

# Zhiwei Steven Wu

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## CONTACT INFORMATION

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<http://www.zstevenwu.com>

(Last updated: 8/28/2020)

## RESEARCH INTERESTS

Machine Learning, Data Privacy, Algorithmic Fairness, Algorithmic Economics

## EMPLOYMENT

<b>Carnegie Mellon University</b>	Pittsburgh, Pennsylvania USA
Assistant Professor, School of Computer Science	September 2020 –
<b>University of Minnesota</b>	Twin Cities, Minnesota USA
Assistant Professor of Computer Science	August 2018 – August 2020
<b>Microsoft Research-New York City</b>	New York City, New York USA
Postdoctoral Researcher	July 2017 – June 2018
Research Groups: Machine Learning & Algorithmic Economics	

## EDUCATION

<b>University of Pennsylvania</b>	Philadelphia, Pennsylvania USA
Ph.D., Computer Science	September 2012 – June 2017
Thesis: <i>Data Privacy Beyond Differential Privacy</i>	
Advisors: Michael Kearns & Aaron Roth	
<b>Received the Morris and Dorothy Rubinoff Dissertation Award (Best Thesis)</b>	
<b>Bard College</b>	Annandale, NY USA
B.A., Mathematics	May 2012
B.A., Computer Science	May 2012
Distinguished Scientist Scholarship (four-year full scholarship)	
<b>Budapest Semesters in Mathematics (BSM)</b> , Budapest, Hungary	
Study-abroad program in mathematics	Fall 2010

## HONORS AND AWARDS

2019 - Google Faculty Research Award  
2019 - J.P. Morgan Research Faculty Award  
2019 - Facebook Mechanism Design for Social Good Research Award  
2017 - Morris and Dorothy Rubinoff Dissertation Award for Best Thesis  
2017 - Simons-Berkeley Research Fellowship (declined)  
2011 - Kenneth Bush Memorial Scholarship in Mathematics  
2010 - BSM Mathematics Competition Honorable Mention  
2010 - Mathematical Association of America Presentation Prize  
2008-2012 - Distinguished Scientist Scholarship (four-year full scholarship)

## RESEARCH FUNDING

- Role: Co-PI  
(PI: Haiyi Zhu (CMU), co-PIs: Gord Burtch (UMN), Yanhua Li (WPI), Min Kyung Lee (UT Austin))  
Funding Agency: NSF

**(Awarded)** “SCC-IRG Track 1: Empowering and Enhancing Workers Through Building A Community-Centered Gig Economy”

10/1/2020–9/30/2023

Total award amount: \$1,997,764 total

- Role: PI  
(Co-PIs: Alexandra Chouldechova (CMU), Min Kyung Lee (UT Austin), Haiyi Zhu (CMU))  
Funding Agency: NSF and Amazon  
**(Awarded)** “FAI: Advancing Fairness in AI with Human-Algorithm Collaborations”  
1/1/2020–12/31/2022  
Total award amount: \$1,037,000 total, \$338,286 for UMN
- Role: UMN PI  
(PI: Haiyi Zhu (CMU), co-PIs: Mark Snyder, Loren Terveen)  
Funding Agency: NSF  
**(Awarded)** “EAGER: AI-DCL: Capture, Explain and Negotiate the Inherent Trade-offs in Machine Learning Algorithms”  
10/01/2019–9/30/2021  
Total award amount: \$295,713, \$193,267 for UMN
- Role: Co-PI  
(PI: Haiyi Zhu (CMU), co-PIs: Mark Snyder, Loren Terveen)  
Funding Agency: NSF  
**(Awarded)** “CHS: Small: Incorporating and Balancing Stakeholder Values in Algorithm Design”  
8/1/2019–7/31/2022  
Total award amount: \$500,000, \$243,941 for UMN
- Role: PI  
(Co-PI: Haiyi Zhu (CMU))  
Funding Agency: Facebook  
**(Awarded)** “Promoting Diversity in Peer Production through Mechanism Design”  
Awarded in 2019  
Total award amount: \$50,000, \$50,000 for UMN
- Role: Sole PI  
Funding Agency: J.P. Morgan  
**(Awarded)** “Preventing Unfair Discrimination in Interactive Learning”  
3/4/2019–3/3/2021  
Total award amount: \$155,034
- Role: Sole PI  
Funding Agency: Google  
**(Awarded)** “Incentive-Aware Learning via Algorithmic Stability”  
Awarded in 2019  
Total award amount: \$50,000
- Role: Sole PI  
Funding Agency: Mozilla  
**(Awarded)** “DP-Fathom: Private, Accurate, and Communication-Efficient”  
Awarded in 2019  
Total award amount: \$25,000

