

# Cong Ma

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## EDUCATION

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**Princeton University**, NJ, USA

Sept. 2015 - June 2020

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

**Tsinghua University**, Beijing, China

Aug. 2011 - July 2015

- Bachelor of Engineering, Electrical Engineering

**Georgia Institute of Technology**, GA, USA

Aug. 2013 - Dec. 2013

- Exchange student, Electrical and Computer Engineering

## RESEARCH INTERESTS

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

## JOURNAL ARTICLES

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- [J1] Yuxin Chen, Jianqing Fan, **Cong Ma**, Yuling Yan (**alphabetical order**), "Bridging Convex and Nonconvex Optimization in Robust PCA: Noise, Outliers, and Missing Data," 2020.
- [J2] Tian Tong, **Cong Ma**, Yuejie Chi, "Accelerating Ill-Conditioned Low-Rank Matrix Estimation via Scaled Gradient Descent," 2020.
- [J3] Yuxin Chen, Jianqing Fan, **Cong Ma**, Yuling 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).
- [J4] Yuxin Chen, Yuejie Chi, Jianqing Fan, **Cong 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.
- [J5] **Cong Ma**, Kaizheng Wang, Yuejie Chi, Yuxin 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.
- [J6] Yuxin Chen, Jianqing Fan, **Cong Ma**, Kaizheng 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.
- [J7] Yuxin Chen, Yuejie Chi, Jianqing Fan, **Cong Ma**, Yuling Yan (**alphabetical order**), "Noisy Matrix Completion: Understanding Statistical Guarantees for Convex Relaxation via Nonconvex Optimization," minor revision with *SIAM Journal on Optimization*, 2019.
- [J8] Jianqing Fan, **Cong Ma**, Yiqiao Zhong (**alphabetical order**), "A Selective Overview of Deep Learning," accepted to *Statistical Science*, 2019 (**invited overview article**).
- [J9] Yuanxin Li, **Cong Ma**, Yuxin Chen, Yuejie Chi, "Nonconvex Matrix Factorization from Rank-One Measurements," 2018.
- [J10] **Cong Ma**, Junwei Lu, Han Liu, "Inter-Subject Analysis: Inferring Sparse Interactions with Dense Intra-Graphs," major revision with *Journal of the American Statistical Association*, 2017.
- [J11] Jing Zhang, Jie Tang, **Cong Ma**, Hanghang Tong, Yu Jing, Juanzi Li, Walter Luyten, Marie-Francine 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] **Cong Ma**, Yuanxin Li, Yuejie Chi, “Beyond Procrustes: Balancing-free Gradient Descent for Asymmetric Low-Rank Matrix Sensing,” *Asilomar Conference on Signals, Systems and Computers*, Nov. 2019.
- [C2] Yuanxin Li, **Cong Ma**, Yuxin Chen, Yuejie Chi, “Nonconvex Matrix Factorization from Rank-One Measurements,” *International Conference on Artificial Intelligence and Statistics (AISTATS)*, Apr. 2019.
- [C3] **Cong Ma**, Kaizheng Wang, Yuejie Chi, Yuxin 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] Jing Zhang, Jie Tang, **Cong Ma**, Hanghang Tong, Yu Jing, Juanzi Li, “Panther: Fast Top- $k$  Similarity Search on Large Networks,” *ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, Aug. 2015.

