

ADITYANARAYANAN (ADIT) RADHAKRISHNAN

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Massachusetts Institute of Technology, Broad Institute of MIT and Harvard, OuterProduct

APPOINTMENTS

MIT Mathematics Cambridge, MA, USA.

- Assistant Professor July 2025

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

- Associate Member July 2025
- 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: Single-cell genomics, metabolomics, genetic discovery.

JOURNAL PUBLICATIONS

1. D. Beaglehole*, **A. Radhakrishnan***, E. Boix-Adserà, and M. Belkin. *Toward universal steering and monitoring of AI models*. Science (2026). Available at [Science](#).
2. **A. Radhakrishnan***, Y. Jain, C. Uhler, E.S. Lander. *Efficiently quantifying dependence in massive scientific datasets using InterDependence Scores*. PNAS (2025). Available at [PNAS](#).
3. 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*. Nature Microbiology 10, pages 1989-2002 (2025). Available at [Nature Microbiology](#).
4. D. Paysan*, **A. Radhakrishnan***, G.V. Shivashankar, and C. Uhler. *Image2Reg: Linking chromatin images to gene regulation using genetic perturbation screens*. Cell Systems Vol. 16, Issue 6 (2025). Available at [Cell Systems](#).
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](#).

6. **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](#).
7. **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](#).
8. **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](#).
9. **A. Radhakrishnan***, M. Ruiz Luyten*, N. Prasad, and C. Uhler. *Transfer learning with kernel methods*. Accepted in Nature Communications (2023). Available at [Nature Communications](#).
10. **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](#).
11. 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](#).
12. K. Yang, A. Belyaeva, S. Venkatachalapathy, 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](#).
13. **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](#).
14. **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](#).
15. **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. D. Beaglehole, D. Holzmüller, **A. Radhakrishnan**, M. Belkin. *xRFM: Accurate, scalable, and interpretable feature learning models for tabular data*. ICLR (2026). Available at [arXiv:2508.10053](#).
2. 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*. ICML, **Oral Presentation** (2025). Available at [arXiv:2407.20199](#).
3. 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](#).
4. L. Zhu, C. Liu, **A. Radhakrishnan**, M. Belkin. *Quadratic models for understanding neural network dynamics*. ICLR (2024). Available at [arXiv:2205.11787](#).
5. 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](#).
6. **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](#).
7. **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](#).

8. **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](https://arxiv.org/abs/1810.10333).
9. **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).
10. **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. C. Cai*, **A. Radhakrishnan***, C. Uhler. *Synthetic lethality screening with Recursive Feature Machines*. Preprint available at [bioRxiv:2023.12.03.569803v1](https://doi.org/10.1101/2023.12.03.569803v1).
2. 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).
3. **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).
4. P. Davarmanesh, A. Wilson, **A. Radhakrishnan**. *Efficient and accurate steering of Large Language Models through attention-guided feature learning*. Preprint available at [arXiv:2602.00333](https://arxiv.org/abs/2602.00333).

ALL HONORS AND AWARDS

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|---|-----------|
| 1. Ted Kelly Prize | 2026 |
| 2. George F. Carrier Postdoctoral Fellowship | 2023 |
| 3. First prize for ITA graduation day talk | 2023 |
| 4. Rising Stars in Data Science, UChicago | 2022 |
| 5. Broad Institute Eric and Wendy Schmidt Center Graduate Fellowship | 2021-2023 |
| 6. Best Poster Award at MIT Statistics and Data Science Conference | 2022 |
| 7. Outstanding Reviewer Award at International Conference on Learning Representations | 2021 |
| 8. Best Poster Award at Genomes & AI: From Packing to Regulation | 2019 |
| 9. Phi Beta Kappa Honor Society Inductee (MIT) | 2016 |

SUMMER RESEARCH PROGRAMS

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

TEACHING

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| 1. Instructor: 18.S998 (Topics in Deep Learning), MIT | Spring 2026. |
| 2. Instructor: <i>Tutorial on infinite width neural networks and feature learning</i> , KIT | Fall 2023. |
| 3. Instructor: 6.S088, <i>Modern Machine Learning: Simple Methods that Work</i> , MIT
Link to online lecture notes . | Winter 2022, 2023. |
| 4. Teaching Assistant: <i>Deep Learning Theory Summer School</i> , Princeton | Summer 2021. |
| 5. Teaching Assistant: 6.042, <i>Math for Computer Science</i> , MIT | Fall 2016. |
| 6. Instructor for MIT Splash: <i>Introduction to Python</i> , 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. Broad Cancer Program Bootcamp 2026
2. Multidisciplinary University Research Initiative (MURI) Neuroglia 2026
3. Information Theory and Algorithms 2026
4. Statistics and Data Science Seminar, Northwestern University 2025
5. INFORMS 2025
6. SIAM Math of Data Science 2025
7. Pizza Seminar, MIT 2025
8. Jones Seminar, Dartmouth University 2025
9. University of California, San Diego Computer Science seminar 2025
10. Harvard School of Public Health and Dana-Farber Cancer Institute Data Science Colloquium 2025
11. Information Theory and Algorithms 2025
12. MIT Mathematics seminar 2025
13. University of Michigan, Biostatistics seminar 2025
14. Broad Institute Retreat 2024
15. INFORMS, Advances in Deep Learning Theory 2024
16. SIAM Mathematics of Data Science 2024
17. IPAM Workshop on Theory and Practice in Deep Learning 2024
18. DIMACS Workshop on Modeling Randomness in Neural Network Training 2024
19. Eric and Wendy Schmidt Center Scientific Advisory Board 2024
20. Lawrence Livermore National Laboratory 2024
21. University of Washington Optimization Seminar 2024
22. Stanford Biomedical Data Science Seminar 2024
23. Columbia University Biomedical Informatics Seminar Series 2023
24. Novo Nordisk Foundation Center workshop on multimodal data integration 2023

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

IN THE NEWS

1. Exposing biases, moods, personalities, and abstract concepts hidden in large language models; [Link to Article](#).
2. Schmidt Center scientists develop a robust machine learning approach for virtual drug screening and other applications ; [Link to Article](#).
3. MIT News: A machine-learning approach to finding treatment options for Covid-19 ; [Link to Article](#).

INDUSTRY EXPERIENCE

OuterProduct - Founder

August 2025

Manifold Valley - Machine Learning Advisor

July 2022-2025

- 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.