Hariharan Narayanan

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EMPLOYMENT

Massachusetts Institute of Technology
Laboratory for Information and Decision Systems,
Postdoctoral Associate, *September 2009 - present*
Mentor: 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

RESEARCH INTERESTS

My current research interests include Statistics, Machine Learning, Convex Optimization, Statistical Physics and Computational Geometry. My work has focused on the use of diffusion as an analytical tool in these fields. I am also interested in Complexity Theory, Algebraic Combinatorics and Distributed Computing.

AWARDS AND HONORS

1. First nationwide (tied with two others) in the Indian National Mathematical Olympiad with a score of 100/100, 1997.

2. Silver Medal in the 39th International Mathematical Olympiad held in Taipei, 1998.

3. KVPY Engineering Fellowship instituted by the Government of India (awarded to 10 students nationwide during 2000-2003), 2000-2003

4. Awarded Institute Colors at IIT Bombay for performance in technical competitions, 2001 and 2002.

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. Chairman's Fellowship, Department of Computer Science, The University of Chicago, 2003-2005

7. William Eckhardt Graduate Fellowship, Department of Computer Science, The University of Chicago, 2006-2007.

PUBLICATIONS

Journal Publications

- *Testing the Manifold Hypothesis*
  C. Fefferman, S. Mitter and H. Narayanan
  In preparation

- *Geometric Interpretation of Halfplane Capacity.*
  S. Lalley and G.Lawler and H. Narayanan
  Electronic Communications in Probability, December 2009

- *On the complexity of computing Kostka numbers and Littlewood-Richardson coefficients.*
  H. Narayanan
  Journal of Algebraic Combinatorics, volume 24, issue 3, November 2006

- *Random walks on polytopes and an affine interior point method for Linear Programming.*
  R. Kannan and H. Narayanan
  Accepted in Mathematics of Operations Research, 2010, under revision

- *Randomized interior point methods for sampling and optimization*
  H. Narayanan
  Submitted to Mathematical Programming Series A, 2010

- *Geometric Complexity Theory III: On deciding nonvanishing of a Littlewood Richardson coefficient.*
  K. Mulmuley and H. Narayanan and M. Sohoni
  Submitted to Journal of Algebraic Combinatorics, 2010

- *Heat flow and a faster algorithm to compute the surface area of a convex body.*
  M. Belkin and H. Narayanan and P. Niyogi
  Submitted to Random Structures and Algorithms, 2009, under revision

Conference Publications

Learning Theory

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

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

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

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

Algorithmic Applications of Diffusion

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

- *Sampling hypersurfaces through diffusion.*
  H. Narayanan and P. Niyogi
  12th Intl. Workshop on Randomization and Computation (RANDOM), August 2008

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

Geometric Complexity Theory (GCT)

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

Network Algorithms

- *Mixing times and ℓ_p bounds for oblivious routing.*
  G. Lawler and H. Narayanan
  Workshop on Analytic Algorithmics and Combinatorics (ANALCO), January 2009

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

- *Minimizing average latency in oblivious routing.*
  P. Harsha and T. Hayes and H. Narayanan and H. Racke and J. Radhakrishnan
  ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2008

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

Invited talks, seminars

- Fourth Workshop on Whitney interpolation, August 2011
- Dagsuhl 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, Princeton
- 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

TEACHING EXPERIENCE

Teaching assistant at the University of Chicago:
Machine Learning: Spring 2009
Introduction to Artificial Intelligence: Winter 2009
Introduction to Artificial Intelligence: Winter 2008
Honors Combinatorics and Probability: Spring 2005
Discrete Mathematics: Fall 2004, Fall 2005, Fall 2006
Introduction to Computer Science-2: Winter 2004
Algorithms: Fall 2003, Winter 2005

ADDITIONAL PROFESSIONAL EXPERIENCE

1. Intern at Microsoft Research Labs, Bangalore, India, Summer 2008

2. Participant at the American Institute of Mathematics (AIM) Algorithmic Convex Geometry Workshop, Palo Alto, CA, November 2007

3. Participant at the American Institute of Mathematics (AIM) Fourier Analytic Methods in Convex Geometry Workshop, Palo Alto, CA, August 2007

4. Participant at the 17th Annual Institute for Advanced Study/Park City Mathematics Institute (IAS/PCMI) Summer School on Statistical Mechanics , Park City, Utah, July 2007

5. Intern at Yahoo! Research, Santa Clara, CA, Summer 2007

SERVICE

Refereed for 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), Symposium on Discrete Algorithms (SODA), Conference on Neural Information Processing Systems (NIPS), Conference on Learning Theory (COLT),

STATUS

Citizenship: Indian
VISA type: F1