

# CURRICULUM VITAE: NAMRATA VASWANI

## I. CANDIDATE INFORMATION

### A. Education

- Ph.D. (Electrical and Computer Engineering), 2004  
**University of Maryland, College Park, MD**
- B.Tech. (Electrical Engineering), 1999  
**Indian Institute of Technology (IIT), Delhi, India**

### B. Academic Experience

- Professor, Dept. of Electrical and Computer Engineering  
Iowa State University, Ames, IA (July 2016 – present)
  - Courtesy Professor, Dept. of Mathematics,
    - Iowa State University, Ames, IA (August 2013 – present)
- Associate Professor, Dept. of Electrical and Computer Engineering  
Iowa State University, Ames, IA (August 2011 – June 2016)
  - Faculty Professional Development Leave (sabbatical) at
    - University of Illinois, Urbana-Champaign (UIUC), Spring 2015
- Assistant Professor, Dept. of Electrical and Computer Engineering  
Iowa State University, Ames, IA (August 2005 – July 2011)
- Research Areas:
  - Data Science (statistical machine learning and signal processing)
    - Robust and Dynamic Robust PCA / Robust Subspace Tracking
    - Computer Vision and Video Analytics
  - Bio-Imaging: dynamic MRI, functional MRI (fMRI), optical coherence tomography

### C. Other Professional Employment

- Research scientist & Postdoctoral fellow, School of Electrical and Computer Engineering  
**Georgia Institute of Technology, Atlanta, GA (August 2004 – July 2005)**
- Research Intern, Signal and Image Processing Division  
**HRL (formerly Hughes Research Labs), Malibu, CA (June – October 2001)**
- Graduate Research Assistant, Dept. of Electrical and Computer Engineering  
**Univ. of Maryland, College Park, MD (August 1999 – July 2004)**

### D. Major Award

- **2014 IEEE Signal Processing Society (SPS) Best Paper Award** for  
N. Vaswani and W. Lu\*, “Modified-CS: Modifying Compressive Sensing for Problems with Partially Known Support”, *IEEE Trans. Signal Processing*, vol. 58(9), pp. 4595-4607, Sep. 2010.
  - The SPS Best Paper Award honors the author(s) of a paper of exceptional merit dealing with a subject related to the Society’s technical scope, and appearing in one of the Society’s solely owned transactions or the Journal of Selected Topics in Signal Processing, irrespective of the author’s age. Eligibility is based on a five-year window: for example, for the 2013 Award, the paper must have appeared in one of the Society’s Transactions between January 1, 2008 and December 31, 2012.

### E. Other Honors/Awards

- Iowa State University Early Career Engineering Faculty Research Award, 2014.
- Harpole-Pentair Assistant Professor, 2009-10

- Invited talk at ICCV (International Conf. on Computer Vision) Workshop on Robust Subspace Learning and Applications in Computer Vision, Venice, Italy, October 2017
- Invited Department Seminar in ECE dept. at Carnegie Mellon University (CMU), Feb. 2015
- Invited Department Colloquium in the ECE dept. at UIUC, Dec. 2013
- Invited participant in year-long program on Sequential Monte Carlo at Statistical and Applied Mathematical Sciences Institute (SAMSI), 2008-09
- Invited workshop talks at SAMSI, Institute for Pure and Applied Mathematics (IPAM), and Institute of Mathematics and its Applications (IMA)
- ICASSP 2004 paper on *Bound on Errors in Particle Filtering with Incorrect Model Assumptions and its Implication for Change Detection* selected as a top 15% paper in the Signal Processing Theory & Methods category, invited to submit to a Signal Processing Society journal
- Nominated for Best B.Tech Project in Electrical Engineering at IIT-Delhi, India, 1999
- Summer Undergraduate Research Award (SURA) at IIT-Delhi, India, 1997

