

Tengyuan Liang

curriculum vitae

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Academic Appointment

2017– **University of Chicago, Booth School of Business**, United States.
Professor of Econometrics and Statistics, 2022 –
Associate Professor, 2021 – 2022
Assistant Professor, 2017 – 2021

Becker Friedman Institute, *Big Data Initiative*.
Affiliated Scholar, 2018 –
The Center for Applied Artificial Intelligence.
Faculty Affiliates, 2022 –

Education

2012–2017 **University of Pennsylvania, The Wharton School**, United States.
Ph.D. in Statistics

2008–2012 **Peking University**, China.
B.S. in Mathematics

Visiting Positions

2019 Yale University, *Cowles Foundation for Research in Economics*.
Visiting Assistant Professor in Econometrics

2016 Yahoo Research New York, *Online Learning and Optimization Group*.
Summer Research Scientist

Fellowships & Awards

2022– William Ladany Faculty Fellow

2021–2026 NSF CAREER Grant
[DMS - 2042473 "New Statistical Paradigms Reconciling Empirical Surprises in Modern Machine Learning"](#), by
[National Science Foundation, Division of Mathematical Sciences](#)

2021–2022 William S. Fishman Faculty Scholar

2017–2021 George C. Tiao Faculty Fellow
[research fellowship for computational and data science](#) awarded by the Booth School

2014–2017 Winkelman Fellowship
[highest honorific fellowship](#) awarded by the Wharton School

2016 J. Parker Memorial Bursk Award
[awarded by the Statistics Department at the Wharton School](#) for excellence in research

2014 US Junior Oberwolfach Fellow

Research

Research Interests

Fields: Learning, Inference, Optimization, Econometrics.

Working Papers

- T. Liang and B. Recht (2023).
"Randomization Inference When N Equals One."
arXiv:2310.16989 [v1]
- Y. Hur and T. Liang (2023).
"Detecting Weak Distribution Shifts via Displacement Interpolation."
arXiv:2305.15609 [v2] , under revision
- T. Liang (2022).
"Blessings and Curses of Covariate Shifts: Adversarial Learning Dynamics, Directional Convergence, and Equilibria."
arXiv:2212.02457 [v1]
- Y. Hur, W. Guo and T. Liang (2021).
"Reversible Gromov-Monge Sampler for Simulation-Based Inference."
arXiv:2109.14090 [v3] , under revision
- M. H. Farrell, T. Liang and S. Misra (2020).
"Deep Learning for Individual Heterogeneity: An Automatic Inference Framework."
arXiv:2010.14694 [v2]
- T. Liang (2019).
"Estimating Certain Integral Probability Metrics (IPMs) Is as Hard as Estimating under the IPMs."
arXiv:1911.00730 [v1]

Peer-Reviewed Publications

- T. Liang, S. Sen and P. Sur (2022).
"High-Dimensional Asymptotics of Langevin Dynamics in Spiked Matrix Models."
Information and Inference: A Journal of the IMA, 12(4):2720-2752, 2023.
- T. Liang and B. Recht (2021).
"Interpolating Classifiers Make Few Mistakes."
Journal of Machine Learning Research, 24(20):1-27, 2023.
- W. Guo, Y. Hur, T. Liang and C. Ryan (2022).
"Online Learning to Transport via the Minimal Selection Principle."
Conference on Learning Theory, pmlr 178:4085-4109, 2022.
- T. Liang (2021).
"Universal Prediction Band via Semi-Definite Programming."
Journal of the Royal Statistical Society: Series B (Statistical Methodology), 84(4):1558–1580, 2022.
- T. Liang and P. Sur (2020).
"A Precise High-Dimensional Asymptotic Theory for Boosting and Minimum- ℓ_1 -Norm Interpolated Classifiers."
The Annals of Statistics, 50(3):1669-1695, 2022.

