

Jee Whan Choi

Curriculum Vitae

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📍 Computer & Information Science, University of Oregon, Eugene OR, USA.
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Research Interest

My research interest lies in high-performance computing (HPC), with emphasis on predicting the behavior of complex software-hardware interactions. I have developed and optimized numerous scientific kernels on the latest CPUs and accelerators, and modeled their performance and energy efficiency. I am currently studying multi-dimensional tensor decomposition algorithms as means of informed learning and Big Data analytics, as well as developing and optimizing large-scale implementations on the latest supercomputers.

Education

- May 2015 **Ph.D.** Electrical & Computer Engineering Georgia Institute of Technology
THESIS - *Power and Performance Modeling for High-Performance Computing Algorithms*
- May 2004 **M.S.** Electrical & Computer Engineering Georgia Institute of Technology
THESIS - *Reducing Communication Through Buffers on a SIMD Architecture*
- May 2000 **B.Sc.** Electrical & Computer Engineering Georgia Institute of Technology
Highest Honors

Employment History

- Dec. 2018 – **Assistant Professor**
Current Computer & Information Science, *University of Oregon*
- Nov. 2017 – **Research Staff Member**
Dec. 2018 IBM T. J. Watson Research Center, *IBM Research*
- May 2015 – **Postdoctoral Researcher**
Nov. 2017 IBM T. J. Watson Research Center, *IBM Research*
- Aug. 2006 – **Graduate Research/Teaching Assistant**
May 2015 Computational Science & Engineering, *Georgia Institute of Technology*
- May – **Graduate Intern**
Dec. 2010 Parallel Computing Lab, *Intel*
- Aug. 2004 – **Researcher**
Aug. 2006 Network Research Center, Samsung Electronics
- Aug. 2000 – **Graduate Teaching Assistant**
May 2004 Electrical and Computer Engineering, *Georgia Institute of Technology*

Publications

Google Scholar <https://scholar.google.com/citations?user=yCA985IAAAAJ&hl=en>
Citations 1293
H-index 14

Papers in refereed conference proceedings

1. Helal, AE, J Laukemann, F Checonni, JJ Tithi, T Ranadive, F Petrini, and JW Choi (June 2021). ALTO: Adaptive Linearized Storage of Sparse Tensors. In: *The 35th ACM International Conference on Supercomputing (ICS'21)*.
2. Soh, Y, P Flick, X Liu, S Smith, F Checonni, F Petrini, and JW Choi (May 2021). High Performance Streaming Tensor Decomposition. In: *The 35th IEEE International Parallel and Distributed Processing Symposium (IPDPS'21)*.
3. Chakaravarthy, VT, JW Choi, DJ Joseph, P Murali, Y Sabharwal, S Shivmaran, and D Sreedhar (June 2018). On Optimizing Distributed Tucker Decomposition for Sparse Tensors. In: *The 32nd ACM International Conference on Supercomputing (ICS'18)*.
4. Choi, JW, X Liu, and VT Chakaravarthy (Nov. 2018). High-performance Dense Tucker Decomposition on GPU Clusters. In: *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'18)*.
5. Choi, JW, X Liu, S Smith, and T Simon (May 2018). Blocking Optimization Techniques for Sparse Tensor Computation. In: *The 32nd IEEE International Parallel and Distributed Processing Symposium (IPDPS'18)*.
6. Buono, D, F Artico, F Checonni, JW Choi, X Que, and L Schneidenbach (May 2017). Data Analytics with NVLink: An SpMV Case Study. In: *14th ACM International Conference on Computing Frontiers (CF'17)*.
7. Chakaravarthy, VT, JW Choi, DJ Joseph, X Liu, P Murali, Y Sabharwal, and D Sreedhar (May 2017). On Optimizing Distributed Tucker Decomposition for Dense Tensors. In: *The 31st IEEE International Parallel and Distributed Processing Symposium (IPDPS'17)*.
8. Li, J, JW Choi, I Perros, J Sun, and R Vuduc (May 2017). Model-Driven Sparse CP Decomposition for Higher-Order Tensors. In: *The 31st IEEE International Parallel and Distributed Processing Symposium (IPDPS'17)*.
9. Liu, X, D Buono, F Checonni, JW Choi, X Que, F Petrini, JA Gunnels, and JA Stuecheli (May 2016). An Early Performance Study of Large-Scale POWER8 SMP Systems. In: *The 30th IEEE International Parallel and Distributed Processing Symposium (IPDPS'16)*.
10. Choi, JW, M Dukhan, X Liu, and R Vuduc (May 2014). Algorithmic Time, Energy, and Power on Candidate HPC Compute Building Blocks. In: *The 28th IEEE International Parallel and Distributed Processing Symposium (IPDPS'14)*.
11. Choi, JW, D Bedard, R Fowler, and R Vuduc (May 2013). A Roofline Model of Energy. In: *The 27th IEEE International Symposium on Parallel and Distributed Processing (IPDPS'13)*.
12. Chandramowliswaran, A, JW Choi, K Madduri, and R Vuduc (June 2012). Brief Announcement: Towards a Communication Optimal Fast Multipole Method and Its Implications at Exascale. In: *The 24th Annual ACM Symposium on Parallelism in Algorithms and Architectures (SPAA'12)*.
13. Smelyanskiy, M, K Vaidyanathan, JW Choi, B Joó, J Chhugani, MA Clark, and P Dubey (Nov. 2011). High-performance lattice QCD for multi-core based parallel systems using a cache-friendly hybrid threaded-MPI approach. In: *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'11)*.
14. Choi, JW, A Singh, and RW Vuduc (Jan. 2010). Model-driven autotuning of sparse matrix-vector multiply on GPUs. In: *The 15th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP'10)*.
15. Vuduc, R, A Chandramowliswaran, JW Choi, M Guney, and A Shringarpure (June 2010). On the limits of GPU acceleration. In: *The 2nd USENIX conference on Hot topics in parallelism (HotPar'10)*.
16. Choi, J, S Apewokin, B Valentine, DS Wills, and L Wills (Jan. 2008). Edge noise removal in multimodal background modeling techniques. In: *Electronic Imaging*.
17. Valentine, B, JW Choi, S Apewokin, L Wills, and S Wills (Sept. 2008). Bypassing BigBackground: An efficient hybrid background modeling algorithm for embedded video surveillance. In: *The 2nd ACM/IEEE International Conference on Distributed Smart Cameras (ICDSC'08)*.

