Vivek Bharadwaj

Graduate Student Researcher, UC Berkeley
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EDUCATION

University of California, Berkeley 2020 — 2025 (expected)
PhD in Computer Science
Advisers: James Demmel and Aydın Buluç
Focus: Geometric Deep Learning, Sparse Tensors, Graph Problems
Funding: DOE National Computational Science Graduate Fellowship

California Institute of Technology (Caltech) 2016 — 2020
BS, Computer Science and Mathematics Cumulative GPA: 3.9/4.3

RESEARCH INTERESTS AND SKILLS

Interests	Graph Neural Networks, GPU Kernel Engineering, Randomized Algorithms, Sparsity in Machine Learning, Tensor Decomposition
Languages	C, C++, Python, Java, OCaml
Parallel Computing	MPI, CUDA, OpenMP
Libraries / Frameworks	Pybind11, Pytorch

PUBLICATIONS

Preprints

- **V. Bharadwaj***, A. Glover*, A. Buluç, J. Demmel. An Efficient Sparse Kernel Generator for O(3)-Equivariant Deep Networks. *Preprint*, January 2025.

Conference Papers

- B. Rakhshan*, **V. Bharadwaj***, O. A. Malik, G. Rabusseau. Efficient Leverage Score Sampling for Tensor Train Decomposition. *Neural Information Processing Systems (NeurIPS) Main Conference*, December 2024.
- **V. Bharadwaj**, O. A. Malik, R. Murray, A. Buluç, J. Demmel. Distributed-Memory Randomized Algorithms for Sparse Tensor CP Decomposition. *ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, June 2024.
- **V. Bharadwaj**, O. A. Malik, R. Murray, L. Grigori, A. Buluç, J. Demmel. Fast Exact Leverage Score Sampling from Khatri-Rao Products with Applications to Tensor Decomposition. *Neural Information Processing Systems (NeurIPS) Main Conference*, December 2023.
- **V. Bharadwaj**, A. Buluç, J. Demmel. Distributed-Memory Sparse Kernels for Machine Learning. *IEEE International Parallel and Distributed Processing Symposium (IPDPS)*, June 2022.

Journal Papers

- P. Ramesh, S.J. Hwang, H.C. Davis, A. Lee-Gosselin, **V. Bharadwaj**, M. A. English, J. Sheng, V. Iyer, M. G. Shapiro. Ultraparamagnetic Cells Formed Through Intracellular Oxidation and Chelation of Paramagnetic Iron. *Angewandte Chemie (International ed. in English)*, September 2018.

* denotes equal contribution.

EXPERIENCE

NVIDIA Math Libraries Team Summer 2024
Sparse Linear Algebra Intern

- Focus: Rewrote large parts of cuSPARSELt, a library for structured sparse-dense matrix multiplication in machine learning, for new Blackwell generation GPUs.
- Also investigated custom semiring support with JIT linking for sparse matrix-vector multiplication.

Lawrence Berkeley National Laboratory Summers 2023, 2021, 2020
Graduate Student Researcher

- Focus: High Performance Algorithms for Randomized Sparse Problems
- Research was a blend of theoretical and applied work, ranging from development of new randomized algorithms to optimizing software kernels to achieve high performance.

National Renewable Energy Laboratory Summer 2022
Visiting Graduate Student Researcher

- Focus: Krylov subspace methods for ill-conditioned linear systems
- Wrote CUDA kernels for randomized butterfly transformations and incomplete LDL preconditioners.

Jane Street Capital Summer 2019
Software Engineering Intern

- Wrote protocols to relay market data from exchanges to traders.
- Made improvements to Iron, an in-house fork of the Mercurial version control system.

Anandkumar Lab, Caltech Summer 2018
Summer Undergraduate Research Fellowship (SURF) Intern

- Focus: tensor decompositions and Gaussian process modeling, mentored by Rose Yu (now UCSD).