- T. Liang and H. Tran-Bach (2020).
 "Mehler's Formula, Branching Process, and Compositional Kernels of Deep Neural Networks."
Journal of the American Statistical Association (Theory and Methods), 117:539, 1324-1337, 2022.
- T. Liang (2018).
 "How Well Generative Adversarial Networks Learn Distributions."
Journal of Machine Learning Research, 22(228):1-41, 2021.
- M. H. Farrell, T. Liang and S. Misra (2018).
 "Deep Neural Networks for Estimation and Inference."
Econometrica, 89(1):181-213, 2021.
- T. Liang, A. Rakhlin and X. Zhai (2019).
 "On the Multiple Descent of Minimum-Norm Interpolants and Restricted Lower Isometry of Kernels."
Conference on Learning Theory, pmlr 125:2683-2711, 2020.
- X. Dou and T. Liang (2019).
 "Training Neural Networks as Learning Data-adaptive Kernels: Provable Representation and Approximation Benefits."
Journal of the American Statistical Association (Theory and Methods), 116:535, 1507-1520, 2021.
- T. Liang and A. Rakhlin (2018).
 "Just Interpolate: Kernel "Ridgeless" Regression Can Generalize."
The Annals of Statistics, 48(3):1329-1347, 2020.
- T. Liang and W. J. Su (2017).
 "Statistical Inference for the Population Landscape via Moment Adjusted Stochastic Gradients."
Journal of the Royal Statistical Society: Series B (Statistical Methodology), 81(2):431-456, 2019.
- T. T. Cai, T. Liang and A. Rakhlin (2017).
 "Weighted Message Passing and Minimum Energy Flow for Heterogeneous Stochastic Block Models with Side Information."
Journal of Machine Learning Research, 21(11):1-34, 2020.
- T. Liang and J. Stokes (2018).
 "Interaction Matters: A Note on Non-asymptotic Local Convergence of Generative Adversarial Networks."
International Conference on Artificial Intelligence and Statistics, pmlr 89:907-915, 2019.
- T. Liang, T. Poggio, A. Rakhlin and J. Stokes (2017).
 "Fisher-Rao Metric, Geometry, and Complexity of Neural Networks."
International Conference on Artificial Intelligence and Statistics, pmlr 89:888-896, 2019.
- B. Tzen, T. Liang and M. Raginsky (2018).
 "Local Optimality and Generalization Guarantees for the Langevin Algorithm via Empirical Metastability."
Conference on Learning Theory, pmlr 75:857-875, 2018.
- S. Kale, Z. Karnin, T. Liang and D. Pál (2017).
 "Adaptive Feature Selection: Computationally Efficient Online Sparse Linear Regression under RIP."
International Conference on Machine Learning, pmlr 70:1780-1788, 2017.

- T. T. Cai, T. Liang and A. Rakhlin (2015).
"Computational and Statistical Boundaries for Submatrix Localization in a Large Noisy Matrix."
The Annals of Statistics, 45(4):1403-1430, 2017.
- T. T. Cai, T. Liang and A. Rakhlin (2016).
"On Detection and Structural Reconstruction of Small-World Random Networks."
IEEE Transactions on Network Science and Engineering, 4(3):165-176, 2017.
- T. T. Cai, T. Liang and A. Rakhlin (2014).
"Geometric Inference for General High-Dimensional Linear Inverse Problems."
The Annals of Statistics, 44(4):1536-1563, 2016.
- T. Liang, A. Rakhlin and K. Sridharan (2015).
"Learning with Square Loss: Localization through Offset Rademacher Complexity."
Conference on Learning Theory, pmlr 40:1260-1285, 2015.
[nominated for the best paper award](#)
- A. Belloni, T. Liang, H. Narayanan and A. Rakhlin (2014).
"Escaping the Local Minima via Simulated Annealing: Optimization of Approximately Convex Functions."
Conference on Learning Theory, pmlr 40:240-265, 2015.
- T. T. Cai, T. Liang and H. H. Zhou (2013).
"Law of Log Determinant of Sample Covariance Matrix and Optimal Estimation of Differential Entropy for High-Dimensional Gaussian Distributions."
Journal of Multivariate Analysis, 137:161-172, 2015.

Professional Activities

2023– **Associate Editors**, *Operations Research*.

2020– **Editorial Board**, *Journal of Machine Learning Research*.

2020– **Senior Program Committee**, *Conference on Learning Theory (COLT)*.

2014– **Journal and Conference Referee**.

