

Kedar Karhadkar

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Education

Ph.D. Mathematics, *University of California, Los Angeles* 08/2021 – present | Los Angeles, CA

- Research interests: machine learning theory, graph neural networks.
- GPA: 3.95.
- Passed all qualifying exams (Analysis, Algebra, Basic) upon entry.
- Selected coursework: Machine Learning, Optimization, Numerical Linear Algebra, High-dimensional Statistics.

B.S. Mathematics, *Pennsylvania State University* 08/2017 – 05/2021 | University Park, PA

- GPA: 3.93.
- Selected coursework: Data Structures and Algorithms, Probability, Mathematical Statistics, Real/Complex/Functional Analysis (Graduate), Abstract Algebra (Graduate), Algebraic Geometry (Graduate).

Skills

- Languages: Python, C++, Java.
- Tools: Numpy, Pandas, Matplotlib, PyTorch, Scikit-learn, Numba, Git.

Experience

Quantitative Research Intern, 06/2024 – 08/2024

Susquehanna International Group (SIG)

- Learned about machine learning techniques and options theory, and applied them to find signals and develop automated trading strategies.

Visiting Researcher, 06/2023 – 09/2023

Max Planck Institute for Mathematics in the Sciences

- Conducted research on optimization landscapes and graph neural networks and presented results to other researchers.

Graduate Student Researcher, *UCLA* 08/2021 – present

- Conducted research on graph neural networks and deep learning theory accepted to major conferences.
- Designed architectures for graph neural networks (GNNs) to prevent bottlenecks, increasing accuracy on graph classification tasks by up to 20% while achieving a 10x speedup over existing state-of-the-art rewiring algorithms. Implemented all methods in PyTorch.
- Served as a reviewer for NeurIPS, ICML, ICLR, TMLR, TPAMI, Discrete Applied Mathematics.

Teaching Assistant, *UCLA* 08/2021 – present

- Served as a teaching assistant for several undergraduate math classes, including Machine Learning, Stochastic Processes, Discrete Math, and Calculus.

Undergraduate Researcher, *University of Minnesota REU* 06/2020 – 08/2020

- Determined and proved necessary algebraic conditions for the Yang-Baxter equation to hold in a more general setting than previously known.
- Found new combinatorial interpretations of the six-vertex and eight-vertex models from statistical mechanics in terms of discrete differential forms and graph coloring.

Undergraduate Researcher, *Moravian University REU*

- Conducted research on graph theory, number theory, and combinatorics, leading to two publications in Discrete Applied Mathematics.

Publications

Asterisk (*) indicates alphabetical order.

- 1) *Bounds for the smallest eigenvalue of the NTK for arbitrary spherical data of arbitrary dimension*
Kedar Karhadkar, Michael Murray, and Guido Montúfar. Preprint: arxiv:2405.14630 [↗](#) . Accepted to NeurIPS 2024.
- 2) *Benign overfitting in leaky ReLU networks with moderate input dimension*
Kedar Karhadkar, Erin George, Michael Murray, Guido Montúfar, and Deanna Needell. Preprint: arXiv:2403.06903 [↗](#) . Accepted to NeurIPS 2024 (Spotlight).
- 3) *Mildly Overparameterized ReLU Networks Have a Favorable Loss Landscape*
Kedar Karhadkar, Michael Murray, Hanna Tseran, and Guido Montúfar. Transactions on Machine Learning Research (2023). Preprint: arXiv:2305.19510 [↗](#) .
- 4) *FoSR: First-order spectral rewiring for addressing oversquashing in GNNs*
Kedar Karhadkar, Pradeep Kr. Banerjee, and Guido Montúfar. ICLR 2023. Preprint: arXiv:2210.11790 [↗](#) .
- 5) *Oversquashing in GNNs through the lens of information contraction and graph expansion*
Pradeep Kr. Banerjee, **Kedar Karhadkar**, Yu Guang Wang, Uri Alon, and Guido Montúfar. 58th Annual Allerton Conference on Communication, Control and Computing (2022). Preprint: arXiv:2208.03471 [↗](#) .
- 6) *Sum index and difference index of graphs*
* Joshua Harrington, Eugene Henninger-Voss, **Kedar Karhadkar**, Emily Robinson, Tony W.H. Wong. Discrete Applied Mathematics (2023). Preprint: arXiv:2008.09265 [↗](#) .
- 7) *Two dependent probabilistic chip-collecting games*
* Joshua Harrington, **Kedar Karhadkar**, Madeline Kohutka, Tessa Stevens, and Tony W.H. Wong. Discrete Applied Mathematics (2021).
- 8) *Parity of the partition function $p(n, k)$*
Kedar Karhadkar. International Journal of Number Theory (2019). Preprint: arXiv:1809.07459 [↗](#) .
- 9) *Lattice models, differential forms, and the Yang-Baxter equation*
Kedar Karhadkar. Preprint: arXiv:2207.13282 [↗](#) .

Awards

- Putnam Mathematics Competition, Top 500
- Leonhard Euler Memorial Scholarship
 - Awarded by Penn State math department based on academic performance.
- Provost's Award
 - Four-year scholarship awarded by Penn State to incoming freshmen based on academic performance.