

# Chinmay Hegde

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## Research Interests

Data Analytics  
Machine Learning  
Signal Processing  
Design and Analysis of Algorithms

## Education

- 2012** Ph.D. in Electrical and Computer Engineering, Rice University  
Advisor: Richard G. Baraniuk  
Thesis: "Nonlinear Signal Models: Geometry, Analysis, and Algorithms"  
*Winner of 2013 Ralph Budd Award for Best Thesis in School of Engineering*
- 2010** M.S. in Electrical and Computer Engineering, Rice University
- 2006** B.Tech. in Electrical Engineering, Indian Institute of Technology Madras

## Positions

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|----------------|--|-------------------------------|
| <b>2019-</b>   | New York University, Tandon School of Engineering      | Assistant Professor           |
| <b>2015-19</b> | Iowa State University, ECpE Department                 | Assistant Professor           |
| <b>2017-19</b> | Iowa State University, College of Engineering          | Black & Veatch Faculty Fellow |
| <b>2012-15</b> | Massachusetts Institute of Technology, CSAIL           | Postdoctoral Associate        |
| <b>2014-15</b> | Massachusetts Institute of Technology, EECS Department | Instructor                    |
| <b>2011</b>    | Mitsubishi Electric Research Labs (MERL)               | Summer Intern                 |
| <b>2006-12</b> | Rice University  | Graduate Research Assistant   |
| <b>2005</b>    | Ittiam Systems Pvt. Ltd.                               | Summer Intern                 |

## Honors and Awards

- 2018-23** NSF CAREER Award
- 2019** 2019 NeurIPS Top Reviewer Award
- 2019** MRS Open Data Challenge Award

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| <b>2018</b>    | Boast-Nilsson Educational Impact Award   |
| <b>2017</b>    | Black & Veatch Building a World of Difference Faculty Fellowship               |
| <b>2017</b>    | Best Poster Award, Midwest Machine Learning Symposium (MMLS)                   |
| <b>2016</b>    | NSF CISE Research Initiation Initiative (CRII) Award                           |
| <b>2016</b>    | Warren B. Boast Undergraduate Teaching Award                                   |
| <b>2015</b>    | Best Paper Award, International Conference on Machine Learning (ICML)          |
| <b>2013</b>    | Ralph Budd Award for Best Thesis in the School of Engineering, Rice University |
| <b>2010</b>    | Robert L. Patten Award for university service, Rice University                 |
| <b>2009</b>    | Best Student Paper Award, SPARS Workshop                                       |
| <b>2006-12</b> | Rice University Fellowship   |
| <b>2002-03</b> | National Board of Higher Mathematics (NBHM) Fellowship, India                  |
| <b>2002</b>    | Gold Medal, Indian National Physics Olympiad                                   |
| <b>2001,02</b> | Certificate of Distinction, Indian National Mathematics Olympiad               |
| <b>2001</b>    | Certificate of Distinction, Indian National Astronomy Olympiad                 |
| <b>2000-02</b> | Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship, India                    |
| <b>2000</b>    | National Talent Search Exam (NTSE) Scholarship, India                          |

## Funding

PI, “CAREER: Advances in Graph Learning and Inference”, National Science Foundation (NSF), February 2018-January 2023, \$420,000 (sole PI).

PI, “PALM: A Physics-Aware Learning Framework for Microstructure Design”, Defence Advanced Research Projects Agency (DARPA), January 2019-June 2020, \$785,000 (CH share: 33%).

co-PI, “HDR TRIPODS: D4 (Dependable Data-Driven Discovery) Institute”, National Science Foundation (NSF), Jan 2020-Dec 2022, \$1,498,999. (PI: Hriday Rajan, CH share: 10%).

co-PI, “Deep Insight: A Deep-Net Approach for Estimating Driver State from Naturalistic Data”, Federal Highway Administration, 7/1/2019-6/30/2021, \$1,354,417 (PI: Anuj Sharma, CH share: 5%).

co-PI, “Robust Learning of Dynamic Interactions for Enhancing Power System Resilience”, US Department of Energy (DOE), 7/1/2019-12/31/2020, \$1,250,000 (PI: Zhaoyu Wang, CH share: 10%).

co-PI, “CIF: Small: Structured High-dimensional Data Recovery from Phaseless Measurements”, National Science Foundation (NSF), July 2018-June 2021, \$499,071. (PI: Namrata Vaswani, CH share: 50%).

co-PI, “ATD: Efficient and Stable Algorithms for Non-Euclidean Regression in Discrete Geometries”, National Science Foundation (NSF), October 2018-September 2021, \$225,000. (PI: Eric Weber, CH share: 25%).

co-PI, “Learning under Adversarial Conditions with a focus on Self-Driving Car Applications”, Exploratory Research Program (ERP), Iowa State University, January 2019-July 2019, \$33,000 (CH share: 33%).

PI, “Faculty Fellowship”, Black & Veatch Foundation, September 2017-May 2020, \$22,500.

Co-PI, “Modeling Multi-dimensional Risk in Real-World Drivers with Diabetes”, Toyota Collaborative Safety Research Center (sub-award of grant given to University of Nebraska Medical Center), \$198,664. (PI: Anuj Sharma, CH share: 33%).

