Yu Cheng

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Research Interests

Machine Learning: scalable and provable learning algorithms, theoretical machine learning, theoretical deep learning, high-dimensional robust statistics, and learning with strategic agents.

Optimization: non-convex optimization, spectral graph theory, and combinatorial optimization.

Game Theory: information structure design, fairness and social choice, and equilibrium computation.

Academic Positions

2022–present **Assistant Professor**, *Department of Computer Science, Brown University*.

2019–2022 **Assistant Professor**, *Department of Mathematics, University of Illinois Chicago*.

2019–2022 **Adjunct Assistant Professor**, *Department of Computer Science, University of Illinois Chicago*.

Fall 2019 **Visiting Scholar**, *School of Mathematics, Institute for Advanced Study (Princeton, NJ)*.
Member of the Special Year on Optimization, Statistics, and Theoretical Machine Learning.

2017–2019 **Postdoctoral Researcher**, *Department of Computer Science, Duke University*.
Hosted by Vincent Conitzer, Rong Ge, Kamesh Munagala, and Debmalya Panigrahi.

Education

2011–2017 **Ph.D. in Computer Science**, *University of Southern California*.
Dissertation title: Computational Aspects of Optimal Information Revelation.
Advisor: Shang-Hua Teng.
Dissertation committee: Shaddin Dughmi, David Kempe, Yan Liu, and Ben Reichardt.

2007–2011 **B.S. in Computer Science**, *Shanghai Jiao Tong University*, China.
ACM Honors Class.

Honors and Awards

2018 **Best Paper Award**, the 14th Conference on Web and Internet Economics (WINE 2018).

2017 **Finalist**, Excellence in Graduate Research Award in Machine Learning, University of Southern California (5 finalists selected).

2013 **14th place**, International Collegiate Programming Contest (ICPC) World Finals.

2011, 2012 **Champion**, ICPC Southern California Regional Contest.

2010 **Assistant coach** of ICPC World Champion team (invited to the ACM Awards Banquet).

Research Grants

Jan. 2022–Dec. 2025 National Science Foundation (NSF) Award CCF-2307106. *AF: Small: Faster Algorithms for High-Dimensional Robust Statistics*. PI: Yu Cheng. Award Amount: $395,171.

Publications

Papers labeled (α-β) indicate equal contribution with authors ordered alphabetically.

Conference Papers

[34] Xing Gao, Binhao Chen, Yu Cheng. Semi-Random Noisy and One-Bit Matrix Completion via Nonconvex Optimization. *In Proceedings of the 29th Annual Conference on Artificial Intelligence and Statistics* **(AISTATS)**, 2026.

[33] Yixuan Even Xu, Hanrui Zhang, Yu Cheng, Vincent Conitzer. Aggregating Quantitative Relative Judgments: From Social Choice to Ranking Prediction. *In Proceedings of the 38th Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 19933–19964, 2024.

[32] (α-β) Yu Cheng, Max Li, Honghao Lin, Zi-Yi Tai, David P. Woodruff, Jason Zhang. Tight Lower Bounds for Directed Cut Sparsification and Distributed Min-Cut. *In Proceedings of the 43rd ACM Symposium on Principles of Database Systems* **(PODS)**, pp. 85:1–85:18, 2024.

[31] Xing Gao, Yu Cheng. Robust Matrix Sensing in the Semi-Random Model. *In Proceedings of the 37th Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 63385–63408, 2023.

[30] Shuyao Li, Yu Cheng, Ilias Diakonikolas, Jelena Diakonikolas, Rong Ge, Stephen J. Wright. Robust Second-Order Nonconvex Optimization and Its Application to Low Rank Matrix Sensing. *In Proceedings of the 37th Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 54386–54398, 2023.

[29] Muthu Chidambaram, Chenwei Wu, Yu Cheng, Rong Ge. Hiding Data Helps: On the Benefits of Masking for Sparse Coding. *In Proceedings of the 40th International Conference on Machine Learning* **(ICML)**, pp. 5600–5615, 2023.

