Cong Ma

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Appointment

Assistant Professor, Department of Statistics and the College, University of Chicago *July 2021 - present*

Education

University of California, Berkeley, CA, USA *June 2020 - June 2021*

- Postdoc, Department of Statistics and Department of Electrical Engineering and Computer Sciences,
- Advisor: Professor *Martin J. Wainwright*

Princeton University, NJ, USA *Sept. 2015 - June 2020*

- Ph.D., Department of Operations Research and Financial Engineering
- Advisors: Professor *Yuxin Chen* and Professor *Jianqing Fan*

Tsinghua University, Beijing, China *Aug. 2011 - July 2015*

- Bachelor of Engineering, Department of Electrical Engineering

Georgia Institute of Technology, GA, USA *Aug. 2013 - Dec. 2013*

- Exchange student, School of Electrical and Computer Engineering

Research Interests

Mathematics of data science, reinforcement learning, high-dimensional statistics, large-scale optimization, inference and uncertainty quantification, and their applications to neuroscience and signal processing.

Preprints

[P1] P. Rashidinejad, B. Zhu, **C. Ma**, J. Jiao, S. Russel, "Bridging Offline Reinforcement Learning and Imitation Learning: A Tale of Pessimism," 2021.

[P2] **C. Ma**, B. Zhu, J. Jiao, M. J. Wainwright, "Minimax Off-Policy Evaluation for Multi-Armed Bandits," 2021.

[P3] T. Tong, **C. Ma**, A. Prater-Bennette, E. Tripp, Y. Chi, "Scaling and Scalability: Provable Nonconvex Low-Rank Tensor Estimation from Incomplete Measurements," 2021.

Journal articles

[J1] Y. Chen, Y. Chi, J. Fan, **C. Ma**, Y. Yan (**alphabetical order**), "Noisy Matrix Completion: Understanding Statistical Guarantees for Convex Relaxation via Nonconvex Optimization," *SIAM Journal on Optimization*, vol. 30, no. 4, pp. 3098–3121, Oct. 2020.

[J2] Y. Chen, Y. Chi, J. Fan, **C. Ma** (**alphabetical order**), "Gradient Descent with Random Initialization: Fast Global Convergence for Nonconvex Phase Retrieval," *Mathematical Programming*, vol. 176, no. 1-2, pp. 5-37, July 2019.

[J3] **C. Ma**, K. Wang, Y. Chi, Y. Chen, "Implicit Regularization in Nonconvex Statistical Estimation: Gradient Descent Converges Linearly for Phase Retrieval, Matrix Completion, and Blind Deconvolution," *Foundations of Computational Mathematics*, vol. 20, no. 3, pp. 451-632, June 2020.

[J4] Y. Chen, Y. Chi, J. Fan, **C. Ma** (**alphabetical order**), "Spectral Methods for Data Science: A Statistical Perspective," accepted to *Foundations and Trends in Machine Learning*, 2021.

[J5] T. Tong, **C. Ma**, Y. Chi, "Low-Rank Matrix Recovery with Scaled Subgradient Methods: Fast and Robust Convergence Without the Condition Number," accepted to *IEEE Transactions on Signal Processing*, 2021.

[J6] Y. Chen, J. Fan, **C. Ma**, Y. Yan (**alphabetical order**), "Bridging Convex and Nonconvex Optimization in Robust PCA: Noise, Outliers, and Missing Data," accepted to *Annals of Statistics*, 2021.

[J7] Y. Chen, **C. Ma**, H. V. Poor, Y. Chen, "Learning Mixtures of Low-Rank Models," *IEEE Transactions on Information Theory*, vol. 67, no. 7, pp. 4613-4636, July 2021.

[J8] J. Fan, **C. Ma**, Y .Zhong (**alphabetical order**), "A Selective Overview of Deep Learning," *Statistical Science*, vol. 36, no. 2, pp. 264-290, May 2021 (**invited overview article**).

[J9] T. Tong, **C. Ma**, Y. Chi, "Accelerating Ill-Conditioned Low-Rank Matrix Estimation via Scaled Gradient Descent," *Journal of Machine Learning Reseasrch*, vol. 22, no. 150, pp. 1-63, May 2021.

[J10] Y. Li, **C. Ma**, Y. Chen, Y. Chi, "Nonconvex Matrix Factorization from Rank-One Measurements," *IEEE Transactions on Information Theory*, vol. 67, no. 3, pp. 1928-1950, March 2021.

