Chinmay Hegde

Postdoctoral Associate, CSAIL
Massachusetts Institute of Technology
32 Vassar St, 32-G564, Cambridge MA 02139
http://people.csail.mit.edu/chinmay/
chinmay@csail.mit.edu | 281-804-5037

Research Interests

Signal Processing · Algorithm Design · Information Theory · Machine Learning

Education

2012 Ph.D., Electrical and Computer Engineering, Rice University
2010 M.S., Electrical and Computer Engineering, Rice University
2006 B.Tech., Electrical Engineering, Indian Institute of Technology Madras

Positions

2012–'15 Postdoctoral Associate, CSAIL, MIT, Cambridge MA
2014–'15 Instructor, EECS Department, MIT, Cambridge MA
2006–'12 Research Assistant, ECE Department, Rice University, Houston TX
2011 Summer Intern, Mitsubishi Electric Research Labs, Cambridge MA
2005 Summer Intern, Ittiam Systems Pvt. Ltd., Bangalore, India

Honors & awards

2013 Ralph Budd Award for Best Thesis in the School of Engineering, Rice University
2010 Robert L. Patten Award for university service, Rice University
2009 Best Student Paper Award, SPARS, Saint Malo (France)
2006 Rice University Fellowship
2002 National Board of Higher Mathematics (NBHM) Fellowship, India
2002 Gold Medal, Indian National Physics Olympiad
2001, '02 Certificate of Distinction, Indian National Mathematics Olympiad
2000 Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship, India
2000 National Talent Search Exam (NTSE) Scholarship, India

Publications

Thesis

C. Hegde, *Nonlinear Signal Models: Geometry, Algorithms, and Analysis*. PhD thesis, ECE Department, Rice University, Sept. 2012
Winner of 2013 Ralph Budd Award for Best Thesis in the School of Engineering.
Advisor: Dr Richard G. Baraniuk.

Journal Articles

1. C. Hegde, P. Indyk, and L. Schmidt, "Approximation algorithms for model-based compressive sensing." Preprint.
2. S. Nagaraj, C. Hegde, A. Sankaranarayanan, and R. Baraniuk, "Optical flow-based transport for image manifolds," *Appl. Comput. Harmon. Anal.*, vol. 36, pp. 280–301, March 2014.
3. Y. Li, C. Hegde, A. Sankaranarayanan, R. Baraniuk, and K. Kelly, "Compressive image classification via secant projections." Preprint.
4. C. Hegde and R. Baraniuk, "Signal recovery on incoherent manifolds," *IEEE Trans. Inform. Theory*, vol. 58, pp. 7204–7214, Dec. 2012.
5. C. Hegde, A. Sankaranarayanan, W. Yin, and R. Baraniuk, "NuMax: A convex approach for learning near-isometric linear embeddings." Preprint.
6. C. Hegde, A. Sankaranarayanan, and R. Baraniuk, "Learning manifolds in the wild." Preprint.
7. C. Hegde and R. Baraniuk, "Sampling and recovery of pulse streams," *IEEE Trans. Sig. Proc.*, vol. 59, pp. 1505–1517, Apr. 2011.
8. M. Davenport, C. Hegde, M. Duarte, and R. Baraniuk, "Joint manifolds for data fusion," *IEEE Trans. Image Proc.*, vol. 19, pp. 2580–2594, Oct. 2010.
9. R. Baraniuk, V. Cevher, M. Duarte, and C. Hegde, "Model-based compressive sensing," *IEEE Trans. Inform. Theory*, vol. 56, pp. 1982–2001, Apr. 2010.

Conference and Workshop Proceedings

1. J. Acharya, I. Diakonikolas, C. Hegde, J. Li, and L. Schmidt, "Fast, near-optimal algorithms for approximating distributions by histograms," in *ACM Symp. Principles of Database Sys. (PODS)*, 2015. Submitted.
2. L. Schmidt, C. Hegde, P. Indyk, J. Kane, L. Lu, and D. Hohl, "Seismic feature extraction using Steiner tree methods," in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, 2015. Submitted.
3. C. Hegde, P. Indyk, and L. Schmidt, "Nearly linear-time model-based compressive sensing," in *Intl. Conf. Automata, Languages, and Programming (ICALP)*, July 2014.
4. C. Hegde, P. Indyk, and L. Schmidt, "A fast approximation algorithm for tree-sparse recovery," in *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*, June 2014.

5. C. Hegde, A. Sankaranarayanan, and R. Baraniuk, "Lie operators for compressive sensing," in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, May 2014.

6. L. Schmidt, C. Hegde, P. Indyk, J. Kane, L. Lu, and D. Hohl, "Automatic fault localization using the Generalized Earth Movers Distance," in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, May 2014.

7. C. Hegde, P. Indyk, and L. Schmidt, "Approximation-tolerant model-based compressive sensing," in *Proc. ACM Symp. Discrete Alg. (SODA)*, Jan. 2014.