- Brett K. Beaulieu-Jones, Zhiwei Steven Wu, Chris Williams, Ran Lee, Sanjeev P Bhavnani, James Brian Byrd, Casey S. Greene and Casey S. Greene. Privacy-preserving generative deep neural networks support clinical data sharing. In *Circulation: Cardiovascular Quality and Outcomes 2019; 12* (Contributinal order)
- Paul W. Goldberg, Francisco J. Marmolejo Cossío, and Zhiwei Steven Wu. Logarithmic query complexity for approximate nash computation in large games. *Theory of Computing Systems (TOCS)*, 2019. Special issue for selected papers from SAGT 2016
- Michael Kearns, Aaron Roth, Zhiwei Steven Wu, and Grigory Yaroslavtsev. Private algorithms for the protected in social network search. *Proceedings of the National Academy of Sciences (PNAS)*, 113(4), 2016
- Justin Hsu, Zhiyi Huang, Aaron Roth, Tim Roughgarden, and Zhiwei Steven Wu. Private matchings and allocations. *SIAM Journal on Computing (SICOMP)*, 2016. Previously published in ACM SIGACT Symposium on Theory of Computing (STOC 2014)
- Marco Gaboardi, Emilio Jesús Gallego Arias, Justin Hsu, Aaron Roth, and Zhiwei Steven Wu. Dual query: Practical private query release for high dimensional data. *Journal of Privacy and Confidentiality (JPC)*, 2016. Previously published in International Conference on Machine Learning (ICML 2014)

CONFERENCE  
PUBLICATIONS

- Giuseppe Vietri, Grace Tian, Mark Bun, Thomas Steinke and Zhiwei Steven Wu. New Oracle-Efficient Algorithms for Private Synthetic Data Release. In *Proceedings of the 37th International Conference on Machine Learning, ICML*, 2020. (Contribution order)
- Giuseppe Vietri, Borja Balle, Akshay Krishnamurthy, and Zhiwei Steven Wu. Private Reinforcement Learning with PAC and Regret Guarantees. In *Proceedings of the 37th International Conference on Machine Learning, ICML*, 2020. (Contribution order)
- Seth Neel, Aaron Roth, Giuseppe Vietri, and Zhiwei Steven Wu. Oracle Efficient Private Non-Convex Optimization. In *Proceedings of the 37th International Conference on Machine Learning, ICML*, 2020
- Vidyashankar Sivakumar, Zhiwei Steven Wu, and Arindam Banerjee. Structured Linear Contextual Bandits: A Sharp and Geometric Smoothed Analysis. In *Proceedings of the 37th International Conference on Machine Learning, ICML*, 2020. (Contribution order)
- Huanyu Zhang, Gautam Kamath, Janardhan Kulkarni, and Zhiwei Steven Wu. Privately Learning Markov Random Fields. In *Proceedings of the 37th International Conference on Machine Learning, ICML*, 2020. (Contribution order)
- Raef Bassily, Albert Cheu, Shay Moran, Aleksandar Nikolov, Jonathan Ullman, and Zhiwei Steven Wu. Private Query Release Assisted by Public Data. In *Proceedings of the 37th International Conference on Machine Learning, ICML*, 2020
- Sivakanth Gopi, Gautam Kamath, Janardhan Kulkarni, Aleksandar Nikolov, Zhiwei Steven Wu, and Huanyu Zhang. Locally Private Hypothesis Selection. In *Proceedings of the 33rd Annual Conference on Learning Theory, COLT*, 2020
- Nicole Immorlica, Jieming Mao, Alex Slivkins, and Zhiwei Steven Wu. Incentivizing Exploration with Selective Disclosure In *The 21st ACM conference on Economics and Computation EC*, 2020
- Bowen Yu, Ye Yuan, Loren Terveen, Zhiwei Steven Wu, Jodi Forlizzi and Haiyi Zhu. Keeping Designers in the Loop: Communicating Inherent Algorithmic Trade-offs Across Multiple Objectives. In *ACM Designing Interactive Systems, DIS* 2020 (Contribution order)

