Hariharan Narayanan

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EMPLOYMENT

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

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
Ph.D in Computer Science, *August 2009*
  Title: Applications of Diffusion in Computer Science and Statistics
  Advisor: Partha Niyogi
M.S 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 Institute of Statistics, Calcutta, India
Participant in Nurture Program in Mathematics, *Summers of 1999 - 2002*
Attended courses on Stochastic Processes, Differential Geometry, Topology and Commutative Algebra

PUBLICATIONS

Preprints

1. *On the linear static output feedback problem: the annihilating polynomial approach,*
   H Narayanan, Hariharan Narayanan
   ArXiv preprint: `arXiv:1810.11609`

2. *On the distribution of random words in a compact Lie group,*
   Hariharan Narayanan
   Arxiv preprint: `http://arxiv.org/abs/1804.07146`

3. *John's Walk,*
   Adam Gustafson, Hariharan Narayanan
   Arxiv preprint: `http://arxiv.org/abs/1803.02032`

4. *Structural Risk Minimization for $C^{1,1}(\mathbb{R}^d)$ Regression,*
   Adam Gustafson, Matthew Hirn, Kitty Mohammed, Hariharan Narayanan, Jason Xu
   Arxiv preprint: `http://arxiv.org/abs/1803.10884`

5. *Reconstruction and interpolation of manifolds I: The geometric Whitney problem,*
   Charles Fefferman, Sergei Ivanov, Yaroslav Kurylev, Matti Lassas, Hariharan Narayanan
   Arxiv preprint: `http://arxiv.org/abs/1508.00674`

6. *Manifold Learning Using Kernel Density Estimation and Local Principal Components Analysis,*
   Kitty Mohammed, Hariharan Narayanan
   Arxiv preprint: `http://arxiv.org/abs/1709.03615`

7. *Higher dimensional electrical circuits and the matroid dual of a nonplanar graph,*
   Hariharan Narayanan, H. Narayanan
   Arxiv preprint: `http://arxiv.org/abs/1711.04242`

Journal Publications

1. *Efficient sampling from time varying log-concave distributions,*
   Hariharan Narayanan and Alexander Rakhlin,
   Journal of Machine Learning Research, 2017, volume 18, 1-29.

2. *Testing the Manifold Hypothesis,*
   Charles Fefferman, Sanjoy Mitter and Hariharan Narayanan,
   Online February 9, 2016, Journal of the American Mathematical Society,
   Volume 29 (2016), 983-1049.

3. *Randomized interior point methods for sampling and optimization,*
   Hariharan Narayanan,
   Annals of Applied Probability, Volume 26, Number 1, February 2016, pp 597 - 641.

4. $\sin(\omega x)$ *Can Approximate Almost Every Finite Set of Samples,*
   Gilad Harman and Sanjeev Kulkarni and Hariharan Narayanan,
   Constructive Approximation, October 2015, Volume 42, Issue 2, pp 303-311.

5. *Language evolution, coalescent processes and the consensus problem on a social network,*
   Hariharan Narayanan and Partha Niyogi,
   Journal of Mathematical Psychology, Volume 61, August 2014, pages 19-24.

6. *Heat flow and a faster algorithm to compute the surface area of a convex body,*
   Mikhail Belkin and Hariharan Narayanan and Partha Niyogi,
   Random Structures and Algorithms, Volume 43, Issue 4, December 2013, pages 407-428.

7. *Random walks on polytopes and an affine interior point method for Linear Programming,*
   Ravi Kannan and Hariharan Narayanan,
   Mathematics of Operations Research. Volume 37, Issue 1, (On line) January 9, 2012, pages 1 – 20.

8. *Geometric Complexity Theory III: on deciding non-vanishing of a Generalized Littlewood-Richardson Coefficient,*
   Ketan Mulmuley, Hariharan Narayanan, Milind Sohoni,
   Journal of Algebraic Combinatorics, Volume 36, Issue 1, August 2012, pages 103–110.