Co-PI, “Prediction of Driver Safety in Advancing Age: Real-World Recorders”, University of Nebraska Medical Center (sub-award of NIH grant), \$76,122. (PI: Anuj Sharma, CH share: summer support).

PI, “CRII: CIF: Towards Linear-Time Computation of Structured Data Representations”, National Science Foundation (NSF), April 2016-March 2018, \$173,282 (sole PI).

Senior Personnel, “PFI: BIC: A Smart Service System for Traffic Incident Management Enabled by Large-data Innovations”, National Science Foundation (NSF), September 2016-August 2019, \$1,000,000. (PI: Anuj Sharma, CH share: summer support).

PI, “GPU Grant Program”, NVIDIA Corporation, \$2,500 (equipment).

## Publications

Google Scholar metrics (Aug 2019): 3068 citations, H-index=21, i10-index=34.

## Thesis

C. Hegde. *Nonlinear Signal Models: Geometry, Algorithms, and Analysis*. PhD thesis, ECE Department, Rice University, Sept. 2012. **Ralph Budd Award for Best Thesis in School of Engineering.**

## Journal Articles

T. Nguyen, R. Wong, and C. Hegde. A provable approach for double-sparse coding. *J. Machine Learning Research (JMLR)*, Sept. 2019. To appear, available online at <https://arxiv.org/abs/1711.03638>.

G. Jagatap, Z. Chen, S. Nayer, C. Hegde, and N. Vaswani. Sub-diffraction super-resolution imaging for structured data. *IEEE Trans. Computational Imaging*, Aug. 2019. To appear.

P. Chakraborty, J. Merickel, V. Shah, A. Sharma, C. Hegde, C. Desouza, A. Drincic, P. Gunaratne, and M. Rizzo. Quantifying vehicle control from physiology in type-1 diabetes. *Traffic Injury Prevention*, Aug. 2019. To appear.

P. Chakraborty, C. Hegde, and A. Sharma. Data-driven parallelizable traffic incident detection using spatio-temporally denoised robust thresholds. *Transportation Research Part C*, 105:81–99, August 2019.

G. Jagatap and C. Hegde. Sample-efficient algorithms for recovering structured signals from magnitude-only measurements. *IEEE Trans. Inform. Theory*, July 2019.

M. Soltani and C. Hegde. Provable algorithms for learning two-layer polynomial neural networks. *IEEE Trans. Sig. Proc.*, 67(13):3361–3371, July 2019.

M. Soltani and C. Hegde. Fast algorithms for demixing signals from nonlinear observations. *IEEE Trans. Sig. Proc.*, 65(16):4209–4222, Aug. 2017.

C. Hegde, A. Sankaranarayanan, W. Yin, and R. Baraniuk. NuMax: A convex approach for learning near-isometric linear embeddings. *IEEE Trans. Sig. Proc.*, 63(22):6109–6121, Nov. 2015.

C. Hegde, P. Indyk, and L. Schmidt. Fast algorithms for structured sparsity. *Bulletin of the EATCS*, 1(117):197–228, Oct. 2015.

C. Hegde, P. Indyk, and L. Schmidt. Approximation algorithms for model-based compressive sensing. *IEEE Trans. Inform. Theory*, 61(9):5129–5147, Sept. 2015.

Y. Li, C. Hegde, A. Sankaranarayanan, R. Baraniuk, and K. Kelly. Compressive image classification via secant projections. *J. Optics*, 17(6), June 2015.

- S. Nagaraj, C. Hegde, A. Sankaranarayanan, and R. Baraniuk. Optical flow-based transport for image manifolds. *Appl. Comput. Harmon. Anal.*, 36(2):280–301, March 2014.
- C. Hegde and R. Baraniuk. Signal recovery on incoherent manifolds. *IEEE Trans. Inform. Theory*, 58(12):7204–7214, Dec. 2012.
- C. Hegde and R. Baraniuk. Sampling and recovery of pulse streams. *IEEE Trans. Sig. Proc.*, 59(4):1505–1517, Apr. 2011.
- M. Davenport, C. Hegde, M. Duarte, and R. Baraniuk. Joint manifolds for data fusion. *IEEE Trans. Image Proc.*, 19(10):2580–2594, Oct. 2010.
- R. Baraniuk, V. Cevher, M. Duarte, and C. Hegde. Model-based compressive sensing. *IEEE Trans. Inform. Theory*, 56(4):1982–2001, Apr. 2010.