## TALKS

- [T1] “Bridging convex and nonconvex optimization in noisy matrix completion: Stability and uncertainty quantification,” *Young Data Science Researcher Seminar Zurich, ETH*, June 2020.
- [T2] “Understanding statistical properties by bridging convex and nonconvex optimization,” *AMS Fall Eastern Sectional Meeting, Binghamton University*, Oct. 2019.
- [T3] “Noisy matrix completion: understanding statistical guarantees for convex relaxation via nonconvex optimization,” *Annual Young Researchers Workshop, ORIE, Cornell University*, Oct. 2019.
- [T4] “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.
- [T5] “Nonconvex matrix completion without regularization,” *Asilomar Conference on Signals, Systems, and Computers, Pacific Grove*, Oct. 2018.
- [T6] “Spectral method and regularized MLE are both optimal for top- $K$  ranking,” *Energy and Information Systems Seminar, CMU*, July 2018.
- [T7] “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.
- [T8] “Implicit regularization in nonconvex statistical estimation: gradient descent converges linearly for phase retrieval, matrix completion”, *International Conference on Machine Learning (ICML), Stockholm*, July 2018.
- [T9] “Implicit regularization in nonconvex statistical estimation,” *International Symposium on Mathematical Programming, Bordeaux*, July 2018.
- [T10] “Implicit regularization in nonconvex statistical estimation,” *Department of Electrical Engineering, Tsinghua University*, Jan. 2018.
- [T11] “Spectral method and regularized MLE are both optimal for top- $K$  ranking,” *International Conference on Data Science, Shanghai*, Dec. 2017.
- [T12] “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<sup>th</sup> *Princeton Day of Statistics*, ORFE, Princeton University
3. Co-organizer of reading group on mathematical data science, Princeton University Sept. 2018 – present
4. Member of Technical Program Committee for *52nd Annual Conference on Information Sciences and Systems (CISS 2018)*
5. Reviewer for *Proceedings of the IEEE*
6. Reviewer for *Journal of Machine Learning Research*
7. Reviewer for *IEEE Transactions on Signal Processing*
8. Reviewer for *Conference on Neural Information Processing Systems (NeurIPS)*

9. Reviewer for *IEEE International Symposium on Information Theory (ISIT)*
10. Reviewer for *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*
11. Reviewer for *52nd Annual Conference on Information Sciences and Systems (CISS 2018)*
12. Reviewer for *Transactions on Knowledge and Data Engineering*

## TEACHING EXPERIENCE

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1. *Statistical Foundations of Data Science* by Professor Jianqing Fan, Spring 2019, Head Teaching Assistant
2. *Mathematics of High-Dimensional Data* by Professor Yuxin Chen, Fall 2018, Head Teaching Assistant
3. *Large-Scale Optimization for Data Science* by Professor Yuxin Chen, Spring 2018, Head Teaching Assistant
4. *Statistical Learning and Nonparametric Estimation* by Professor Han Liu, Spring 2017, Teaching Assistant
5. *Analysis of Big Data* by Professor Han Liu, Spring 2017, Teaching Assistant
6. *Probability and Stochastic Systems* by Professor Mykhaylo Shkolnikov, Fall 2016, Teaching Assistant

## AWARDS AND HONORS

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| 1. Hannan Graduate Student Travel Award, Institute of Mathematical Statistics   | 2020 |
| 2. <b>School of Engineering and Applied Science Award for Excellence</b> , Princeton University<br><i>This award is given to SEAS advanced graduate students who have performed at the highest level as scholars and researchers.</i> | 2019 |
| 3. <b>AI Labs Fellowship</b> , Hudson River Trading   | 2019 |
| 4. Best Poster Award, Princeton Day of Optimization   | 2018 |
| 5. Student Travel Award, 35 <sup>th</sup> International Conference on Machine Learning (ICML)   | 2018 |
| 6. SEAS Travel Grant, Princeton University  | 2018 |
| 7. SEAS Travel Grant, Princeton University  | 2017 |
| 8. <b>ICSA Student Paper Award</b> , International Chinese Statistical Association  | 2017 |
| 9. <b>First Year Engineering Fellowship</b> , Princeton University  | 2015 |
| 10. <b>Outstanding Academic Performance Scholarship</b> , Tsinghua University   | 2014 |
| 11. <b>National Scholarship</b> , Tsinghua University (Highest honor, 2 out of 118 in department)   | 2013 |
| 12. <b>CNPC Scholarship</b> , Tsinghua University (Highest honor, only recipient in department)   | 2012 |