Yuchen Zhang

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Gates Computer Science 254,
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Education

University of California, Berkeley **2011 - 2016**
Doctor of Philosophy in Computer Science
Advised by Michael I. Jordan and Martin J. Wainwright

University of California, Berkeley **2011 - 2013**
Master of Arts in Statistics

Tsinghua University **2007 - 2011**
Bachelor of Engineering in Computer Science
Supervised by Andrew C. Yao

Employment

Post-doc Researcher at Stanford University **2016 - Now**
Hosted by Percy Liang and Moses Charikar

Intern at Baidu **Winter, 2015**
Project: burst detection in web search

Intern at Microsoft Research Redmond **Summer, 2014**
Project: convex optimization

Intern at Google Mountain View **Summer, 2013**
Project: personalized recommender systems

Intern at Microsoft Research Asia **2010 - 2011**
Project: click modeling for web search and online advertising

Selected Awards & Honors

2017 Best Paper Award, Conference on Learning Theory (COLT).
2016 Outstanding Reviewer Award, International Conference on Machine Learning (ICML).
2015 Baidu Fellowship (awards 8 PhD students every year worldwide).
2013 Microsoft Research PhD Fellowship Finalist.
2011 Outstanding Undergraduate Dissertation Award, Tsinghua University.
2006 Silver Medal in Asian Physics Olympiad.
2006 Gold Medal in Chinese Physics Olympiad (5^{th} among 400,000 participants).

Research Projects

My research interest lies in the field of *artificial intelligence*. My past projects spanned machine learning, natural language processing and statistical methods. They consist of new algorithms, fundamental theory and practical software. Below is a list of projects that I have been working on (with publication references):

Natural language processing

- Semantic parsing for question answering systems [C1].

  - Efficient algorithm for parsing natural language into executable logical forms.
  - Impact: 11x-16x faster and 13% more accurate than the state-of-the-art parser.

Machine learning and optimization

- Deep learning and non-convex optimization [C2,C3,C4,C5,C6].
  - Algorithms for non-convex optimization (with applications to deep learning).
  - Impact: stronger theoretical guarantee and improved empirical performance on DNN/CNN/LSTM.
- Convex optimization [J1,C9].
  - Efficient algorithm for convex optimization.
  - Impact: orders-of-magnitude faster convergence than SGD in theory/practice.
- Crowdsourcing [J5,C10].
  - Algorithm for estimating the true labels from noisy crowdsourced data.
  - Impact: first algorithm to guarantee the best possible statistical accuracy.
- Personalized recommender systems [C12].
  - Non-parametric model for modeling very sparse user-item relations.
  - Impact: improved state-of-the-art models by 9%-12% on the quality of recommending less frequent items for online shopping.
- Web search and online advertising [C16,C17,C18,C19,C20,C21]
  - Learning from massive search & ads click logs to improve ranking quality.
  - Impact: currently in production as a part of Microsoft Bing.

Distributed computing

- Distributed algorithms for machine learning [J6,J7,C7,C8,C14,C15].
  - Communication-efficient algorithms for distributed machine learning on large clusters.
  - Impact: guarantee the best possible accuracy and the least possible computation/communication.
- Foundamental theory of distributed computing [C11,C13,M2].
  - Understanding the foundamental trade-offs between communication, computation and statistical accuracy on any distributed system.
  - Impact: seminal papers on the study of communication complexity of distributed statistical estimation.
- Programming interface for parallelizing stochastic algorithms [M1].
  - A user-friendly framework for parallelizing online algorithms on Spark.
  - Impact: component of Berkeley Data Analytics Stack (BDAS), 80+ Github stars.

Other projects

- Theoretical statistics [J2,J3,J4].
- Theoretical computer science [J8,C22].

Manuscripts

[M1] **Y. Zhang** and MI. Jordan. Splash: User-friendly Programming Interface for Parallelizing Stochastic Algorithms. *arXiv:1506.07552*, 2015.

[M2] J. Duchi, MI. Jordan, M. Wainwright and **Y. Zhang** (alpha-beta order). Optimality Guarantees for Distributed Statistical Estimation. *arXiv:1405.0782*, 2014.

Journal Publications

[J1] **Y. Zhang** and L. Xiao. Stochastic Primal-Dual Coordinate Method for Regularized Empirical Risk Minimization. *Journal of Machine Learning Research.*

[J2] X. Chen, A. Guntuboyina and **Y. Zhang**. A note on the approximate admissibility of regularized estimators in the Gaussian sequence model. *Electronic Journal of Statistics*.

[J3] **Y. Zhang**, M. Wainwright and MI. Jordan. Optimal prediction for sparse linear models? Lower bounds for coordinate-separable M-estimators. *Electronic Journal of Statistics*.

[J4] X. Chen, A. Guntuboyina and **Y. Zhang** (alpha-beta order). On Bayes Risk Lower Bounds. *Journal of Machine Learning Research*.

[J5] **Y. Zhang**, X. Chen, D. Zhou and MI. Jordan. Spectral Methods meet EM: A Provably Optimal Algorithm for Crowdsourcing. *Journal of Machine Learning Research*.

[J6] **Y. Zhang**, J. Duchi and M. Wainwright. Divide and Conquer Kernel Ridge Regression: A Distributed Algorithm with Minimax Optimal Rates. *Journal of Machine Learning Research*.

[J7] **Y. Zhang**, J. Duchi and M. Wainwright. Communication-Efficient Algorithms for Statistical Optimization. *Journal of Machine Learning Research*.

[J8] **Y. Zhang** and X. Sun. The Antimagicness of the Cartesian Product of Graphs. *Theoretical Computer Science*.