9. *Geometric Interpretation of Halfplane Capacity,*
   Steven Lalley and Gregory Lawler and Hariharan Narayanan,
   Electronic Communications in Probability, Volume 14, December 2009, pages 566-571.

10. *On the complexity of computing Kostka numbers and Littlewood-Richardson coefficients,*
    Hariharan Narayanan,
    Journal of Algebraic Combinatorics, volume 24, issue 3, November 2006, Volume 24, Issue 3, November 2006, pages 347–354.

Book Chapter

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

Conference Publications

1. *Fitting a putative manifold to noisy data,*
   Charles Fefferman, Sergei Ivanov, Yaroslav Kurylev, Matti Lassas, Hariharan Narayanan
   31sth Annual Conference on Learning Theory (COLT), June 2018.

2. *Escaping the Local Minima via Simulated Annealing: Optimization of Approximately Convex Functions,*
   Alexandre Belloni, Tengyuan Liang, Hariharan Narayanan, Alexander Rakhlin,
   28th Annual Conference on Learning Theory (COLT), June 2015.

3. *Estimating deep Littlewood-Richardson Coefficients,*
   Hariharan Narayanan,
   26th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), June 2014.

4. *Sample Complexity of Testing the Manifold Hypothesis,*
   Hariharan Narayanan and Sanjoy Mitter,
   24th Annual Conference on Neural Information Processing Systems (NIPS), December 2010.

5. *Random walk Approach to Regret Minimization,*
   Hariharan Narayanan and Alexander Rakhlin,
   24th Annual Conference on Neural Information Processing Systems (NIPS), December 2010.

6. *On the sample complexity of learning smooth cuts on a manifold,*
   Hariharan Narayanan and Partha Niyogi,
   22nd Annual Conference on Learning Theory (COLT), June 2009.

7. *Random walks on polytopes and an affine interior point method for Linear Programming,*
   Ravi Kannan and Hariharan Narayanan,
   41st ACM Symposium on Theory of Computing (STOC), May 2009.

8. *Mixing times and ℓ_p bounds for oblivious routing,*
   Gregory Lawler and Hariharan Narayanan,
   Workshop on Analytic Algorithmics and Combinatorics (ANALCO), January 2009.

9. *Distributed averaging in the presence of a sparse cut,*
   Hariharan Narayanan,
   ACM Symposium on Principles of Distributed Computing (PODC), August 2008.

10. *Minimizing average latency in oblivious routing,*
    Prahladh Harsha and Tom Hayes and Hariharan Narayanan and Harald Racke and Jaikumar Radhakrishnan,
    ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2008.

11. *Sampling hypersurfaces through diffusion,*
    Hariharan Narayanan and Partha Niyogi,
    12th Intl. Workshop on Randomization and Computation (RANDOM), August 2008.

12. *Geographic gossip on geometric random graphs via affine combinations,*
    Hariharan Narayanan,
    ACM Symposium on Principles of Distributed Computing (PODC), August 2007.

13. *On the relation between low density separation, spectral clustering and graph cuts,*
    Hariharan Narayanan and Mikhail Belkin and Partha Niyogi,
    20th Annual Conference on Neural Information Processing Systems (NIPS), December 2006.

14. *Heat flow and a faster algorithm to compute the surface area of a convex body,*
    Mikhail Belkin and Hariharan Narayanan and Partha Niyogi,
    47th Annual IEEE Symposium on Foundations of Computer Science (FOCS), October 2006.

15. *On the complexity of computing Kostka numbers and Littlewood-Richardson coefficients,*
    Hariharan Narayanan,
    18th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC), June 2006.

Invited talks, seminars

- 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
- Probabiity 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 Annals of Statistics, International Journal of Computer Vision, Random Structures and Algorithms, Mathematical Programming A, International Conference on Algorithmic Learning Theory(ALT), Conference on Neural Information Processing Systems (NIPS), Conference on Learning Theory (COLT), Symposium on Theory of Computing (STOC), Symposium on Foundations of Computer Science (FOCS),

Funding