu-Jones, **Synthetic data distillation enables the extraction of clinical information at scale**, npj Digital Medicine 8 (2025)
- M. Burkhart, L. Lee, D. Vaghari, A. Toh, E. Chong, C. Chen, P. Tiño, & Z. Kourtzi, **Unsupervised multimodal modeling of cognitive and brain health trajectories for early dementia prediction**, Scientific Reports 14 (2024)
- L. Lee, D. Vaghari, M. Burkhart, P. Tiño, M. Montagnese, Z. Li, K. Zühlsdorff, J. Giorgio, G. Williams, E. Chong, C. Chen, B. Underwood, T. Rittman, & Z. Kourtzi, **Robust and interpretable AI-guided marker for early dementia prediction in real-world clinical settings**, eClinicalMedicine 74 (2024)
- M. Burkhart & G. Ruiz, **Neuroevolutionary representations for learning heterogeneous treatment effects**, Journal of Computational Science 71 (2023)
- M. Burkhart, **Discriminative Bayesian filtering lends momentum to the stochastic Newton method for minimizing log-convex functions**, Optimization Letters 17 (2023)
- R. Li, E. Harshfield, S. Bell, M. Burkhart, A. Tuladhar, ..., C. Chen, Z. Kourtzi, & H. Markus, **Predicting incident dementia in cerebral small vessel disease: comparison of machine learning and traditional statistical models**, Cerebral Circulation – Cognition and Behavior 5 (2023)
- R. Borchert, T. Azevedo, A. Badhwar, J. Bernal, M. Betts, R. Bruffaerts, M. Burkhart, I. Dewachter, ..., D. Llewellyn, M. Veldsman, & T. Rittman, **Artificial intelligence for diagnostic and prognostic neuroimaging in dementia: a systematic review**, Alzheimer's & Dementia 19 (2023)
- M. Burkhart, **Conjugacy conditions for supersoluble complements of an abelian base and a fixed point result for non-coprime actions**, Proceedings of the Edinburgh Mathematical Society 65 (2022)
- M. Burkhart & G. Ruiz, **Neuroevolutionary feature representations for causal inference**, Computational Science – ICCS 2022
- M. Burkhart, **Discriminative Bayesian filtering for the semi-supervised augmentation of sequential observation data**, Computational Science – ICCS 2021
- M. Burkhart & K. Shan, **Deep low-density separation for semi-supervised classification**, Computational Science – ICCS 2020
- M. Burkhart, D. Brandman, B. Franco, L. Hochberg, & M. Harrison, **The discriminative Kalman filter for Bayesian filtering with nonlinear and nongaussian observation models**, Neural Computation 32 (2020)
- M. Burkhart & K. Modarresi, **Determining adaptive loss functions and algorithms for predictive models**, Computational Science – ICCS 2019
- M. Burkhart & K. Modarresi, **Adaptive objective functions and distance metrics for recommendation systems**, Computational Science – ICCS 2019
- D. Brandman, M. Burkhart, J. Kelemen, B. Franco, M. Harrison, & L. Hochberg, **Robust closed-loop control of a cursor in a person with tetraplegia using Gaussian process regression**, Neural Computation 30 (2018)
- D. Brandman, T. Hosman, J. Saab, M. Burkhart, B. Shanahan, J. Ciancibello, ..., M. Harrison, J. Simeral, & L. Hochberg, **Rapid calibration of an intracortical brain computer interface for people with tetraplegia**, Journal of Neural Engineering 15 (2018)
- M. Burkhart, Y. Heo, & V. Zavala, **Measurement and verification of building systems under uncertain data: a Gaussian process modeling approach**, Energy and Buildings 75 (2014)

Dissertation

M. Burkhart, **A Discriminative Approach to Bayesian Filtering with Applications to Human Neural Decoding**, Ph.D. advised by Prof. Matthew Harrison, Division of Applied Mathematics, Brown University, Providence, 2019

Patents & Pending

- M. Burkhart & G. Ruiz, **Causal inference via neuroevolutionary selection**, U.S. Patent Application #17/748,891 filed 2022, published as US 2023/0376776 A1
- M. Burkhart & K. Shan, **User classification from data via deep segmentation for semi-supervised learning**, U.S. Patent Application #16/681,239 filed 2019, granted 2022 as US 11,455,518 B2
- M. Burkhart & K. Modarresi, **Digital experience enhancement using an ensemble deep learning model**, U.S. Patent Application #16/375,627 filed 2019, granted 2023 as US 11,816,562 B2

Selected Preprints

- M. Burkhart, B. Ramadan, L. Solo, W. Parker, & B. Beaulieu-Jones, **Quantifying surprise in clinical care: detecting highly informative events in electronic health records with foundation models**, arXiv:2507.22798
- S. Sethi, D. Chen, T. Statchen, M. Burkhart, N. Bhandari, B. Ramadan, & B. Beaulieu-Jones, **ProtoECGNet: case-based interpretable deep learning for multi-label ECG classification with contrastive learning**, arXiv:2504.08713
- M. Abroshan, M. Burkhart, O. Giles, S. Greenbury, Z. Kourtzi, J. Roberts, M. van der Schaar, J. Steyn, A. Wilson, & M. Yong, **Safe AI for health and beyond – monitoring to transform a health service**, arxiv:2303.01513

Recent Talks

- Local conjugacy and primary-type decompositions in nonabelian cohomology**, Algebra Seminar, Mathematics Institute, University of Warwick, UK, 2025
- Clustering trajectories of neurodegenerative disease**, Trustworthy AI for medical & health research workshop, Cavendish Laboratory, Cambridge, UK, 2022
- Neuroevolutionary feature representations for causal inference**, International Conference on Computational Science (ICCS), London, UK, 2022

Community Involvement

Cambridge Psych. Dept. <small>Cambridge, UK</small>	Research Staff Representative	2022–2023
ICCS Conference	Program Committee Member <ul style="list-style-type: none">• thematic track on Applications of Computational Methods in Artificial Intelligence and Machine Learning	2019–2021
Brown SIAM Student Chapter <small>Providence, RI</small>	Vice President, Chapter Records Interdepartmental Liaison Officer <ul style="list-style-type: none">• organized events within the applied math community	2015–2017
Rutgers Math Dept. <small>New Brunswick, NJ</small>	Graduate Liaison Committee Member	2012–2013
Purdue Student Publishing Foundation <small>West Lafayette, IN</small>	Member, Corporate Board of Directors Chairperson, Finance Committee <ul style="list-style-type: none">• oversaw the <i>Exponent</i>, Purdue's Independent Daily (at the time) Student Newspaper	2009–2011

Online

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