- Mark Bun, Gautam Kamath, Thomas Steinke, and Zhiwei Steven Wu. Private hypothesis selection. In *Advances in Neural Information Processing Systems 32: Annual Conference on Neural Information Processing Systems*, **NeurIPS**, 2019
- Matthew Joseph, Janardhan Kulkarni, Jieming Mao, and Zhiwei Steven Wu. Locally private Gaussian estimation. In *Advances in Neural Information Processing Systems 32: Annual Conference on Neural Information Processing Systems*, **NeurIPS**, 2019
- Yahav Bechavod, Katrina Ligett, Aaron Roth, Bo Waggoner, and Zhiwei Steven Wu. Equal Opportunity in Online Classification with Partial Feedback. In *Advances in Neural Information Processing Systems 32: Annual Conference on Neural Information Processing Systems*, **NeurIPS**, 2019
- Arindam Banerjee, Qilong Gu, Vidyashankar Sivakumar, and Zhiwei Steven Wu. Random quadratic forms with dependence: applications to restricted isometry and beyond. In *Advances in Neural Information Processing Systems 32: Annual Conference on Neural Information Processing Systems*, **NeurIPS**, 2019
- Seth Neel, Aaron Roth, and Zhiwei Steven Wu. How to Use Heuristics for Differential Privacy. In *Proceedings of The 60th Annual IEEE Symposium on Foundations of Computer Science*, **FOCS**, 2019
- Alekh Agarwal, Miroslav Dudik, Zhiwei Steven Wu. Fair Regression: Quantitative Definitions and Reduction-based Algorithms. In *Proceedings of the 36th International Conference on Machine Learning*, **ICML**, 2019
- Aaron Schein, Zhiwei Steven Wu, Alexandra Schofield, Mingyuan Zhou, and Hanna Wallach. Locally private bayesian inference for count models. In *Proceedings of the 36th International Conference on Machine Learning*, **ICML**, 2019. (Contributinal order)
- Miruna Oprescu, Vasilis Syrgkanis, and Zhiwei Steven Wu. Orthogonal Random Forest for Causal Inference. In *Proceedings of the 36th International Conference on Machine Learning*, **ICML**, 2019
- Guy Aridor, Kevin Liu, Aleksandrs Slivkins, Zhiwei Steven Wu. The Perils of Exploration under Competition: A Computational Modeling Approach. In *The 20th ACM conference on Economics and Computation* **EC**, 2019
- Nicole Immorlica, Jieming Mao, Alex Slivkins, and Zhiwei Steven Wu. Bayesian Exploration with Heterogeneous Agents. In *The Web Conference 2019* **TheWebConf (Oral presentation)**, 2019
- Michael J. Kearns, Seth Neel, Aaron Roth, and Zhiwei Steven Wu. An empirical study of rich subgroup fairness for machine learning. In *Proceedings of the second Annual ACM Conference on Fairness, Accountability, and Transparency*, **FAT\***, 2019
- Sampath Kannan, Jamie Morgenstern, Aaron Roth, Bo Waggoner, and Zhiwei Steven Wu. A smoothed analysis of the greedy algorithm for the linear contextual bandit problem. In *Advances in Neural Information Processing Systems 30: Annual Conference on Neural Information Processing Systems*, **NeurIPS (Spotlight)**, 2018
- Manish Raghavan, Aleksandrs Slivkins, Jenn Wortman Vaughan, and Zhiwei Steven Wu. The unfair externalities of exploration and how data diversity helps exploitation. In *The 31st Annual Conference on Learning Theory*, **COLT**, 2018
- Michael J. Kearns, Seth Neel, Aaron Roth, and Zhiwei Steven Wu. Preventing fairness gerrymandering: Auditing and learning for subgroup fairness. In *Proceedings of the 35th International Conference on Machine Learning*, **ICML**, 2018

