

# Lei, Qi

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Website: <https://cecilialeiqi.github.io/>

Google Scholar: <https://scholar.google.com/citations?user=kG0gaowAAAAJ&hl=en>

Email: [qilei@princeton.edu](mailto:qilei@princeton.edu)

<b>Research Interests</b>	My research aims to bridge the theoretical and empirical boundary of modern machine learning algorithms, with a focus on large-scale optimization and representation/transfer learning.	
<b>Professional Experience</b>	<i>New York University, NY, United States</i>	September 2022 -
	<ul style="list-style-type: none"><li>• <i>Assistant Professor in Mathematics and Data Science</i>, Courant Institute of Mathematical Sciences and the Center for Data Science</li></ul>	
	<i>Princeton University, NJ, United States</i>	July 2020 - August 2022
	<ul style="list-style-type: none"><li>• <i>Associate Research Scholar (CIFellow)</i>, Electrical and Computer Engineering Department</li></ul>	
		September 2021 - Present
	<ul style="list-style-type: none"><li>• <i>Postdoc Research Associate (CIFellow)</i>, Electrical and Computer Engineering Department</li></ul>	
		July 2020 - September 2021
	<ul style="list-style-type: none"><li>• Mentor: Jason D. Lee</li></ul>	
	<i>Institute for Advanced Study, Princeton, NJ, United States</i>	
		September 2019 - July 2020
	<ul style="list-style-type: none"><li>• Visiting Graduate Student for the “Special Year on Optimization, Statistics, and Theoretical Machine Learning”</li></ul>	
	<i>Simons Institute, Berkeley, CA, United States</i>	May 2019 - August 2019
	<ul style="list-style-type: none"><li>• Research Fellow for the Foundations of Deep Learning Program</li></ul>	
<b>Education</b>	<i>University of Texas at Austin, TX, United States</i>	August 2014 - May 2020
	<ul style="list-style-type: none"><li>• <i>Ph.D., Oden Institute for Computational Sciences and Engineering</i></li></ul>	
	<ul style="list-style-type: none"><li>• Advisors: Alexandros G. Dimakis and Inderjit S. Dhillon</li></ul>	
	<i>Zhejiang University, Zhejiang, China</i>	Sep 2010 - June 2014
	<ul style="list-style-type: none"><li>• <i>B.S., School of Mathematics (with honors)</i> (GPA 3.92/4.0, rank 1<sup>st</sup>)</li></ul>	
<b>Awards and Recognitions</b>	<ul style="list-style-type: none"><li>• Computing Innovation Fellowship</li></ul>	
		CRA, 2020-2022
	<ul style="list-style-type: none"><li>• Simons-Berkeley Research Fellowship</li></ul>	
		Simons Institute, 2019
	<ul style="list-style-type: none"><li>• The National Initiative for Modeling and Simulation Research Fellowship</li></ul>	
		UT Austin, 2014-2018
	<ul style="list-style-type: none"><li>• Young Investigators Lecturer award</li></ul>	
		Caltech, 2021
	<ul style="list-style-type: none"><li>• Outstanding Dissertation Award</li></ul>	
		Oden Institute, 2021
	<ul style="list-style-type: none"><li>• Rising Star for Machine Learning</li></ul>	
		University of Maryland, 2021
	<ul style="list-style-type: none"><li>• Rising Star for EECS</li></ul>	
		UIUC, 2019 & MIT, 2021
	<ul style="list-style-type: none"><li>• Rising Star for Computational and Data Science</li></ul>	
		UT Austin, 2020
<b>Thesis</b>	<b>Qi Lei</b> , “Provably effective algorithms for min-max optimization”	May 2020
	<i>Received the 2021 Outstanding Dissertation Award, Oden Institute</i>	

## Publications

(\* indicates

$\alpha$ - $\beta$  order)

