Tong (Tony) Liu (he/him)

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Research Interests Last updated: 2025-05-29

Machine learning methods for observational causal inference. Data science and causal inference applications in healthcare, mental wellness, and social science.

Academic Appointments

Mount Holyoke College Summer 2024 — present
Assistant Professor of Computer Science South Hadley, MA

Education

University of Pennsylvania Fall 2018 — Spring 2024
Ph.D. in Computer and Information Science Philadelphia, PA
Advisors: Lyle Ungar and Konrad Kording

Williams College 2012 — 2016
B.A. in Computer Science, concentration in Cognitive Science Williamstown, MA
summa cum laude, with highest honors in Computer Science

Research

Machine Learning Methods for Observational Causal Inference
Developing machine learning methodology for improving efficiency of observational causal studies.
- Works: [J9, C2, J4]

Data Science for Social Communication
Using quasi-experiments and explainable AI (XAI) methods to study computer-mediated social communication.
- Works: [C3, C1]

Automated and Interpretable Machine Learning for Medicine
Developing workflows using automated machine learning methods and post-hoc interpretability to produce robust predictions for surgical hernia risk, liquid biopsy, and suicide risk.
- Works: [J13, W1, A2, A1, J2, J1]

Mobile Sensing for Depression and Anxiety
Analyzing digital phenotyping signals from mobile sensor data as markers for depression and anxiety.
- Works: [J10, J8, J6, J7, J3, P1]

Peer-Reviewed Journal Papers (J)

J13. Steven C Marcus, Sara Wiesel Cullen, Timothy Schmutte, Ming Xie, **Tony Liu**, Lyle H Ungar, Nick Cardamone, Nathaniel J Williams, and Mark Olfson. A cohort study of predictors of short-term nonfatal suicidal and self-harm events among individuals with mental health disorders treated in the emergency department. *Journal of Psychiatric Research*, 2025

J12. Nicholas C Cardamone, Mark Olfson, Timothy Schmutte, Lyle Ungar, **Tony Liu**, Sara W Cullen, Nathaniel J Williams, and Steven C Marcus. Classifying unstructured text in electronic health records for mental health prediction models: Large language model evaluation study. *JMIR Medical Informatics*, 2025

J11. Ben Baker, **Tony Liu**, Jordan Matelsky, Felipe Parodi, John W Krakauer, Brett Mensh, and Konrad Kording. Computational kinematics of dance: Distinguishing hip hop genres. *Frontiers in Robotics and AI*, 2024

J10. Caitlin A Stamatis, Jonah Meyerhoff, Yixuan Meng, Zhi Chong Chris Lin, Young Min Cho, **Tony Liu**, Chris J Karr, Tingting Liu, Brenda L Curtis, Lyle H Ungar, et al. Differential temporal utility of passively sensed smartphone features for depression and anxiety symptom prediction: a longitudinal cohort study. *npj Mental Health Research*, 3(1):1, 2024

J9. **Tony Liu**, Patrick Lawlor, Lyle Ungar, Konrad Kording, and Rahul Ladhania. Automated detection of causal inference opportunities: Regression discontinuity subgroup discovery. *Transactions on Machine Learning Research (TMLR)*, 2023

J8. Jonah Meyerhoff, Tingting Liu, Caitlin Stamatis, **Tony Liu**, Harry Wang, Yixuan Meng, Brenda Curtis, Chris J Karr, Garrick Sherman, Lyle H Ungar, and David C Mohr. Analyzing text message linguistic features: Do people with depression communicate differently with their close and non-close contacts? *Behavior Research and Therapy*, 2023

J7. **Tony Liu**, Jonah Meyerhoff, Johannes C Eichstaedt, Chris J Karr, Susan M Kaiser, Konrad P Kording, David C Mohr, and Lyle H Ungar. The relationship between text message sentiment and self-reported depression. *Journal of affective disorders*, 302:7–14, 2022

J6. Caitlin A Stamatis, Jonah Meyerhoff, Tingting Liu, Garrick Sherman, Harry Wang, **Tony Liu**, Brenda Curtis, Lyle H Ungar, and David C Mohr. Prospective associations of text-message-based sentiment with symptoms of depression, generalized anxiety, and social anxiety. *Depression and anxiety*, 2022

J5. Bernard t Hart, Titipat Achakulvisut, Ayoade Adeyemi, Athena Akrami, Bradly Alicea, Alicia Alonso-Andres, Diego Alzate-Correa, Arash Ash, Jesus Ballesteros, Aishwarya Balwani, ..., **Tony Liu**, et al. Neuromatch academy: a 3-week, online summer school in computational neuroscience. *Journal of Open Source Education*, 5(49):118, 2022

J4. **Tony Liu**, Lyle Ungar, and Konrad Kording. Quantifying causality in data science with quasi-experiments. *Nature computational science*, 1(1):24–32, 2021

J3. Jonah Meyerhoff, **Tony Liu**, Konrad P Kording, Lyle H Ungar, Susan M Kaiser, Chris J Karr, and David C Mohr. Evaluation of changes in depression, anxiety, and social anxiety using smartphone sensor features: longitudinal cohort study. *Journal of medical Internet research*, 23(9):e22844, 2021

J2. Omar Elfanagely, Yoshiko Toyoda, Sammy Othman, Joseph A Mellia, Marten Basta, **Tony Liu**, Konrad Kording, Lyle Ungar, and John P Fischer. Machine learning and surgical outcomes prediction: a systematic review. *Journal of Surgical Research*, 264:346–361, 2021