- Akshay Krishnamurthy, Zhiwei Steven Wu, and Vasilis Syrgkanis. Semiparametric Contextual Bandits. In *Proceedings of the 35th International Conference on Machine Learning, ICML*, 2018. (Contributational order)
- Jinshuo Dong, Aaron Roth, Zachary Schutzman, Bo Waggoner, and Zhiwei Steven Wu. Strategic classification from revealed preferences. In *The 19th ACM conference on Economics and Computation EC*, 2018
- Yishay Mansour, Aleksandrs Slivkins, and Zhiwei Steven Wu. Competing bandits: Learning in competition. In *Proceedings of the 2018 ACM Conference on Innovations in Theoretical Computer Science, ITCS*, 2018
- Katrina Ligett, Seth Neel, Aaron Roth, Bo Waggoner, and Zhiwei Steven Wu. Accuracy first: Selecting a differential privacy level for accuracy-constrained ERM. In *Advances in Neural Information Processing Systems 29: Annual Conference on Neural Information Processing Systems, NIPS*, 2017
- Sampath Kannan, Michael Kearns, Jamie Morgenstern, Mallesh M. Pai, Aaron Roth, Rakesh V. Vohra, and Zhiwei Steven Wu. Fairness incentives for myopic agents. In *Proceedings of the 2017 ACM Conference on Economics and Computation, EC*, 2017
- Aaron Roth, Aleksandrs Slivkins, Jonathan Ullman, and Zhiwei Steven Wu. Multidimensional dynamic pricing for welfare maximization. In *Proceedings of the 2017 ACM Conference on Economics and Computation, EC*, 2017. Invited to the special issue of ACM Transactions on Economics and Computation for EC’17
- Michael Kearns, Aaron Roth, and Zhiwei Steven Wu. Meritocratic fairness for cross-population selection. In *Proceedings of the 34th International Conference on Machine Learning, ICML*, 2017
- Michael Kearns and Zhiwei Steven Wu. Predicting with distributions. In *Proceedings of the 30th Conference on Learning Theory, COLT*, 2017
- Shahin Jabbari, Ryan Rogers, Aaron Roth, and Zhiwei Steven Wu. Learning from rational behavior: Predicting solutions to unknown linear programs. In *Advances in Neural Information Processing Systems 28: Annual Conference on Neural Information Processing Systems, NIPS*, 2016
- Yishay Mansour, Aleksandrs Slivkins, Vasilis Syrgkanis, and Zhiwei Steven Wu. Bayesian exploration: Incentivizing exploration in bayesian games. In *Proceedings of the 2016 ACM Conference on Economics and Computation, EC*, 2016. Invited to the special issue of ACM Transactions on Economics and Computation for EC’16 (declined)
- Aaron Roth, Jonathan Ullman, and Zhiwei Steven Wu. Watch and learn: optimizing from revealed preferences feedback. In *Proceedings of the 48th Annual ACM SIGACT Symposium on Theory of Computing, STOC*, 2016
- Rachel Cummings, Katrina Ligett, Kobbi Nissim, Aaron Roth, and Zhiwei Steven Wu. Adaptive learning with robust generalization guarantees. In *Proceedings of the 29th Conference on Learning Theory, COLT*, 2016
- Paul W. Goldberg, Francisco J. Marmolejo Cossío, and Zhiwei Steven Wu. Logarithmic query complexity for approximate nash computation in large games. In *Proceedings of the 9th International Symposium on Algorithmic Game Theory, SAGT*, 2016. Invited to the special issue of Theory of Computing Systems for SAGT’16
- Justin Hsu, Zhiyi Huang, Aaron Roth, and Zhiwei Steven Wu. Jointly private convex programming. In *Proceedings of the Twenty-Seventh Annual ACM-SIAM Symposium on Discrete Algorithms, SODA*, 2016

