Kelly W. Zhang

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https://kellywzhang.github.io/

Research Interests

Sequential decision-making, *Machine learning*, *Statistics*.

Work Experience

Imperial College London — London, UK
Lecturer (Assistant Professor) — September 2024 - Present
I-X AI Initiative and Mathematics Department (Statistics section)

Columbia Business School — New York, NY
Postdoctoral Fellow — August 2023 - July 2024
Postdoctoral researcher in the Decision, Risk, and Optimization group at Columbia Business School working with Daniel Russo and Hongseok Namkoong on incorporating decision-making algorithms that incorporate large language models, with applications to recommendation systems.

Harvard University — Cambridge, MA
Postdoctoral Researcher — May 2023 - July 2023
Postdoctoral researcher with Susan Murphy working on statistical reinforcement learning, with a focus on applications to digital health.

Apple — Seattle, WA
HealthAI Research Intern — May 2022 - August 2022
Developed statistical inference methods specific to mobile health problems in large-scale, industry settings.

Facebook AI Research — New York, NY
Research Intern — May 2018 - August 2018
Worked on sparse coding and text generation with Yann LeCun.

eBay — New York, NY
Software Engineering Intern on Recommendations Team — May 2017 - August 2017
Worked on detecting "Not Suitable for Work" content, like nudity, in products sold on eBay.

Collaborations

American Express. Research collaboration investigating how reinforcement learning and experimentation can be used to improve credit line decisions. *January 2025 - Present.*

Neonatal Care. Working with the developers of the National Neonatal Research Database (NRDD) to develop a clinical decision support tool. *November 2024 - Present.*

Spotify. Research collaboration on developing bandit algorithms for making effective long-term recommendations; See Impatient Bandits: Optimizing Recommendations for the Long-Term Without Delay. *October 2023 - January 2025.*

Oralytics. Research collaboration with researchers at Harvard University, University of Michigan, and UCLA on a clinical trial to help individuals improve oral health behaviors. Incorporates mobile app and Blue-tooth enabled toothbrushes to augment standard of care between dental visits. *September 2019 - July 2023.*

Education

Harvard University, School of Engineering and Applied Sciences — Cambridge MA
Ph.D. in Computer Science — September 2018 - May 2023
Advisors: Susan A. Murphy and Lucas Janson
Thesis: Statistical Inference for Adaptive Experimentation

New York University, College of Arts and Sciences — New York, NY
BA in Computer Science; *summa cum laude* (GPA 3.956) — May 2018
Advisors: Sam Bowman and Yann LeCun

University of Chicago, College — Chicago, IL
Studied economics; Transferred after two years — September 2013 - June 2015

Honors

Siebel Scholar, Class of 2023 *($35,000 award; given to 100 final year engineering PhD candidates worldwide)*

Institute of Mathematical Statistics Hannan Graduate Student Travel Award, 2022 *($800 award)*

Certificate of Distinction in Teaching awarded by the Harvard Office of Undergraduate Education, based on reviews of my performance as a Teaching Fellow for Susan Murphy's course on *Sequential Decision Making*

National Science Foundation GFRP Fellowship, awarded in 2019 *($147,000 award)*

Computer Science Prize for Academic Excellence in the Honors Program, New York University, 2018

Research

Paper titles are linked to the online pdf of the papers. * Denotes denotes equal contribution.

Statistical Inference after Adaptive Sampling

Kelly W. Zhang, Nowell Closser, Anna L. Trella, Susan A. Murphy. "Replicable Bandits for Digital Health Interventions." *Minor revision at Statistical Science.*

Kelly W. Zhang. "Statistical Inference for Adaptive Experimentation." *Ph.D. Thesis, 2023.*

Kelly W. Zhang, Lucas Janson, and Susan A. Murphy. "Statistical Inference After Adaptive Sampling for Longitudinal Data." *Working paper.*

Kelly W. Zhang, Lucas Janson, and Susan A. Murphy. "Statistical Inference with M-Estimators on Adaptively Collected Data." *35th Conference on Neural Information Processing Systems (NeurIPS 2021).*

Kelly W. Zhang, Lucas Janson, and Susan A. Murphy. "Inference for Batched Bandits." *34th Conference on Neural Information Processing Systems (NeurIPS 2020).*

Designing Decision-Making Algorithms

Kelly W. Zhang, Tiffany (Tianhui) Cai, Hongseok Namkoong, Daniel Russo. "Contextual Thompson Sampling via Generation of Missing Data." *Under submission.*

Kelly W. Zhang, Thomas McDonald, Lucas Maystre, Mouina Lalmas, Daniel Russo, Kamil Ciosek. "Impatient Bandits: Optimizing Recommendations for the Long-Term Without Delay." *Under submission.*

