Shusen Wang

Assistant Professor, Department of Computer Science, Stevens Institute of Technology

Phone: (201)216-5485 **Email:** shusen.wang@stevens.edu **Homepage:** wangshusen.github.io

Research

Keywords Machine learning (ML), randomized linear algebra, optimization, big data, distributed computing.

Summary My expertise is in statistical ML, computational methods for ML, and deep learning. I am most interested in practical, scalable, and sound algorithms for learning from big data. In the past, I developed randomized algorithms for making matrix computation, numerical optimization, and machine learning faster and more scalable. My current research is focused on communication-efficiency and privacy-preserving algorithms for federated learning.

Work Experience

from 2018 **Tenure-track assistant professor**; Department of Computer Science, Stevens Institute of Technology (Hoboken, NJ, USA)

2016-2018 **Postdoctoral Scholar**; Department of Statistics, UC Berkeley (Berkeley, CA, USA)

Advisor: Michael W. Mahoney

Research: randomized linear algebra and implementation

2014-2015 **Research Intern**; Baidu Big Data Lab (Beijing, China)

Mentor: Tong Zhang

Research: optimization algorithms

2012 **Research Intern**; Google Research (Beijing, China)

Research: randomized algorithms

2011-2012 **Intern**; Microsoft Research Asia (Beijing, China)

Mentors: Haixun Wang and Yangqiu Song

Project: probabilistic knowledge base

Education

2011-2016 **Doctor of Engineering**; Zhejiang University (Hangzhou, China)

Major: Computer Science

Advisor: Zhihua Zhang

Thesis: Large-Scale Machine Learning: A Randomized Approach and Theoretical Analysis

2007-2011 **Bachelor of Engineering**; Zhejiang University (Hangzhou, China)

Major: Computer Science

Academic Service

- **Journal Reviewer**
  - Journal of Machine Learning Research, 2015 to 2020
  - SIAM Journal on Scientific Computing, 2017
  - ACM Transactions on Mathematical Software, 2017
  - Journal of Econometrics, 2017
  - SIAM Journal on Matrix Analysis and Applications, 2017, 2019
  - Pattern Recognition Letters, 2018
  - International Journal of Data Science and Analytics, 2018
  - IEEE Transactions on Signal Processing, 2018
  - IEEE Transactions on Information Theory, 2019
  - IEEE Transactions on Pattern Analysis and Machine Intelligence, 2019
- **Conference Committee Member or Reviewer**
  - NIPS 2014, 2015, 2017, 2018, 2020
  - ICML 2017, 2018, 2019
  - IJCAI 2015, 2017, 2018, 2019, 2020
  - AAAI 2017, 2018, 2020
  - AISTATS 2019, 2020
  - UAI 2019, 2020
  - Supercomputing (SC) 2019

Major Honors & Awards

2014 **Baidu Scholarship**, awarded to 8 Chinese students in the world, US$30,000

2013 **Microsoft Research Asia Fellow**, awarded to 10 students in Asia Pacific, US$10,000

2012 **Scholarship Award for Excellent Doctoral Student Granted by Ministry of Education**, US$5,000

2012-2014 **National Scholarship for Graduate Students**, 3 times, each time US$5,000

Journal Papers

- **A Bootstrap Method for Error Estimation in Randomized Matrix Multiplication.** Miles E. Lopes, **Shusen Wang**, Michael W. Mahoney. *Journal of Machine Learning Research* (**JMLR**), 20(39):1-40, 2019.
- **Scalable Kernel K-Means Clustering with Nystrom Approximation: Relative-Error Bounds.** **Shusen Wang**, Alex Gittens, and Michael W. Mahoney. *Journal of Machine Learning Research* (**JMLR**), 20(12):1-49, 2019.
- **Sketched Ridge Regression: Optimization Perspective, Statistical Perspective, and Model Averaging.** **Shusen Wang**, Alex Gittens, and Michael W. Mahoney. *Journal of Machine Learning Research* (**JMLR**), 18:1-50, 2018.

- **Efficient Data-Driven Geologic Feature Characterization from Pre-stack Seismic Measurements using Randomized Machine-Learning Algorithm.** Youzuo Lin, **Shusen Wang**, Jayaraman Thiagarajan, George Guthrie, and David Coblentz. *Geophysical Journal International*, ggy385, 2018.
- **Alchemist: An Apache Spark <=> MPI Interface.** Alex Gittens, Kai Rothauge, Michael W. Mahoney, **Shusen Wang**, Lisa Gerhardt, Prabhat, Jey Kottalam, Michael Ringenburg, and Kristyn Maschhoff. *Concurrency and Computation Practice and Experience* (**CCPE**), Special Issue on the Cray User Group, to appear, 2018.
- **Towards More Efficient SPSD Matrix Approximation and CUR Matrix Decomposition**. **Shusen Wang**, Zhihua Zhang, and Tong Zhang. *Journal of Machine Learning Research* (**JMLR**), 17(210):1-49, 2016.
- **SPSD Matrix Approximation vis Column Selection: Theories, Algorithms, and Extensions.** **Shusen Wang**, Luo Luo, and Zhihua Zhang. *Journal of Machine Learning Research* (**JMLR**), 17(49):1-49, 2016.
- **Improving CUR Matrix Decomposition and the Nystrom Approximation via Adaptive Sampling.** **Shusen Wang** and Zhihua Zhang. *Journal of Machine Learning Research* (**JMLR**), 14: 2729-2769, 2013.
- **EP-GIG Priors and Applications in Bayesian Sparse Learning.** Zhihua Zhang, **Shusen Wang**, Dehua Liu, and Michael I. Jordan. *Journal of Machine Learning Research* (**JMLR**), 13: 2031-2061, 2012.