- Rachel Cummings, Katrina Ligett, Jaikumar Radhakrishnan, Aaron Roth, and Zhiwei Steven Wu. Coordination complexity: Small information coordinating large populations. In *Proceedings of the 2016 ACM Conference on Innovations in Theoretical Computer Science*, **ITCS**, 2016
- Rachel Cummings, Michael Kearns, Aaron Roth, and Zhiwei Steven Wu. Privacy and truthful equilibrium selection for aggregative games. In *Proceedings of the 11th International Conference on Web and Internet Economics*, **WINE**, 2015
- Ryan Rogers, Aaron Roth, Jonathan Ullman, and Zhiwei Steven Wu. Inducing approximately optimal flow using truthful mediators. In *Proceedings of the Sixteenth ACM Conference on Economics and Computation*, **EC**, 2015
- Rachel Cummings, Katrina Ligett, Aaron Roth, Zhiwei Steven Wu, and Juba Ziani. Accuracy for sale: Aggregating data with a variance constraint. In *Proceedings of the 2015 Conference on Innovations in Theoretical Computer Science*, **ITCS**, 2015
- Sampath Kannan, Jamie Morgenstern, Aaron Roth, and Zhiwei Steven Wu. Approximately stable, school optimal, and student-truthful many-to-one matchings (via differential privacy). In *Proceedings of the Twenty-Sixth Annual ACM-SIAM Symposium on Discrete Algorithms*, **SODA**, 2015
- Marco Gaboardi, Emilio Jesús Gallego Arias, Justin Hsu, Aaron Roth, and Zhiwei Steven Wu. Dual query: Practical private query release for high dimensional data. In *Proceedings of the 31th International Conference on Machine Learning*, **ICML**, 2014
- Justin Hsu, Zhiyi Huang, Aaron Roth, Tim Roughgarden, and Zhiwei Steven Wu. Private matchings and allocations. In *Proceedings of the 46th ACM Symposium on Theory of Computing*, **STOC**, 2014. Invited to the special issue of ACM Transactions on Economics and Computation for STOC’14 (declined)

#### PRE-PRINTS

- Chris Jung, Michael Kearns, Seth Neel, Aaron Roth, Logan Stapleton, and Zhiwei Steven Wu. Eliciting and Enforcing Subjective Individual Fairness. *Manuscript*, 2019
- Xiangyi Chen\*, Tiancong Chen\*, Haoran Sun, Zhiwei Steven Wu, and Mingyi Hong. Distributed Training with Heterogeneous Data: Bridging Median- and Mean-Based Algorithms. *Manuscript*, 2019 (Contributinal order)

#### SURVEYS/ NEWSLETTERS

- Aaron Roth, Jonathan Ullman, and Zhiwei Steven Wu. Watch and learn: optimizing from revealed preferences feedback. *SIGecom Exchanges*, 2015

#### ADVISING

##### Ph.D. Students

- Giuseppe Vietri (co-advised by Maria Gini). 2018–present
- Logan Stapleton. 2019–present
- Dung Ngo. 2019–present
- Hao-Fei Cheng (co-advised by Haiyi Zhu). 2019–present

##### Thesis Committees

- Vidyashankar Sivakumar (Univ. of Minnesota)
- Qilong Gu (Univ. of Minnesota)
- Anthony Zhenhuan Zhang (Univ. of Minnesota)

- Gautam Goel (Caltech)

## TEACHING

### **Carnegie Mellon University**

Pittsburgh, PA

*Instructor*

- 05-318 / 05-618: Human AI Interaction

Fall 2020

### **University of Minnesota**

Twin-Cities, MN

*Instructor*

- CSCI 5525: Machine Learning
- CSCI 8980: The Algorithmic Foundations of Data Privacy

Fall 2019, Spring 2020

Fall 2018

### **Bard Prison Initiative,**

Eastern Correctional Facility, NY

*Math tutor:* gave math tutorials to inmates

Spring 2011

## SERVICE AND OUTREACH

Organizer of Recent Developments in Research on Fairness. The Simons Institute for the Theory of Computing, Berkeley, CA. July 8-10, 2019.

Program Committee: ALT 2021, AISTATS 2021 (Area Chair), NeurIPS 2020 (Area Chair), ICML 2020 (Area Chair), ICLR 2020, 2021 (Area Chair), WWW 2020, EC 2020, TPD 2019, EC 2019, FAT\* 2019 (Track chair on ML/Stats/Data Mining), AAAI 2019, EC 2018, WWW 2018, ICML 2018, ICML 2017.