[28] Hanrui Zhang, Yu Cheng, Vincent Conitzer. Efficiently Solving Turn-Taking Stochastic Games with Extensive-Form Correlation. *In Proceedings of the 24th ACM Conference on Economics and Computation* **(EC)**, pp. 1161–1186, 2023.

[27] (α-β) Yu Cheng, Ilias Diakonikolas, Rong Ge, Shivam Gupta, Daniel M. Kane, Mahdi Soltanolkotabi. Outlier-Robust Sparse Estimation via Non-Convex Optimization. *In Proceedings of the 36th Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 7318–7327, 2022.

[26] Hanrui Zhang, Yu Cheng, Vincent Conitzer. Efficient Algorithms for Planning with Participation Constraints. *In Proceedings of the 23rd ACM Conference on Economics and Computation* **(EC)**, pp. 1121–1140, 2022.

[25] Hanrui Zhang, Yu Cheng, Vincent Conitzer. Planning with Participation Constraints. *In Proceedings of the 36th AAAI Conference on Artificial Intelligence* **(AAAI)**, pp. 5260–5267, 2022.

[24] (α-β) Ruoxu Cen, Yu Cheng, Debmalya Panigrahi, Kevin Sun. Sparsification of Directed Graphs via Cut Balance. *In Proceedings of the 48th International Colloquium on Automata, Languages and Programming* **(ICALP)**, pp. 45:1–45:21, 2021.

[23] (α-β) Yu Cheng, Honghao Lin. Robust Learning of Fixed-Structure Bayesian Networks in Nearly-Linear Time. *In Proceedings of the 9th International Conference on Learning Representations* **(ICLR)**, 2021.

[22] Anilesh Krishnaswamy, Zhihao Jiang, Kangning Wang, Yu Cheng, Kamesh Munagala. Fair for All: Best-Effort Fairness Guarantees for Classification. *In Proceedings of the 24th International Conference on Artificial Intelligence and Statistics* **(AISTATS)**, pp. 3259–3267, 2021.

[21] Hanrui Zhang, Yu Cheng, Vincent Conitzer. Classification with Few Tests through Self-Selection. *In Proceedings of the 35th AAAI Conference on Artificial Intelligence* **(AAAI)**, pp. 5805–5812, 2021.

[20] Hanrui Zhang, Yu Cheng, Vincent Conitzer. Automated Mechanism Design for Classification with Partial Verification. *In Proceedings of the 35th AAAI Conference on Artificial Intelligence* **(AAAI)**, pp. 5789–5796, 2021.

[19] (α-β) Yu Cheng, Ilias Diakonikolas, Rong Ge, Mahdi Soltanolkotabi. High-Dimensional Robust Mean Estimation via Gradient Descent. *In Proceedings of the 37th International Conference on Machine*

Learning **(ICML)**, pp. 1768–1778, 2020.

[18] Hanrui Zhang, Yu Cheng, Vincent Conitzer. Distinguishing Distributions When Samples Are Strategically Transformed. *In Proceedings of the 33rd Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 3187–3195, 2019.

[17] (α-β) Yu Cheng, Zhihao Jiang, Kamesh Munagala, Kangning Wang. Group Fairness in Committee Selection. *In Proceedings of the 20th ACM Conference on Economics and Computation* **(EC)**, pp. 263–279, 2019.

[16] (α-β) Yu Cheng, Ilias Diakonikolas, Rong Ge, David P. Woodruff. Faster Algorithms for High-Dimensional Robust Covariance Estimation. *In Proceedings of the 32nd Conference on Learning Theory* **(COLT)**, pp. 727–757, 2019.

[15] Hanrui Zhang, Yu Cheng, Vincent Conitzer. When Samples Are Strategically Selected. *In Proceedings of the 36th International Conference on Machine Learning* **(ICML)**, pp. 7345–7353, 2019.

[14] Hanrui Zhang, Yu Cheng, Vincent Conitzer. A Better Algorithm for Societal Tradeoffs. *In Proceedings of the 33rd AAAI Conference on Artificial Intelligence* **(AAAI)**, pp. 2229–2236, 2019.