## Conference Proceedings

- G. Jagatap and C. Hegde. Algorithmic guarantees for inverse imaging with untrained network priors. In *Adv. Neural Inf. Proc. Sys. (NIPS)*, Dec. 2019.
- Z. Jiang, A. Balu, S. Tan, C. Hegde, and S. Sarkar. On higher order moments in adam. In *Proc. NeurIPS Workshop: Beyond First-Order Optimization Methods (OPT)*, Dec. 2019.
- A. Mukherjee, A. Joshi, S. Sarkar, and C. Hegde. Domain adaptation for deep classifiers via gan-based data augmentation. In *Proc. NeurIPS Autonomous Driving Workshop (ADW)*, Dec. 2019.
- V. Shah and C. Hegde. Signal reconstruction from modulo observations. In *Proc. IEEE Global Conf. Signal and Image Processing (GlobalSIP)*, Nov. 2019.
- M. Soltani, S. Jain, and C. Hegde. Learning structured signals using gans with applications in denoising and demixing. In *Proc. Asilomar Conf. Sig. Sys. Comput.*, Nov. 2019.
- R. Hyder, C. Hegde, and S. Asif. Phase retrieval with side information. In *Proc. Asilomar Conf. Sig. Sys. Comput.*, Nov. 2019.
- A. Joshi, A. Mukherjee, S. Sarkar, and C. Hegde. Semantic adversarial attacks: Parametric transformations that fool deep classifiers. In *Intl. Conf. Computer Vision (ICCV)*, Oct. 2019.
- P. Chakraborty, J. Merickel, V. Shah, A. Sharma, C. Hegde, C. Desouza, A. Drincic, P. Gunaratne, and M. Rizzo. Predicting risk from physiology in drivers with type-1 diabetes. In *Proc. AAAM Annual Scientific Conf. (AAAM)*, Oct. 2019.
- V. Shah, J. Merickel, P. Chakraborty, C. Hegde, A. Sharma, C. Desouza, A. Drincic, P. Gunaratne, and M. Rizzo. Quantifying driver speed behavior from real-time physiology in type 1 diabetes. In *Proc. Intl. Symp. Future Active Safety Technology (FastZero)*, Sep. 2019.
- J. Merickel, V. Shah, P. Chakraborty, A. Sharma, C. Hegde, C. Desouza, A. Drincic, P. Gunaratne, and M. Rizzo. Impact of physiology and environment on vehicle control behavior in drivers with type 1 diabetes. In *Proc. Intl. Symp. Future Active Safety Technology (FastZero)*, Sep. 2019.
- G. Jagatap and C. Hegde. Linearly convergent algorithms for learning shallow residual networks. In *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*, July 2019.
- A. Mukherjee, A. Joshi, S. Sarkar, and C. Hegde. Attribute-controlled traffic data augmentation using conditional generative models. In *Proc. CVPR Workshop on Vision for All Seasons (CVPR VAS)*, June 2019.
- T. Nguyen, A. Soni, and C. Hegde. Tractable learning of sparsely used dictionaries from incomplete samples. In *Proc. Sampling Theory and Appl. (SampTA)*, July 2019.
- R. Hyder, V. Shah, C. Hegde, and S. Asif. Alternating phase projected gradient descent with generative priors for solving compressive phase retrieval. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, May 2019.

- M. Cho and C. Hegde. Reducing the search space for hyperparameter optimization using group sparsity. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, May 2019.
- T. Nguyen, R. Wong, and C. Hegde. On the dynamics of gradient descent for autoencoders. In *Proc. Intl. Conf. Artificial Intelligence and Statistics (AISTATS)*, April 2019.
- R. Singh, V. Shah, B. Pokuri, B. Ganapathysubramanian, S. Sarkar, and C. Hegde. Physics-aware deep generative models for microstructure simulation. In *Proc. NIPS Workshop on Machine Learning for Molecules and Materials*, Dec. 2018.
- S. Asif and C. Hegde. Phase retrieval for signals in a union of subspaces. In *Proc. IEEE Global Conf. Signal and Image Processing (GlobalSIP)*, Nov. 2018.
- P. Chakraborty, C. Hegde, and A. Sharma. Freeway incident detection from cameras: A semi-supervised learning approach. In *Proc. IEEE Int. Conf. Intelligent Transportation Systems (ITSC)*, Nov. 2018.
- C. Hegde. Algorithmic aspects of inverse problems using generative models. In *Proc. Allerton Conf. on Comm., Contr., and Comp.*, Oct. 2018.
- G. Jagatap, Z. Chen, C. Hegde, and N. Vaswani. Model corrected low rank ptychography. In *Proc. IEEE Conf. Image Proc.*, Sept. 2018.
- T. Nguyen, A. Soni, and C. Hegde. On learning sparsely used dictionaries from incomplete samples. In *Proc. Int. Conf. Machine Learning (ICML)*, Jul. 2018.
- T. Nguyen, R. Wong, and C. Hegde. Autoencoders learn generative linear models. In *Proc. ICML Workshop on Theory and Applications of Deep Generative Modeling (TADGM)*, June 2018.
- Z. Jiang, A. Balu, C. Hegde, and S. Sarkar. Incremental consensus-based collaborative deep learning. In *Proc. ICML Workshop on Nonconvex Optimization for Machine Learning*, July 2018.
- G. Jagatap and C. Hegde. Towards sample-optimal methods for solving random quadratic equations with structure. In *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*, June 2018.
- M. Soltani and C. Hegde. Fast low-rank matrix estimation for ill-conditioned matrices. In *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*, June 2018.
- V. Shah and C. Hegde. Solving linear inverse problems using gan priors: An algorithm with provable guarantees. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Apr. 2018.
- Z. Chen, G. Jagatap, S. Nayer, C. Hegde, and N. Vaswani. Low rank fourier ptychography. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Apr. 2018.
- G. Jagatap, Z. Chen, C. Hegde, and N. Vaswani. Fourier ptychography using structured sparsity. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Apr. 2018.
- M. Soltani and C. Hegde. Towards provable learning of polynomial neural networks using low-rank matrix estimation. In *Proc. Intl. Conf. Artificial Intelligence and Statistics (AISTATS)*, Apr. 2018.
- T. Nguyen, R. Wong, and C. Hegde. A provable approach for double-sparse coding. In *Proc. AAAI Conf. Artificial Intelligence*, Feb. 2018.
- G. Jagatap and C. Hegde. Fast sample-efficient algorithms for structured phase retrieval. In *Adv. Neural Inf. Proc. Sys. (NIPS)*, Dec. 2017.
- Z. Jiang, A. Balu, C. Hegde, and S. Sarkar. Collaborative deep learning over fixed topology networks. In *Adv. Neural Inf. Proc. Sys. (NIPS)*, Dec. 2017.
- A. Balu, T. Nguyen, A. Kokate, C. Hegde, and S. Sarkar. A forward-backward approach for visualizing information flow in deep networks. In *Proc. NIPS Symposium on Interpretability for Machine Learning*, Dec. 2017.
- P. Chakraborty, C. Hegde, and A. Sharma. Trend filtering in network time series with applications to traffic incident detection. In *Proc. NIPS Time Series Workshop (TSW)*, Dec. 2017.

