Zhao Zhang

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CURRENT POSITION

Texas Advanced Computing Center July 2016 - present
Research Associate, Data Intensive Computing Group

EDUCATION

University of Chicago September 2009 - June 2014
Ph.D. Computer Science

University of Chicago January 2007 - December 2007
M.S. Computer Science

Beijing University of Posts and Telecommunications August 2002 - June 2006
B.E. Software Engineering

EXPERIENCE

Postdoc Researcher and Data Science Fellow July 2014 - June 2016
AMPlab and Berkeley Institute for Data Science Berkeley, CA
Advisor: Michael J. Franklin

Graduate Student Researcher September 2009 - June 2014
Department of Computer Science, University of Chicago Chicago, IL
Advisor: Ian T. Foster

Scientific Application Specialist January 2008 - July 2009
Computation Institute, University of Chicago Chicago, IL

Senior Technical Associate July 2006 - December 2006
Lucent Technology Beijing, China

ACTIVE PROJECTS

- PI, NSF OAC-2106661 "Collaborative Research: OAC Core: ScaDL: New Approaches to Scaling Deep Learning for Science Applications on Supercomputers" (10/1/21-9/30/24)
- TACC PI, NSF OAC-2112606 "AI Institute for Intelligent CyberInfrastructure with Computational Learning in the Environment (ICICLE)" (11/1/21-10/31/26)
- PI, NSF OAC-2008388 "Collaborative Research: OAC Core: Small: Efficient and Policy-driven Burst Buffer Sharing" (10/1/20-9/30/22)
- co-PI, NSF OAC-1931537 "Collaborative Research: Frameworks: Designing Next-Generation MPI Libraries for Emerging Dense GPU Systems" (11/1/19-10/31/22)

CONFERENCE PUBLICATIONS

- [SC'21] J. G. Pauloski, Q. Huang, L. Huang, K. Chard, I. T. Foster, **Z. Zhang**. KAISA: An Adaptive Second-order Optimizer Framework for Deep Neural Networks. *to appear in Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis, 2021 (SC).*
- [SC'20] J. G. Pauloski, **Z. Zhang**, L. Huang, W. Xu, I. T. Foster. Convolutional Neural Network Training with Distributed K-FAC. *In Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis, 2020 (SC).*
- [IPDPS'20] **Z. Zhang**, L. Huang, J. G. Pauloski, I. T. Foster. Efficient I/O for Neural Network Training with Compressed Data. *In 2020 IEEE International Parallel and Distributed Processing Symposium (IPDPS).*
- [CLUSTER'19] **Z. Zhang**, L. Huang, R. Huang, W. Xu, D. S. Katz. Quantifying the Impact of Memory Errors in Deep Learning. *In Proceedings of 2019 IEEE International Conference on Cluster Computing (CLUSTER), p.1-12, 2019.*
- [ICPP'18] Y. You, **Z. Zhang**, J. Demmel, K. Keutzer, C. Hsieh. ImageNet Training in Minutes. *In Proceedings of the 47th International Conference on Parallel Processing, p. 0. ACM, 2018.* **Best Paper**
- [HPDC'17] **Z. Zhang**, E. Sparks, M. J. Franklin. Diagnosing Machine Learning Pipelines with Fine-grained Lineage. *In Proceedings of the 26th international symposium on High-performance parallel and distributed computing (HPDC' 17)*
- [IPDPS'16] M. Turilli, F. Liu, **Z. Zhang**, A. Merzky, M. Wilde, J. Weissman, D. S. Katz, and S. Jha. Integrating abstractions to enhance the execution of distributed applications. *In 2016 IEEE International Parallel and Distributed Processing Symposium (IPDPS), pp. 953-962. IEEE, 2016*
- [CIDR'15] D. Crankshaw, P. Bailis, J. E. Gonzalez, H. Li, **Z. Zhang**, M. J. Franklin, A. Ghodsi, M. I. Jordan. The Missing Piece in Complex Analytics: Low Latency, Scalable Model Management and Serving with Velox. *7th Biennial Conference on Innovative Data Systems Research (CIDR), 2015.*
- [SIGMOD'15] F. A. Nothaft, M. Massie, T. Danford, **Z.Zhang**, U. Laserson, C. Yeksigian, J.Kottalam et al. Rethinking data-intensive science using scalable analytics systems. *In Proceedings of the 2015 ACM SIGMOD International Conference on Management of Data, pp. 631-646. ACM, 2015.*
- [eScience'14] **Z. Zhang**, D. S. Katz. Using Application Skeletons to Improve eScience Infrastructure. *In e-Science (e-Science), 2014 IEEE 10th International Conference on, vol. 1, pp. 111-118. IEEE, 2014.*
- [SC'13] **Z. Zhang**, D. S. Katz, T. Armstrong, J. Wozniak, I. Foster. Parallelizing the Execution of Sequential Scripts. *In Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis (Supercomputing), p. 31. ACM, 2013.*
- [IPDPS'13] T. Li,, X. Zhou, K. Brandstatter, D. Zhao, K. Wang, A. Rajendran, **Z. Zhang**, and I. Raicu. ZHT: A light-weight reliable persistent dynamic scalable zero-hop distributed