[13] (α-β) Yu Cheng, Ilias Diakonikolas, Rong Ge. High-Dimensional Robust Mean Estimation in Nearly-Linear Time. *In Proceedings of the 30th ACM-SIAM Symposium on Discrete Algorithms* **(SODA)**, pp. 2755–2771, 2019.

[12] (α-β) Yu Cheng, Nick Gravin, Kamesh Munagala, Kangning Wang. A Simple Mechanism for a Budget-Constrained Buyer. *In Proceedings of the 14th Conference on Web and Internet Economics* **(WINE)**, pp. 96–110, 2018. **Best Paper Award.**

[11] (α-β) Yu Cheng, Ilias Diakonikolas, Daniel M. Kane, Alistair Stewart. Robust Learning of Fixed-Structure Bayesian Networks. *In Proceedings of the 32nd Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 10304–10316, 2018.

[10] (α-β) Yu Cheng, Rong Ge. Non-Convex Matrix Completion Against a Semi-Random Adversary. *In Proceedings of the 31st Conference on Learning Theory* **(COLT)**, pp. 1362–1394, 2018.

[9] (α-β) Yu Cheng, Wade Hann-Caruthers, Omer Tamuz. A Deterministic Protocol for Sequential Asymptotic Learning. *In Proceedings of 2018 IEEE International Symposium on Information Theory* **(ISIT)**, pp. 1735–1738, 2018.

[8] (α-β) Yu Cheng, Shaddin Dughmi, David Kempe. On the Distortion of Voting with Multiple Representative Candidates. *In Proceedings of the 32nd AAAI Conference on Artificial Intelligence* **(AAAI)**, pp. 973–980, 2018.

[7] (α-β) Yu Cheng, Shaddin Dughmi, David Kempe. Of the People: Voting Is More Effective with Representative Candidates. *In Proceedings of the 18th ACM Conference on Economics and Computation* **(EC)**, pp. 305–322, 2017.

[6] (α-β) Xi Chen, Yu Cheng, Bo Tang. Well-Supported versus Approximate Nash Equilibria: Query Complexity of Large Games. *In Proceedings of the 8th Innovations in Theoretical Computer Science Conference* **(ITCS)**, pp. 57:1–57:9, 2017.

[5] (α-β) Yu Cheng, Ilias Diakonikolas, Alistair Stewart. Playing Anonymous Games Using Simple Strategies. *In Proceedings of the 28th ACM-SIAM Symposium on Discrete Algorithms* **(SODA)**, pp. 616–631, 2017.

[4] (α-β) Yu Cheng, Xi Chen, Bo Tang. On the Recursive Teaching Dimension of VC Classes. *In Proceedings of the 30th Conference on Neural Information Processing Systems* **(NeurIPS)**, pp. 2164–2171, 2016.

[3] (α-β) Umang Bhaskar, Yu Cheng, Young Kun Ko, Chaitanya Swamy. Hardness Results for Signaling in Bayesian Zero-Sum and Network Routing Games. *In Proceedings of the 17th ACM Conference on*

Economics and Computation **(EC)**, pp. 479–496, 2016.

[2] (α-β) Yu Cheng, Ho Yee Cheung, Shaddin Dughmi, Ehsan Emamjomeh-Zadeh, Li Han, Shang-Hua Teng. Mixture Selection, Mechanism Design, and Signaling. *In Proceedings of the 56th Symposium on Foundations of Computer Science* **(FOCS)**, pp. 1426–1445, 2015.

[1] (α-β) Dehua Cheng, Yu Cheng, Yan Liu, Richard Peng, Shang-Hua Teng. Efficient Sampling for Gaussian Graphical Models via Spectral Sparsification. *In Proceedings of the 28th Conference on Learning Theory* **(COLT)**, pp. 364–390, 2015.

