

Hariharan Narayanan

Tata Institute for Fundamental
Research
School of Computer Science and
Technology

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Mumbai, 400005

EMPLOYMENT

Tata Institute for Fundamental Research
School of Computer Science and Technology
Associate Professor *July 2020 - present*

Tata Institute for Fundamental Research
School of Computer Science and Technology
Reader *January 2017 - July 2020*

University of Washington
Departments of Statistics and Mathematics
Assistant Professor *March 2012 - December 2016*

Princeton University
Department of Electrical Engineering,
Postdoctoral Associate, *September 2011 - March 2012*
Advisors: Charles Fefferman and Sanjeev Kulkarni

Massachusetts Institute of Technology
Laboratory for Information and Decision Systems,
Postdoctoral Associate, *September 2009 - August 2011*
Advisor: Sanjoy Mitter

EDUCATION

The University of Chicago, Chicago, IL
PhD in Computer Science, *August 2009*
Title: Applications of Diffusion in Computer Science and Statistics
Advisor: Partha Niyogi
MS in Computer Science, *February 2006*
Advisor: Partha Niyogi

Indian Institute of Technology, Bombay, India
Dual degree (BTech + MTech) in Electrical Engineering,
Specializing in Communication and Signal processing, *August 2003*

Indian Statistical Institute, Calcutta, India

Participant in Nurture Program in Mathematics, *Summers of 1999 - 2002*

Attended courses on Stochastic Processes, Differential Geometry, Topology and Commutative Algebra

Awards

1. Swarna Jayanti Fellowship for the year 2019-2020
2. Ramanujan Fellowship, 2017-2022
3. William Eckhardt Graduate Fellowship, Department of Computer Science, The University of Chicago, 2006-2007.
4. Chairman's Fellowship, Department of Computer Science, The University of Chicago, 2003-2005
5. First place (in collaboration with 3 other students) in the Hardcore Hardware electronics competition hosted during the IIT Bombay Technological Festival (Tech-Fest) for a Bluetooth-enabled Neonatal Monitor, 2002.
6. KVPY Engineering Fellowship instituted by the Government of India, 2000-2003
7. Silver Medal in the 39th International Mathematical Olympiad held in Taipei, 1998.

Synergistic Activities

Graduated two Ph.D. students, Adam Gustafson and Kitty Mohammed from the University of Washington in 2018 and 2019 respectively.

Graduated one Ph.D. student, Somnath Chakraborty from TIFR.

PUBLICATIONS

Preprints

1. Charles Fefferman, Sergei Ivanov, Matti Lassas, Jimpeng Lu, Hariharan Narayanan
Reconstruction and interpolation of manifolds II: Inverse problems for Riemannian manifolds with partial distance data
ArXiv preprint: <http://arxiv.org/abs/2111.14528>, 2021
2. Hariharan Narayanan, Scott Sheffield
Large deviations for random hives and the spectrum of the sum of two random matrices
ArXiv preprint: <http://arXiv.org/abs/2111.00421>, 2021
3. Hariharan Narayanan
Random discrete concave functions on an equilateral lattice with periodic Hessians,
Arxiv preprint: <http://arxiv.org/abs/2005.13376>, 2020
4. Somnath Chakraborty and Hariharan Narayanan
Learning Mixtures of Spherical Gaussians via Fourier Analysis,
Arxiv preprint: <http://arxiv.org/abs/2004.05813>, 2020
5. Charles Fefferman, Sergei Ivanov, Matti Lassas, Hariharan Narayanan
Fitting a manifold of large reach to noisy data,
Arxiv preprint: <http://arxiv.org/abs/1905.07182>, 2019
Accepted in Journal of Topology and Analysis

6. Adam Gustafson, Hariharan Narayanan
John's Walk,
Arxiv preprint: <http://arxiv.org/abs/1803.02032>, 2018
Accepted in Advances in Applied Probability

