

# Vivek Bharadwaj

Graduate Student Researcher, UC Berkeley

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## EDUCATION

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### University of California, Berkeley

2020 — 2025 (expected)

PhD in Computer Science

Advisers: James Demmel and Aydın Buluç

Focus: Exploiting Sparsity and Randomness to Accelerate Linear Algebra at Scale

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

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### Interests

Numerical Linear Algebra, Tensor Problems, Parallel Computing, Randomized Methods, Sparsity in Machine Learning

### Languages

C, C++, Python, Java, OCaml

### Parallel Computing

OpenMP, MPI, CUDA

### Libraries / Frameworks

Pybind11, Pytorch

## PUBLICATIONS

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### Conference Papers

- B. Rakhshan\*, **V. Bharadwaj\***, O. A. Malik, G. Rabusseau. Efficient Leverage Score Sampling for Tensor Train Decomposition. *To appear in 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

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### 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**

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**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**

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**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**

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**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**

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**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**

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**Graduate Courses**

- CS281A: Statistical Learning Theory
- CS262A: Advanced Topics in Computer Systems
- CS270: Combinatorial Algorithms and Data Structures
- ELEN 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**

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**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.