Journal Papers

[2] (α-β) Yu Cheng, Nick Gravin, Kamesh Munagala, Kangning Wang. A Simple Mechanism for a Budget-Constrained Buyer. *In ACM Transactions on Economics and Computation* **(TEAC)**, 9(2), pp. 10:1–10:25, 2021.

[1] (α-β) Yu Cheng, Zhihao Jiang, Kamesh Munagala, Kangning Wang. Group Fairness in Committee Selection. *In ACM Transactions on Economics and Computation* **(TEAC)**, 8(4), pp. 23:1–23:18, 2020.

Talks

Bridging High-Dimensional Robust Statistics and Non-Convex Optimization.

Apr. 2026 *Theory of Computing Seminar*, Rutgers University, New Brunswick, NJ.

Apr. 2026 *Theory Lunch*, Princeton University, Princeton, NJ.

Mar. 2026 *Theory Seminar*, Duke University, Durham, NC.

June 2025 *New England Statistics Symposium*, New Haven, CT.

June 2024 *Workshop on New Frontiers in Robust Statistics*, Toyota Technological Institute at Chicago, Chicago, IL.

Scalable and Provably Robust Algorithms for Machine Learning.

Nov. 2023 *Advanced Topics in Computer Science Seminar*, Shanghai Jiao Tong University, virtual.

July 2022 *Institute for Foundations of Data Science (IFDS) Seminar*, University of Wisconsin-Madison, Madison, WI.

May 2022 Brown University, virtual.

Apr. 2022 University of Virginia, virtual.

Apr. 2022 University of Michigan, Ann Arbor, MI.

Apr. 2022 University of California, Santa Barbara, Santa Barbara, CA.

Apr. 2022 Rutgers University, virtual.

Mar. 2022 Northeastern University, Boston, MA.

Of the People: Voting with Representative Candidates.

June 2022 *Summer School on Game Theory and Social Choice*, City University of Hong Kong, virtual.

July 2020 *Workshop on the Distortion and Information-Efficiency Tradeoffs (with EC 2020)*, virtual.

High-Dimensional Robust Statistics: Faster Algorithms and Optimization Landscape.

Mar. 2021 *CS Theory Lunch*, University of Southern California, virtual.

High-Dimensional Robust Mean Estimation via Gradient Descent.

July 2020 *International Conference on Machine Learning (ICML)*, virtual.

Robustness and Strategic Aspects of Machine Learning.

Dec. 2019 *Institute for Interdisciplinary Information Sciences (IIIS)-Haihua Frontier Seminar*, Tsinghua University, Beijing, China.

Oct. 2019 *Seminar on Theoretical Machine Learning*, Institute for Advanced Study, Princeton, NJ.

Aug. 2019 *Algorithms Seminar*, Google, Mountain View, CA.

May 2019 *Nanjing Theory Day*, Nanjing, China.

Jan. 2019 *Institute for Theoretical Computer Science (ITCS) Seminar*, Shanghai University of Finance and Economics, Shanghai, China.

Mar. 2019 University of Virginia, Charlottesville, VA.

Mar. 2019 Pennsylvania State University, State College, PA.

Mar. 2019 *Machine Learning Seminar*, Google, New York, NY.

Mar. 2019 Washington University in St. Louis, St. Louis, MO.

Feb. 2019 University of Utah, Salt Lake City, UT.

Feb. 2019 University of Illinois Chicago, Chicago, IL.

Feb. 2019 Rensselaer Polytechnic Institute, Troy, NY.

Feb. 2019 *John Hopcroft Center Seminar*, Shanghai Jiao Tong University, Shanghai, China.

Faster Algorithms for High-Dimensional Robust Covariance Estimation.

June 2019 *Conference on Learning Theory (COLT)*, Phoenix, AZ.

High-Dimensional Robust Mean Estimation in Nearly-Linear Time.

Feb. 2019 *Information Theory and Applications (ITA) Workshop*, San Diego, CA.

Jan. 2019 *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, San Diego, CA.

Oct. 2018 *Algorithms, Combinatorics, and Optimization (ACO) Student Seminar*, Georgia Institute of Technology, Atlanta, GA.

