Tengyuan Liang

Appointment

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

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

Research

Research Interests

Fields: statistical learning, statistical inference, stochastic optimization.

Topics:
- bridge the empirical and theoretical gap in modern statistical learning;
- understand the computational and algorithmic aspects of statistical inference;
- explore the role of stochasticity in solving non-convex optimization;
- apply learning and inference methods to economic and business domains.

Under Review & Manuscripts

[21] T. Liang and H. Tran-Bach (2020). **arXiv**
"Mehler's Formula, Branching Process, and Compositional Kernels of Deep Neural Networks."
available on arXiv:2004.04767 (v1)

[20] T. Liang and P. Sur (2020). **arXiv**
"A Precise High-Dimensional Asymptotic Theory for Boosting and Minimum-ℓ_1-Norm Interpolated Classifiers."
available on arXiv:2002.01586 (v2)

[19] T. Liang (2019). **arXiv**
"Estimating Certain Integral Probability Metrics (IPMs) Is as Hard as Estimating under the IPMs."
available on arXiv:1911.00730 (v1)

[18] T. Liang (2018). **arXiv**
"On How Well Generative Adversarial Networks Learn Densities: Nonparametric and Parametric Results."
available on arXiv:1811.03179 (v3)

[17] W. L. Cong, T. Liang and X. Zhang (2019). **SSRN**
"Textual Factors: A Scalable, Interpretable, and Data-driven Approach to Analyzing Unstructured Information."
available on SSRN:3307057 (v2), *minor revision for Management Science*

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Peer-Reviewed Publications

[16] M. H. Farrell, T. Liang and S. Misra (2018+). **ECMA**
"Deep Neural Networks for Estimation and Inference."
Econometrica, forthcoming, 2020.

[15] T. Liang, A. Rakhlin and X. Zhai (2020). **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 (2020). **AOS**
"Just Interpolate: Kernel "Ridgeless" Regression Can Generalize."
The Annals of Statistics, 48(3):1329-1347, 2020.

[12] T. Liang and W. J. Su (2019). **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 (2020). **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 (2019). **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 (2019). **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.

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[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.

Experience

Visiting Experience

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

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

Teaching Experience

2017–present **University of Chicago Booth School of Business**, *Instructor*.
- Fall 19: Business Statistics (BUSN41000, MBA), average rating 4.0/5.0 (three sections)
- Fall 18: Business Statistics (BUSN41000, MBA), average rating 3.6/5.0 (three sections)
- Spring 18: Business Statistics (BUSN41000, MBA), average rating 4.0/5.0 (two sections)

2012–2017 **Wharton School at University of Pennsylvania**, *Teaching Assistant*.
- Spring 17: Stochastic Processes (STAT931, PhD)
- Spring 15: Concentration Inequalities (STAT991, PhD), guest lecturer
- Spring 14, Spring 15: Advanced Quantitative Modeling (STAT622, MBA)
- Fall 13: Introductory Statistics (STAT111), recitation instructor
- Spring 13: Statistical Inference (STAT431)
- Fall 12, Fall 15, Fall 16: Probability (STAT430)

Service

Professional Service

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

2014–present **Journal & 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*
- **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*

2018 **Session Chair**.
- COLT 2018, Stochastic Optimization Session

University Service

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

Mentoring & Advising

2018–present 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–present Organizer for Data Science Reading Group, UChicago
mentoring PhD students from Statistics and Computational and Applied Mathematics, *list of papers*

Invited Seminars & Presentations

2020–2021 (scheduled)
- Rutgers (Statistics Seminer, Dept. of Statistics)
- UMass Amherst (Statistics and Probability Seminar, Dept. of Mathematics and Statistics)

2019–2020 Academic Year
- 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 Academic Year
- 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 Academic Year

- UIUC (Machine Learning Seminar, ECE Dept.)
- UChicago (Statistics Colloquium, Dept. of Statistics)
- HKUST (Joint Statistics Seminar, Business School and Dept. of Mathematics)

2016–2017 Academic Year

- 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)

Invited Conferences

JSM 2020 (IMS Invited Session, "Theory of Deep Learning"), ICCOPT 2019 (Generalization and Optimization Invited Session), JSM 2019 (Invited Session on "Modern Non-parametrics"), AISTATS 2019 (Present Two Papers), DALI 2019 (Machine Learning Theory Invited Session, George, South Africa), Econometric Conference on Big Data and AI (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)

Honors & Awards

2017–now 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

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