- M. Cohen, C. Hegde, S. Jegelka, and L. Schmidt. Efficiently optimizing over (non-convex) cones via approximate projections. In *Proc. NIPS Workshop on Optimization for Machine Learning (OPT)*, Dec. 2017.
- C. Hubbard and C. Hegde. Parallel computing heuristics for matrix completion. In *Proc. IEEE Global Conf. Signal and Image Processing (GlobalSIP)*, Nov. 2017.
- M. Soltani and C. Hegde. Demixing structured superposition signals from periodic and aperiodic nonlinearities. In *Proc. IEEE Global Conf. Signal and Image Processing (GlobalSIP)*, Nov. 2017.
- C. Hegde. Learning graph evolutions from cut sketches: Faster algorithms, fewer samples. In *Proc. Asilomar Conf. Sig. Sys. Comput.*, Nov. 2017.
- V. Shah, M. Soltani, and C. Hegde. Reconstruction from periodic nonlinearities, with applications to HDR imaging. In *Proc. Asilomar Conf. Sig. Sys. Comput.*, Nov. 2017.
- M. Soltani and C. Hegde. Fast algorithms for learning latent variables in graphical models. In *Proc. ACM KDD Workshop on Mining and Learning with Graphs (KDD MLG)*, Aug. 2017.
- B. Wang, C. Gan, J. Yang, C. Hegde, and J. Wu. Graph-based multiple-line outage identification in power transmission systems. In *IEEE Power and Engineering Systems General Meeting (PES)*, Jul. 2017.
- M. Soltani and C. Hegde. Stable recovery of sparse vectors from random sinusoidal feature maps. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Mar. 2017.
- C. Hegde, P. Indyk, and L. Schmidt. Fast recovery from a union of subspaces. In *Adv. Neural Inf. Proc. Sys. (NIPS)*, Dec. 2016.
- M. Soltani and C. Hegde. Iterative thresholding for demixing structured superpositions in high dimensions. In *Proc. NIPS Workshop on Learning in High Dimensions with Structure (LHDS)*, Dec. 2016.
- M. Soltani and C. Hegde. A fast iterative algorithm for demixing sparse signals from nonlinear observations. In *Proc. IEEE Global Conf. Signal and Image Processing (GlobalSIP)*, Dec. 2016.
- M. Soltani and C. Hegde. Demixing sparse signals from nonlinear observations. In *Proc. Asilomar Conf. Sig. Sys. Comput.*, Nov. 2016.
- C. Hubbard, J. Bavslik, C. Hegde, and C. Hu. Data-driven prognostics of lithium-ion rechargeable battery using bilinear kernel regression. In *Annual Conf. Prognostics and Health Management (PHM)*, Oct. 2016.
- C. Hegde, P. Indyk, and L. Schmidt. Nearly linear-time algorithms for graph-structured sparsity. In *Proc. Intl. Joint Conf. Artificial Intelligence (IJCAI)*, Best Paper Awards Track, July 2016.
- C. Hegde. A fast algorithm for demixing signals with structured sparsity. In *Proc. Intl. Conf. Sig. Proc. Comm. (SPCOM)*, June 2016.
- C. Hegde. Bilevel feature selection in nearly-linear time. In *Proc. Stat. Sig. Proc. (SSP)*, June 2016.
- C. Hegde, P. Indyk, and L. Schmidt. A nearly linear-time framework for graph-structured sparsity. In *Proc. Int. Conf. Machine Learning (ICML)*, July 2015. **Best Paper Award.**
- J. Acharya, I. Diakonikolas, C. Hegde, J. Li, and L. Schmidt. Fast and near-optimal algorithms for approximating distributions by histograms. In *Proc. Symp. Principles of Database Systems (PODS)*, May 2015.
- M. Araya-Polo, C. Hegde, P. Indyk, and L. Schmidt. Greedy strategies for data-adaptive shot selection. In *Proc. Annual EAGE Meeting*, May 2015.
- L. Schmidt, C. Hegde, P. Indyk, L. Lu, X. Chi, and D. Hohl. Seismic feature extraction using Steiner tree methods. In *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Apr. 2015.
- C. Hegde, P. Indyk, and L. Schmidt. Nearly linear-time model-based compressive sensing. In *Proc. Intl. Colloquium on Automata, Languages, and Programming (ICALP)*, July 2014.
- 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.