Conference Reviewer: STOC 2019, SODA 2018, ITCS 2018, NIPS 2017, ALT 2017, FOCS 2017, EC 2017, ICALP 2017, SODA 2017, COLT 2016, ESA 2016, TEAC, WINE 2015, ISAAC 2015, NIPS 2015, FOCS 2015, STOC 2015, FOCS 2014, WINE 2014, WINE 2013

Journal Reviewer: Proceedings of the National Academy of Sciences (PNAS), Machine Learning, Journal of Machine Learning Research, Operations Research, Journal of Privacy and Confidentiality, Transactions on Pattern Analysis and Machine Intelligence.

## SELECTED TALKS

Differential Privacy Techniques Beyond Differential Privacy

- FOCS 2019 Workshop “A TCS Quiver”, November 2019

Between Individual and Group Fairness

- DIMACS 30th Birthday Conference “Three Decades of DIMACS: The Journey Continues”

Locally Private Bayesian Inference for Count Models

- Simons Workshop on Privacy and the Science of Data Analysis, April 2019

How to Use Heuristics for Differential Privacy

- Simons Institute Seminar, Feb 2019
- IMA Workshop: Recent Themes in Resource Tradeoffs: Privacy, Fairness, and Robustness, June 2019

Preventing Fairness Gerrymandering: Auditing and Learning for Subgroup Fairness

- Google Research Seminar, April 2018
- CalTech Theory Seminar, March 2018

Privacy-Preserving GANs Support Clinical Data Sharing

- Microsoft Research-NYC tea talk, March 2019
- Banff workshop on “Mathematical Foundations of Data Privacy”, May 2018

A Smoothed Analysis of the Greedy Algorithm for the Linear Contextual Bandit Problem

- Rutgers/DIMACS Theory of Computing Seminar, Oct 2017
- UMass Machine Learning and Friends Lunch (MLFL), Nov 2017

Differential Privacy: A Rigorous Notion for Data Privacy

- Muhlenberg College Math/CS Colloquium, May 2017
- Carleton College CS Tea Talk, Oct 2019

Leveraging No-Regret Algorithms in Private Data Analysis

- Princeton CS theory lunch, Feb 2017

Social Norms for Data-Driven Algorithms: Privacy, Incentive-Compatibility and Fairness

- SIGAI CNC, Boston, MA, Oct 2016
- NY Area Theory Day, New York, NY, Dec 2016

Adaptive Data Analysis and Differential Privacy

- Guest Lecture in the course Computational Learning Theory at UPenn

Adaptive Learning with Robust Generalization Guarantees

- COLT, New York City, June 2016

Coordination Complexity: Small Information Coordinating Large Populations

- Northeastern University Theory Seminar, January 2016
- UPenn Theory Lunch, September 2015
- University of Hong Kong, Theory Seminar, December 2015

Bayesian Exploration: Incentivizing Exploration in Bayesian Games

- Harvard EconCS Seminar, September 2016
- EC, Maastricht, July 2016
- Microsoft Research NYC Tea Talk, July 2015

Watch and Learn: Optimizing from Revealed Preferences Feedback

- STOC, Cambridge, June 2016
- Caltech Theory Lunch, April 2015
- The First Workshop on Algorithmic Game Theory and Data Science, Portland, June 2015

Inducing Approximately Optimal Flow Using Truthful Mediators

- EC, Portland, June 2015

Privacy for the Protected (Only)

- Columbia CS Seminar, Dec. 2016
- Cornell Theory Seminar, Nov. 2016
- Workshop on The Theory of Bringing Privacy into Practice, Pasadena, April 2015

Privacy and Truthful Equilibrium Selection in Aggregative Games

- UPenn Theory Lunch, September 2014
- WINE, December 2015

Dual Query: Practical Private Query Release for High Dimensional Data

- ICML, Beijing, June 2014

Private Matchings and Allocations

- STOC, New York, June 2014
- UPenn Theory Lunch, May 2014