

ADITYANARAYANAN (ADIT) RADHAKRISHNAN

APPOINTMENTS

Broad Institute of MIT and Harvard Cambridge, MA, USA.

- Eric and Wendy Schmidt Center Postdoctoral Fellow June 2024

Harvard University Cambridge, MA, USA.

- Associate in Applied Mathematics August 2024
- George F. Carrier Postdoctoral Fellow, School of Engineering and Applied Sciences September 2023

EDUCATION

Massachusetts Institute of Technology Cambridge, MA, USA.

- Ph.D. Candidate, Electrical Engineering and Computer Science June 2023
Thesis: Foundations of Machine Learning: Over-parameterization and Feature Learning
Thesis Advisor: Caroline Uhler
- M.Eng., Electrical Engineering and Computer Science June 2017
Thesis: Theory and application of neural and graphical models in early cancer diagnostics
Thesis Advisor: Caroline Uhler
- B.S. in Mathematics and Electrical Engineering and Computer Science June 2016
Thesis: Combinatorial Analysis of Markov Equivalence Classes
Thesis Advisor: Caroline Uhler

RESEARCH INTERESTS

Machine Learning: Feature learning, kernels, representation learning, infinite-width neural networks;
Computational Biology: Genomics, multi-modal data integration, genetic discovery.

SELECTED PUBLICATIONS

1. **A. Radhakrishnan***, D. Beaglehole*, P. Pandit, and M. Belkin. *Mechanism for feature learning in neural networks and backpropagation-free machine learning models*. *Science* (2024). Available at [Science](#).
2. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Wide and deep neural networks achieve optimality for classification*. *Proceedings of the National Academy of Science* 120, Article 14 (2023). Available at [PNAS](#).
3. **A. Radhakrishnan**, G. Stefanakis, M. Belkin, C. Uhler. *Simple, fast, and flexible framework for matrix completion with infinite width neural networks*. *Proceedings of the National Academy of Science* 119, Article 16 (2022). Available at [PNAS](#).
4. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Overparameterized neural networks implement associative memory*. *Proceedings of the National Academy of Science* 117, Article 44 (2020). Available at [PNAS](#).
5. **A. Radhakrishnan**, M. Belkin, and D. Drusvyatskiy. *Linear Recursive Feature Machines provably recover low-rank matrices*. *Proceedings of the National Academy of Science* 122, Article 13 (2025). Available at [PNAS](#).

JOURNAL PUBLICATIONS

1. **A. Radhakrishnan**, M. Belkin, and D. Drusvyatskiy. *Linear Recursive Feature Machines provably recover low-rank matrices*. Proceedings of the National Academy of Science 122, Article 13 (2025). Available at [PNAS](#).
2. **A. Radhakrishnan***, D. Beaglehole*, P. Pandit, and M. Belkin. *Mechanism for feature learning in neural networks and backpropagation-free machine learning models*. Science (2024). Available at [Science](#).
3. **A. Radhakrishnan***, S. Friedman*, S. Khurshid, K. Ng, P. Batra, S. Lubitz, A. Philippakis, C. Uhler. *A cross-modal autoencoder framework learns holistic representations of cardiovascular state*. Nature Communications 14, Article 2436 (2023). Available at [Nature Communications](#).
4. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Wide and deep neural networks achieve optimality for classification*. Proceedings of the National Academy of Science 120, Article 14 (2023). Available at [PNAS](#).
5. **A. Radhakrishnan***, M. Ruiz Luyten*, N. Prasad, and C. Uhler. *Transfer learning with kernel methods*. Accepted in Nature Communications (2023). Available at [Nature Communications](#).
6. **A. Radhakrishnan**, G. Stefanakis, M. Belkin, C. Uhler. *Simple, fast, and flexible framework for matrix completion with infinite width neural networks*. Proceedings of the National Academy of Science 119, Article 16 (2022). Available at [PNAS](#).
7. A. Belyaeva*, L. Cammarata*, **A. Radhakrishnan***, C. Squires, K. Yang, G.V. Shivashankar, C. Uhler. *Causal network models of SARS-CoV-2 expression and aging to identify candidates for drug repurposing*. Nature Communications 12, Article 1024 (2021). Available at [Nature Communications](#).
8. K. Yang, A. Belyaeva, S. Venkatachalam, K. Damodaran, **A. Radhakrishnan**, A. Katcoff, G.V. Shivashankar, C. Uhler. *Multi-domain translation between single-cell imaging and sequencing data using autoencoders*. Nature Communications 12, Article 31 (2021). Available at [Nature Communications](#).
9. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Overparameterized neural networks implement associative memory*. Proceedings of the National Academy of Science 117, Article 44 (2020). Available at [PNAS](#).
10. **A. Radhakrishnan**, L. Solus, and C. Uhler. *Counting Markov equivalence classes for DAG models on trees*. Discrete Applied Mathematics 244 (2018), pp. 170-185. Available at [Discrete Applied Mathematics](#).
11. **A. Radhakrishnan***, K. Damodaran*, A. Soylemezoglu, C. Uhler and G.V. Shivashankar. *Machine learning for nuclear mechano-morphometric biomarkers in cancer diagnosis*. Scientific Reports 7, Article 17946 (2017). Available at [Scientific Reports](#).