Papers in refereed workshop proceedings

1. Choi, JW and RW Vuduc (May 2016). Analyzing the Energy Efficiency of the Fast Multipole Method Using a DVFS-Aware Energy Model. In: *The 30th IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW'16)*.
2. Choi, JW, A Chandramowliswaran, K Madduri, and R Vuduc (Mar. 2014). A CPU: GPU Hybrid Implementation and Model-Driven Scheduling of the Fast Multipole Method. In: *The 7th Workshop on General Purpose Processing Using GPUs (GPGPU'14)*.
3. Choi, JW and RW Vuduc (May 2012). Modeling and Analysis for Performance and Power. In: *The 26th IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW'12)*.
4. Vuduc, RW, K Czechowski, A Chandramowliswaran, and JW Choi (May 2012). Courses in High-performance Computing for Scientists and Engineers. In: *The 26th IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW'12)*.

Papers in refereed journals

1. Apewokin, S, B Valentine, JW Choi, L Wills, and S Wills (Jan. 2011). Real-Time Adaptive Background Modeling for Multicore Embedded Systems. *Journal of Signal Processing Systems* **62** (1), 65–76.

Ph.D. & M.S. thesis

1. Choi, JW (May 2015). “Power and performance modeling for high-performance computing algorithms”. PhD thesis. Georgia Institute of Technology.
2. Choi, JW (May 2004). “Reducing Communication Through Buffers on a SIMD Architecture”. MA thesis. Georgia Institute of Technology.

Articles

1. Choi, JW and RW Vuduc (Mar. 2013). How Much (Execution) Time and Energy Does My Algorithm Cost? *XRDS* **19**(3), 49–51.

Books & book chapters

1. Vuduc, R and JW Choi (Nov. 2013). “A Brief History and Introduction to GPGPU”. In: *Modern Accelerator Technologies for Geographic Information Science*. Ed. by X Shi, V Kindratenko, and C Yang. Boston, MA: Springer US, pp. 9–23.
2. Kim, H, R Vuduc, S Baghsorkhi, and JW Choi (Nov. 2012). *Performance Analysis and Tuning for General Purpose Graphics Processing Units (GPGPU)*.
3. Williams, SW, N Bell, JW Choi, M Garland, L Oliker, and R Vuduc (Dec. 2010). “Sparse Matrix-Vector Multiplication on Multicore and Accelerators”. In: *Scientific Computing with Multicore and Accelerators*. Boca Raton, FL: CRC Press, pp. 1–27.

