

Tengyuan Liang

curriculum vitae

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Academic Appointment

- 2017– **University of Chicago, Booth School of Business**, United States.
Associate Professor of Econometrics and Statistics (without Tenure), 2021.07 –
Assistant Professor of Econometrics and Statistics, 2017.07 – 2021.06
- Becker Friedman Institute, *Big Data Initiative*.
Affiliated Scholar, 2018 –

Education

- 2012–2017 **University of Pennsylvania, The Wharton School**, United States.
Ph.D. in Statistics
- 2008–2012 **Peking University**, China.
B.S. in Mathematics and Applied 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

Honors & Awards

- 2021–2026 NSF Career Award
[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: Statistical Learning, Statistical Inference, Stochastic Optimization.

Working Papers

- T. Liang (2021). [arXiv](#)
"Universal Prediction Band via Semi-Definite Programming."
arXiv:2103.17203 [\[v1\]](#)
- T. Liang and B. Recht (2021). [arXiv](#)
"Interpolating Classifiers Make Few Mistakes."
arXiv:2101.11815 [\[v1\]](#)
- T. Liang and P. Sur (2020). [arXiv](#)
"A Precise High-Dimensional Asymptotic Theory for Boosting and Minimum- ℓ_1 -Norm Interpolated Classifiers."
arXiv:2002.01586 [\[v2\]](#) , *R&R*
- M. H. Farrell, T. Liang and S. Misra (2020). [arXiv](#)
"Deep Learning for Individual Heterogeneity."
arXiv:2010.14694 [\[v1\]](#)
- T. Liang (2019). [arXiv](#)
"Estimating Certain Integral Probability Metrics (IPMs) Is as Hard as Estimating under the IPMs."
arXiv:1911.00730 [\[v1\]](#)
- T. Liang (2018). [arXiv](#)
"How Well Generative Adversarial Networks Learn Distributions."
arXiv:1811.03179 [\[v4\]](#) , *R&R*

Publications

17. T. Liang and H. Tran-Bach (2020). [JASA](#)
"Mehler's Formula, Branching Process, and Compositional Kernels of Deep Neural Networks."
Journal of the American Statistical Association (Theory and Methods), 1-14, 2021.
16. M. H. Farrell, T. Liang and S. Misra (2018). [ECMA](#)
"Deep Neural Networks for Estimation and Inference."
Econometrica, 89(1):181-213, 2021.
15. T. Liang, A. Rakhlin and X. Zhai (2019). [COLT](#)
"On the Multiple Descent of Minimum-Norm Interpolants and Restricted Lower Isometry of Kernels."
Conference on Learning Theory, pmlr 125:2683-2711, 2020.

14. X. Dou and T. Liang (2019). JASA
 "Training Neural Networks as Learning Data-adaptive Kernels: Provable Representation and Approximation Benefits."
Journal of the American Statistical Association (Theory and Methods), 1-14, 2020.
13. T. Liang and A. Rakhlin (2018). AOS
 "Just Interpolate: Kernel "Ridgeless" Regression Can Generalize."
The Annals of Statistics, 48(3):1329-1347, 2020.
12. T. Liang and W. J. Su (2017). JRSS-B
 "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.
11. T. T. Cai, T. Liang and A. Rakhlin (2017). JMLR
 "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.
10. T. Liang and J. Stokes (2018). AISTATS
 "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.
9. T. Liang, T. Poggio, A. Rakhlin and J. Stokes (2017). AISTATS
 "Fisher-Rao Metric, Geometry, and Complexity of Neural Networks."
International Conference on Artificial Intelligence and Statistics, pmlr 89:888-896, 2019.
8. B. Tzen, T. Liang and M. Raginsky (2018). COLT
 "Local Optimality and Generalization Guarantees for the Langevin Algorithm via Empirical Metastability."
Conference on Learning Theory, pmlr 75:857-875, 2018.
7. S. Kale, Z. Karnin, T. Liang and D. Pál (2017). ICML
 "Adaptive Feature Selection: Computationally Efficient Online Sparse Linear Regression under RIP."
International Conference on Machine Learning, pmlr 70:1780-1788, 2017.
6. T. T. Cai, T. Liang and A. Rakhlin (2017). AOS
 "Computational and Statistical Boundaries for Submatrix Localization in a Large Noisy Matrix."
The Annals of Statistics, 45(4):1403-1430, 2017.
5. T. T. Cai, T. Liang and A. Rakhlin (2017). IEEE-TNSE
 "On Detection and Structural Reconstruction of Small-World Random Networks."
IEEE Transactions on Network Science and Engineering, 4(3):165-176, 2017.

4. T. T. Cai, T. Liang and A. Rakhlin (2016). AOS
 "Geometric Inference for General High-Dimensional Linear Inverse Problems."
The Annals of Statistics, 44(4):1536-1563, 2016.
3. T. Liang, A. Rakhlin and K. Sridharan (2015). COLT
 "Learning with Square Loss: Localization through Offset Rademacher Complexity."
Conference on Learning Theory, pmlr 40:1260-1285, 2015.
 nominated for the best paper award
2. A. Belloni, T. Liang, H. Narayanan and A. Rakhlin (2015). COLT
 "Escaping the Local Minima via Simulated Annealing: Optimization of Approximately Convex Functions."
Conference on Learning Theory, pmlr 40:240-265, 2015.
1. T. T. Cai, T. Liang and H. H. Zhou (2015). JMVA
 "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

- 2020– **Editorial Board**, *Journal of Machine Learning Research*.
- 2020– **Senior Program Committee**, *Conference on Learning Theory (COLT)*.
- 2014– **Journal and Conference Referee**.
 - **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)*.
 - **Econometrics**: *Econometrica*, *Journal of Econometrics*.
 - **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*.

Invited Presentations

- 2020–2021
[scheduled]
- 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 [Seminar at Business School]
 - LSE [Econometrics Seminar, Dept. of Economics]
 - UIUC [Statistics Seminar, Dept. of Statistics]
 - UBC [Operations Research Seminar, Sauder School of Business]
- 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 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.**

- Fall 20: Business Statistics [BUSN41000, MBA, 3 sections]
- Fall 19: Business Statistics [BUSN41000, MBA, 3 sections]
- Fall 18: Business Statistics [BUSN41000, MBA, 3 sections]
- Spring 18: Business Statistics [BUSN41000, MBA, 2 sections]

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

- Spring 17: Stochastic Processes [STAT931, PhD]
- Spring 15: Concentration Inequalities [STAT991, PhD]
- Spring 14, Spring 15: Advanced Quantitative Modeling [STAT622, MBA]
- Fall 13: Introductory Statistics [STAT111]
- Spring 13: Statistical Inference [STAT431]
- Fall 12, Fall 15, Fall 16: Probability [STAT430]

University Service

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

Mentoring & Advising

2018– **Doctoral Students.**

Hai Tran-Bach [2023, PhD UChicago Stat], Xialiang Dou [2021, PhD UChicago Stat]

2018– **Dissertation Committee.**

Hai Tran-Bach [2023, PhD UChicago Stat], Xialiang Dou [2021, PhD UChicago Stat], Sen Na [2021, PhD UChicago Stat], Jingyu He [2020, PhD Chicago Booth → 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 [list of papers]