hash table.
In 2013 IEEE 27th International Symposium on Parallel and Distributed Processing, pp. 775-787. IEEE, 2013.

- [HPDC'12] **Z. Zhang**, D. S. Katz, M. Wilde, J. Wozniak, I. Foster.
MTC Envelope: Defining the Capability of Large Scale Computers in the Context of Parallel Scripting Applications.
In Proceedings of the 22nd international symposium on High-performance parallel and distributed computing (HPDC), pp. 37-48. ACM, 2013.
- [SC'12] **Z. Zhang**, D. S. Katz, J. Wozniak, A. Espinosa, I. Foster.
Design and Analysis of Data Management in Scalable Parallel Scripting.
In Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis (Supercomputing), p. 85. IEEE Computer Society Press, 2012.
- [SC'08] I. Raicu, **Z. Zhang**, M. Wilde, I. Foster, P. Beckman, K. Iskra, B. Clifford.
Toward Loosely Coupled Programming on Petascale Systems.
In Proceedings of the 2008 ACM/IEEE conference on Supercomputing, p. 22. IEEE Press, 2008.

JOURNAL PUBLICATIONS

- [Nature Methods'21] Fang, Linjing, Fred Monroe, ..., **Z. Zhang**, et al.
Deep learning-based point-scanning super-resolution imaging.
In Nature Methods (2021): 1-11.
- [TPDS'19] Y. You, **Z. Zhang**, J. Demmel, K. Keutzer, C. Hsieh.
Fast Deep Neural Network Training on Distributed Systems and Cloud TPUs
IEEE Transactions on Parallel and Distributed Systems 30, no. 11 (2019): 2449-2462.
- [TBD'16] **Z. Zhang**, K. Barbary, F. A. Nothaft, E. Sparks, O. Zahn, M. J. Franklin, D. A. Patterson, S. Perlmutter.
Kira: Processing Astronomy Imagery Using Big Data Technology.
IEEE Transactions on Big Data, Volume: 3. 2016
- [CCPE'16] T. Li, X. Zhou, K. Wang, D. Zhao, I. Sadooghi, **Z. Zhang**, and I. Raicu.
A convergence of key-value storage systems from clouds to supercomputers.
Concurrency and Computation: Practice & Experience 28, no. 1 (2016): 44-69.
- [FGCS'15] D. S. Katz, A. Merzky, **Z. Zhang**, S. Jha.
Application Skeletons: Construction and Use in eScience.
In Press, Future Generation Computer Systems (FGCS), 2015.
- [CLUSTER'10] I. Raicu, I. Foster, M. Wilde, **Z. Zhang**, K. Iskra, P. Beckman, Y. Zhao et al.
Middleware support for many-task computing.
Cluster Computing 13, no. 3 (2010): 291-314.
- [COMPUTER'09] M. Wilde, I. Foster, K; Iskra, P. Beckman, **Z. Zhang**, A. Espinosa, M. Hategan, B. Clifford, and I. Raicu.
Parallel scripting for applications at the petascale and beyond.
Computer 42, no. 11 (2009): 50-60.

