

Tong (Tony) Liu (he/him)
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Research Interests

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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

Assistant Professor of Computer Science

Summer 2024 — present
South Hadley, MA

Education

University of Pennsylvania

Ph.D. in Computer and Information Science

Advisors: Lyle Ungar and Konrad Kording

Fall 2018 — Spring 2024
Philadelphia, PA

Williams College

B.A. in Computer Science, concentration in Cognitive Science
summa cum laude, with highest honors in Computer Science

2012 — 2016
Williamstown, MA

Research

Machine Learning Methods for Observational Causal Inference

2020 — present

Developing machine learning methodology for improving efficiency of observational causal studies.

- Works: [J9, M1, C2, J4]

Data Science for Social Communication

2018 — present

Using quasi-experiments and explainable AI (XAI) methods to study computer-mediated social communication.

- Works: [C3, C1]

Automated and Interpretable Machine Learning for Medicine

2020 — present

Developing workflows using automated machine learning methods and post-hoc interpretability to produce robust predictions for surgical hernia risk and liquid biopsy.

- Works: [W1, A2, A1, J2, J1]

Mobile Sensing for Depression and Anxiety

2018 — present

Analyzing digital phenotyping signals from mobile sensor data as markers for depression and anxiety.

- Works: [J10, J8, J6, J7, J3, P1]

Teaching

Instructor

Fall 2020, Fall 2021, Spring 2023

CIS 1920: Python Programming, University of Pennsylvania

- Organized and taught half-credit course for classes of 15-25 undergraduates over three semesters
- Designed and recorded lectures to support remote learning

Graduate Fellow for Teaching Excellence

Fall 2021 — Spring 2022

Center of Teaching and Learning, University of Pennsylvania

- Served as graduate student teaching observer and facilitated teaching reflections
- Organized and led nine teaching workshops within CIS department and across the university

Teaching Certificate

Fall 2020

Center of Teaching and Learning, University of Pennsylvania

- Completed CTL Course on College Teaching
- Participated in teaching observation and teaching philosophy reflection workshop

Course Content Creator

Summer 2020

Network Causality Tutorials, Neuromatch Academy

- Developed teaching material on causality for computational neuroscience summer school [J5]
- Course material is open sourced and has reached 10,000+ students [link]

Lead Teaching Assistant

Fall 2019

CIS 520: Machine Learning, University of Pennsylvania

- Managed teaching assistant team for 130+ person class, wrote exam and homework material
- Gave guest lecture on Bayesian Networks

Teaching Assistant

Spring 2013 – Spring 2016

Williams College

- Courses TA'd: CS 134: Introduction to Computer Science, CS 135: Diving into the Deluge of Data, CS 136: Data Structures, CS 237: Computer Organization, CS 334: Principles of Programming Languages

Conference Proceedings (C)

- C3. **Tony Liu**, Lyle Ungar, Konrad Kording, and Morgan McGuire. Measuring causal effects of civility without randomization. *To appear in 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 (CLearR)*, 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

Journal Papers (J)

- 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 Ladhanian. 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 Workshop Papers (W)

- W3. **Tony Liu**, Patrick Lawlor, Lyle Ungar, Konrad Kording, and Rahul Ladhanian. 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 Assumptions 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

Manuscripts in Progress (M)

- M1. **Tony Liu**, Xinyue Wang, Dante Lokitayakul, Lyle Ungar, and Konrad Kording. Learning to efficiently use instrumental variables. 2023

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

Student Mentees and Projects

- Dante Lokitayakul (UPenn BS '23 → UPenn MSE): [M1](#)
- Xinyue Wang (UPenn MSE '23 → UCSD PhD): [M1](#)
- Pooja Dattatri (UPenn MSE '23 → UPenn NLP Lab): [A2](#)
- Vivek James (UPenn Wharton '22 → Stripe): [A1](#)
- Harry Wang (UPenn MSE '22 → Pinterest): [J6](#), [J8](#)
- Zach Duey (UPenn MSE '22 → CalypsoAI): [Master's thesis](#)
- Jesse Cui (UPenn BS '19 → Facebook): [J1](#)

Industry Research

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

- Continued research on measuring causal effects of civility and safety on platform [C3]
- Coordinating 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]

Professional Service

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

Reviewer
AAAI AI4BC 2021, AAAI AI4BC 2022, SIGKDD 2023

Other Industry Experience

Advisory Software Engineer August 2016 — August 2018
IBM Watson Health

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

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

Sam Goldberg Colloquium Prize Summer 2016
Williams College: Awarded for the best thesis presentations in computer science

Sigma Xi Society Associate Member Summer 2016
Williams College

Phi Beta Kappa Honor Society Member Fall 2015
Williams College

Ward Prize Summer 2015
Williams College: Awarded for the best student projects in computer science