- Y. Li, C. Hegde, and K. Kelly. Object tracking via compressive sensing. In *Proc. Comput. Optical Sensing and Imaging (COSI)*, June 2014.
- 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.
- 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.
- C. Hegde, P. Indyk, and L. Schmidt. Approximation-tolerant model-based compressive sensing. In *Proc. ACM Symp. Discrete Alg. (SODA)*, Jan. 2014.
- 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.
- C. Hegde, A. Sankaranarayanan, and R. Baraniuk. Learning measurement matrices for redundant dictionaries. In *Proc. Work. Struc. Parc. Rep. Adap. Signaux (SPARS)*, July 2013.
- 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.
- Y. Li, C. Hegde, R. Baraniuk, and K. Kelly. Compressive classification via secant projections. In *Proc. Comput. Optical Sensing and Imaging (COSI)*, June 2013.
- 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.
- 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.
- C. Hegde, A. Sankaranarayanan, and R. Baraniuk. Near-isometric linear embeddings of manifolds. In *Proc. Stat. Sig. Proc. (SSP)*, Aug. 2012.
- C. Hegde and R. Baraniuk. SPIN: Iterative signal recovery on incoherent manifolds. In *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*, July 2012.
- 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.
- 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.
- 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.
- 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.
- 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.
- C. Hegde and R. Baraniuk. Compressive sensing of streams of pulses. In *Proc. Allerton Conf. on Comm., Contr., and Comp.*, Sept. 2009.
- 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.
- 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. **Best Student Paper Award.**
- M. Duarte, C. Hegde, V. Cevher, and R. Baraniuk. Recovery of compressible signals from unions of subspaces. In *Proc. IEEE Conf. Inform. Science and Systems (CISS)*, March 2009.

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.

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

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.

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

## Papers Under Review

B. Wang, C. Gan, J. Yang, C. Hegde, and J. Wu. Graph-based multiple-line outage identification in power transmission systems. Preprint, Sept. 2019.

M. Cho, M. Soltani, and C. Hegde. One-shot neural architecture search via compressive sensing. Preprint, Sept. 2019.

T. Nguyen, Y. Mroueh, S. Hoffman, P. Das, P. Dognin, G. Romano, and C. Hegde. Surrogate-based constrained langevin sampling with applications to optimal material configuration design. Preprint, Sept. 2019.

T. Nguyen, M. Liu, K. Yen, Y. Hu, and C. Hegde. Robust login risk detection via adversarial learning and lstm-based user history modeling. Preprint, Sept. 2019.

X. Lee, S. Ghadai, K. Tan, C. Hegde, and S. Sarkar. Spatiotemporally constrained action space attacks on deep reinforcement learning agents. Preprint, Sept. 2019.

A. Joshi, M. Cho, V. Shah, B. Pokuri, B. Ganapathysubramanian, S. Sarkar, and C. Hegde. Invnet: Encoding geometric and statistical invariances in deep generative models. Preprint, Sept. 2019.

C. Hegde, F. Keinert, and E. Weber. A kaczmarsz algorithm for solving tree based distributed systems of equations. Preprint, Apr. 2019.

M. Soltani and C. Hegde. Fast low-rank matrix estimation without the condition number. Preprint, Dec. 2017.

## Books and Monographs

C. Hegde and A. Kamal. Theoretical foundations of computer engineering. Monograph available online, June 2017.

C. Hegde. Lecture notes on data analytics. Monograph available online, June 2017.

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

## Technical Reports

C. Hubbard and C. Hegde. GPUFish: A parallel computing framework for matrix completion from a few observations. Technical report, Iowa State University, December 2016.

C. Hegde. Bilevel feature selection in nearly-linear time. Preprint, 2016.

C. Hegde, A. Sankaranarayanan, and R. Baraniuk. Learning manifolds in the wild. Preprint, July 2012.

C. Hegde, P. Indyk, and L. Schmidt. A fast adaptive variant of the GW algorithm for the Prize-Collecting Steiner Tree problem. DIMACS Workshop, Dec. 2014.

C. Hegde, O. Tuzel, and F. Porikli. Efficient upsampling of natural images. MERL Technical Report, March 2012.



M. Davenport, C. Hegde, M. Duarte, and R. Baraniuk. A theoretical analysis of joint manifolds. Technical Report TREE0901, Rice University ECE Department, Jan. 2009.

C. Hegde, M. Wakin, and R. Baraniuk. Random projections for manifold learning: Proofs and analysis. Technical Report TREE-0710, Rice Univ., ECE Dept., Dec. 2007.

## Patents

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

## Invited Presentations

### At ISU

“Invariance Networks for Solving Partial Differential Equations”, NIH Workshop on Machine Learning and Multiscale Modeling, Bethesda MD, October 2019.

“Invariance Networks for Solving Partial Differential Equations”, University of Wisconsin, Madison WI, October 2019.

“Invariance Networks for Solving Partial Differential Equations”, Data Science Seminar, Iowa State University, October 2019.

“Tractable Dictionary Learning from Incomplete Samples”, Sampling Theory and Applications, Bordeaux, France, July 2019.

“Unsupervised Neural Network Learning via an Algorithmic Lens”, Department Seminar, New York University Tandon School of Engineering, New York NY, March 2019.