Aug. 2018 *Workshop on Computational Efficiency and High-Dimensional Robust Statistics*, Toyota Technological Institute at Chicago, Chicago, IL.

Non-Convex Matrix Completion Against a Semi-Random Adversary.

Aug. 2018 *Machine Learning Seminar*, Google, New York, NY.

July 2018 *Conference on Learning Theory (COLT)*, Stockholm, Sweden.

Apr. 2018 Microsoft Research, Redmond, WA.

On the Distortion of Voting with Multiple Representative Candidates.

Feb. 2018 *AAAI Conference on Artificial Intelligence (AAAI)*, New Orleans, LA.

Playing Anonymous Games Using Simple Strategies.

July 2017 *China Theory Week*, Shanghai, China.

Jan. 2017 *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, Barcelona, Spain.

Nov. 2016 *Southern California Theory Day*, Pasadena, CA.

Of the People: Voting Is More Effective with Representative Candidates.

June 2017 *ACM Conference on Economics and Computation (EC)*, Cambridge, MA.

Computational Aspects of Optimal Information Revelation.

Apr. 2017 *Algorithms Seminar*, Google, New York, NY.

Mar. 2017 *CS-ECON Seminar*, Duke University, Durham, NC.

Mar. 2017 *Social and Information Sciences Laboratory (SISL) Seminar*, California Institute of Technology, Pasadena, CA.

Random-Walk Sparsification, Newton's Method, and Gaussian Sampling.

Mar. 2017 *Algorithms Seminar*, Duke University, Durham, NC.

Well-Supported vs. Approximate Nash Equilibria: Query Complexity of Large Games.
Jan. 2017 *Innovations in Theoretical Computer Science Conference (ITCS)*, Berkeley, CA.

Hardness Results for Signaling in Bayesian Zero-Sum and Network Routing Games.
July 2016 *ACM Conference on Economics and Computation (EC)*, Maastricht, The Netherlands.

Mixture Selection, Mechanism Design, and Signaling.
Oct. 2015 *Symposium on Foundations of Computer Science (FOCS)*, Berkeley, CA.

Advising and Mentoring

Current Ph.D. Students

Binhao Chen, Brown University, 2023–present.

Former Ph.D. Students

Xing Gao, University of Illinois Chicago, 2020–2025.
Co-advised with Lev Reyzin.
Dissertation title: Optimism and Robustness: Learning From Structured and Semi-Random Inputs.

Former Undergraduate Students

Tianle Jiang, Shanghai Jiao Tong University, 2024–2025.

Jay Sarva, Brown University, 2024–2025.

Haichen Dong, Shanghai Jiao Tong University, 2021–2022.

Honghao Lin, Shanghai Jiao Tong University, 2019–2021.

Ph.D. Dissertation Committee Memberships (not as advisor)

Denizalp Goktas, Ph.D. in Computer Science, Brown University, 2025 (advisor: Amy Greenwald).

Wenyu Jin, Ph.D. in Computer Science, Brown University, 2025 (advisor: Xiaorui Sun).

Ahmed Agiza, Ph.D. in Computer Science, Brown University, 2024 (advisor: Sherief Reda).

Abdelrahman Hosny, Ph.D. in Computer Science, Brown University, 2023 (advisor: Sherief Reda).

Shelby Heinecke, Ph.D. in Mathematics, University of Illinois Chicago, 2020 (advisor: Lev Reyzin).

Teaching

Courses Taught as Instructor

Brown University

Data Structures, Algorithms, and Intractability: An Introduction (undergraduate). Fall 2025.

Algorithmic Aspects of Machine Learning (undergraduate). Spring 2025, Spring 2024, Spring 2023.

Robust Algorithms for Machine Learning (graduate). Fall 2024, Fall 2023, Fall 2022.

University of Illinois Chicago

Computer Algorithms I (undergraduate). Fall 2021, Fall 2020.