1. Jason D. Lee\*, **Qi Lei\***, Nikunj Saunshi\*, Jiacheng Zhuo\*, “Predicting What You Already Know Helps: Provable Self-Supervised Learning”, *Neural Information Processing Systems (NeurIPS)*, 2021
2. Baihe Huang\*, Kaixuan Huang\*, Sham M. Kakade\*, Jason D. Lee\*, **Qi Lei\***, Runzhe Wang\*, Jiaqi Yang\*, “Optimal Gradient-based Algorithms for Non-concave Bandit Optimization”, *Neural Information Processing Systems (NeurIPS)*, 2021
3. Kurtland Chua, **Qi Lei**, Jason D. Lee. “How Fine-Tuning Allows for Effective Meta-Learning”, *Neural Information Processing Systems (NeurIPS)*, 2021
4. Baihe Huang\*, Kaixuan Huang\*, Sham M. Kakade\*, Jason D. Lee\*, **Qi Lei\***, Runzhe Wang\*, Jiaqi Yang\*, “Going Beyond Linear RL: Sample Efficient Neural Function Approximation”, *Neural Information Processing Systems (NeurIPS)*, 2021
5. **Qi Lei**, Wei Hu, Jason D. Lee. “Near-Optimal Linear Regression under Distribution Shift”, *International Conference of Machine Learning (ICML)*, 2021: 6164-6174
6. Tianle Cai\*, Ruiqi Gao\*, Jason D Lee\*, **Qi Lei\***. “A Theory of Label Propagation for Subpopulation Shift”, *International Conference of Machine Learning (ICML)*, 2021: 1170-1182
7. Jay Whang, **Qi Lei**, Alexandros G. Dimakis. “Solving Inverse Problems with a Flow-based Noise Model”, *International Conference of Machine Learning (ICML)*, 2021: 11146-11157
8. Simon S. Du\*, Wei Hu\*, Sham M. Kakade\*, Jason D. Lee\*, **Qi Lei\***. “Few-Shot Learning via Learning the Representation, Provably”, *International Conference on Learning Representations (ICLR)*, 2021
9. **Qi Lei\***, Sai Ganesh Nagarajan\*, Ioannis Panageas\*, Xiao Wang\*. “Last iterate convergence in no-regret learning: constrained min-max optimization for convex-concave landscapes”, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2021: 1441-1449
10. Xiao Wang, **Qi Lei**, Ioannis Panageas. “Fast Convergence of Langevin Dynamics on Manifold: Geodesics meet Log-Sobolev”, *Neural Information Processing Systems (NeurIPS)*, 2020
11. Jiacheng Zhuo, **Qi Lei**, Alexandros G. Dimakis, Constantine Caramanis. “Communication-Efficient Asynchronous Stochastic Frank-Wolfe over Nuclear-norm Ball”, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2020: 1464-1474
12. **Qi Lei**, Jason Lee, Alexandros G. Dimakis, Contantinos Daskalakis. “SGD Learns One-Layer Networks in WGANs”, *International Conference of Machine Learning (ICML)*, 2020: 5799-5808
13. **Qi Lei**, Jiacheng Zhuo, Constantine Caramanis, Inderjit S. Dhillon, Alexandros G. Dimakis. “Primal-Dual Block Generalized Frank-Wolfe”, *Neural Information Processing Systems (NeurIPS)*, 2019: 13866-13875
14. **Qi Lei**, Ajil Jalal, Inderjit S. Dhillon, Alexandros G. Dimakis. “Inverting Deep Generative models, One layer at a time”, *Neural Information Processing Systems (NeurIPS)*, 2019: 13910-13919
15. **Qi Lei**, Jinfeng Yi, Roman Vaculin, Lingfei Wu, Inderjit S. Dhillon. “Similarity Preserving Representation Learning for Time Series Analysis”, *International Joint Conference on Artificial Intelligence (IJCAI)*, 2019: 2845-2851

16. **Qi Lei**, Lingfei Wu, Pin-Yu Chen, Alexandros G. Dimakis, Inderjit S. Dhillon, Michael Witbrock. “Discrete Adversarial Attacks and Submodular Optimization with Applications to Text Classification”, *Systems and Machine Learning (MLSys)*, 2019 (**covered by Nature News**)
17. Jinfeng Yi, **Qi Lei**, Wesley M Gifford, Ji Liu, Junchi Yan, Bowen Zhou. “Fast Unsupervised Location Category Inference from Highly Inaccurate Mobility Data”, *SIAM International Conference on Data Mining 2019*: 55-63
18. Zhewei Yao, Amir Gholami, **Qi Lei**, Kurt Keutzer, Michael W. Mahoney. “Hessian-based Analysis of Large Batch Training and Robustness to Adversaries”, *Neural Information Processing Systems (NIPS)*, 2018: 4954-4964
19. Jiong Zhang, **Qi Lei**, Inderjit S. Dhillon. “Stabilizing Gradients for Deep Neural Networks via Efficient SVD Parameterization”, *International Conference of Machine Learning (ICML)*, 2018: 5801-5809
20. Jinfeng Yi, **Qi Lei**, Junchi Yan, Wei Sun. “Session expert: A lightweight conference session recommender system”, *IEEE International Conference on Big Data (Big Data)*, 2018: 1677-1682
21. Lingfei Wu, Ian En-Hsu Yen, Jinfeng Yi, Fangli Xu, **Qi Lei**, Michael Witbrock. “Random Warping Series: A Random Features Method for Time-Series Embedding”, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2018: 793-802
22. Hsiang-fu Yu, Cho-Jui Hsieh, **Qi Lei**, Inderjit S. Dhillon. “A Greedy Approach for Budgeted Maximum Inner Product Search”, *Neural Information Processing Systems (NIPS)*, 2017: 5453-5462
23. **Qi Lei**, Enxu Yen, Chao-yuan Wu, Inderjit S. Dhillon, Pradeep Ravikumar. “Doubly Greedy Primal-Dual Coordinate Methods on Sparse Empirical Risk Minimization”, *International Conference of Machine Learning (ICML)*, 2017: 2034-2042
24. Rashish Tandon, **Qi Lei**, Alexandros G. Dimakis, Nikos Karampatziakis, “Gradient Coding: Avoiding Stragglers in Distributed Learning”, *International Conference of Machine Learning (ICML)*, 2017: 3368-3376
25. **Qi Lei**, Kai Zhong, Inderjit S. Dhillon. “Coordinate-wise Power Method”, *Neural Information Processing System (NIPS)*, 2016: 2056-2064
26. Arnaud Vandaele, Nicolas Gillis, **Qi Lei**, Kai Zhong, Inderjit S. Dhillon. “Coordinate Descent Methods for Symmetric Nonnegative Matrix Factorization”, *IEEE Transactions on Signal Processing*, 64.21 (2016): 5571-5584
27. Maria R. D’Orsogna, **Qi Lei**, Tom Chou, “First assembly times and equilibration in stochastic coagulation-fragmentation”, *Journal of Chemical Physics*, 2015: 143.1, 014112
28. Jiazhou Chen, **Qi Lei**, Yongwei Miao, Qunsheng Peng, “Vectorization of Line Drawing Image based on Junction Analysis”, *Science China Information Sciences*, 2014:1-14
29. Jiazhou Chen, **Qi Lei**, Fan Zhong, Qunsheng Peng, “Interactive Tensor Field Design Based on Line Singularities”, *Proceedings of the 13th International CAD/Graphics*, 2013

