

Michael C. Burkhardt

michael_burkhardt@alumni.brown.edu | Plainfield, IN, US

Interests

applied AI/ML • sequential inference • computational science • causality • feature engineering

Education

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

Experience

University of Cambridge <small>Cambridge, UK</small>	Research Associate (Visiting Researcher in 2024) <ul style="list-style-type: none">developed trajectory models for the early diagnosis of neurodegenerative diseasetrained graph neural networks to predict brain age (PyTorch geometric)worked with research engineers at the Alan Turing Institute to automate the detection of covariate shift	2021–2024
Adobe, Inc. <small>San Jose, CA</small>	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
BrainGate Clinical Trial <small>Providence, RI</small>	Graduate Research Assistant <ul style="list-style-type: none">developed and implemented a novel nonlinear filter for online neural decoding (Matlab/Python)this framework enabled participants with quadriplegia to communicate and interact with their environments in real time using mental imagery alone	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 & 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)
- 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. Burkhart & G. Ruiz. Causal inference via neuroevolutionary selection. Filed 2022. Published as US 2023/0376776 A1
- M. Burkhart & K. Shan. User classification from data via deep segmentation for semi-supervised learning. Filed 2019. Granted 2022 as US 11,455,518 B2
- M. Burkhart & K. Modarresi. Digital experience enhancement using an ensemble deep learning model. Filed 2019. Granted 2023 as US 11,816,562 B2

Preprints & Working Papers

- M. Burkhart. **Fixed point conditions for non-coprime actions.** (accepted, Proceedings of the Royal Society of Edinburgh Section A: Mathematics)
- 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 [cs.LG]
- R. Li, E. Harshfield, S. Bell, M. Burkhart, A. Tuladhar, S. Hilal, D. Tozer, F. Chappell, S. Makin, J. Lo, J. Wardlaw, F.-E. de Leeuw, C. Chen, Z. Kourtzi, & H. Markus. **Predicting Incident Dementia in Cerebral Small Vessel Disease: Comparison of Machine Learning and Traditional Statistical Models.** (accepted, Cerebral Circulation - Cognition and Behavior)
- 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.** (accepted, Alzheimer's & Dementia)
- M. Burkhart, L. Lee, D. Vaghari, A. Toh, E. Chong, C. Chen, P. Tiño, & Z. Kourtzi. **AI-guided early dementia prediction using unsupervised multimodal modeling of brain health trajectories.** (under review)
- 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.** (under review)

Recent Talks

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

Selected Presentations

- M. Burkhart, 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. Burkhart, 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. Burkhart, M. Montagnese, K. Zuhlsdorff, ..., 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. Burkhart, 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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