Codes and Cryptography (undergraduate). Fall 2021, Fall 2020, Spring 2020.

Spectral Graph Theory (graduate). Spring 2020.

Courses Taught as Teaching Assistant

Duke University

Computational Microeconomics (graduate). Fall 2018.

University of Southern California

Randomized Algorithms (graduate). Fall 2015.

Convex and Combinatorial Optimization (graduate). Fall 2013.

Discrete Methods in Computer Science (undergraduate). Fall 2012, Fall 2011.

Competitive Programming Coaching

Brown University

ICPC coach, 2022–present.

University of Southern California

ICPC assistant coach, 2011–2015.

Organizer, USC Programming Contest. 2013–2015.

Shanghai Jiao Tong University

ICPC assistant coach, 2009–2011.

Professional Activities

Grant Review Panels

Panelist (virtual), National Science Foundation (NSF), 2021, 2023, 2024, 2025, 2026.

Workshop Organization

Co-organizer, Special Quarter on "Robustness in High-Dimensional Statistics and Machine Learning" at the Institute for Data, Econometrics, Algorithms, and Learning (IDEAL), Chicago, IL. Fall 2021.

Program Committee Memberships

Conference on Neural Information Processing Systems (NeurIPS), 2025.

AAAI Conference on Artificial Intelligence (AAAI), 2024.

International Conference on Machine Learning (ICML), top 10% reviewer, 2022.

Conference on Economics and Computation (EC), 2022.

International Conference on Artificial Intelligence and Statistics (AISTATS), top 10% reviewer, 2022.

Conference on Web and Internet Economics (WINE), 2021.

Conference Reviewing

AAAI Conference on Artificial Intelligence (AAAI). International Conference on Artificial Intelligence and Statistics (AISTATS). Conference on Learning Theory (COLT). Conference on Economics and Computation (EC). European Symposium on Algorithms (ESA). Foundations of Computer Science (FOCS). International Colloquium on Automata, Languages, and Programming (ICALP). International Conference on Machine Learning (ICML). Innovations in Theoretical Computer Science (ITCS). Conference on Neural Information Processing Systems (NeurIPS). Symposium on Algorithmic Game Theory (SAGT). Symposium on Discrete Algorithms (SODA). Symposium on Theory of Computing (STOC). Conference on Web and Internet Economics (WINE).

Journal Reviewing

Artificial Intelligence. Bernoulli. Games and Economic Behavior. IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems. IEEE Transactions on Information Theory. Information Sciences. Journal of Machine Learning Research. SIAM Journal on Computing. Social Network Analysis and Mining.

Institutional Service

Brown University

Chair of the Ph.D. Admissions Committee, Department of Computer Science. 2026.

Ph.D. Admissions Committee, Department of Computer Science. 2023, 2024, 2025.

Co-organizer, CS Theory Seminar. 2023–2025.

University of Illinois Chicago

Graduate Admissions Committee, Department of Mathematics. 2020, 2021, 2022.

Master's Exam Coordinator, Department of Mathematics. 2021.

Duke University

Ph.D. Admissions Committee, Department of Computer Science. 2019.

Organizer, Algorithms Seminars. 2017–2019.

Co-organizer, CS-ECON Seminar Series. 2017–2019.

University of Southern California

Organizer, Theory Reading Group. 2014–2016.

Internships

May–Aug. 2013 — *Google*, New York, NY.
Mentor: Konstantin Voevodski.
Projects: Local clustering algorithms (Geo); Parallel algorithms for set cover (Research).

May–Aug. 2012 — *Google*, Mountain View, CA.
Mentor: Wen Xu.
Project: Load balancing algorithms (Infrastructure).

July 2010–Feb. 2013 — *Microsoft Research Asia*, Beijing, China.
Mentor: Chin-Yew Lin.
Project: Structured queries and knowledge base (Web Search and Mining).

Sep. 2009–Jan. 2010 — *APEX Data & Knowledge Management Lab*, Shanghai, China.
Mentor: Yong Yu.
Project: 3D reconstruction from multiple images.