CONFERENCE AND WORKSHOP PUBLICATIONS

1. L. Zhu, C. Liu, **A. Radhakrishnan**, M. Belkin. *Catapults in sgd: spikes in the training loss and their impact on generalization through feature learning*. ICML (2024). Available at [arXiv:2306.04815](#).
2. L. Zhu, C. Liu, **A. Radhakrishnan**, M. Belkin. *Quadratic models for understanding neural network dynamics*. ICLR (2024). Available at [arXiv:2205.11787](#).
3. E. Nichani*, **A. Radhakrishnan***, C. Uhler. *Increasing depth leads to U-shaped test risk in over-parameterized convolutional networks*. Workshop on Over-parameterization: Pitfalls and Opportunities in ICML (2021). Available at [arXiv:2010.09610](#).
4. **A. Radhakrishnan***, E. Nichani*, D. Bernstein, C. Uhler. *On alignment in deep linear neural networks*. Workshop on Over-parameterization: Pitfalls and Opportunities in ICML (2021). Available at [arXiv:2003.06340](#).
5. **A. Radhakrishnan**, M. Belkin, C. Uhler. *Local quadratic convergence of stochastic gradient descent with adaptive step size*. Workshop on Beyond first-order methods in ML systems in ICML (2021). Available via [workshop link](#).
6. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Memorization in overparameterized autoencoders*. ICML Workshop on Identifying and Understanding Deep Learning Phenomena (2019). Available at [arXiv:1810.10333](#).

7. **A. Radhakrishnan**, C. Durham, A. Soylemezoglu, and C. Uhler. *Patchnet: Interpretable neural networks for image classification*. NeurIPS ML4H Workshop (2018). Available at [arXiv:1705.08078](https://arxiv.org/abs/1705.08078).
8. **A. Radhakrishnan**, L. Solus, and C. Uhler. *Counting Markov equivalence classes by number of immoralities*. Proceedings of the Thirty-Third Conference on Uncertainty in Artificial Intelligence (UAI) (2017). Available at [arXiv:1611.07493](https://arxiv.org/abs/1611.07493).

PREPRINTS

1. D. Paysan*, **A. Radhakrishnan***, G.V. Shivashankar, and C. Uhler. *Image2Reg: Linking chromatin images to gene regulation using genetic perturbation screens*. Under revision in Cell Systems.
2. R. J. Carlson, J.J. Patten, G. Stefanakis, B. Y. Soong, **A. Radhakrishnan**, A. Singh, N. Thakur, G. K. Amarasinghe, N. Hacohen, C. F. Basler, D. Leung, C. Uhler, R. A. Davey, P. C. Blainey. *Single-cell image-based genetic screens systematically identify regulators of Ebola virus subcellular infection dynamics*. Under revision in Nature Microbiology. Preprint available at [bioRxiv:2024.04.06.588168v1](https://bioRxiv.org/abs/2024.04.06.588168v1).
3. N. Mallinar, D. Beaglehole, L. Zhu, **A. Radhakrishnan**, P. Pandit, M. Belkin. *Emergence in non-neural models: grokking modular arithmetic via average gradient outer product*. Preprint available at [arXiv:2407.20199](https://arxiv.org/abs/2407.20199).
4. C. Cai*, **A. Radhakrishnan***, C. Uhler. *Synthetic lethality screening with Recursive Feature Machines*. Preprint available at [bioRxiv:2023.12.03.569803v1](https://bioRxiv.org/abs/2023.12.03.569803v1).
5. D. Beaglehole*, **A. Radhakrishnan***, P. Pandit, and M. Belkin. *Mechanism of feature learning in convolutional neural networks*. Preprint available at [arXiv:2309.00570](https://arxiv.org/abs/2309.00570).
6. S. Jain*, **A. Radhakrishnan***, and C. Uhler. *A mechanism for producing aligned latent spaces with autoencoders*. Preprint available at [arXiv:2106.15456](https://arxiv.org/abs/2106.15456).
7. **A. Radhakrishnan**, M. Belkin, C. Uhler. *Linear convergence of generalized mirror descent with time-dependent mirrors*. Preprint available at [arXiv:2009.08574](https://arxiv.org/abs/2009.08574).

ALL HONORS AND AWARDS

1. George F. Carrier Postdoctoral Fellowship 2023
2. First prize for ITA graduation day talk 2023
3. Rising Stars in Data Science, UChicago 2022
4. Broad Institute Eric and Wendy Schmidt Center Graduate Fellowship 2021-2023
5. Best Poster Award at MIT Statistics and Data Science Conference 2022
6. Outstanding Reviewer Award at International Conference on Learning Representations 2021
7. Best Poster Award at Genomes & AI: From Packing to Regulation 2019
8. Phi Beta Kappa Honor Society Inductee (MIT) 2016

SUMMER RESEARCH PROGRAMS

1. Simons Institute - Deep Learning Theory Workshop and Summer School Summer 2022
2. Simons Institute - Foundations of Deep Learning Summer 2019

TEACHING

1. Instructor: *Tutorial on infinite width neural networks and feature learning*, KIT Fall 2023.
2. Instructor: *6.S088, Modern Machine Learning: Simple Methods that Work*, MIT Winter 2022, 2023.
[Link to online lecture notes](#).
3. Teaching Assistant: *Deep Learning Theory Summer School*, Princeton Summer 2021.

