ADITYANARAYANAN (ADIT) RADHAKRISHNAN

Email: aradha@seas.harvard.edu ◇ Website: aditradha.com ◇ Phone: +1(561) 801-0811

Harvard University, John A. Paulson School of Engineering and Applied Sciences

EDUCATION

Harvard University Cambridge, MA, USA.

- George F. Carrier Postdoctoral Fellow, School of Engineering and Applied Sciences   September 2023-

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: Virtual drug screening, multi-modal data integration, genetic discovery.

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.

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). First release 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***, 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.

SELECTED HONORS

1. Rising Stars in Data Science, UChicago   2022

2. Broad Institute Eric and Wendy Schmidt Center Graduate Fellowship   2021-2023

3. Phi Beta Kappa Honor Society Inductee (MIT)   2016

JOURNAL 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). First release available at Science.

2. **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.

3. **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.

4. **A. Radhakrishnan***, M. Ruiz Luyten*, N. Prasad, and C. Uhler. *Transfer learning with kernel methods.* Accepted in Nature Communications (2023). Available at Nature Communications.

5. **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.

6. 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.

7. 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.

8. **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.

9. **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.

10. **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. *Quadratic models for understanding neural network dynamics.* ICLR (2024). Available at arXiv:2205.11787.

2. 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.

3. **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.

4. **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.

5. **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.

6. **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.

7. **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.

PREPRINTS

1. **A. Radhakrishnan**, M. Belkin, and D. Drusvyatskiy. *Linear Recursive Feature Machines provably recover low-rank matrices.* Preprint available at arXiv:2401.04553.

2. C. Cai*, **A. Radhakrishnan***, C. Uhler. *Synthetic lethality screening with Recursive Feature Machines.* Preprint available at bioRxiv:2023.12.03.569803v1.

3. D. Paysan*, **A. Radhakrishnan***, G.V. Shivashankar, and C. Uhler. *Image2Reg: Linking chromatin images to gene regulation using genetic perturbation screens.* Under review.

4. L. Zhu, C. Liu, **A. Radhakrishnan**, M. Belkin. *Catapults in sgd: spikes in the training loss and their impact on generalization through feature learning.* Preprint available at arXiv:2306.04815.

5. D. Beaglehole*, **A. Radhakrishnan***, P. Pandit, and M. Belkin. *Mechanism of feature learning in convolutional neural networks.* Preprint available at arXiv: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.

7. **A. Radhakrishnan**, M. Belkin, C. Uhler. *Linear convergence of generalized mirror descent with time-dependent mirrors.* Preprint available at arXiv: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 Link to online lecture notes and video recordings.	Winter 2022, 2023.
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 PNAS, NeurIPS, ICML, ICLR, IEEE Transactions on Medical Imaging.

INVITED TALKS

1. University of Washington Optimization Seminar	2024
2. Stanford Biomedical Data Science Seminar	2024
3. Columbia University Biomedical Informatics Seminar Series	2023
4. Novo Nordisk Foundation Center workshop on multimodal data integration	2023
5. INFORMS, Statistical and Machine Learning Methods in Healthcare	2023
6. Apple Seminar	2023
7. KIT Workshop on Deep Learning	2023
8. Broad Symposium: Ladders to Cures	2023
9. Amazon Science Seminar	2023
10. IBM Research AI Seminar	2023
11. Broad Scientific Counsel	2023
12. Cosyne Workshop on Attractors	2023
13. ITA Graduation Day	2023
14. MIT LIDS Student Conference	2023
15. Broad Institute Retreat	2022
16. UChicago Rising Stars	2022
17. INFORMS, Data-Driven Healthcare: From Predictions to Decisions	2022
18. SIAM MDS, Algebraic Geometry and Machine Learning Minisymposium	2022
19. Workshop on the Theory of Overparameterized Machine Learning	2022
20. Guest Lecture for 6.881: Tissue vs. Silicon in Machine Learning	2021
21. ML Collective, Deep Learning: Classics and Trends	2021
22. Phillips Exeter Academy, Biology Club Speaker Series	2021
23. Broad Institute, Machine Learning for Healthcare Seminar	2021
24. CompCancer Graduate Program Invited Lecture	2021
25. Max Delbrück Center for Molecular Medicine System's Biology Lecture Series	2021
26. MILA Biology + AI Reading Group Invited Lecture	2021
27. Broad Institute Cell Circuits and Epigenomics Virtual Seminar Series	2020

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.

- Building the AI research team.