

# Lingfei (Teddy) Wu

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## RESEARCH INTERESTS

- Large-scale machine learning, data mining, and big data analytics
- Scientific computing, numerical linear algebra, and mathematical software
- Parallel and high performance computing

## EDUCATION

- College of William and Mary 2010 – 2016  
Ph.D. Candidate in Computer Science  
Advisor: Professor Andreas Stathopoulos  
GPA: 3.92/4.00
- University of Science and Technology of China 2007 – 2010  
M.S. in Information Acquiring and Control  
GPA: 3.90/4.00 Rank: 1/71
- Anhui University 2003 – 2007  
B.S. in Electronic Engineering  
GPA: 3.85/4.00 Rank: 3/100

## PROFESSIONAL EXPERIENCE

- **Graduate Research Intern, IBM T. J. Watson Research Center** May 2015 - Present  
Senior manager: Richard Lawrence **Yorktown Heights, NY**
  - Presented an efficient one-vs-one kernel ridge regression method via randomized Fourier features to scale up large-scale kernel machines for speech recognition.
  - Conducted the first analysis of Random Binning features from two perspectives: fast convergence and strong parallelizability for scalable kernel machines.
  - Developing a high-performance machine learning software for large-scale speech recognition tasks by leveraging hybrid MPI/OpenMP and MPI/GPU.
- **Graduate Research Intern, Lawrence Berkeley National Laboratory** Summer 2014  
Group leader: Kesheng (John) Wu **Berkeley, CA**
  - Presented a new region outlier detection and tracking algorithm for efficiently finding blob-filaments in fusion experiments and numerical simulations.
  - Developed for the first time a big data analysis component for real-time blob detection by exploiting heterogeneous many-core architecture with hybrid MPI/OpenMP.
- **Graduate Research Assistant, College of WM,** May 2012 – July 2016  
Advisor: Prof. Andreas Stathopoulos **Williamsburg, VA**
  - Presented a novel hybrid, two-stage method to compute both largest and smallest singular triplets of large sparse matrices accurately and efficiently.
  - Developed a high-performance preconditioned SVD solver software for accurately computing large-scale singular value problems in PRIMME.
  - Proposed a new efficient approach and implementation of the refined projection method for computing interior eigenvalue accurately in (Jacobi-)Davidson methods.
  - Presented a novel trace estimation method for large sparse matrix inverse by exploiting the pattern correlation between the approximation and the original large sparse square matrix.

## TEACHING EXPERIENCE

- Lab Instructor, CSC141, Computational Problem Solving in Python, Fall 2012
  - Giving lectures and Q/A to two labs of about 60 students, three hours per week
- Teaching Assistant, CSC420/520, Introduction to Machine Learning, Summer 2011
  - Design, implement and test the course projects for controlling mobile robot with speech
- Teaching Assistant, CSC131, Concepts of Computer Science, Fall 2010, 2011 and Spring 2011

## JOURNAL PUBLICATIONS

1. **Lingfei Wu** and Andreas Stathopoulos, “A Preconditioned Hybrid SVD Method for Computing Accurately Singular Triplets of Large Matrices”, *SIAM Journal on Scientific Computing* 37-5 (2015), pp. S365-S388. [**SIAM SISC**]
2. **Lingfei Wu**, Max Q.-H. Meng, and Huawei Liang, “A Collinearity-Based Localization Algorithm for Wireless Sensor Networks”, *Chinese Journal of Sensors and Actuators*, 2009, 22(5):722-727.

## JOURNAL MANUSCRIPTS IN PREPARATION OR UNDER REVIEW

3. **Lingfei Wu**, Andreas Stathopoulos, Jesse Laeuchli, Vassilis Kalantzis and Efstratios Gallopoulos, “Estimating the Trace of the Matrix Inverse by Interpolating from the Diagonal of an Approximate Inverse”, <http://arxiv.org/abs/1507.07227>, *Journal of Computational Physics*, Invited to Resubmit.
4. **Lingfei Wu**, Kesheng Wu, Alex Sim, Michael Churchill, Jong Y. Choi, Andreas Stathopoulos, Cs Chang and Scott Klasky, “Towards Real-Time Detection and Tracking of Blob-Filaments in Fusion Plasma Big Data”, <http://arxiv.org/abs/1505.0353>, *IEEE Transaction on Big Data*, Invited to Resubmit.
5. **Lingfei Wu**, Eloy Romero, and Andreas Stathopoulos, “PRIMME\_SVDS: A High-performance Preconditioned SVD Solver for Accurate Large-scale Computations”, <http://arxiv.org/abs/1607.01404>, *SIAM Journal on Scientific Computing*, Submitted.
6. **Lingfei Wu** and Andreas Stathopoulos, “An Implementation and Analysis of The Refined Projection Method for (Jacobi-)Davidson Type Methods”, In Preparation.