## Workshop Articles

1. Tianci Liu, Quan Zhang, **Qi Lei**, “PANOM: Automatic Hyper-parameter Tuning for Inverse Problems”, *NeurIPS 2021 Workshop on Deep Learning and Inverse Problems*
2. Kaixuan Huang\*, Sham M. Kakade\*, Jason D. Lee\*, **Qi Lei\***, “A Short Note on the Relationship of Information Gain and Eluder Dimension”, *ICML 2021 Workshop on Reinforcement Learning Theory*
3. Jason D. Lee\*, **Qi Lei\***, Nikunj Saunshi\*, Jiacheng Zhuo\*, “Predicting What You Already Know Helps: Provable Self-Supervised Learning”, *NeurIPS 2020 Workshop: Self-Supervised Learning - Theory and Practice*
4. Jay Whang, **Qi Lei**, Alex Dimakis, “Compressed Sensing with Invertible Generative Models and Dependent Noise”, *NeurIPS 2020 Workshop: Deep Learning and Inverse Problems*
5. **Qi Lei**, Ajil Jalal, Inderjit Dhillon, Alexandros Dimakis, “Inverting Deep Generative models, One layer at a time”, *ICML 2019 Workshop on Invertible Neural Networks and Normalizing Flows*
6. Rashish Tandon, **Qi Lei**, Alexandros G. Dimakis, Nikos Karampatziakis, “Gradient Coding”, *NIPS 2016 Workshop on ML Systems (MLSys)*

## Under Review Preprints

1. Shuo Yang, Yijun Dong, Rachel Ward, Inderjit S Dhillon, sujay sanghavi, **Qi Lei**. “Theoretical Analysis of Consistency Regularization with Limited Augmented Data”, *under review*
2. Kurtland Chua, **Qi Lei**, Jason D Lee. “Provable Hierarchy-Based Meta-Reinforcement Learning”, *arXiv preprint*
3. Lemeng Wu, Mao Ye, **Qi Lei**, Jason D. Lee, and Qiang Liu. “Steepest Descent Neural Architecture Optimization: Escaping Local Optimum with Signed Neural Splitting”, *arXiv preprint*
4. Minhao Cheng, **Qi Lei**, Pin-Yu Chen, Inderjit Dhillon, Cho-Jui Hsieh. “CAT: Customized Adversarial Training for Improved Robustness”, *arXiv preprint*

## Patents

- “Method and System for General and Efficient Time Series Representation Learning via Dynamic Time Warping.”  
**Q. Lei**, J. Yi, R. Vaculin, and W. Sun
- “Real-Time Cold Start Recommendation and Rationale within a Dialog System”.  
**Q. Lei**, J. Yi, R. Vaculin, M. Pietro

## Teaching

- Department of Electrical and Computer Engineering, Princeton*      Fall 2020
- Theory of Deep Learning: Representation and Weakly Supervised Learning: *Teaching Assistant*
- Department of Electrical and Computer Engineering, UT Austin*      Fall 2019
- Scalable Machine Learning: *Teaching Assistant*
- Oden Institute for Computational Engineering and Sciences, UT Austin*      Fall 2015
- Mathematical Methods in Applied Engineering and Sciences: *Instructor Intern*

## Internships

*Facebook/Photo&Video Search* June 2018 - September 2018

- Explored offline/online evaluation gaps by estimating expected number of clicks based on historical logging data.

