

# Lei, Qi

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

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## Research Interests

My research aims to bridge the theoretical and empirical boundary of modern machine learning algorithms and in particular AI safety, with a focus on data privacy, distributionally robust algorithms, sample- and parameter-efficient learning.

## Professional Experience

*New York University, NY, United States* September 2022 -  
• *Assistant Professor in Mathematics and Data Science*, Courant Institute of Mathematical Sciences and the Center for Data Science

*Princeton University, NJ, United States* July 2020 - August 2022  
• *Associate Research Scholar (CIFellow)*, Electrical and Computer Engineering Department September 2021 - Present  
• *Postdoc Research Associate (CIFellow)*, Electrical and Computer Engineering Department July 2020 - September 2021  
• Mentor: Jason D. Lee

*Institute for Advanced Study, Princeton, NJ, United States* September 2019 - July 2020  
• Visiting Graduate Student for the “Special Year on Optimization, Statistics, and Theoretical Machine Learning”

*Simons Institute, Berkeley, CA, United States* May 2019 - August 2019  
• Research Fellow for the Foundations of Deep Learning Program

## Education

*University of Texas at Austin, TX, United States* August 2014 - May 2020  
• *Ph.D., Oden Institute for Computational Sciences and Engineering*  
• Advisors: Alexandros G. Dimakis and Inderjit S. Dhillon

*Zhejiang University, Zhejiang, China* Sep 2010 - June 2014  
• *B.S., School of Mathematics (with honors)* (GPA 3.92/4.0, rank 1<sup>st</sup>)

## Grants and Award (Faculty)

- NYU Research Catalyst Prize, “Towards Data-Driven Resilient Supply Chains: A Statistical Foundation of Learning Robust Inventory Control Policies” Co-PI, 15k NYU, 2023
- Whitehead Fellowship for Junior Faculty in Biomedical and Biological Sciences, “Provably Privacy-preserving Learning Pipelines for Sensitive Health Data”, PI, 30k NYU, 2023
- Award #DE-SC0024721, “Learning reduced models under extreme data conditions for design and rapid decision-making in complex systems”, Co-PI, 3.97M U.S. Department of Energy, Office of Science Energy Earthshot Initiative, 2023

## Selected Grants and Awards (pre-faculty)

- Computing Innovation Fellowship CRA, 2020-2022
- Simons-Berkeley Research Fellowship Simons Institute, 2019
- The National Initiative for Modeling and Simulation Research Fellowship UT Austin, 2014-2018

- Outstanding Dissertation Award Oden Institute, 2021
- Rising Star for Machine Learning University of Maryland, 2021
- Rising Star for EECS UIUC, 2019 & MIT, 2021
- Rising Star for Computational and Data Science UT Austin, 2020

## Thesis

**Qi Lei**, “Provably effective algorithms for min-max optimization” May 2020  
*Received the 2021 Outstanding Dissertation Award, Oden Institute*

## Publications

(\* indicates  
 $\alpha$ - $\beta$  order)