Posters in peer reviewed venues

1. Tsai, YM, JW Choi, X Liu, and W Wang (Nov. 2017). Accelerating the Higher Order Singular Value Decomposition Algorithm for Big Data with GPUs. In: *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'17)*.
2. Choi, JW and R Vuduc (Feb. 2014). What Can the Roofline Model of Energy Tell Us About How to Build the Next Supercomputer? In: *SIAM Conference on Parallel Processing for Scientific Computing (SIAM PP'14)*.
3. Choi, JW and R Vuduc (Nov. 2013). Power and Performance Modeling for High Performance Computing Algorithms. In: *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'17)*.
4. Choi, JW and R Vuduc (May 2012). Modeling and Analysis for Performance and Power. In: *The 26th IEEE International Symposium on Parallel and Distributed Processing (IPDPS'12)*.
5. Choi, JW and R Vuduc (Jan. 2010). Model-driven Autotuning of Sparse Matrix-Vector Multiply on GPUs. In: *The 15th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP'10)*.

Grants

I have acquired approximately \$327.5K in external research grants since 2019.

| Source | Status | Project Period | Title | Amount |
|--------|---------|-------------------|---|------------|
| NSF | Pending | | Extreme-scale Sparse Data Analytics | \$ 75,000 |
| NSF | Pending | | Convergence Institute for Research in Quantum Integrated Technologies (CIRQuIT) | \$ 496,600 |
| Intel | Funded | 11/2020 – 11/2021 | Optimizing Streaming Tensor Decomposition | \$ 157,500 |
| DoE | Funded | 08/2020 – 07/2021 | Analysis of High Performance Portable Tensor Decomposition Implementations | \$ 81,500 |
| Intel | Funded | 01/2020 – 07/2020 | Optimizing Streaming Tensor Decomposition | \$ 88,500 |

Teaching

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|-------------|--------|-------------|---|
| 2021 | Fall | CIS 431/531 | <i>Introduction to Parallel Computing</i> |
| | Spring | CIS 330 | <i>C/C++ and Unix</i> |
| | Winter | CIS 330 | <i>C/C++ and Unix</i> |
| | | CIS 607 | <i>High-Performance Tensor Decomposition and Data Analytics</i> |
| 2020 | Fall | CIS 631 | <i>Parallel Processing</i> |
| | Spring | CIS 330 | <i>C/C++ and Unix</i> |
| | | CIS 607 | <i>High-Performance Tensor Decomposition and Data Analytics</i> |
| | Winter | CIS330 | <i>C/C++ and Unix</i> |
| 2019 | Fall | CIS 631 | <i>Parallel Processing</i> |
| | Spring | CIS 330 | <i>C/C++ and Unix</i> |

Services

Departmental Committees

I have served on the following departmental committees.

- **Diversity** (Fall 2020 – Current)
- **Programming Competitions** (Fall 2020 – Current)
- **Graduate Education** (Winter 2019 – Spring 2020)
- **Computing Resources** (Winter 2019 – Spring 2020)

Student Advising & Committees

I have advised and served on the committees for the following students at the University of Oregon.

- **Yongseok Soh** (09/2019 – Current) *Ph.D. Advisor*
- **Isaac Geronimo Anderson** (09/2019 – Current) *Ph.D. Advisor*
- **Andy Nguyen** (06/2020 – Current) Undergraduate Research Advisor
- **Alexandre Chern** (02/2021 – Current) Dissertation Committee
- **Kewen Meng** (02/2020 – 06/2021) Dissertation Committee
- **Abhishek Yenpure** (04/2019 – Current) Directed Research Project & Area Exam Committee

Academic Services

Technical program committee for conferences

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|-------------|--|
| 2021 | <ul style="list-style-type: none"> ● 28th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC'21) Dec. 2021 ● The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'21) Nov. 2021 ● The 35th IEEE International Parallel and Distributed Processing Symposium (IPDPS'21) May 2021 |
| 2020 | <ul style="list-style-type: none"> ● 28th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC'20) Dec. 2020 ● The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'20) Nov. 2020 |
| 2018 | <ul style="list-style-type: none"> ● The 47th International Conference on Parallel Processing (ICPP'18) Aug. 2018 ● The 11th International Conference on Contemporary Computing (IC3'18) Aug. 2018 ● The 32nd IEEE International Parallel and Distributed Processing Symposium (IPDPS'18) May 2018 |
| 2017 | <ul style="list-style-type: none"> ● The 47th International Conference on Parallel Processing (ICPP'18) Aug. 2018 ● The 10th International Conference on Contemporary Computing (IC3'17) Aug. 2017 |
| 2016 | <ul style="list-style-type: none"> ● 23rd IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC'16) Dec. 2016 |
| 2014 | <ul style="list-style-type: none"> ● The 7th International Conference on Contemporary Computing (IC3'14) Aug. 2014 |