Journal Publications

1. On a convexity property of tensor products of irreducible, rational representations of $SL(n)$.
H Narayanan, CS Rajan
Journal of Lie Theory, Volume 32, 2022.
2. Somnath Chakraborty, Hariharan Narayanan
Generating an equidistributed net on a unit n -sphere using random rotations,
Arxiv preprint: <http://arxiv.org/abs/1812.01845>, 2018
Discrete & Computational Geometry, Volume 67, Issue 1, 2022.
3. Hariharan Narayanan and Piyush Srivastava
On the mixing time of Coordinate Hit-and-Run,
Arxiv preprint: <http://arxiv.org/abs/2009.14004>, 2020
Combinatorics, Probability and Computing, Volume 21, Issue 2, 2022.
4. Charles Fefferman, Sergei Ivanov, Matti Lassas, Hariharan Narayanan
Reconstruction of a Riemannian manifold from noisy intrinsic distances,
Arxiv preprint: <http://arxiv.org/abs/1905.07182>
SIAM Journal on Mathematics of Data Science, 2019
5. Charles Fefferman, Sergei Ivanov, Yaroslav Kurylev, Matti Lassas, Hariharan Narayanan
Reconstruction and interpolation of manifolds I: The geometric Whitney problem,
Foundations of Computational Mathematics, 2019
<https://doi.org/10.1007/s10208-019-09439-7>
6. Narayanan Harihar, Hariharan Narayanan
On the linear static output feedback problem: the annihilating polynomial approach,
Linear Algebra and its Applications
Volume 579, Pages 336–364, 2019
7. Hariharan Narayanan and Alexander Rakhlin,
Efficient sampling from time varying log-concave distributions,
Journal of Machine Learning Research, 2017, volume 18, 1-29.
8. Charles Fefferman, Sanjoy Mitter and Hariharan Narayanan,
Testing the Manifold Hypothesis,
Online February 9, 2016, Journal of the American Mathematical Society,
Volume 29 (2016), 983-1049.
9. Hariharan Narayanan,
Randomized interior point methods for sampling and optimization,
Annals of Applied Probability, Volume 26, Number 1, February 2016, pp 597 - 641.
10. Gilad Harman and Sanjeev Kulkarni and Hariharan Narayanan,
 $\sin(\omega x)$ Can Approximate Almost Every Finite Set of Samples,
Constructive Approximation, October 2015, Volume 42, Issue 2, pp 303-311.

11. Hariharan Narayanan and Partha Niyogi,
Language evolution, coalescent processes and the consensus problem on a social network,
Journal of Mathematical Psychology, Volume 61, August 2014, pages 19—24.
12. Mikhail Belkin and Hariharan Narayanan and Partha Niyogi,
Heat flow and a faster algorithm to compute the surface area of a convex body,
Random Structures and Algorithms, Volume 43, Issue 4, December 2013, pages 407—428.
13. Ravi Kannan and Hariharan Narayanan,
Random walks on polytopes and an affine interior point method for Linear Programming,
Mathematics of Operations Research. Volume 37, Issue 1, (On line) January 9, 2012, pages 1 – 20.
14. Ketan Mulmuley, Hariharan Narayanan, Milind Sohoni,
Geometric Complexity Theory III: on deciding non-vanishing of a Generalized Littlewood-Richardson Coefficient,
Journal of Algebraic Combinatorics, Volume 36, Issue 1, August 2012, pages 103–110.
15. Steven Lalley and Gregory Lawler and Hariharan Narayanan,
Geometric Interpretation of Halfplane Capacity,
Electronic Communications in Probability, Volume 14, December 2009, pages 566—571.
16. Hariharan Narayanan,
On the complexity of computing Kostka numbers and Littlewood-Richardson coefficients,
Journal of Algebraic Combinatorics, volume 24, issue 3, November 2006, Volume 24, Issue 3, November 2006, pages 347–354.

Book Chapter

Hariharan Narayanan,
Chapter 4: “Sample Complexity in Manifold learning,”
Manifold Learning, Theory and Applications,
Edited by Yunqian Ma and Yun Fu,
CRC Press, December 2011.