Conference Publications

[C1] **Y. Zhang**, P. Pasupat, P. Liang. Macro Grammars and Holistic Triggering for Efficient Semantic Parsing. *Empirical Methods on Natural Language Processing (EMNLP)*, 2017.

[C2] **Y. Zhang**, P. Liang, M. Wainwright. Convexified Convolutional Neural Networks. *International Conference on Machine Learning (ICML)*, 2017.

[C3] **Y. Zhang**, P. Liang, M. Charikar. A Hitting Time Analysis of Stochastic Gradient Langevin Dynamics. *Conference on Learning Theory (COLT)*, 2017 **(Best paper award)**.

[C4] **Y. Zhang**, JD. Lee, M. Wainwright and MI. Jordan. On the Learnability of Fully-connected Neural Networks. *Artificial Intelligence and Statistics (AISTATS)*, 2017.

[C5] C. Jin, **Y. Zhang**, S. Balakrishnan, M. Wainwright, MI. Jordan. Local Maxima in the Likelihood of Gaussian Mixture Models: Structural Results and Algorithmic Consequences. *Neural Information Processing Systems (NIPS)*, 2016.

[C6] **Y. Zhang**, JD. Lee, MI. Jordan. ℓ_1-regularized Neural Networks are Improperly Learnable in Polynomial Time. *International Conference on Machine Learning (ICML)*, 2016.

[C7] **Y. Zhang**, M. Wainwright and MI. Jordan. Distributed Estimation of Generalized Matrix Rank: Efficient Algorithms and Lower Bounds. *International Conference on Machine Learning (ICML)*, 2015.

[C8] **Y. Zhang** and L. Xiao. DiSCO: Communication-Efficient Distributed Optimization of Self-Concordant Loss. *International Conference on Machine Learning (ICML)*, 2015.

[C9] **Y. Zhang** and L. Xiao. Stochastic Primal-Dual Coordinate Method for Regularized Empirical Risk Minimization. *International Conference on Machine Learning (ICML)*, 2015.

[C10] **Y. Zhang**, X. Chen, D. Zhou and MI. Jordan. Spectral Methods meet EM: A Provably Optimal Algorithm for Crowdsourcing. *Neural Information Processing Systems (NIPS)*, 2014. **(Spotlight presentation, 4.8% acceptance rate)**

[C11] **Y. Zhang**, M. Wainwright and MI. Jordan. Lower Bounds on the Performance of Polynomial-time Algorithms for Sparse Linear Regression. *Conference on Learning Theory (COLT)*, 2014.

[C12] **Y. Zhang**, A. Ahmed, V. Josifovski and A. Smola. Taxonomy Discovery for Personalized Recommendation. *ACM International Conference on Web Search and Data Mining (WSDM)*, 2014.

[C13] **Y. Zhang**, J. Duchi, M. Wainwright and MI. Jordan. Information-theoretic Lower Bounds for Distributed Statistical Estimation with Communication Constraints. *Neural Information Processing Systems (NIPS)*, 2013. **(Oral presentation, 1.4% acceptance rate)**

[C14] **Y. Zhang**, J. Duchi and M. Wainwright. Divide and Conquer Kernel Ridge Regression. *Conference on Learning Theory (COLT)*, 2013.

[C15] **Y. Zhang**, J. Duchi and M. Wainwright. Communication-Efficient Algorithms for Statistical Optimization. *Neural Information Processing Systems (NIPS)*, 2012.

[C16] W. Chen, D. Wang, **Y. Zhang** and Q. Yang. Understanding Click Noise: A Noise-aware Click Model for Web Search. *ACM International Conference on Web Search and Data Mining (WSDM)*, 2012.

[C17] **Y. Zhang**, W, Chen and D, Wang, Q. Yang. User-click Modeling for Understanding and Predicting Search-behavior. *ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, 2011.

[C18] B. Hu, **Y. Zhang**, G. Wang, Q. Yang, W. Chen. Characterize Search Intent Diversity into Click Models. *International World Wide Web Conference (WWW)*, 2011.

[C19] **Y. Zhang**, D. Wang, G. Wang, W. Chen, Z. Zhang, B. Hu and L. Zhang. Learning Click Model via Probit Bayesian Inference. *ACM International Conference on Information and Knowledge Management (CIKM)*, 2010.

[C20] D. Wang, W. Chen, G. Wang, **Y Zhang** and B. Hu. Explore Click Models for Search Ranking. *ACM International Conference on Information and Knowledge Management (CIKM)*, short paper, 2010.

[C21] F. Zhong, D. Wang, G. Wang, W. Chen, **Y. Zhang**, Z. Chen and H. Wang. Incorporating Post-Click Behaviors Into a Click Model. *Annual International ACM SIGIR Conference (SIGIR)*, 2010.

[C22] **Y. Zhang** and L. Zhang. Extracting Independent Rules: a New Perspective of Boosting. *International Symposium on Artificial Intelligence and Mathematics (ISAIM)*, 2010.

Teaching

Graduate Student Instructor, Introduction to machine learning, UC Berkeley **Spring, 2015**
Graduate Student Instructor, Randomized algorithms for matrices and data, UC Berkeley **Fall, 2013**

Service

Journal Reviewer: Journal of Machine Learning Research, Annals of Statistics, Mathematical Programming, ACM Transactions on the Web.
Conference Reviewer: ICML (2013 -), NIPS (2013 -), AISTAT (2015 -), IJCAI (2015 -).

Programming

Capable of Python, C/C++, C#, Java, Scala, MATLAB.

References

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Pehong Chen Distinguished Professor
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