## PEER-REVIEWED CONFERENCE PUBLICATIONS

1. **Lingfei Wu\***, Ian E.H. Yen\*, Jie Chen, and Rui Yan (**\*equally contributed**), “Revisiting Random Binning Feature: Fast Convergence and Strong Parallelizability”, In the Proceeding of the 22th SIGKDD conference on Knowledge Discovery and Data Mining. [**KDD 2016**]
2. Jie Chen\*, **Lingfei Wu\***, Kartik Audhkhasi, Brian Kingsbury, and Bhuvana Ramabhadran (**\*equally contributed**), “Efficient One-VS-One Kernel Ridge Regression for Speech Recognition”, The 41st IEEE International Conference on Acoustics, Speech and Signal Processing. [**ICASSP 2016**]
3. **Lingfei Wu** and Andreas Stathopoulos, “High-Performance Algorithms for Large-Scale Singular Value Problems and Big Data Applications”, In The International Conference for High Performance Computing, Networking, Storage, and Analysis, 2015. [**SC15 Doctoral Showcase**]
4. **Lingfei Wu**, Andreas Stathopoulos, and Eloy Romero, “A High-Performance Preconditioned SVD Solver for Accurately Computing Large-Scale Singular Value Problems in PRIMME”, In The International Conference for High Performance Computing, Networking, Storage, and Analysis, 2015. [**SC15 SRC Poster**]
5. **Lingfei Wu**, Kesheng Wu, Alex Sim, Michael Churchill, Jong Y. Choi, Andreas Stathopoulos, Cs Chang and Scott Klasky, “High-Performance Outlier Detection Algorithm for Finding Blob-Filaments in Plasma”, In Proceedings of 5rd International Workshop on Big Data Analytics: Challenges and Opportunities (**BDAC-14**), held in conjunction with **SC14**.
6. **Lingfei Wu**, Kesheng Wu, Alex Sim and Andreas Stathopoulos, “Real-Time Outlier Detection Algorithm for Finding Blob-Filaments in Plasma”, In The International Conference for High Performance Computing, Networking, Storage, and Analysis, 2014. [**SC14 SRC Poster**]
7. **Lingfei Wu**, Max Q.-H. Meng, Zijing Lin, Wu He, Chao Peng, and Huawei Liang, “A Practical

- Evaluation of Radio Signal Strength for Mobile Robot Localization”, In Proceedings of the IEEE International Conference on Robotics and Biomimetics, 2009. [IEEE ROBIO 2009]
8. **Lingfei Wu**, Max Q.-H. Meng, Zhenzhong Dong, and Huawei Liang, “An Empirical Study of DV-Hop Localization Algorithm in Random Sensor Networks”, In Proceedings of the IEEE International Conference on Intelligent Computation Technology and Automation, 2009. [IEEE ICICTA 2009]
  9. **Lingfei Wu**, Max Q.-H. Meng, and Huawei Liang, “A Beacon Selected Localization Algorithm for Ad-Hoc Networks of Sensors”, In Proceedings of the IEEE International Conference on Mechatronics and Automation, 2009. [IEEE ICMA 2009 Best Student Paper Nomination (4/926)]
  10. **Lingfei Wu**, Max Q.-H. Meng, Huawei Liang, and Wen Gao, “Accurate Localization in Combination with Wireless Sensor Networks and Laser Localization”, In Proceedings of the IEEE International Conference on Automation and Logistics, 2009. [IEEE ICAL 2009]
  11. **Lingfei Wu**, Max Q.-H. Meng, Jian Huang, Huawei Liang, and Zijing Lin, “An Improvement of DV-Hop Algorithm Based on Collinearity,” In Proceedings of the IEEE International Conference on Information and Automation, 2009. [IEEE ICIA 2009]

## TECHNICAL REPORTS

1. **Lingfei Wu**, Kesheng Wu, Alex Sim, Michael Churchill, Jong Y. Choi, Andreas Stathopoulos, Cs Chang and Scott Klasky, “Towards Real-Time Detection and Tracking of Blob-Filaments in Fusion Plasma Big Data”, Tech Report: WM-CS-2015-01, Department of Computer Science, College of William and Mary, 2015.
2. **Lingfei Wu** and Andreas Stathopoulos, “PRIMME\_SVDS: A Preconditioned SVD solver for Computing Accurately Singular Triplets of Large Matrices Based on The PRIMME Eigensolver”, Tech Report: WM-CS-2014-06, Department of Computer Science, College of William and Mary, 2014.
3. **Lingfei Wu** and Andreas Stathopoulos, “Enhancing the PRIMME Eigensolver for Computing Accurately Singular Triplets of Large Matrices”, Tech Report: WM-CS-2014-03, Department of Computer Science, College of William and Mary, 2014.