Conference Publications

1. Hariharan Narayanan, Rikhav Shah and Nikhil Srivastava
A spectral approach to polytope diameter,
Arxiv preprint: <http://arxiv.org/abs/2101.12198>”, 2021
Innovations in Theoretical Computer Science, 2022
2. Hariharan Narayanan
On the distribution of random words in a compact Lie group,
Proceedings of the 32nd Conference on Formal Power Series and Algebraic Combinatorics (Online)

3. Charles Fefferman, Sergei Ivanov, Yaroslav Kurylev, Matti Lassas, Hariharan Narayanan
Fitting a putative manifold to noisy data,
31st Annual Conference on Learning Theory (COLT), June 2018.
4. Alexandre Belloni, Tengyuan Liang, Hariharan Narayanan, Alexander Rakhlin,
Escaping the Local Minima via Simulated Annealing: Optimization of Approximately Convex Functions,
28th Annual Conference on Learning Theory (COLT), June 2015.
5. Hariharan Narayanan,
Estimating deep Littlewood-Richardson Coefficients,
26th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), June 2014.
6. Hariharan Narayanan and Sanjoy Mitter,
Sample Complexity of Testing the Manifold Hypothesis,
24th Annual Conference on Neural Information Processing Systems (NIPS), December 2010.
7. Hariharan Narayanan and Alexander Rakhlin,
Random walk Approach to Regret Minimization,
24th Annual Conference on Neural Information Processing Systems (NIPS), December 2010.
8. Hariharan Narayanan and Partha Niyogi,
On the sample complexity of learning smooth cuts on a manifold,
22nd Annual Conference on Learning Theory (COLT), June 2009.
9. Ravi Kannan and Hariharan Narayanan,
Random walks on polytopes and an affine interior point method for Linear Programming,
41st ACM Symposium on Theory of Computing (STOC), May 2009.
10. Gregory Lawler and Hariharan Narayanan,
Mixing times and ℓ_p bounds for oblivious routing,
Workshop on Analytic Algorithmics and Combinatorics (ANALCO), January 2009.
11. Hariharan Narayanan,
Distributed averaging in the presence of a sparse cut,
ACM Symposium on Principles of Distributed Computing (PODC), August 2008.
12. Prahladh Harsha and Tom Hayes and Hariharan Narayanan and Harald Racke and Jaikumar Radhakrishnan,
Minimizing average latency in oblivious routing,
ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2008.
13. Hariharan Narayanan and Partha Niyogi,
Sampling hypersurfaces through diffusion,
12th Intl. Workshop on Randomization and Computation (RANDOM), August 2008.
14. Hariharan Narayanan,
Geographic gossip on geometric random graphs via affine combinations,
ACM Symposium on Principles of Distributed Computing (PODC), August 2007.
15. Hariharan Narayanan and Mikhail Belkin and Partha Niyogi,
On the relation between low density separation, spectral clustering and graph cuts,

- 20th Annual Conference on Neural Information Processing Systems (NIPS), December 2006.
16. Mikhail Belkin and Hariharan Narayanan and Partha Niyogi,
Heat flow and a faster algorithm to compute the surface area of a convex body,
47th Annual IEEE Symposium on Foundations of Computer Science (FOCS), October 2006.
 17. Hariharan Narayanan,
On the complexity of computing Kostka numbers and Littlewood-Richardson coefficients,
18th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), June 2006.