- **Probability and Statistics**: *Annals of Statistics*, *Journal of the Royal Statistical Society Series B (Statistical Methodology)*, *Journal of the American Statistical Association (Theory and Methods)*, *Biometrika*, *Bernoulli Journal*, *Statistica Sinica*, *Latin American Journal of Probability and Mathematical Statistics*, *Statistical Science*, *Probability Theory and Related Fields*.
- **Learning Theory**: *Journal of Machine Learning Research*, *Conference on Learning Theory (COLT)*, *Symposium on the Theory of Computing (STOC)*, *International Conference for Learning Representations (ICLR)*.
- **Economics**: *Review of Economic Studies*, *Econometrica*, *Journal of Econometrics*, *Review of Economics and Statistics*.
- **Information Theory**: *IEEE Transactions on Information Theory*, *IEEE International Symposium on Information Theory (ISIT)*.
- **Operations Research**: *Mathematics of Operations Research*.
- **Applied Mathematics**: *SIAM Journal on Mathematics of Data Science*, *Mathematical Statistics and Learning*.

Invited Presentations

- 2022–2023 [\[scheduled\]](#)
- Academia Sinica [\[Statistics Seminar, Institute of Statistical Science\]](#)
 - HKUST [\[Data Science Seminar, Business School\]](#)
 - LSE [\[Data Science Seminar, Dept. of Statistics\]](#)
 - Cornell [\[Statistics Seminar, Dept. of Statistics and Data Science\]](#)
 - UCSD [\[Econometrics Seminar, Dept. of Economics\]](#)
 - Princeton [\[Wilks Seminar Series, ORFE\]](#)
 - UPenn [\[Statistics Seminar, Wharton School of Business\]](#)
 - UW Madison [\[Statistics Seminar, Dept. of Statistics\]](#)
 - UCLA [\[Econometrics Seminar, Dept. of Economics\]](#)
 - UC Irvine [\[Econometrics Seminar, Dept. of Economics\]](#)
- 2021–2022
- UBC [\[Operations Research Seminar, Sauder School of Business\]](#)
 - UCL [\[Econometrics Seminar, Dept. of Economics\]](#)
 - UIUC [\[Statistics Seminar, Dept. of Statistics\]](#)
 - MSR New England [\[Machine Learning Seminar\]](#)
- 2020–2021
- NSF-Simons Research Collaborations [\[Mathematics of Deep Learning Workshop, 60 mins talk\]](#)
 - UMass Amherst [\[Statistics and Probability Seminar, Dept. of Mathematics and Statistics\]](#)
 - Rutgers [\[Statistics Seminar, Dept. of Statistics\]](#)
 - Durham [\[Econometrics Seminar at Business School\]](#)
 - LSE [\[Econometrics Seminar, Dept. of Economics\]](#)
- 2019–2020
- MIT [\[Statistics and Stochastics Seminar Series, IDSS\]](#)
 - Yale [\[Econometrics Seminar, Dept. of Economics\]](#)
 - Harvard [\[Statistics Colloquium, Dept. of Statistics\]](#)
 - MIT [\[MIFODS Workshop “Learning with a complex structure,” 45 mins talk\]](#)
 - Duke [\[TRIPODS Workshop “Theory and modeling of deep learning,” 50 mins talk\]](#)
 - Google Research NYC [\[Learning Theory Seminar\]](#)
- 2018–2019
- Duke [\[Decision Sciences Seminar, Fuqua School of Business\]](#)
 - ENSAE-CREST [\[Center for Research in Economics and Statistics Seminar\]](#)
 - UChicago [\[Joint U Chicago and TTIC Machine Learning Seminar\]](#)
- 2017–2018
- UIUC [\[Machine Learning Seminar, ECE Dept.\]](#)
 - UChicago [\[Statistics Colloquium, Dept. of Statistics\]](#)
 - HKUST [\[Joint Statistics Seminar, Business School and Dept. of Mathematics\]](#)