[J11] **C. Ma**, Y. Li, Y. Chi, "Beyond Procrustes: Balancing-Free Gradient Descent for Asymmetric Low-Rank Matrix Sensing," *IEEE Transactions on Signal Processing*, vol. 69, pp. 867-877, Jan. 2021.

[J12] **C. Ma**, J. Lu, H. Liu, "Inter-Subject Analysis: A Partial Gaussian Graphical Model Approach," *Journal of the American Statistical Association*, vol. 116, no. 534, pp. 746-755, 2021.

[J13] Y. Chen, J. Fan, **C. Ma**, Y. Yan (**alphabetical order**), "Inference and Uncertainty Quantification for Noisy Matrix Completion," *Proceedings of the National Academy of Sciences (PNAS)* vol. 116, no. 46, pp. 22931-22937, Nov. 2019 (direct submission).

[J14] Y. Chen, J. Fan, **C. Ma**, K. Wang (**alphabetical order**), "Spectral Method and Regularized MLE Are Both Optimal for Top-K Ranking," *Annals of Statistics,* vol. 47, no. 4, pp. 2204-2235, Aug. 2019.

[J15] J. Zhang, J. Tang, **C. Ma**, H. Tong, Y. Jing, J. Li, W. Luyten, M-F. Moens, "Fast and Flexible Top-k Similarity Search on Large Networks," *ACM Transactions on Information Systems*, vol. 36, no. 2, pp. 13:1-13:30, Sept. 2017.

Conference papers

[C1] **C. Ma**, Y. Li, Y. Chi, "Beyond Procrustes: Balancing-Free Gradient Descent for Asymmetric Low-Rank Matrix Sensing," *Asilomar Conference on Signals, Systems and Computers*, Nov. 2019.

[C2] Y. Li, **C. Ma**, Y. Chen, Y. Chi, "Nonconvex Matrix Factorization from Rank-One Measurements," *International Conference on Artificial Intelligence and Statistics (AISTATS)*, Apr. 2019.

[C3] **C. Ma**, K. Wang, Y. Chi, Y. Chen, "Implicit Regularization in Nonconvex Statistical Estimation: Gradient Descent Converges Linearly for Phase Retrieval and Matrix Completion," *International Conference on Machine Learning (ICML)*, July 2018.

[C4] J. Zhang, J. Tang, **C. Ma**, H. Tong, Y. Jing, J. Li, "Panther: Fast Top-k Similarity Search on Large Networks," *ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, Aug. 2015.

Tutorials

[Tut1] "Nonconvex Optimization for High-Dimensional Signal Estimation: Spectral and Iterative Methods," European Signal Processing Conference (EUSIPCO) 2020, together with Y. Chen and Y. Chi.

Invited talks

[T1] "Minimax Off-Policy Evaluation for Multi-Armed Bandits," *FODSI Seminar, UC Berkeley*, Apr. 2021.

[T2] "Bridging Convex and Nonconvex Optimization in Noisy Matrix Completion: Stability and Uncertainty Quantification," *BLISS Seminar, UC Berkeley*, Nov. 2020.

[T3] "Bridging Convex and Nonconvex Optimization in Noisy Matrix Completion: Stability and Uncertainty Quantification," *Young Data Science Researcher Seminar, ETH*, June 2020.

[T4] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification," *ISyE Seminar, School of Industrial & Systems Engineering, Georgia Tech,* Feb. 2020.

[T5] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification," *Department Seminar, Department of IEOR, Columbia University,* Feb. 2020.

[T6] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification," *Department Seminar, Department of Statistics, University of Pennsylvania,* Feb. 2020.

[T7] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification," *Department of Statistics, UC Irvine,* Feb. 2020.

[T8] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification," *Department Seminar, Department Seminar, Department of Statistics, UC Davis,* Feb. 2020.

[T9] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification," *Department of Statistics, Rutgers University,* Jan. 2020.

[T10] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty Quantification", *Statistics Colloquium, Department of Statistics, University of Chicago,* Jan. 2020.

[T11] "Statistics Meets Nonconvex Optimization: Computational Efficiency and Uncertainty quantification," *Department Seminar, Department of Data Sciences and Operations, USC*, Jan. 2020.

[T12] "Nonconvex Optimization Meets Statistics: Towards Rigorous Computational and Inferential Guarantees," *School of Industrial Engineering, Purdue University*, Dec. 2019.

