ADITYANARAYANAN (ADIT) RADHAKRISHNAN

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Massachusetts Institute of Technology ⋄ Broad Institute of MIT and Harvard

EDUCATION

Massachusetts Institute of Technology Cambridge, MA, USA.

1. Ph.D. Candidate, Electrical Engineering and Computer Science — Expected June 2023
   Thesis Advisor: Caroline Uhler
2. 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
3. B.S. in Mathematics and Electrical Engineering and Computer Science — June 2016
   Bachelor's Thesis: Combinatorial Analysis of Markov Equivalence Classes
   Thesis Advisor: Caroline Uhler

RESEARCH INTERESTS

Machine Learning: Kernels, infinite-width neural networks, autoencoders, representation learning ;
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**, 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.
2. **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.
3. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Wide and deep neural networks achieve consistency in classification.* Under review in PNAS (2022). Preprint available at arXiv:2204.14126.
4. **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.* Under review in Nature Communications (2022). Preprint available at biorxiv:10.1101.
5. **A. Radhakrishnan***, M. Ruiz Luyten*, N. Prasad, and C. Uhler. *Transfer learning with kernel methods.* Submitted to Nature Machine Intelligence (2022). Preprint available at arxiv:2211.00227.

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

ALL PUBLICATIONS (REVERSE CHRONOLOGICAL ORDER)

Journal publications in PNAS, Nature Communications, Scientific Reports, Discrete Applied Mathematics. Conference/workshop publications in ICML, ICLR, NeurIPS, UAI.

1. **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.

2. **A. Radhakrishnan**, M. Belkin, and C. Uhler. *Wide and deep neural networks achieve consistency in classification.* Under review in PNAS (2022). Preprint available at arXiv:2204.14126.

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.* Under review in Nature Communications (2022). Preprint available at biorxiv:10.1101.

4. **A. Radhakrishnan***, M. Ruiz Luyten*, N. Prasad, and C. Uhler. *Transfer learning with kernel methods.* Submitted to Nature Machine Intelligence (2022). Preprint available at arxiv:2211.00227.

5. D. Paysan*, **A. Radhakrishnan***, G.V. Shivashankar, and C. Uhler. *Image2Reg: Linking chromatin images to gene regulation using genetic perturbation screens.* Preprint in Progress (2022).

6. L. Zhu, C. Liu, **A. Radhakrishnan**, M. Belkin. *Quadratic models for understanding neural network dynamics.* Under review in ICLR (2022). Preprint available at arXiv:2205.11787.

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. S. Jain*, **A. Radhakrishnan***, and C, Uhler. *A mechanism for producing aligned latent spaces with autoencoders* (2021). Preprint available at arXiv:2106.15456.

9. 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 International Conference on Machine Learning (2021). Available at arXiv:2010.09610.

10. **A. Radhakrishnan**, M. Belkin, C. Uhler. *Linear convergence of generalized mirror descent with time-dependent mirrors* (2021). Preprint available at arXiv:2009.08574.

11. **A. Radhakrishnan***, E. Nichani*, D. Bernstein, C. Uhler. *On alignment in deep linear neural networks.* Workshop on Over-parameterization: Pitfalls and Opportunities in International Conference on Machine Learning (2021). Available at arXiv:2003.06340.

12. **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 International Conference on Machine Learning (2021). Available at workshop link.

13. 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.

14. **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.

15. **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.

16. **A. Radhakrishnan**, C. Durham, A. Soylemezoglu, and C. Uhler. *Patchnet: Interpretable neural networks for image classification.* NeurIPS Machine Learning for Health (ML4H) Workshop (2018). Available at arXiv:1705.08078.

17. **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 arXiv:1706.06091.

18. **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.

19. **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.

ALL HONORS AND AWARDS

1. Rising Stars in Data Science, UChicago — 2022
2. Eric and Wendy Schmidt Center Graduate Fellowship — 2021-2023
3. Best Poster Award at MIT Statistics and Data Science Conference — 2022
4. Outstanding Reviewer Award at International Conference on Learning Representations — 2021
5. Best Poster Award at Genomes & AI: From Packing to Regulation — 2019
6. Phi Beta Kappa Honor Society Inductee (MIT) — 2016

SUMMER RESEARCH PROGRAMS

1. Simons Institute - Deep Learning Theory Workshop and Summer School — Summer 2022
   Visiting student with long term visitor Mikhail Belkin.
2. Simons Institute - Foundations of Deep Learning — Summer 2019
   Visiting student with long term visitor Mikhail Belkin.

TEACHING

1. **Instructor:** *6.S088, Modern Machine Learning: Simple Methods that Work*, MIT — Winter 2022.
   Link to online lecture notes and video recordings.
2. Teaching Assistant: *Deep Learning Theory Summer School*, Princeton — Summer 2021.
3. Teaching Assistant: *6.042, Math for Computer Science*, MIT — Fall 2016.
4. Instructor for MIT Splash: *Introduction to Python*, MIT — Fall 2012.

MENTORSHIP

Mentored 8 undergraduate and master's students at MIT.

1. Divya Nori, BS — 2022-
2. Cathy Cai, BS — 2020-
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 NeurIPS, ICML, ICLR, IEEE Transactions on Medical Imaging.

INVITED TALKS

1. INFORMS, Data-Driven Healthcare: From Predictions to Decisions 2022
2. SIAM MDS, Algebraic Geometry and Machine Learning Minisymposium 2022
3. Workshop on the Theory of Overparameterized Machine Learning 2022
4. Guest Lecture for 6.881: Tissue vs. Silicon in Machine Learning 2021
5. ML Collective, Deep Learning: Classics and Trends 2021
6. Phillips Exeter Academy, Biology Club Speaker Series 2021
7. Broad Institute, Machine Learning for Healthcare Seminar 2021
8. CompCancer Graduate Program Invited Lecture 2021
9. Max Delbrück Center for Molecular Medicine System's Biology Lecture Series 2021
10. MILA Biology + AI Reading Group Invited Lecture 2021
11. Broad Institute Cell Circuits and Epigenomics Virtual Seminar Series 2020
12. Machine Learning at MIT Lecture Series (YouTube link) 2020
13. Algebra, Statistics, and Optimization Seminar at MIT 2020
14. NVIDIA ASUG Executive Exchange: Reimagine Your Business with AI 2018
15. MIT Student Colloquium for Undergraduates Lecture Series 2015

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.