Invited talks, seminars

- Geometry and Physics seminar, Boston University, February 2021
- Probability seminar, MIT, February 2021
- Simons workshop on Concentration of Measure Phenomena, Berkeley, October 2020
- Inverse Problems and nonlinearity, Helsinki, August 2020
- Advances in Applied Probability, ICTS Bangalore in August 2019
- Seminar, ICTS Bangalore, Statistical Physics Methods in Machine Learning, January 2019
- LIDS Stochastics and Statistics Seminar, MIT in May 2018.
- Indo-UK Frontiers of Science meet in May 2018.
- Eleventh Workshop on Whitney interpolation, Trinity College Dublin, August 2018
- Stochastics and Statistics Seminar, MIT, May 2018
- Seminar, ICTS Bangalore, Statistical Physics Methods in Machine Learning, December 2017
- Short talk, Lectures in Probability and Stochastic Processes, ISI Kolkata, December 2017
- Department Colloquium, Electrical Engineering, IIT Bombay, March 2017
- International Conference on Continuous Optimization (ICCOPT), Tokyo, August 2016
- IMA workshop on Power of Randomness in Computation, GaTech, March 2015
- Seventh Workshop on Whitney interpolation, College of William and Mary, August 2014
- Seminar, August 2014, Indian Institute of Technology, Bombay
- Seminar, August 2014, Tata Institute for Fundamental Research, Bombay
- University of Washington, Computer Science Theory Seminar, April 2013
- Arkansas Spring Lecture Series on Interpolation and extension, April 2013
- University of Washington – Yahoo Machine Learning seminar, March 2013
- Microsoft Research Machine Learning day, October 2012

- Partha Niyogi Memorial Workshop, The University of Chicago, December 2011
- Fourth Workshop on Whitney interpolation, College of William and Mary, August 2011
- Dagstuhl Workshop of Mathematical and Computational Foundations of Learning Theory, July 2011
- Seminar, July 2011, Monsoon Conference on Data Assimilation, Center for Applicable Mathematics, TIFR, Bangalore
- Seminar, July 2011, Department of Computer Science and Automation, Indian Institute of Science, Bangalore
- Seminar, April 2011, Department of Mathematics, Brown University
- Seminar, March 2011, Department of Mathematics, University of Washington, Seattle
- Statistics Seminar, March 2011, Department of Mathematics, MIT
- Probability Seminar, March 2011, Department of Mathematics, MIT
- Seminar, March 2011, Department of Computer Science, Duke University
- Seminar, February 2011, Department of Electrical and Computer Engineering, Boston University
- Seminar, February 2011, Department of Statistics, University of Washington Seattle
- International Conference on Continuous Optimization, July 2010, Santiago, Chile (Was unable to participate for Visa related reasons).
- Workshop on Geometric Complexity Theory, June 2010, Intractability Center, Princeton University
- Seminar, May 2010, Department of Electrical Engineering and Computer Science, Boston University
- INFORMS, October 2009, Special session on Random Walks and Convex Optimization
- Workshop on Statistical Learning for Statistical Physics, Los Alamos National Laboratory, November 2009
- Laboratory for Information and Decision Sciences, MIT, March 2009
- IDeAS Seminar, Program in Applied and Computational mathematics, Princeton University, March 2009
- Applied Math Seminar, Yale University, February 2009
- Seminar, Algorithms and Randomness Center, Georgia Institute of Technology, January 2009
- Probability Seminar, Department of Mathematics, The University of Chicago, November 2008
- Theory Seminar, Indian Institute of Science (IISc), Bangalore, India, September 2008
- Microsoft Research Labs, Bangalore, India, August 2008
- Workshop on Algorithms for Modern Massive Data Sets (MMDS), Stanford, CA, June 2008
- 17th Annual Institute for Advanced Study/Park City Mathematics Institute (IAS/PCMI) Summer School on Statistical Mechanics, Park City, Utah, July 2007

- Theory Seminar, Georgia Institute of Technology, Atlanta, GA, August 2006
- Seminar, The Ohio State University, March 2006
- Toyota Technological Institute, Chicago, October 2006, November 2005, November 2004
- Seminar, Tata Institute of Fundamental Research (TIFR), Bombay, August 2004

Editorial and PC work

Refereed for many journals including Annals of Statistics, Random Structures and Algorithms, Mathematical Programming A, Foundations of Computational Mathematics

Funding

NSF Grant on Fitting Manifolds to Noisy data, Sep 2016 to Aug 2020
Ramanujan Fellowship, July 2017 to June 2022.
Swarna Jayanti Fellowship January 2020 - December 2024.