[T13] "Bridging convex and nonconvex optimization in noisy matrix completion: Stability and uncertainty quantification," *Statistics Seminar, Department of Mathematics, University of Maryland, College Park*, Dec. 2019.

[T14] "Understanding statistical properties by bridging convex and nonconvex optimization," *AMS Fall Eastern Sectional Meeting, Binghamton University*, Oct. 2019.

[T15] "Noisy matrix completion: understanding statistical guarantees for convex relaxation via nonconvex optimization," *Annual Young Researchers Workshop*, *ORIE, Cornell University*, Oct. 2019.

[T16] "Noisy matrix completion: understanding statistical guarantees for convex relaxation via nonconvex optimization," *Mathematics, Information and Computation (MIC) Seminar*, *Center for Data Science and Courant Institute, NYU*, Apr. 2019.

[T17] "Nonconvex Matrix Completion Without Regularization," *Asilomar Conference on Signals, Systems, and Computers, Pacific Grove*, Oct. 2018.

[T18] "Spectral Method and Regularized MLE are Both Optimal for Top-K Ranking," *Energy and Information Systems Seminar, CMU*, July 2018.

[T19] "Gradient Descent with Random Initialization: Fast Global Convergence for Nonconvex Phase Retrieval," *ICML Workshop on Modern Trends in Nonconvex Optimization for Machine Learning, Stockholm*, July 2018.

[T20] "Implicit Regularization in Nonconvex Statistical Estimation: Gradient Descent Converges Linearly for Phase Retrieval, Matrix Completion", *International Conference on Machine Learning (ICML), Stockholm*, July 2018.

[T21] "Implicit Regularization in Nonconvex Statistical Estimation," *International Symposium on Mathematical Programming, Bordeaux*, July 2018.

[T22] "Implicit Regularization in Nonconvex Statistical Estimation," *Department of Electrical Engineering, Tsinghua University*, Jan. 2018.

[T23] "Spectral Method and Regularized MLE are Both Optimal for Top-K Ranking," *International Conference on Data Science, Shanghai*, Dec. 2017.

[T24] "Inter-Subject Analysis: Inferring Sparse Interactions with Dense Intra-Graphs," *ICSA Applied Statistics Symposium, Chicago*, June 2017.

PROFESSIONAL SERVICE

1. Co-organizer of *Wilks statistics seminar*, ORFE, Princeton University July 2018 – May 2019
2. Co-organizer of 6^{th} *Princeton Day of Statistics*, ORFE, Princeton University
3. Member of Technical Program Committee for *52nd Annual Conference on Information Sciences and Systems* (*CISS 2018*)
4. Reviewer for the following journals: *Annals of Statistics*, *Statistical Science*, *Bernoulli Journal*, *Operations Research*, *Proceedings of the IEEE*, *Journal of Machine Learning Research*, *IEEE Transactions on Signal Processing*, *IEEE Transactions on Information Theory*, *Journal of Business & Economic Statistics*, *Transactions on Knowledge and Data Engineering*, *SIAM Journal on Mathematics of Data Science*

5. Reviewer for the following conferences: *ACM Symposium on Theory of Computing*, *Conference on Neural Information Processing Systems* (*NeurIPS*), *International Conference on Artificial Intelligence and Statistics*, *IEEE International Symposium on Information Theory*, *Annual Conference on Information Sciences and Systems*, *International Conference on Acoustics, Speech, and Signal Processing* (*ICASSP*)

Teaching Experience

1. Topics in Mathematical Data Science: Spectral Methods and Nonconvex Optimization, Fall 2021

Awards and Honors

1. Hannan Graduate Student Travel Award, Institute of Mathematical Statistics *2020*
2. School of Engineering and Applied Science Award for Excellence, Princeton University *2019*
   This award is given to SEAS advanced graduate students who have performed at the highest level as scholars and researchers.
3. AI Labs Fellowship, Hudson River Trading *2019*
4. Best Poster Award, Princeton Day of Optimization *2018*
5. Student Travel Award, 35^{th} International Conference on Machine Learning (ICML) *2018*
6. ICSA Student Paper Award, International Chinese Statistical Association *2017*
7. First Year Engineering Fellowship, Princeton University *2015*
8. Outstanding Academic Performance Scholarship, Tsinghua University *2014*
9. National Scholarship, Tsinghua University (Highest honor, 2 out of 118 in department) *2013*
10. CNPC Scholarship, Tsinghua University (Highest honor, only recipient in department) *2012*