“On the Dynamics of Gradient Descent for Autoencoders”, Information Theory and Applications Workshop, San Diego CA, February 2019.

“Algorithmic Aspects of Inverse Problems using Generative Models”, Allerton Conference, Monticello IL, October 2018.

“Event Detection in Networks using Steiner Tree Methods”, NSF Workshop on Algorithms for Threat Detection, Washington DC, October 2018.

“Unsupervised Neural Network Learning from an Algorithmic Lens”, CS Department Seminar, University of Iowa, Iowa City IA, September 2018.

“Unsupervised Neural Network Learning from an Algorithmic Lens”, ECE Graduate Seminar, Carnegie Mellon University, Pittsburgh PA, September 2018.

“Fast Algorithms for Learning Structured Dictionaries and Autoencoders”, Midwest Machine Learning Symposium, Chicago IL, June 2018.

“Provably Accurate Double-Sparse Coding”, Information Theory and Applications Workshop, San Diego CA, February 2018.

“The Curse of Dimensionality”, Big Data Seminar Series, Iowa State University, November 2017.

“Phase Retrieval: Challenges, Solutions, and Applications”, Department of Mathematics Seminar, Iowa State University, October 2017.

“Fast(er) Algorithms for Machine Learning in High Dimensions”, Department of Statistics Seminar, Iowa State University, September 2017.

“Fast Algorithms for Learning Latent Variables in Graphical Models”, ACM KDD Mining and Learning with Graphs Workshop (spotlight presentation), Halifax NS, August 2017.

“Fast(er) Algorithms for Machine Learning in High Dimensions”, The Alan Turing Institute, London UK, August 2017.

“Phase Retrieval with Structured Sparsity”, International Linear Algebra Society (ILAS) Conference, Ames IA, July 2017.

“SVD-free Algorithms for Low-Rank Matrix Recovery”, SIAM Conference on Optimization, Vancouver BC, Canada, May 2017.

“Stable Inversion of (Certain) Periodic Random Feature Maps”, Information Theory and Applications Workshop, San Diego CA, February 2017.

“Iterative Thresholding for Demixing Structured Superpositions in High Dimensions”, NIPS Workshop on Learning in High Dimensions, Barcelona, Spain, December 2016. **Oral presentation; acceptance rate: 2/50.**

“A Fast Algorithm for Demixing Signals with Structured Sparsity”, International Conference on Signal Processing and Communications, Bangalore, India, June 2016.

“Nearly Linear-Time Algorithms for Structured Sparsity”, Information Theory and Applications Workshop, San Diego CA, February 2016.

“Learning Structured Sparse Representations Using Approximation”, Joint Mathematics Society, Special Session on “Analysis, Geometry, and Data”, Seattle WA, January 2016.

“Fast Algorithms for Structured Sparsity”, EE Seminar, Indian Institute of Technology Bombay, Mumbai, India, October 2015.

“Fast Algorithms for Structured Sparsity”, ECE Seminar, Indian Institute of Science, Bangalore, India, October 2015.

“Fast Algorithms for Structured Sparsity”, Computer Science Colloquium, Iowa State University, Ames IA, September 2015.

## **Pre-ISU**

“Nearly Linear-Time Algorithms for Structured Sparsity”, International Symposium on Mathematical Programming (ISMP), Pittsburgh PA, July 2015.

“The Power of Structured Sparsity in Data Acquisition and Analysis”, ECE Seminar, Ohio State University, Columbus OH, April 2015.

“The Power of Structured Sparsity in Data Acquisition and Analysis”, ECpE Seminar, Iowa State University, Ames IA, March 2015.

“Structured Sparsity: Models, Algorithms, and Applications”, ECE Seminar, University of Illinois, Chicago IL, March 2015.

“Structured Sparsity: Models, Algorithms, and Applications”, EECS Seminar, Washington State University, Pullman WA, February 2015.

“Structured Sparsity: Models, Algorithms, and Applications”, EECS Seminar, University of California, Irvine CA, February 2015.

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

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

“Linear Dimensionality Reduction of Large-Scale Datasets”, PED Seminar Series, MIT Lincoln Laboratory, Lexington MA, March 2014.

“Approximation Algorithms for Structured Sparse Recovery”, INFORMS Optimization Society Conference, Houston TX, March 2014.

“Approximation-Tolerant Model-Based Compressive Sensing”, EIS Seminar, Carnegie Mellon University, Pittsburgh PA, November 2013.

“Approximation-Tolerant Model-Based Compressive Sensing”, CSIP Seminar, Georgia Institute of Technology, Atlanta GA, October 2013.

“Sparse Modeling Techniques for Geological Exploration”, Hunters Network Meeting, Massachusetts Institute of Technology, Cambridge MA, August 2013.

“A Convex Approach for Designing Good Linear Embeddings”, Workshop on Sparse Fourier Transform etc., Massachusetts Institute of Technology, Cambridge MA, February 2013.

“Geometric Models for Signal Acquisition and Processing”, University of Wisconsin, Madison WI, May 2012.

“Near-Isometric Linear Embeddings of Manifolds”, KECOM Workshop, The Ohio State University, Columbus OH, May 2012.

“A Geometric Approach for Compressive Sensing”, Shell Bellaire Technology Center, Houston TX, April 2012.