8. E. Grant, C. Hegde, and P. Indyk, "Nearly optimal linear embeddings into very low dimensions," in *Proc. IEEE Global Conf. Signal and Image Processing (GlobalSIP)*, Dec. 2013.

9. C. Hegde, A. Sankaranarayanan, and R. Baraniuk, "Learning measurement matrices for redundant dictionaries," in *Proc. Work. Struc. Parc. Rep. Adap. Signaux (SPARS)*, July 2013.

10. L. Schmidt, C. Hegde, and P. Indyk, "The Constrained Earth Movers Distance model, with applications to compressive sensing," in *Proc. Sampling Theory and Appl. (SampTA)*, July 2013.

11. Y. Li, C. Hegde, R. Baraniuk, and K. Kelly, "Compressive classification via secant projections," in *Proc. Comput. Optical Sensing and Imaging (COSI)*, June 2013.

12. D. Grady, M. Moll, C. Hegde, A. Sankaranarayanan, R. Baraniuk, and L. Kavraki, "Multi-robot target verification with reachability constraints," in *Proc. IEEE Int. Symp. on Safety, Security, and Rescue Robotics (SSRR)*, Nov. 2012.

13. D. Grady, M. Moll, C. Hegde, A. Sankaranarayanan, R. Baraniuk, and L. Kavraki, "Multi-objective sensor replanning for a car-like robot," in *Proc. IEEE Int. Symp. on Safety, Security, and Rescue Robotics (SSRR)*, Nov. 2012.

14. C. Hegde, A. Sankaranarayanan, and R. Baraniuk, "Near-isometric linear embeddings of manifolds," in *Proc. Stat. Sig. Proc. (SSP)*, Aug. 2012.

15. C. Hegde and R. Baraniuk, "SPIN : Iterative signal recovery on incoherent manifolds," in *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*, July 2012.

16. A. Sankaranarayanan, C. Hegde, S. Nagaraj, and R. Baraniuk, "Go with the flow: Optical flow-based transport operators for image manifolds," in *Proc. Allerton Conf. on Comm., Contr., and Comp.*, Sept. 2011.

17. D. Grady, M. Moll, C. Hegde, A. Sankaranarayanan, R. Baraniuk, and L. Kavraki, "Look before you leap: Predictive sensing and opportunistic navigation," in *Proc. IROS Workshop on Open Prob. Motion Plan.*, Sept. 2011.

18. M. Davenport, C. Hegde, M. Duarte, and R. Baraniuk, "High-dimensional data fusion via joint manifold learning," in *Proc. AAAI Fall Symp. on Manifold Learning*, Nov. 2010.

19. C. Hegde and R. Baraniuk, "Compressive sensing of a superposition of pulses," in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, March 2010.

20. S. Schnelle, J. Laska, C. Hegde, M. Duarte, M. Davenport, and R. Baraniuk, "Texas hold 'em algorithms for distributed compressive sensing," in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, March 2010.

21. C. Hegde and R. Baraniuk, "Compressive sensing of streams of pulses," in *Proc. Allerton Conf. on Comm., Contr., and Comp.*, Sept. 2009.

22. V. Cevher, P. Indyk, C. Hegde, and R. Baraniuk, “Recovery of clustered sparse signals from compressive measurements,” in *Proc. Sampling Theory and Appl. (SampTA)*, May 2009.

23. C. Hegde, M. Duarte, and V. Cevher, “Compressive sensing recovery of spike trains using a structured sparsity model,” in *Proc. Work. Struc. Parc. Rep. Adap. Signaux (SPARS)*, Apr. 2009. ***Winner of Best Student Paper Award at SPARS 2009.***

24. M. Duarte, C. Hegde, V. Cevher, and R. Baraniuk, “Recovery of clustered sparse signals from compressive measurements,” in *Proc. Sampling Theory and Appl. (SampTA)*, March 2009.

25. V. Cevher, M. Duarte, C. Hegde, and R. Baraniuk, “Sparse signal recovery using Markov Random Fields,” in *Adv. Neural Inf. Proc. Sys. (NIPS)*, Dec. 2008.

26. C. Hegde, M. Wakin, and R. Baraniuk, “Random projections for manifold learning,” in *Adv. Neural Inf. Proc. Sys. (NIPS)*, Dec. 2007.

27. M. Davenport, C. Hegde, M. Wakin, and R. Baraniuk, “Manifold-based approaches for improved classification,” in *Proc. NIPS Workshop on Topology Learning*, Dec. 2007.

28. C. Hegde, M. Davenport, M. Wakin, and R. Baraniuk, “Efficient machine learning using random projections,” in *Proc. NIPS Workshop on Efficient Machine Learning*, Dec. 2007.

BOOKS

1. R. Baraniuk, M. Davenport, M. Duarte, and C. Hegde, *An Introduction to Compressive Sensing*. Connexions e-textbook, 2011

TECHNICAL REPORTS

1. C. Hegde, P. Indyk, and L. Schmidt, “A fast, adaptive variant of the Goemans-Williamson algorithm for the Prize-Collecting Steiner Tree problem.” MIT Tech. Report, Nov. 2014.

