Michael C. Burkhart

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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) — 2021–2024

- developed trajectory models for the early diagnosis of neurodegenerative disease
- cleaned/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

Adobe, Inc.
San Jose, CA
Machine Learning Scientist — 2018–2021

- 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)

Brown University
Providence, RI
Graduate Research Assistant — 2014–2018

- 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

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. Tiňo, & 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, 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.** 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. 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.** Proceedings of the Royal Society of Edinburgh Section A: Mathematics (in press)

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.** arχiv:2303.01513 [cs.LG]

L. Lee, D. Vaghari, M. Burkhart, P. Tiňo, 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. Tiňo, & 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. Tiňo, & 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. Tiňo, & 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. Tiňo, & 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. Cambridge, UK	**Research Staff Representative**	2022–2023
ICCS Conference	**Program Committee Member** • thematic track on Applications of Computational Methods in Artificial Intelligence and Machine Learning	2019–2021
Brown SIAM Student Chapter Providence, RI	**Vice President, Chapter Records** **Interdepartmental Liaison Officer** • organized events within the applied math community	2015–2017
Rutgers Math Dept. New Brunswick, NJ	**Graduate Liaison Committee Member**	2012–2013
Purdue Student Publishing Foundation West Layfayette, IN	**Member, Corporate Board of Directors** **Chairperson, Finance Committee** • oversaw the *Exponent*, Purdue's Independent Daily (at the time) Student Newspaper	2009–2011

Online

Homepage • LinkedIn • Google Scholar • Github • OrcID