“Geometric Signal Models for Compressive Sensing”, Mitsubishi Electric Research Labs, Cambridge MA, June 2011.

“Random Projections for Manifold Learning”, IMA Workshop on Multi-Manifold Data Modeling, Minneapolis MN, October 2008.

## Teaching Experience

### At ISU

|                    |  |                       |
|--------------------|--|-----------------------|
| <b>Spring 2019</b> | CprE 310: Theoretical Foundations of Computer Eng.<br>Professor (Evaluation: 4.6/5 (mean)) | Iowa State University |
| <b>Fall 2018</b>   | CprE 310: Theoretical Foundations of Computer Eng.<br>Professor (Evaluation: 4.4/5 (mean)) | Iowa State University |
| <b>Spring 2018</b> | EE 525X: Principles of Data Analytics for ECpE<br>Professor (Evaluation: 4.8/5 (mean))     | Iowa State University |
| <b>Spring 2018</b> | CprE 310: Theoretical Foundations of Computer Eng.<br>Professor (Evaluation: 4.6/5 (mean)) | Iowa State University |
| <b>Fall 2017</b>   | CprE 310: Theoretical Foundations of Computer Eng.<br>Professor (Evaluation: 4.4/5 (mean)) | Iowa State University |
| <b>Spring 2017</b> | EE 525X: Principles of Data Analytics for ECpE<br>Professor (Evaluation: 4.8/5 (mean))     | Iowa State University |
| <b>Fall 2016</b>   | CprE 310: Theoretical Foundations of Computer Eng.<br>Professor (Evaluation: 4.4/5 (mean)) | Iowa State University |
| <b>Spring 2016</b> | EE 525X: Principles of Data Analytics for ECpE<br>Professor (Evaluation: 4.7/5 (mean))     | Iowa State University |
| <b>Fall 2015</b>   | EE 324: Signals and Systems II<br>Professor (Evaluation: 4.8/5 (mean))                     | Iowa State University |

## Pre-ISU

|                    |  |                                       |
|--------------------|--|---------------------------------------|
| <b>Spring 2015</b> | 6.006: Introduction to Algorithms<br>Instructor          | Massachusetts Institute of Technology |
| <b>Spring 2014</b> | 6.042: Mathematics for Computer Science<br>Instructor    | Massachusetts Institute of Technology |
| <b>Summer 2010</b> | Summer School on Image Analysis<br>Teaching Assistant    | Park City Mathematical Institute      |
| <b>2007-2011</b>   | ELEC 301, ELEC431, ELEC 531<br>Graduate Course Assistant | Rice University                       |

## Student Supervision

### Graduate Students

#### [current]

Gauri Jagatap (PhD, August 2016-present)  
Thanh Nguyen (PhD, August 2016-present)  
Daniel Cho (PhD, August 2018-present)  
Ameya Joshi (PhD, co-advised with Soumik Sarkar, August 2018-present)  
Amitangshu Mukherjee (PhD, co-advised with Soumik Sarkar, June 2018-present)

#### [graduated]

Mohammadreza Soltani (PhD, Jan 2016-February 2019; First position: Postdoc, EE Department, Duke University)  
Pranamesh Chakraborty (PhD, co-advised with Anuj Sharma, Jan 2017-July 2019. First position: Faculty in Transportation Engineering, IIT Kanpur)  
Viraj Shah (MS, August 2016-October 2019)  
Souparni Agnihotri (MS, August 2018-May 2019; First position: Cerner Corporation)  
Rahul Singh (MS, June 2018-February 2019; First position: Wells Fargo)  
Charlie Hubbard (MS, May 2016-Dec 2017; First position: Hy-Vee Data Science Division)  
Shen Fu (MS, co-advised with Prof. Daji Qiao, August 2016-Dec 2017)  
Manaswi Podduturi (MS, May 2016-Feb 2018; First position: Kingland Analytics)  
Jayganesh Rajaraman (MS, Aug 2017-May 2018; First position: Rockwell Automation)

### Undergraduate Students

Luke Schoeberle (Honors Study, 2019.)  
Andrew Whitehead (McNair scholar, 2018-2019.)  
Yazan Okasha (Independent study, 2017-2018.)  
Omar Taylor (Independent study, 2016-2019.)  
Souparni Agnihotri (Independent study, 2016-2017.)  
Yifan Liu (Independent study, 2018.)  
Chun-Hao Lo (Independent study, 2016.)

### Senior Design Mentoring

Blake Roberts, Colton Goode, Lee Fulbel, Nikolas Moeller, "Real Estate Portfolio Optimization", 2018.  
Alex Mortimer, Carter Scheve, Sam Howard, "Asset Management and Financial Factor Discovery", 2018.  
Jose Candelario, Bradley Stiff, Yifan Liu, Sam Park, "FollowMe: A Guided Autonomous Vehicle", 2017.  
Cameron Cornick, Ashlyn Freestone, Yiru Gao, Wen-Chi Hsu, Zachary Snyder, "A Voice for Autism", 2016.  
Daniel Kim, Ryan Ostwinkle, Johnny Panicola, Matt Ruebbelke, "Traffic Control Warning Lights", 2016.  
Dillon Einck, Paul Gerlich, and Brian Shannan, "Machine Learning for Retinopathy Detection", 2015-2016.

## **ISU Future Faculty Program**

Davood Hajinezhad, Fall 2016.  
Ardhendu Tripathy, Fall 2017.