Shapiro Lab, Caltech Summer 2017
Summer Undergraduate Research Fellowship (SURF) Intern

- Focus: GPU-based MRI simulations of diffusing water molecule spins.
- Work published in a journal of the German Chemical Society (code on Github).

SELECTED TALKS

SIAM Conference on Applied Linear Algebra (LA24) May 13 2024, Paris, France
Leverage-Based Sampling at Scale for Sparse Tensor CP Decomposition

SIAM Conference on Parallel Processing (PP24) Mar. 5 2024, Baltimore MD
Distributed and Randomized Sparse Tensor Decomposition

Workshop on Sparse Tensor Computations Oct. 18, 2023, Chicago IL
Faster Algorithms for ALS CP and Tensor Train Fitting

SIAM Computational Science and Engineering (CSE23) Mar. 1, 2023, Amsterdam, Netherlands
New Leverage-Based Sampling Algorithms for Canonical Tensor Decomposition

AWARDS

Berkeley Teaching Effectiveness Award 2024
Awarded to fifteen selected graduate TAs who identified and fixed a particular teaching problem.

Berkeley Outstanding Graduate Student Instructor 2022
Awarded for teaching work in CS267 (Parallel Computing).

Department of Energy Computational Science Graduate Fellowship 2021
Awarded to 32 selected graduate students nationwide. Fellowship covers full PhD tuition and stipend for four years.

Honorable Mention, National Science Foundation GRFP 2020

Caltech Thomas A. Tisch Prize for Undergraduate Teaching 2020
Awarded for three years of teaching work in Caltech CS38 (Algorithms).

Best Educational Hack, Hacktech 2019
Awarded for *Presentr*, a prototype of a blackboard image-to-text decoder.

Ph11 Scholar 2017
Funded summer research position awarded for solving "hurdle" problems at Caltech.

National Merit Scholar 2016

TEACHING

SLMATH 1064: Mathematics of Big Data and Sketching Summer 2023
TA for a two-week graduate summer program held by the Simons Laufer Mathematical Institute at IBM Research, Almaden.

CS267: Applications of Parallel Computers Spring 2022
TA, Berkeley graduate course on parallelism and high-performance computing.

CS38 / 138: Algorithms Spring 2020, 2019, 2018
TA, Caltech undergraduate / graduate proof-based algorithms class.

CS21: Decidability and Tractability Winter 2018
TA, Caltech undergraduate complexity theory class.

PROFESSIONAL SERVICE

Peer Review for Journals / Conferences

- Neural Information Processing Systems (NeurIPS) 2024
- Supercomputing (SC) Artifact Evaluation 2024
- Numerical Linear Algebra with Applications, Wiley 2023
- IEEE Signal Processing Letters 2021

Reviewer, Berkeley SURF Research Applications March 2022

Caltech Board of Control 2019-2020
Served on the student panel adjudicating cases of academic dishonesty.

Student Chair, Caltech CS Student-Faculty Conference 2018

SELECTED COURSEWORK

Graduate Courses

- CS281A: Statistical Learning Theory
- CS262A: Advanced Topics in Computer Systems
- CS270: Combinatorial Algorithms and Data Structures
- ELENG C227C: Convex Optimization and Approximation

Undergraduate Courses

- Ma109ABC: Introduction to Geometry and Topology
- EE126A: Information Theory
- MA140: Probability
- CS150: Probability and Algorithms
- CS151: Complexity Theory

VOLUNTEERING

Middle / High School Competition Judge

- Alameda County Science Fair 2023, 2022
- USA Young Physicists' Tournament 2021
- Blair Middle School Science Fair 2020

CRS Science Ambassador Oct-Dec 2021
Presented science talks virtually for students at Washington Elementary, Richmond.

Virtual Be a Scientist Mentor Jan-Mar, 2021
Coached Berkeley students through science projects weekly.

Caltech RISE Tutor Jan-April, 2020
Volunteer tutor for high school students in need of assistance from Pasadena Unified School District.