

# Tengyuan Liang

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📄 [tyliang.github.io/Tengyuan.Liang/](https://tyliang.github.io/Tengyuan.Liang/)

## Employment

07/2017– **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.

Goals: 

- 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.

### Working Papers

20. 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]
19. T. Liang and P. Sur (2020). arXiv  
"A Precise High-Dimensional Asymptotic Theory for Boosting and Minimum- $\ell_1$ -Norm Interpolated Classifiers."  
available on arXiv:2002.01586 [v2]
18. T. Liang (2019). arXiv  
"Estimating Certain Integral Probability Metrics (IPMs) Is as Hard as Estimating under the IPMs."  
available on arXiv:1911.00730 [v1]
17. T. Liang (2018). arXiv  
"How Well Generative Adversarial Networks Learn Distributions."  
available on arXiv:1811.03179 [v4]

## 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.

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.

## 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

- 2017– 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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## Professional Activities

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

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*.
- **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*.

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## Invited Presentations

2020–2021 [scheduled] ○ Rutgers [Statistics Seminar, Dept. of Statistics]  
○ UMass Amherst [Statistics and Probability Seminar, Dept. of Mathematics and Statistics]

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** 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 [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 19: Business Statistics [BUSN41000, MBA]
  - Fall 18: Business Statistics [BUSN41000, MBA]
  - Spring 18: Business Statistics [BUSN41000, MBA]
- 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– **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]