4. Teaching Assistant: *6.042, Math for Computer Science*, MIT

Fall 2016.

5. Instructor for MIT Splash: *Introduction to Python*, MIT

Fall 2012.

MENTORSHIP

Mentored 8 undergraduate and master's students at MIT.

1. Cathy Cai, BS	2020-
2. Divya Nori, BS	2022-2023
3. Ishika Shah, BS	2020-2021
4. Max Ruiz Luyten, BS, now at Meta	2020-2021
5. George Stefanakis, BS + MEng, now at NVIDIA	2019-2021
6. Neha Prasad, MEng, now at Valo	2019-2020
7. Eshaan Nichani, BS + MEng, now Ph.D. student at Princeton	2018-2020
8. Ali Soylemezoglu, BS + MEng, now at Microsoft	2016-2017

ACADEMIC SERVICE

Reviewer for Annals of Statistics, JASA, PNAS, NeurIPS, ICML, ICLR, IEEE Transactions on Medical Imaging.

INVITED TALKS

1. University of California, San Diego Computer Science seminar	2025
2. Harvard School of Public Health and Dana-Farber Cancer Institute Data Science Colloquium	2025
3. Information Theory and Algorithms	2025
4. MIT Mathematics seminar	2025
5. University of Michigan, Biostatistics seminar	2025
6. Broad Institute Retreat	2024
7. INFORMS, Advances in Deep Learning Theory	2024
8. SIAM Conference on Mathematics of Data Science	2024
9. IPAM Workshop on Theory and Practice in Deep Learning	2024
10. DIMACS Workshop on Modeling Randomness in Neural Network Training	2024
11. Eric and Wendy Schmidt Center Scientific Advisory Board	2024
12. Lawrence Livermore National Laboratory	2024
13. University of Washington Optimization Seminar	2024
14. Stanford Biomedical Data Science Seminar	2024
15. Columbia University Biomedical Informatics Seminar Series	2023
16. Novo Nordisk Foundation Center workshop on multimodal data integration	2023
17. INFORMS, Statistical and Machine Learning Methods in Healthcare	2023
18. Apple Seminar	2023
19. KIT Workshop on Deep Learning	2023
20. Broad Symposium: Ladders to Cures	2023

21. Amazon Science Seminar	2023
22. IBM Research AI Seminar	2023
23. Broad Scientific Counsel	2023
24. Cosyne Workshop on Attractors	2023
25. ITA Graduation Day	2023
26. MIT LIDS Student Conference	2023
27. Broad Institute Retreat	2022
28. UChicago Rising Stars	2022
29. INFORMS, Data-Driven Healthcare: From Predictions to Decisions	2022
30. SIAM MDS, Algebraic Geometry and Machine Learning Minisymposium	2022
31. Workshop on the Theory of Overparameterized Machine Learning	2022
32. Guest Lecture for 6.881: Tissue vs. Silicon in Machine Learning	2021
33. ML Collective, Deep Learning: Classics and Trends	2021
34. Phillips Exeter Academy, Biology Club Speaker Series	2021
35. Broad Institute, Machine Learning for Healthcare Seminar	2021
36. CompCancer Graduate Program Invited Lecture	2021
37. Max Delbrück Center for Molecular Medicine System's Biology Lecture Series	2021
38. MILA Biology + AI Reading Group Invited Lecture	2021
39. Broad Institute Cell Circuits and Epigenomics Virtual Seminar Series	2020
40. Machine Learning at MIT Lecture Series	2020
41. Algebra, Statistics, and Optimization Seminar at MIT	2020
42. NVIDIA ASUG Executive Exchange: Reimagine Your Business with AI	2018
43. MIT Student Colloquium for Undergraduates Lecture Series	2015

IN THE NEWS

1. Schmidt Center scientists develop a robust machine learning approach for virtual drug screening and other applications ; [Link to Article](#).
2. MIT News: A machine-learning approach to finding treatment options for Covid-19 ; [Link to Article](#).

INDUSTRY EXPERIENCE

Manifold Valley - Machine Learning Advisor

July 2022-

- Provide guidance to CEO and machine learning team regarding model development.

App Orchid - Principal Data Scientist

August 2017-May 2019

Primary Responsibilities Include:

- Developing machine learning IP.
- Designing solution architecture for AI related customer problems (domains include Insurance, Health Care, Energy & Utilities).
- Serving as pre-sales technical advisor to present products and solutions to customers. Managing solution life-cycle directly with customers.