Conference Papers

- **On the Convergence of FedAvg on Non-IID Data.** Xiang Li, Kaixuan Huang, Wenhao Yang, **Shusen Wang**, and Zhihua Zhang. In *International Conference on Learning Representations* (**ICLR**), 2020.
- **Do Subsampled Newton Methods Work for High-Dimensional Data?** Xiang Li, **Shusen Wang**, and Zhihua Zhang. In *AAAI Conference on Artificial Intelligence* (**AAAI**), 2020.
- **Sharper Generalization Bound for the Divide-and-Conquer Ridge Regression.** **Shusen Wang**. In *AAAI Conference on Artificial Intelligence* (**AAAI**), 2019.
- **GIANT: Globally Improved Approximate Newton Method for Distributed Optimization.** **Shusen Wang**, Farbod Roosta-Khorasani, Peng Xu, and Michael W. Mahoney. In *Advances in Neural Information Processing Systems* (**NIPS**), 2018.
- **Error Estimation for Randomized Least-Squares Algorithms via the Bootstrap.** Miles E. Lopes, **Shusen Wang**, and Michael W. Mahoney. In *International Conference on Machine Learning* (**ICML**), 2018.
- **Accelerating Large-Scale Data Analysis by Offloading to High-Performance Computing Libraries using Alchemist.** Alex Gittens, Kai Rothauge, **Shusen Wang**, Michael W. Mahoney, Lisa Gerhardt, Prabhat, Jey Kottalam, Michael Ringenburg, and Kristyn Maschhoff. In *ACM SIGKDD Conference on Knowledge Discovery and Data Mining* (**KDD**), 2018.
- **OverSketch: Approximate Matrix Multiplication for the Cloud.** Vipul Gupta, **Shusen Wang**, Thomas Courtade, and Kannan Ramchandran. In *IEEE International Conference on Big Data*, 2018.
- **Sketched Ridge Regression: Optimization Perspective, Statistical Perspective, and Model Averaging.** **Shusen Wang**, Alex Gittens, and Michael W. Mahoney. In *International Conference on Machine Learning* (**ICML**), 2017.
- **Towards Real-Time Geologic Feature Detection from Seismic Measurements using a Ran-**

domized Machine-Learning Algorithm. Youzuo Lin, **Shusen Wang**, Jayaraman Thiagarajan, George Guthrie, and David Coblentz. In *Proceeding of Society of Exploration Geophysics* (**SEG**), 2017.

- **Open Domain Short Text Conceptualization: A Generative + Descriptive Modeling Approach.** Yangqiu Song, **Shusen Wang**, and Haixun Wang. In *International Joint Conference on Artificial Intelligence* (**IJCAI**), 2015.
- **Improving the Modified Nystrom Method Using Spectral Shifting.** **Shusen Wang**, Chao Zhang, Hui Qian, and Zhihua Zhang. In *the 20th ACM SIGKDD Conference on Knowledge Discovery and Data Mining* (**KDD**), 2014.
- **Efficient Algorithms and Error Analysis for the Modified Nystrom Method.** **Shusen Wang** and Zhihua Zhang. In *Proceedings of the 17th International Conference on Artificial Intelligence and Statistics, JMLR W&CP* (**AISTATS**), 2014.
- **Making Fisher Discriminant Analysis Scalable.** Bojun Tu, Zhihua Zhang, **Shusen Wang**, and Hui Qian. In *the International Conference on Machine Learning* (**ICML**), 2014.
- **Exact Subspace Clustering in Linear Time.** **Shusen Wang**, Bojun Tu, Congfu Xu, and Zhihua Zhang. In *the 28th AAAI Conference on Artificial Intelligence* (**AAAI**), 2014.
- **Using The Matrix Ridge Approximation to Speedup Determinantal Point Processes Sampling Algorithms.** **Shusen Wang**, Chao Zhang, Hui Qian, and Zhihua Zhang. In *the 28th AAAI Conference on Artificial Intelligence* (**AAAI**), 2014.
- **Transfer Understanding from Head Queries to Tail Queries.** Yangqiu Song, Haixun Wang, Weizhu Chen, and **Shusen Wang**. In *the 23rd ACM International Conference on Information and Knowledge Management* (**CIKM**), 2014.
- **Nonconvex Relaxation Approaches to Robust Matrix Recovery.** **Shusen Wang**, Dehua Liu, and Zhihua Zhang. In *International Joint Conference on Artificial Intelligence* (**IJCAI**), 2013.
- **A Scalable CUR Matrix Decomposition Algorithm: Lower Time Complexity and Tighter Bound.** **Shusen Wang** and Zhihua Zhang. In *Advances in Neural Information Processing Systems* (**NIPS**), 2012.
- **Colorization by Matrix Completion.** **Shusen Wang** and Zhihua Zhang. In *the 26th AAAI Conference on Artificial Intelligence* (**AAAI**), 2012.
- **Efficient Subspace Segmentation via Quadratic Programming.** **Shusen Wang**, Xiaotong Yuan, Tiansheng Yao, Shuicheng Yan, and Jialie Shen. In *the 25th AAAI Conference on Artificial Intelligence* (**AAAI**), 2011.

Teaching

- CS583: Deep Learning, Spring 2021.
- CS600: Advanced Algorithms, Fall 2020.
- CS583: Deep Learning, Spring 2020.
- CS583: Deep Learning, Fall 2019.
- CS583: Deep Learning, Spring 2019.
- Open courses on YouTube: [**English Channel**] [**Chinese Channel**]