Tiffany (Tianhui) Cai, Hongseok Namkoong, Daniel Russo, **Kelly W. Zhang**. "Active Exploration via Autoregressive Generation of Missing Data." *Under submission.*

Ziping Xu, **Kelly W. Zhang**, Susan A. Murphy. "The Fallacy of Minimizing Local Regret in the Sequential Task Setting." *Working paper.*

Anna L. Trella, **Kelly W. Zhang**, Inbal Nahum-Shani, Vivek Shetty, Iris Yan, Finale Doshi-Velez, Susan A. Murphy. "A Deployed Online Reinforcement Learning Algorithm In An Oral Health Clinical Trial." *To appear in Innovative Applications of Artificial Intelligence (IAAI-24).*

Anna L. Trella, **Kelly W. Zhang**, Inbal Nahum-Shani, Vivek Shetty, Iris Yan, Finale Doshi-Velez, Susan A. Murphy. "Monitoring Fidelity of Online Reinforcement Learning Algorithms in Clinical Trials." *Working paper.*

Susobhan Ghosh*, Raphael Kim*, Prasidh Chhabria, Raaz Dwivedi, Predrag Klasnja, Peng Liao, **Kelly W. Zhang**, Susan A. Murphy. "Did we personalize? Assessing personalization by an online reinforcement learning algorithm using resampling." *Machine Learning (Special Issue on Reinforcement Learning for Real Life), 2024.*

Anna L. Trella, **Kelly W. Zhang**, Inbal Nahum-Shani, Vivek Shetty, Finale Doshi-Velez, Susan A. Murphy. "Reward Design For An Online Reinforcement Learning Algorithm Supporting Oral Self-Care." *Thirty-Fifth Annual Conference on Innovative Applications of Artificial Intelligence (IAAI-23), 2023.*

Anna L. Trella, **Kelly W. Zhang**, Inbal Nahum-Shani, Vivek Shetty, Finale Doshi-Velez, Susan A. Murphy. "Designing Reinforcement Learning Algorithms for Digital Interventions: Pre-implementation Guidelines." *Algorithms (Special Issue "Algorithms in Decision Support Systems" Vol. 2).*

Preliminary version presented at the *5th Multidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM 2022);* ***(selected for an oral presentation)***.

Kelly W. Zhang, Omer Gottesman, and Finale Doshi-Velez. "A Bayesian Approach to Learning Bandit Structure in Markov Decision Processes." *Challenges of Real-World Reinforcement Learning (NeurIPS 2020 Workshop).*

Clinical Trial Protocols

Inbal Nahum-Shani, Zara M. Greer, Anna L. Trella, **Kelly W. Zhang**, Stephanie Carpenter, David Elashoff, Susan A. Murphy, Vivek Shetty. "Optimizing an adaptive Digital Oral Health Intervention for promoting Oral Self Care Behaviors: Micro-Randomized Trial Protocol." *Contemporary Clinical Trials, 2024.*

Lara N. Coughlin, Maya Campbell, Tiffany Wheeler, Chavez Rodriguez, Autumn R. Florimbio, Susobhan Ghosh, Yongyi Guo, Pei-Yao Hung, **Kelly W. Zhang**, Lauren Zimmerman, Erin E. Bonar, Maureen A. Walton, Susan A. Murphy, Inbal Nahum-Shani. "A mobile health intervention for emerging adults with regular cannabis use: A micro-randomized pilot trial design protocol." *Contemporary Clinical Trials, 2024.*

Natural Language Processing

Kelly W. Zhang and Samuel R. Bowman. "Language Modeling Teaches You More Syntax than Translation Does: Lessons Learned Through Auxiliary Task Analysis." *BlackboxNLP 2018 (Workshop at Conference on Empirical Methods in Natural Language Processing).*

Jake (Junbo) Zhao, Yoon Kim, **Kelly Zhang**, Alexander M. Rush, and Yann LeCun. "Adversarially Regularized Autoencoders." *Thirty-fifth International Conference on Machine Learning (ICML 2018).*

Invited Talks

Duke-NUS Medical School, *Center for Quantitative Medicine Seminar Series*, February 2025

Cambridge University, *Statistics Seminar*, November 2024

Imperial College London, *Statistics Seminar*, November 2024

INFORMS Annual Meeting 2024, Invited Session on *Frontiers in Language Models and Operations*, October 2024

Bernoulli-IMS World Conference, Invited Session on *Frontiers of Adaptive Experimentation*, August 2024

Columbia University, *Decision, Risk, and Optimization Section of Business School* Brown Bag, December 2023

INFORMS Annual Meeting 2023, Session on *Frontiers in Adaptive Experimentation*, October 2023

Columbia University, *Columbia Biostatistics Annual Research Symposium*, September 2023

Joint Statistical Meeting 2023, Session on *Integrating Algorithms and Analysis for Adaptively Randomized Experiments*, August 2023