1. Tianci Liu, Tong Yang, Quan Zhang, **Qi Lei**, “Beyond Invisibility: Learning Robust Visible Watermarks for Stronger Copyright Protection”, *UAI 2025*
2. Yijun Dong, Yicheng Li, Yunai Li, Jason D Lee, **Qi Lei**, “Discrepancies are Virtue: Weak-to-Strong Generalization through Lens of Intrinsic Dimension”, *ICML 2025*
3. Hoang Phan, Tung Lam Tran, Quyen Tran, Ngoc N. Tran, Tuan Truong, **Qi Lei**, Nhat Ho, Dinh Phung, Trung Le, “Beyond Losses Reweighting: Empowering Multi-Task Learning via the Generalization Perspective”, *to appear at ICCV 2025*
4. Sheng Liu, Zihan Wang, **Qi Lei**, “Data Reconstruction Attacks and Defenses: A Systematic Evaluation”, *AISTATS 2025*
5. Tao Wen, Zihan Wang, Quan Zhang, **Qi Lei**, “Elastic Representation: Mitigating Spurious Correlations for Group Robustness”, *AISTATS 2025*
6. Ziliang Samuel Zhong, Xiang Pan, **Qi Lei**, “Bridging Domains with Approximately Shared Features”, *AISTATS 2025*
7. Jianwei Li, Yijun Dong, **Qi Lei**, “Greedy Output Approximation: Towards Efficient Structured Pruning for LLMs Without Retraining”, *CPAL 2025*
8. Tao Wen, Elynn Chen, Yuzhou Chen, **Qi Lei**, “Bridging Domain Adaptation and Graph Neural Networks: A Tensor-Based Framework for Effective Label Propagation”, *CPAL 2025*
9. Qi Zhang, Yifei Wang, Jingyi Cui, Xiang Pan, **Qi Lei**, Stefanie Jegelka, Yisen Wang, “Beyond Interpretability: The Gains of Feature Monosemanticity on Model Robustness”, *ICLR 2025*
10. Yijun Dong, Hoang Phan, Xiang Pan, **Qi Lei**, “Sketchy Moment Matching: Toward Fast and Provable Data Selection for Finetuning”, *NeurIPS 2024*
11. Qian Yu, Yining Wang, Baihe Huang, **Qi Lei**, Jason D Lee, “Stochastic Zeroth-Order Optimization under Strongly Convexity and Lipschitz Hessian: Minimax Sample Complexity”, *NeurIPS 2024*
12. Hoang Phan, Andrew G Wilson, **Qi Lei**, “Controllable Prompt Tuning For Balancing Group Distributional Robustness”, *International Conference of Machine Learning (ICML), 2024*
13. Hong J Jeon, Jason D Lee, **Qi Lei**, Benjamin Van Roy, “An Information-Theoretic Analysis of In-Context Learning”, *International Conference of Machine Learning (ICML), 2024*
14. Qian Yu, Yining Wang, Baihe Huang, **Qi Lei**, Jason D Lee, “Sample Complexity for Quadratic Bandits: Hessian Dependent Bounds and Optimal Algorithms”, *Advances in Neural Information Processing Systems 36, 2023*
15. Yijun Dong, Kevin Miller, **Qi Lei**, Rachel Ward, “Cluster-aware Semi-supervised Learning: Relational Knowledge Distillation Provably Learns Clustering”, *Advances in Neural Information Processing Systems 36, 2023*

16. Jianwei Li, **Qi Lei**, Wei Cheng, Dongkuan Xu, "Towards Robust Pruning: An Adaptive Knowledge-Retention Pruning Strategy for Language Models", *EMNLP conference, 2023: 1229-1247*
17. Jianwei Li, Weizhi Gao, **Qi Lei**, Dongkuan Xu, "Breaking through Deterministic Barriers: Randomized Pruning Mask Generation and Selection", *EMNLP findings, 2023: 11407-11423*
18. Tianci Liu, Tong Yang, Quan Zhang, **Qi Lei**, "Optimization for Amortized Inverse Problems", *International Conference of Machine Learning (ICML), 2023*
19. Zihan Wang, Jason Lee, **Qi Lei**, "Reconstructing Training Data from Model Gradient, Provably", *International Conference on Artificial Intelligence and Statistics (AISTATS), 2023: 6595-6612*
20. Shuo Yang, Yijun Dong, Rachel Ward, Inderjit Dhillon, Sujay Sanghavi, **Qi Lei**, "Sample Efficiency of Data Augmentation Consistency Regularization", *International Conference on Artificial Intelligence and Statistics (AISTATS), 2023: 3825-3853*
21. Kurtland Chua, **Qi Lei**, Jason Lee, "Provable Hierarchy-Based Meta-Reinforcement Learning", *International Conference on Artificial Intelligence and Statistics (AISTATS), 2023: 10918-10967*
22. Qian Yu, Yining Wang, Baihe Huang, **Qi Lei**, Jason Lee, "Optimal Sample Complexity Bounds for Non-convex Optimization under Kurdyka-Lojasiewicz Condition", *International Conference on Artificial Intelligence and Statistics (AISTATS), 2023: 6806-6821*
23. Minhao Cheng, **Qi Lei**, Pin-Yu Chen, Inderjit Dhillon, Cho-Jui Hsieh, "Cat: Customized adversarial training for improved robustness", *International Joint Conference on Artificial Intelligence (IJCAI), 2022: 673-679*
24. 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: 309-323*
25. 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: 29101-29115*
26. Kurtland Chua, **Qi Lei**, Jason D. Lee, "How Fine-Tuning Allows for Effective Meta-Learning", *Neural Information Processing Systems (NeurIPS), 2021: 8871-8884*
27. 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: 8968-8983*
28. **Qi Lei**, Wei Hu, Jason D. Lee. "Near-Optimal Linear Regression under Distribution Shift", *International Conference of Machine Learning (ICML), 2021: 6164-6174*
29. 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*
30. 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*