- 2016–2017
- Stanford [Statistics Seminar, Dept. of Statistics]
 - Princeton [Colloquia, Operation Research and Financial Engineering]
 - MIT [Operations Research and Statistics Seminar, Sloan School of Management]
 - UChicago [Econometrics and Statistics Seminar, Booth School of Business]
 - Cambridge [Statistical Laboratory Seminar, Dept. of Mathematics]
 - Georgia Tech [Statistics Seminar, Dept. of Mathematics]
 - UCSD [Statistics Seminar, Dept. of Mathematics]
 - UVA [Statistics Seminar, Dept. of Statistics]
 - UIUC [Statistics Seminar, Dept. of Statistics]
 - Rutgers [Statistics Seminar, Dept. of Statistics, cancelled]
 - Imperial College London [Operations Management Seminar, Business School]
 - Yahoo Labs [Machine Learning Seminar]

Conferences NBER [Big Data and Securities Markets Conference], CAS AMSS-PolyU [Joint Laboratory of Applied Mathematics Workshop], COLT 2022, IMS 2022, FIMI 2022 [Invited Speaker, Workshop on Functional Inference and Machine Intelligence, Japan], CIRM [Meeting in Mathematical Statistics: Machine Learning and Nonparametric Statistics, Luminy, France], IMS Annual Meeting 2022 [Invited Session, “Prediction and Sampling with Deep Neural Networks”], ICML 2021 [Invited Speaker, Workshop “Over-parameterization: Pitfalls and Opportunities”], JSM 2020 [IMS Invited Session, “Theory of Deep Learning”], ICCOPT 2019 [Generalization and Optimization Invited Session], JSM 2019 [Invited Session on “Modern Nonparametrics”], AISTATS 2019 [Present Two Papers], DALI 2019 [Machine Learning Theory Invited Session, George, South Africa], Econometric Conference on Big Data [Invited Talk at “Factor Models” Session, Tsinghua Univ.], COLT 2018 [Stochastic Optimization Session, KTH], Issac Newton Institute [Workshop on Future Challenges in Statistical Scalability, Cambridge], EcoSta 2018 [Frontiers in Financial Statistics Invited Session, CityU Hong Kong], CISS 2018 [Statistical Learning Invited Session, Princeton], ICML 2017 [Online Learning Session, Sydney], COLT 2015 [University Pierre and Marie Curie, Two Long Talks], Yale [NSF Workshop for Empirical Process and Modern Statistical Decision Theory], CIRM [Meeting in Mathematical Statistics: New Procedures for New Data, Luminy, France], CRM [Workshop on the Mathematical Foundations of Learning Theory, Barcelona, Spain], MFO [Workshop on Adaptive Statistical Inference, Oberwolfach, Germany].

Teaching Experience

2017– **University of Chicago Booth School of Business, Instructor.**

- Winter 22: Business Statistics
- Fall 21: Business Statistics
- Fall 20: Business Statistics
- Fall 19: Business Statistics
- Fall 18: Business Statistics
- Spring 18: Business Statistics

2012–2017 **Wharton School at University of Pennsylvania, Recitation Instructor and Teaching Assistant.**

- Spring 17: Stochastic Processes
- Spring 15: Concentration Inequalities
- Spring 14, Spring 15: Advanced Quantitative Modeling
- Fall 13: Introductory Statistics
- Spring 13: Statistical Inference
- Fall 12, Fall 15, Fall 16: Probability

University Service

2020–2022 **Organizer, Econometrics and Statistics Colloquium, Chicago Booth.**

Mentoring & Advising

2018– **Doctoral Students.**

Wenxuan Guo [2026, PhD, Chicago Booth], YoonHaeng Hur [2024, PhD, UChicago Stat], Hai Tran-Bach [2023, PhD, UChicago Stat], Xialiang Dou [2021, PhD, UChicago Stat → Two Sigma].

2018– **Dissertation Committee.**

Sen Na [2021, PhD, UChicago Stat → Postdoc, Berkeley], Shihao Gu [2021, PhD, Chicago Booth], Jingyu He [2020, PhD, Chicago Booth → Assistant Professor, CityU Hong Kong], Ming Yu [2020, PhD, Chicago Booth → Citadel], Qi An [2019, PhD, Chicago Booth]

2018– **Organizer, Data Science Reading Group, UChicago.**

mentoring PhD students from Statistics and Computational and Applied Mathematics