INFORMS Applied Probability Society, Session on *Frontiers in Sequential Learning*, June 2023

Carnegie Mellon University, Aaditya Ramdas group; Feburary 2023

Experimental Design and Active Learning in the Real World, Online seminar organized by Ilija Bogunovic, Willie Neiswanger, and Mojmir Mutny; January 2022

University of Copenhagen, *Center for Social Data Science*, January 2022

INFORMS Annual Meeting 2022, Session on *Efficient Learning via Adaptive Experimentation* organized by Daniel Russo, October 2022

University of Amsterdam, *Statistics Department Seminar*, September 2022

Joint Statistical Meeting 2022, Session on *Prediction and Inference in Statistical Machine Learning* organized by Tracy Ke, August 2022

Institute of Mathematical Sciences Annual Meeting 2022, Session on *Inference Methods for Adaptively Collected Data* as a speaker and the session organizer, June 2022

University of Toronto, *Intelligent Adaptive Interventions Lab*, June 2022

Apple Machine Learning Research, *Health AI Team*, June 2022

École Polytechnique Fédérale de Lausanne (EPFL), *Statistics Seminar*, December 2021 (`https://tube.switch.ch/videos/pCYwBwSYh6`)

Pennsylvania State University, *Statistics Colloquium*, November 2021

Pennsylvania State University, *QuantDev Methodology Brown-Bag Seminar*, November 2021

INFORMS Annual Meeting 2021, Session on *Advances in Causal Inference and Reinforcement Learning for the Online Service Industry* organized by Tim Keaton

London School of Hygiene and Tropical Medicine, *Health Data Science Seminar Series*, June 2021

Cambridge University, *Medical Research Council Biostatistics Unit Seminar*, April 2021 (`https://www.youtube.com/watch?v=jflR7KOrqNA&t=2s`)

Bernoulli World One Symposium, Session on *Statistical Methods in Machine Learning*, August 2020

Teaching

Instructor, **Imperial College London**. Course on *Learning Agents* for Masters of Data Science students, Fall 2024.

Guest Lecturer, **Harvard University**. Susan Murphy's course on *Sequential Decision Making*, STAT 234, Spring 2022.

Teaching Fellow, **Harvard University**. Susan Murphy's course on *Sequential Decision Making*, STAT 234, Spring 2021.

Grader, **New York University**. Sam Bowman and Kyunghyun Cho's course on *Natural Language Processing with Representation Learning*, DS-GA 1011, Fall 2017.

Service

Workshops and Sessions

Co-organized Invited Session at INFORMS Annual Meeting on *Causal Inference and Machine Learning*. The speakers were Christina Yu, Angela Zhou, Sadegh Shirani, and Ethan Che.

Co-organized Invited Session at Bernoulli-IMS World Conference 2024 on *Frontiers of Adaptive Experimentation*. The speakers were Dean Foster, Maria Dimakopoulou, Koulik Khamaru, and myself.

Co-organized Workshop at Reinforcement Learning Conference 2024 on *Deployable Reinforcement Learning*. `https://deployable-rl.github.io`

Organized Invited Session at 2022 Institute of Mathematical Sciences Annual Meeting on *Inference Methods for Adaptively Collected Data*. The speakers were Nathan Kallus, Koulik Khamaru, Evan Munro, and myself. Joseph Jay Williams and Nina Deliu chaired the session.

Organized Invited Session at 2022 Institute of Mathematical Sciences Annual Meeting on *Inference Methods for Adaptively Collected Data*. The speakers were Nathan Kallus, Koulik Khamaru, Evan Munro, and myself. Joseph Jay Williams and Nina Deliu chaired the session.

Assisted in Organizing the Harvard Radcliffe 2022 Exploratory Seminar on *Ethical Considerations in the Use of Big Data, AI, and Real-Time Information for Prediction of Behavioral Health Outcomes*, which was led by Jordan Smoller and Matthew Nock.

Co-Organized NeurIPS 2021 Workshop on *Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice* with Aurelien Bibaut, Maria Dimakopoulou, Nathan Kallus, Xinkun Nie, and Masatoshi Uehara.

Co-Organized NeurIPS 2020 Workshop on *Machine Learning for Mobile Health* with Walter Dempsey, Nick Foti, Joseph Futoma, Yian Ma, Marianne Njifon, and Jieru Shi.

Assisted in a practical workshop on Online Learning and Experimentation Algorithms in Mobile Health organized by Walter Dempsey as a part of the AI4Health Winter School 2021.

Reviewing

Neural Information Processing Systems (NeurIPS), International Conference on Artificial Intelligence and Statistics (AISTATS), Conference on Causal Learning and Reasoning (CLEAR), Journal of the American Statistical Association (JASA), Journal of the Royal Statistical Society Series B (JRSS-B), Biometrics, Management Science