31. 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
32. **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
33. Xiao Wang, **Qi Lei**, Ioannis Panageas, “Fast Convergence of Langevin Dynamics on Manifold: Geodesics meet Log-Sobolev”, *Neural Information Processing Systems (NeurIPS)*, 2020
34. 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
35. **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
36. **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
37. **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
38. **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
39. **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 )
40. 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
41. 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
42. 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
43. 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
44. 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
45. 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

46. **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
47. 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
48. **Qi Lei**, Kai Zhong, Inderjit S. Dhillon, “Coordinate-wise Power Method”, *Neural Information Processing System (NIPS)*, 2016: 2056-2064
49. 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
50. 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
51. Jiazhou Chen, **Qi Lei**, Yongwei Miao, Qunsheng Peng, “Vectorization of Line Drawing Image based on Junction Analysis”, *Science China Information Sciences*, 2014:1-14
52. 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. Yijun Dong, Xiang Pan, Hoang Phan, **Qi Lei**, “Randomly Pivoted V-optimal Design: Fast Data Selection under Low Intrinsic Dimension”, *ML and Compression-NeurIPS 2024*
2. Jianwei Li, Sheng Liu, **Qi Lei**, “Beyond Gradient and Priors in Privacy Attacks: Leveraging Pooler Layer Inputs of Language Models in Federated Learning”, *FL@FM-NeurIPS 2023*
3. Chun-Yin Huang, **Qi Lei**, Xiaoxiao Li, “Efficient Medical Image Assessment via Self-supervised Learning”, *DALI@MICCAI Workshop, 2022: 102-111 (with Best Paper Honorable Mention)*
4. 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*

## 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

*Center for Data Science, New York University*

- Linear Algebra and Optimization: *Instructor* Fall 2024
- Modern Topics in Statistical Learning Theory: *Instructor* Spring 2023,2024

*Courant Institute Mathematics Department, New York University*

- Mathematical Statistics: *Instructor* Fall 2023, 2024
- Probability and Statistics: *Instructor* Fall 2022

*Department of Electrical and Computer Engineering, Princeton*

- Theory of Deep Learning: Representation and Weakly Supervised Learning:  
*Teaching Assistant* Fall 2020

*Department of Electrical and Computer Engineering, UT Austin*

- Scalable Machine Learning: *Teaching Assistant* Fall 2019

*Oden Institute for Computational Engineering and Sciences, UT Austin*

- Mathematical Methods in Applied Engineering and Sciences: *Instructor Intern*  
Fall 2015

## **Industry Experiences**

*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 the Math and Data seminar, New York University, since 2022

Co-organizing mini-symposium on "Efficient computation and learning with randomized sampling and pruning", at SIAM MDS 2024

Co-organizing the workshop on meta-learning at NeurIPS 2022

Student mentor, Oden Institute, 2018-2020

*Conference Reviewer:* MLSys, COLT, STOC, NeurIPS, ICML, ICLR, AISTATS, AAAI, and more

*Journal Reviewer:* MOR, JMLR, Annals of Statistics, EJMS, JSAIT, TNNLS, TKDE, ISIT, IT, Computer Speech & Language, and more