## **Professional Activities**

### **Officer Positions**

2019 IEEE Central Iowa SP/CAS/COM Chapter Chair

### **Organizing Committees**

2019 Midwest Big Data Summer School

2018 Midwest Big Data Summer School

2017 Midwest Big Data Summer School

### **Conference Session Chair**

2017 IEEE GlobalSIP 2017

2017 Asilomar Conference on Signals, Systems, and Computers

2016 International Conference on Signal Processing and Communications (SPCOM)

### **Proposal Panels**

2019 National Science Foundation (NSF)

2019 McGraw Hill

2017 Society for Industrial and Applied Mathematics (SIAM)

2017 Israeli Science Foundation (ISF)

2016 German-Israeli Foundation for Scientific Research and Development

### **Technical Program Committees**

2020 AAAAI Conference on Artificial Intelligence (AAAI)

2019 IEEE Signal Processing Theory and Methods (Affiliate Member)

2019 International Joint Conferences on Artificial Intelligence (IJCAI)

2019 National Conference on Communication (NCC)

2019 AAAAI Conference on Artificial Intelligence (AAAI)

2018 International Conference on Machine Learning (ICML)

2018 IEEE International Conference on Computational Photography (ICCP)

2018 International Conference on Signal Processing and Communications (SPCOM)

2016 International Conference on Artificial Intelligence and Statistics (AISTATS)

2016 International Conference on Signal Processing and Communications (SPCOM)

2015 International Joint Conferences on Artificial Intelligence (IJCAI) - ML Track

2013 IEEE GlobalSIP Symposium on New Sensing and Statistical Inference Methods

## Reviewer

Artificial Intelligence  
Artificial Intelligence and Statistics (AISTATS)  
ACM-SIAM Symposium on Discrete Algorithms (SODA)  
ACM Symposium on Principles of Distributed Computing (PODC)  
Applied Computational and Harmonic Analysis  
Cambridge University Press  
European Symposium on Algorithms (ESA)  
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 Conference on International Transportation Systems (ITSC)  
IEEE International Symposium on Information Theory (ISIT)  
IEEE Journal on Selected Topics in Signal Processing  
IEEE Signal Processing Letters  
IEEE Signal Processing Magazine  
IEEE Transactions on Education  
IEEE Transactions on Cyber-Physical Systems  
IEEE Transactions on Geoscience and Remote Sensing  
IEEE Transactions on Information Theory  
IEEE Transactions on Image Processing  
IEEE Transactions on Knowledge and Data Engineering  
IEEE Transactions on Pattern Analysis and Machine Intelligence  
IEEE Transactions on Robotics  
IEEE Transactions on Signal Processing  
IEEE Transactions on Systems, Man and Cybernetics  
IEEE Workshop on Computational Advances in Multi-Sensor Adaptive Processing  
International Conference on Learning Representations (ICLR)  
International Conference on Machine Learning (ICML)  
International Journal on Applied Control and Signal Processing  
Journal of Computational and Graphical Statistics  
Journal of Optics  
Mathematical Reviews  
Neural Information Processing Systems (NeurIPS)  
Neural Computation (NECO)  
Pattern Recognition  
PLOS One  
Sampling Theory and Applications (SampTA)  
SIAM Journal on Computing  
SIAM Journal on Imaging Sciences  
Signal Processing with Adaptive Sparse Structured Representations (SPARS)  
Symposium on Theoretical Aspects of Computer Science (STACS)

## **Affiliations**

- 2018-** Senior Member, IEEE
- 2018-** Senior Member, IEEE Signal Processing Society
- 2012-2018** Member, IEEE
- 2013-2018** Member, IEEE Signal Processing Society
- 2010-2011** Student member, AAAI
- 2007-2012** Student member, IEEE

## **Participant**

- 2018** NSF ATD/AMPS Workshop
- 2016-19** Information Theory and Applications (ITA) Workshop
- 2012** Workshop on Knowledge-Enhanced Compressive Sensing (KeCoM)
- 2009-2011** Winedale Workshop
- 2011** Rice University Office of Faculty Development Workshop
- 2011** Signal Processing Education Network (SPEN) Workshop
- 2010** Park City Mathematics Institute Summer Program on Image Processing
- 2008** IMA Workshop on Multi-Manifold Data Modeling and Applications
- 2008** IMA Workshop on Nonlinear Approximation Techniques using L1
- 2007** IPAM Workshop on Sparsity and High Dimensional Geometry

## **University Service**

### **At ISU**

- 2018-19** ECSEL Mentor
- 2018** Panelist, VPR New Faculty Orientation
- 2016-19** ECE representative, University Honors Committee
- 2016-2017** CoE representative, Data Science Minor Committee
- 2016-19** Member, ECpE Graduate Admissions Committee
- 2016-17** Member, Promotion and Tenure Review Committee
- 2016** Member, ABET Accreditation Subcommittee
- 2015-2016** Member, ECpE Faculty Search Committee
- 2015** Member, Senior Design Committee
- 2015-19** Participant, EE/CprE 294 (Program Discovery)
- 2015-19** Participant, EE/CprE 394 (Program Exploration)
- 2015-19** Participant, Take Your Professor to Lunch (TYPTL) Program

### **Pre-ISU**

- 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