

Michael C. Burkhardt

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Interests

AI/ML for good • causal inference • time series modeling • feature engineering • computational science

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 Cambridge Cambridge, UK	Research Associate (Visiting Researcher in 2024) <ul style="list-style-type: none">developed trajectory models for the early diagnosis of neurodegenerative diseasecleaned/wrangled/processed dementia-related datasets for training & analysis (Pandas)worked 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 <ul style="list-style-type: none">designed and tested personalized pricing interventions within the cancellation flow (causal forests)built and validated predictive models to personalize user experience (PySpark/LightGBM/Airflow)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 and implemented a novel nonlinear filter for online neural decoding (Matlab/Python)collaborated with the BrainGate Clinical Trail to implement this filter in a brain–computer interface and test its performance with human volunteers	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, 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)
- 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)

Patents & Pending

- M. Burkhardt & G. Ruiz, **Causal inference via neuroevolutionary selection**, U.S. Patent Application #17/748,891 filed 2022, published as US 2023/0376776 A1
- M. Burkhardt & K. Shan, **User classification from data via deep segmentation for semi-supervised learning**, U.S. Patent Application #16/681,239 filed 2019, published as US 2021/0142152 A1, granted 2022 as US 11,455,518 B2
- M. Burkhardt & K. Modarresi, **Digital experience enhancement using an ensemble deep learning model**, U.S. Patent Application #16/375,627 filed 2019, published as US 2020/0320382 A1, granted 2023 as US 11,816,562 B2

Preprints & Working Papers

- M. Burkhardt, **Fixed point conditions for non-coprime actions**, Proceedings of the Royal Society of Edinburgh Section A: Mathematics (in press)
- M. Abroshan, M. Burkhardt, 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 [cs.LG]
- L. Lee, D. Vaghari, M. Burkhardt, 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** (under review)

Recent Talks

- M. Burkhardt, L. Lee, P. Tiño, & Z. Kourtzi, **Clustering trajectories of neurodegenerative disease**, Trustworthy AI for medical & health research workshop, Cavendish Laboratory, Cambridge, UK, 2022
- M. Burkhardt & G. Ruiz, **Neuroevolutionary feature representations for causal inference**, International Conference on Computational Science (ICCS), London, UK, 2022
- M. Burkhardt, **Discriminative Bayesian filtering for the semi-supervised augmentation of sequential observation data**, ICCS, Kraków, Poland, 2021 (virtual)

Selected Presentations

- M. Burkhardt, L. Lee, D. Vaghari, J. Venton, S. Thomas, N. Smith, R. Everson, P. Tiño, & Z. Kourtzi, **AI-guided patient stratification for neurodegenerative disorders using unsupervised trajectory modelling**, Alzheimer's Association International Conference (AAIC), Amsterdam, Netherlands, 2023
- D. Vaghari, L. Lee, M. Burkhardt, M. Montagnese, ..., T. Rittman, P. Tiño, & Z. Kourtzi, **Validating the clinical utility of AI-guided tools for early dementia prediction**, AAIC, 2023
- L. Lee, D. Vaghari, M. Burkhardt, M. Montagnese, K. Zühlsdorff, ..., T. Rittman, P. Tiño, & Z. Kourtzi, **Translating AI-guided tools for early dementia prediction to clinical practice**, Dementias Platform UK (DPUK) Translation, London, UK, 2023
- F. Marinaro, C. Morvan, R. Au, S. Bond, M. Burkhardt, N. Carlebach, ..., Z. Walker, R. Everson, C. Hinds, & Z. Kourtzi, **The Early Detection of Neurodegenerative diseases initiative: an international and multidisciplinary effort for transforming the early detection of dementia-causing diseases**, AAIC, San Diego, CA, 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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