J1. Hanfei Shen, **Tony Liu**, Jesse Cui, Piyush Borole, Ari Benjamin, Konrad Kording, and David Issadore. A web-based automated machine learning platform to analyze liquid biopsy data. *Lab on a Chip*, 20(12):2166–2174, 2020

Peer-Reviewed Conference Proceedings (C)

C3. **Tony Liu**, Lyle Ungar, Konrad Kording, and Morgan McGuire. Measuring causal effects of civility without randomization. *International AAAI Conference on Web and Social Media (ICWSM)*, 2024

C2. **Tony Liu**, Patrick Lawlor, Lyle Ungar, and Konrad Kording. Data-driven exclusion criteria for instrumental variable studies. *Conference on causal learning and reasoning (CLeaR)*, pages 485–508, 2022

C1. **Tony Liu**, Jennifer Nicholas, Max M Theilig, Sharath C Guntuku, Konrad Kording, David C Mohr, and Lyle Ungar. Machine learning for phone-based relationship estimation: the need to consider population heterogeneity. *Proceedings of the ACM on interactive, mobile, wearable and ubiquitous technologies (IMWUT)*, 3(4):1–23, 2019

Submissions Under Review (R)

R1. Susanna Howard*, **Tony Liu***, Jesse Hsu, Daniel Zhang, John Farrar, Christina Jackson, and Stephen Bagley. Rate of biopsy prior to resection among patients with high-grade glioma: A nationwide database analysis. *Revise and Resubmit: Journal of Neurosurgery*, 2025

* indicates co-lead author.

Peer-Reviewed Workshop Papers (W)

W3. **Tony Liu**, Patrick Lawlor, Lyle Ungar, Konrad Kording, and Rahul Ladhania. Automated detection of interpretable causal inference opportunities: Regression discontinuity subgroup discovery. *ICML 2023 Workshop: Interpretable Machine Learning for Healthcare*, 2023

W2. **Tony Liu**, Patrick Lawlor, Lyle Ungar, and Konrad Kording. Data-driven exclusion criteria for instrumental variable studies. *ICML 2021 Workshop: Neglected Asumptions of Causal Inference*, 2021

W1. **Tony Liu** and Lyle Ungar. Towards cotenable and causal shapley feature explanations. *AAAI 2021 Workshop: Trustworthy AI for Healthcare*, 2021

Preprints (P)

P2. Jordan K. Matelsky, Felipe Parodi, **Tony Liu**, Richard D. Lange, and Konrad P. Kording. A large language model-assisted education tool to provide feedback on open-ended responses. *arXiv*, 2023

P1. **Tony Liu**, Jonah Meyerhoff, David C Mohr, Lyle H Ungar, and Konrad P Kording. Covid-19 pandemic: every day feels like a weekday to most. *medRxiv*, 2020

Peer-Reviewed Abstracts (A)

A2. C Amro, A Desai, P Dattatri, **Tony Liu**, JY Hsu, RB Broach, LH Ungar, and JP Fischer. Leveraging natural language processing and artificial intelligence to label unstructured data for risk prediction. *British Journal of Surgery*, 2023

A1. Ankoor A Talwar, Abhishek A Desai, Phoebe B McAuliffe, **Tony Liu**, Vivek James, Ivona Percec, Robyn B Broach, Lyle Ungar, and John P Fischer. Automated machine learning for risk prediction of incisional hernia in abdominal surgery patients. *Plastic and Reconstructive Surgery–Global Open*, 2022

Teaching

Mount Holyoke College
COMSC 341CD: Causal Inference for Data Science — Spring 2025
COMSC 205: Data Structures — Fall 2024, Spring 2025

University of Pennsylvania
CIS 1920: Python Programming — Fall 2020, Fall 2021, Spring 2023

Independent Studies and Student Research

Causal Inference and Data Engineering for Evaluating a Mental Health Support System — Spring 2025
Thu Ngo and Bhargavi Patil

Topics in Causal Inference — Fall 2024
Bhargavi Patil

Professional Service

Reviewer
AAAI AI4BC 2021, AAAI AI4BC 2022, SIGKDD 2023

Organizing Committee Member — Winter 2021
AAAI AI for Behavior Change (AI4BC) Workshop 2021

Industry Research

Senior Research Scientist / Senior Research Program Manager April 2022 — June 2024
Roblox (part-time)

- Continued research on measuring causal effects of civility and safety on platform [C3]
- Coordinated external communication, grant administration, conference presence, and tech transfer across Roblox Research

Graduate Research Intern October 2021 — April 2022
Roblox

- Developed observational causal methods for estimating the impact of civility on engagement [C3]

Other Industry Experience

Advisory Software Engineer August 2016 — August 2018
IBM Watson Health

Honors and Awards

Max Mintz TA Hall of Fame, Honorable Mention May 2024
University of Pennsylvania

Michigan Institute for Data Science (MIDAS) Future Leaders Summit April 2024
University of Michigan

Graduate Student Fellowship for Teaching Excellence Fall 2021 — Spring 2022
Center for Teaching and Learning, University of Pennsylvania

Travel Grant Spring 2022
SIGCSE New and Aspiring Educators Professional Development Session

Certifications

Certificate of Course Completion May 2024
Inclusive STEM Teaching Project

Certificate in College and University Teaching January 2021
Center for Teaching and Learning, University of Pennsylvania