*Amazon/A9 Product Search* May 2017 - August 2017

- Inline search suggestions: used deep learning methods for NLP user search tasks.

*Amazon Web Services (AWS Deep Learning Team)* January 2017 - April 2017

- Documentations for MXNet: a deep learning framework designed for both efficiency and flexibility.

*IBM Thomas J. Watson Research Center* May 2016 - October 2016

- Clients' propensity prediction of trading options Partnered with one of the largest American financial companies on a challenge problem of predicting its clients' propensity of trading options
- Create World of Watson Session recommendation system:  
<https://myibm.ibm.com/events/wow/watson/>

## Service

Co-organizing Mathematical Data Science Reading Group, which is a weekly departmental seminar series on Machine Learning Theory in ECE, Princeton, 2020-2021

Student mentor, Oden Institute, 2018-2020

*Conference Reviewer:* MLSys (19,20,Meta-reviewer'21, TPC'22), COLT (21,22), STOC (20), NeurIPS (16,17,18,19,20,21), ICML (18,19,20,21), ICLR (18,19,20,21), AIS-TATS (18,19,20,21), AAAI (20,21), ACML (19), and more

*Journal Reviewer:* JSAIT(20), MOR (18,19,20), TNNLS (19,20), TKDE (19), ISIT (17,18), THIS (17), IT (16,17), and more

## Invited Talks

“Label Propagation on Self-Supervised Representation Space.”

- Adversarial Approaches in Machine Learning Workshop, Simons Institute, CA, 2022
- New Advances in Statistics and Data Science, Honolulu, Hawaii, 2022

“Optimal Gradient-based Algorithms for Non-concave Bandit Optimization.”

- BLISS seminar, UC Berkeley, virtual 2021
- Sampling Algorithms and Geometries on Probability Distributions Workshop, Simons Institute, CA, 2021

“From Reconstruction to Similarity-based Self-supervised Learning.”

- Dartmouth Applied & Computational Mathematics Seminar, virtual, 2022

“Predicting What You Already Know Helps: Provable Self-Supervised Learning.”

- Neural Information Processing Systems, virtual, 2021
- Institute for Foundations of Machine Learning, virtual, 2020
- One-World ML seminar, virtual, 2020
- UW-Madison, virtual, 2020

“Provable representation learning.”

- Young Researcher Spotlight Talk at “Seeking Low-dimensionality in Deep Learning” workshop, virtual, 2020

- Microsoft Research (Redmond and NY), virtual, 2021
  - Caltech Young Investigators Lecture Series, virtual, 2021
  - Rising star presentation at the University of Maryland, virtual, 2021
  - ELLIS Talk at IST Austria, virtual, 2021
  - CSIP seminar at Georgia Tech, virtual, 2021
  - AlgML seminar, Princeton University, NJ, 2022
- “Few-Shot Learning via Learning the Representation, Provably.”
- International Conference on Learning Representations, virtual, 2021
  - IAS, Princeton, NJ, 2020
  - Simons Institute Reunion, virtual, 2020
  - UC Berkeley, virtual, 2020
- “SGD Learns One-Layer Networks in WGANs.”
- International Conference of Machine Learning (ICML), virtual, 2020
  - Workshop on Learning and Testing in High Dimensions, Simons Institute, 2020
- “Deep Generative models and Inverse Problems.”
- Minisymposium on Machine Learning for Solving Partial Differential Equations and Inverse Problems, 2019 SIAM Texas-Louisiana Section, Dallas, TX, 2019
  - Princeton, virtual, 2020
  - Google Research, virtual, 2021
- “Similarity Preserving Representation Learning for Time Series Analysis.”
- The 28th International Joint Conference on Artificial Intelligence (IJCAI), Macao, China, 2019
- “Discrete Adversarial Attacks and Submodular Optimization with Applications to Text Classification.”
- Simons-Berkeley Fellows Talk, Berkeley, CA, 2019
  - The Conference on Systems and Machine Learning (SysML), Stanford, CA, 2019
- “Recent Advances in Primal-Dual Coordinate Methods for ERM.”
- Minisymposium on Recent Progress in Coordinate-wise Descent Methods, SIAM Conference on Computational Science and Engineering, Spokane, WA, 2019
  - International Conference of Machine Learning (ICML), Sydney, 2017
- “Coordinate Descent Methods for Matrix Factorization.”
- Minisymposium on Recent Advances in Nonnegative Matrix Factorization, SIAM Annual Meeting, Boston, MA, 2016