2. M. Davenport, C. Hegde, M. Duarte, and R. Baraniuk, “A theoretical analysis of joint manifolds,” Tech. Rep. TREE0901, Rice University ECE Department, Jan. 2009.

3. C. Hegde, M. Wakin, and R. Baraniuk, “Random projections for manifold learning: Proofs and analysis,” Tech. Rep. TREE-0710, Rice Univ., ECE Dept., 2007.

PATENTS

1. O. Tuzel, F. Porikli, and C. Hegde, “Upscaling Natural Images", US Patent No. 8,620,073, December 2013.

Invited Presentations

1. “Nearly Linear-Time Algorithms for Structured Sparsity", ECE Seminar, Rice University, Houston TX, October 2014.

2. “Nearly Linear-Time Algorithms for Structured Sparsity", ECE Seminar, University of Massachusetts, Amherst MA, October 2014.

3. “Linear Dimensionality Reduction for Large-Scale Datasets", MIT Lincoln Laboratory, Lexington MA, March 2014.
4. “Approximation Algorithms for Structured Sparse Recovery ", INFORMS Optimization Society Conference, Houston TX, March 2014.
5. “Approximation-Tolerant Model-Based Compressive Sensing”, EIS Seminar, Carnegie Mellon University, Pittsburgh PA, November 2013.
6. “Approximation-Tolerant Model-Based Compressive Sensing”, CSIP Seminar, Georgia Institute of Technology, Atlanta GA, October 2013.
7. “Sparse Modeling Techniques for Geological Exploration”, Hunters Network Meeting, Massachusetts Institute of Technology, Cambridge MA, August 2013.
8. “A Convex Approach for Designing Good Linear Embeddings”, Workshop on Sparse Fourier Transform etc., Massachusetts Institute of Technology, Cambridge MA, February 2013.
9. “Geometric Models for Signal Acquisition and Processing”, University of Wisconsin, Madison WI, May 2012.
10. “Near-Isometric Linear Embeddings of Manifolds”, KECoM Workshop, The Ohio State University, Columbus OH, May 2012.
11. “A Geometric Approach for Compressive Sensing”, Shell Bellaire Technology Center, Houston TX, April 2012.
12. “Geometric Signal Models for Compressive Sensing”, Mitsubishi Electric Research Labs, Cambridge MA, June 2011.
13. “Random Projections for Manifold Learning”, IMA Workshop on Multi-Manifold Data Modeling, Minneapolis MN, October 2008.

Teaching Experience

2015 *Instructor*, EECS Department, Massachusetts Institute of Technology.
Course 6.006: “Introduction to Algorithms”.
Will instruct a core undergraduate-level course focussing on the basics of algorithm design and data structures for Computer Science majors.

2014 *Instructor*, EECS Department, Massachusetts Institute of Technology.
Course 6.042: “Mathematics for Computer Science”.
Instructed a core undergraduate-level course focussing on the basics of probability, graph theory, and discrete algorithms for Computer Science majors.

2010 *Teaching Assistant*, Graduate Summer School, IAS/Park City Mathematics Institute.
Prepared numerical problem sets, organized and conducted lab sessions for a short course on compressive sensing.

2007–2011 *Graduate Course Assistant*, ECE Department, Rice University.
Prepared, graded assignments and exams for ELEC 301 (Signals and Systems), ELEC 431 (Digital Signal Processing), and ELEC 533 (Probability and Random Processes).

Professional Activities

Program Committees

2013 IEEE GlobalSIP Symposium on New Sensing and Statistical Inference Methods

Reviewer

ACM-SIAM Symposium on Discrete Algorithms (SODA)
ACM Symposium on Principles of Distributed Computing (PODC)
Applied Computational and Harmonic Analysis
EURASIP Journal on Advances in Signal Processing
IEEE Conference on Acoustics, Speech and Signal Processing (ICASSP)
IEEE Conference on Information Processing and Sensor Networks (IPSN)
IEEE International Symposium on Information Theory (ISIT)
IEEE Journal on Selected Topics in Signal Processing
IEEE Signal Processing Letters
IEEE Transactions on Geoscience and Remote Sensing
IEEE Transactions on Information Theory
IEEE Transactions on Signal Processing
IEEE Transactions on Image Processing
IEEE Transactions on Robotics
IEEE Transactions on Systems, Man and Cybernetics
IEEE Workshop on Computational Advances in Multi-Sensor Adaptive Processing
International Journal on Applied Control and Signal Processing
Neural Information Processing Systems (NIPS)
Pattern Recognition
Sampling Theory and Applications (SampTA)
SIAM Journal on Computing
SIAM Journal on Imaging Sciences

Leadership

2008–2009 President, Indian Students at Rice (ISAR)
2009–2010 Representative, Graduate Students Association (GSA), Rice University
2008–2010 Graduate Mentor, ECE Department, Rice University