## AWARDS and HONORS

- SIAM Student Travel Awards, SIAM AN 2016, SIAM LA 2015, and SIAM CSE 2015
- ACM’s SRC Travel Awards, SC14, SC15
- Student Travel Grant Award, 2014 Copper Mountain Conference on Iterative Methods
- Student Activities Conference Travel Awards, College of William & Mary, 2014, 2015, 2016
- OGSR/GSA Conference Travel Awards, College of William & Mary, 2014, 2015, 2016
- Department Conference Travel Awards, College of William and Mary, 2014, 2015, 2016
- Best Student Paper Finalist (selected 4 from 926 papers), IEEE ICMA 2009
- National Third Prize, 2008 Fifth National Graduate Contest in Mathematical Modeling
- CASC Outstanding Graduate Research Award 2009 (Top 2%), USTC
- Guanghua Outstanding Graduate Research Award 2008 (Top 2 %), USTC
- Outstanding Student Scholarship (Top 5 %) 2004-2007, Anhui University

## CONFERENCE PRESENTATIONS

1. **L. Wu** and A. Stathopoulos, “Improving Thick-Restarting Lanczos Method by Subspace Optimization For Large Sparse Eigenvalue Problems”, 2015 SIAM Conference on Applied Linear Algebra, Atlanta, Georgia, USA, October 2015.
2. **L. Wu**, “Scale Up Large-Scale Kernel Machines for Speech Recognition”, IBM T. J. Watson research center, Summer Intern Seminar 2015, Yorktown Heights, NY.
3. **L. Wu** and A. Stathopoulos, “An Implementation and Analysis of the Refined Projection method For (Jacobi-)Davidson Type Methods”, 2015 SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, USA, March 2015.
4. A. Stathopoulos and **L. Wu**, “Accurate Computation of Smallest Singular Values Using the PRIMME Eigensolver”, 8<sup>th</sup> International Workshop on Parallel Matrix Algorithms and

- Applications (PMAA), Lugano, Switzerland, July 2014.
5. **L. Wu** and A. Stathopoulos, “Enhancing the PRIMME Eigensolver for Computing Accurately Singular Triplets of Large Matrices”, 13<sup>th</sup> Copper Mountain Conference on Iterative Methods Student Paper Competition, Copper Mountain, Colorado, USA, April 2014.
  6. A. Stathopoulos, **L. Wu**, J. Laeuchli, V. Kalatzis, and S. Gallopoulos, “Fitting Techniques for Estimating The Trace of The Inverse of A Matrix”, 6<sup>th</sup> International Conference of the ERCIM on Computational and Methodological Statistics (ERCIM), London, UK, December 2013.
  7. A. Stathopoulos, **L. Wu**, J. Laeuchli, V. Kalatzis, S. Gallopoulos, “Using ILU(0) To Estimate The Diagonal of The Inverse of A Matrix”, 18<sup>th</sup> Conference of International Linear Algebra Society (ILAS), Rhode Island, USA, June 2013.
  8. A. Stathopoulos and **L. Wu**, “A MATLAB Interface for PRIMME for Solving Eigenvalue and Singular Value Problems”, 2013 SIAM Conference on Computational Science and Engineering, Boston, USA, February 2013.

## PROFESSIONAL ACTIVITIES

### SOFTWARE

#### 1. **PRIMME\_SVDS: A State-of-The-Art SVD Solver in PRIMME Library** **June 2016**

My contributions: design and implement a state-of-the-art high-performance SVD software, PRIMME\_SVDS on top of PRIMME for solving large-scale SVD problems. It can be used in a single node or a large cluster, supporting computation of both largest and smallest singular triplets in full accuracy. It provides C, fortran, Matlab and Python interfaces to serve a broad class of users.

Free download at: <https://github.com/primme/primme>

### INVITED TALKS

1. **L. Wu**, “Block Preconditioned Thick-Restart Lanczos Method with Subspace Optimization for Symmetric Eigenvalue Problems”, 2016 SIAM Annual Meeting, Boston, Massachusetts, USA, July 2016.

### REVIEWERS

- SIAM Journal on Scientific Computing (SIAM SISC)
- SIAM Journal on Matrix Analysis and Applications (SIAM SIMAX)
- Mathematical Modelling and Analysis
- IEEE INFOCOM 2015
- IPDPS 2014
- SC 2013

### SOCIETIES

- SIAM and ACM

### LEADERSHIP

- Student Volunteer in ACM/IEEE SC 2015
- Vice President, Computer Science Graduate Students Association, 2010-2012
- Vice President, Chinese Students and Scholars Association, College of WM, 2011-2012
- Student Volunteer in IEEE International Conference on Mechatronics and Automation 2009
- Student Volunteer in IEEE International Conference on Automation and Logistics 2009
- Student Volunteer in IEEE International Conference on Information and Automation 2009

### COMPUTER SKILLS

- **Programming languages:** C, MATLAB, Python, R, C++, Java, Unix Shell
- **Parallel programming tools:** MPI, OpenMP, GPU
- **Applications and tools:** Latex, Bash, Vim, Make, SVN, Git