ACADEMIC TALKS

- Efficient and Scalable Deep Learning on Supercomputers, EECS Seminar, UC Merced, September 2020, Zoom
- Enabling Scalable and Efficient Deep Learning on Supercomputers, Guest Lecture, UChiacgo, Nov 2018, Chicago, IL

- Enabling Scalable and Efficient Deep Learning on Supercomputers, Argonne National Laboratory, Nov 2018, Lemont, IL
- Scientific Computing Meets Big Data Technology: An Astronomy Use Case, Big Data, October 2015, San Jose, CA
- Flexible Astronomy Image Processing in Clouds, SLAC National Accelerator Lab- oratory, Stanford University, July 2015, Palo Alto, CA
- Kira: Flexible Astronomy Image Processing in Clouds, AMP Retreat, May 2015, Santa Cruz, CA
- Parallelizing the Execution of Sequential Scripts, SC13, November 2013, Denver, CO
- Enabling Parallel Scripting on Large Scale Computers, AMPLab, UC Berkeley, August 2013, Berkeley, CA
- MTC Envelope: Defining the Capability of Large Scale Computers in the Context of Parallel Scripting Applications, HPDC13, June 2013, New York, NY
- Parallel Programming on Clouds, Grids, and Supercomputers, Center for Earth System Science, Tsinghua University, December 2012, Beijing, China
- Design and Analysis of Data Management in Scalable Parallel Scripting, SC12, November 2012, Salt Lake City, UT

PROFESSIONAL SERVICE

- **Technical Program Committee Member**, Machine Learning and HPC Track, SC'20, SC'21.
- **Co-chair**, Deep Learning on Supercomputers Workshop Series, SC and ISC, 2018-2021.
- **Review Committee**, Learning and AI Panel for INCITE, DOE, 2020, 2021.
- **Technical Program Committee Member**, International Symposium on Big Data Computing, 2014
- **Guest Co-editor**, Future Generation Computer Systems Special Issue on eScience Applications and Infrastructure, 2014.
- **Organizer**, Weekly System Research Seminar, UChicago Systems Group, 2010-2014.
- **Publicity Chair**, 5th Workshop on Many-Task Computing on Grids and Supercomputers (MTAGS) 2012, November 2012, Salt Lake City, UT.
- **Proceedings Chair**, IEEE International Conference on eScience, October 2012, Chicago, IL.
- **Organizer**, 1st Greater Chicago Area System Research Workshop, May 2012, Chicago, IL.

TUTORIALS

- Tools and Best Practices for Distributed Deep Learning on Supercomputer, Tutorial, SC'18, SC'19, SC'20, SC'21
- Distributed Deep Learning, Tutorial, TACC Machine Learning Institute, 2018, 2019, 2020
- Introduction to ML/DL and its Applications in Natural Hazard, DesignSafe Bootcamp, 2020
- ML4GEO training for Petrobras, 2018
- Spark Internals, TACC Machine Learning Institute, 2017

STUDENTS

- Qi Huang, 09/20-present, M.S. Student in CS at UT Austin
- Ishank Arora, 09/20-present, B.S. Student in CS at UT Austin
- J. Gregory Pauloski, 05/19-08/20, now a Ph.D Student in CS at UChicago

REFERENCE

- **Niall Gaffney**
  Director of Data Intensive Computing, Texas Advanced Computing Center
  Email: ngaffney@tacc.utexas.edu

- **Michael J. Frankin**
  Chair, Department of Computer Science, UChicago
  Email: mjfranklin@cs.uchicago.edu

- **Saul Perlmutter**
  Director, Berkeley Institute for Data Science, UC Berkeley
  Franklin W. and Karen Weber Dabby Professor of Physics, UC Berkeley
  Email: saul@lbl.gov

- **Ian T. Foster**
  Director, Computation Institute, UChicago & ANL
  Arthur Holly Compton Distinguished Service Professor of Computer Science, UChicago
  Email: foster@anl.gov

- **Daniel S. Katz**
  Assistant Director, Scientific Software and Applications, National Center for Supercomputing Applications (NCSA)
  Email: d.katz@ieee.org