Technical program committee for workshops

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|-------------|--|
| 2021 | <ul style="list-style-type: none"> ● International Workshop on Parallel Programming Models in High-Performance Cloud (ParaMo'21) Aug. 2021 |
| 2020 | <ul style="list-style-type: none"> ● Special Session: Auto-Tuning for Multicore and GPU (ATMG'20) Dec. 2020 ● International Workshop on Parallel Programming Models in High-Performance Cloud (ParaMo'20) Aug. 2020 |
| 2019 | <ul style="list-style-type: none"> ● Special Session: Auto-Tuning for Multicore and GPU (ATMG'19) Dec. 2019 ● International Workshop on Parallel Programming Models in High-Performance Cloud (ParaMo'19) Aug. 2019 ● The First International Workshop on the Intersection of High Performance Computing and Machine Learning (HPCaML'19) Feb. 2019 |
| 2017 | <ul style="list-style-type: none"> ● The 13th Workshop on High-Performance, Power-Aware Computing (HP-PAC'17) May 2017 |
| 2015 | <ul style="list-style-type: none"> ● The 3rd International Workshop on Energy Efficient Supercomputing (E2SC'15) May 2015 |

Organizing Committee

I have organized the following meetings.

- Minisymposium @ SIAM Conference on Computational Science and Engineering (2021, 2019)
- Minisymposium @ SIAM Conference on Parallel Processing for Scientific Computing (2020, 2018)
- Workshop on Power and Energy Aspect of Computation (2015)

Journal Review

I am a regular reviewer for the following journals.

- ACM Computing Surveys (2021, 2017, 2016)
- ACM Transactions on Parallel Computing (2019)
- Concurrency and Computation: Practice and Experience (2020, 2018, 2017)
- IEEE Transaction on Computers (2015)
- IEEE Transaction on Parallel and Distributed Systems (2021 – 2017, 2015)
- IET Computers & Digital Techniques (2016, 2015)
- International Journal of High Performance Computing Applications (2019, 2017, 2016)
- Journal of Parallel and Distributed Computing (2018, 2014)
- Knowledge and Information Systems (2019, 2018)
- Scientific Programming (2017)
- SIAM Journal on Scientific Computing (2015)
- Transaction on Mathematical Software (2021, 2017)
- Transactions on Architecture and Code Optimization (2020 – 2018, 2016, 2015)

Miscellaneous Activities

I have also been a reviewer for many conferences and workshops, most notably *IEEE Micro*, *ICPP*, *IPDPS*, and *SC*.

Invited Talks

- *Tensor Decomposition for Topic Modeling in AI*, Communicating AI: Theory, Research, and Practice, Los Angeles, CA, Feb. 2020.
- *Malware Analysis Using Tensor Decomposition*, Workshop on AI and Tensor Factorization for Physical, Chemical, and Biological Systems, Santa Fe, NM, Sep. 2019.
- *Optimizing Tensor Decomposition on HPC Systems - Challenges and Approaches*, Workshop on High-Level Parallel Programming Models and Supportive Environments, Rio de Janeiro, Brazil, May 2019.
- *Blocking Optimizations for Sparse MTTKRP*, Invited Workshop on Compiler Techniques for Sparse Tensor Algebra, Cambridge, MA, Jan. 2019.

Mentoring Experience

I was a mentor to *nine* undergraduate and M.S. students before joining the University of Oregon, including many from underrepresented minority groups. Most notably, I mentored *Jiajia Li* during her summer internship at IBM Research, which led to her receiving the prestigious IBM Fellowship. Jiajia went on to become a tenure-track faculty at the College of William and Mary in 2021.

Professional Memberships

I am a member of the following organizations.

- Association of Computing Machinery (ACM)
- Institute of Electrical and Electronics Engineers (IEEE)
- Society for Industrial and Applied Mathematics (SIAM)