#### F. Major Professional Service

- **Area Editor (Special Issues), IEEE Signal Processing Magazine**  
January 2018 – present
- **Chair of Women in Signal Processing (WISP) Committee of Signal Processing Society**  
January 2018 – present (Chair-Elect in 2017)
- **Associate Editor, IEEE Transactions on Signal Processing**  
March 2017 – present, and Oct 2009 – Feb 2013
- **Lead Guest Editor of a forthcoming (2018) Proceedings IEEE special issue on “Rethinking PCA for Modern Datasets: Theory, Algorithms and Applications”**  
(co-editors: Yuejie Chi and Thierry Bouwmans)
- **Lead Guest Editor of a forthcoming (2018) Signal Processing Magazine Feature Cluster “Exploiting Structure in Big Data Analytics – Sparse and Low-Rank Structures”**

#### G. Citation Summary (taken from Google Scholar on April 2017)

- **h-index:** 30, **g-index:** 49
- **Total Citations:** 3245; 8 papers cited more than 100 times
- **Three Most Cited Papers:**
  1. N. Vaswani and W. Lu\*, “Modified-CS: Modifying Compressive Sensing for Problems with Partially Known Support,” *IEEE Trans. Signal Processing*, vol. 58(9), pp. 4595-4607, Sep. 2010. *Cited 432 times.* [**2014 IEEE Signal Processing Society Best Paper Award**]
  2. N. Vaswani, “Kalman Filtered Compressed Sensing,” in *Proc. IEEE Intl. Conf. Image Processing (ICIP)*, 2008. *Cited 287 times.*
  3. Y. Rathi, N. Vaswani, A. Tannenbaum, A. Yezzi, “Tracking Deforming Objects using Particle Filtering for Geometric Active Contours,” *IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI)*, vol. 29(8), pp. 1470-1475, Aug. 2007. *Cited 225 times.*

## II. RESEARCH / CREATIVE ACTIVITIES

### A. Scholarship (\* denotes student co-author)

#### 1. Preprints

1. P. Narayanamurthy\*, N. Vaswani, “Nearly Optimal Robust Subspace Tracking”, arXiv:1712.06061 [cs.IT].
2. N. Vaswani, P. Narayanamurthy\*, “Finite Sample Guarantees for PCA in Non-Isotropic and Data-Dependent Noise”, arXiv:1709.06255 [stat.ML].

3. P. Narayanamurthy\*, **N. Vaswani**, “Provable Dynamic Robust PCA or Robust Subspace Tracking”, *revised and resubmitted to IEEE Trans. Information Theory*, 2018.
- 2. Articles in Journals and Highly-Selective Conference Proceedings**
1. P. Narayanamurthy\*, **N. Vaswani**, “Nearly Optimal Robust Subspace Tracking and Dynamic Robust PCA”, to appear in *Proc. of Intl. Conf. Machine Learning (ICML)*, 2018.
  2. **N. Vaswani** and P. Narayanamurthy\*, “Static and Dynamic Robust Principal Component Analysis (PCA) and Matrix Completion: A Review”, to appear, *Proceedings of the IEEE*, August 2018 (special issue on Rethinking PCA for Modern Datasets).
  3. **N. Vaswani**, T. Bouwmans, S. Javed, P. Narayanamurthy\*, “Robust PCA, Subspace Learning, and Tracking”, to appear in *IEEE Signal Processing Magazine*, July 2018.
  4. H. Guo and **N. Vaswani**, “Video Denoising via Dynamic Video Layering”, to appear, *IEEE Signal Processing Letters*, 2018.
  5. **N. Vaswani**, S. Nayer\* and Y. Eldar, “Low Rank Phase Retrieval”, *IEEE Trans. Signal Processing*, 2017.
  6. **N. Vaswani** and H. Guo\*, “Correlated-PCA: Principal Components' Analysis when Data and Noise are Correlated”, *Proc. Neural Info. Proc. Systems (NIPS)*, 2016. **Acceptance rate: 22.7%**
  7. J. Zhan\*, B. Lois\*, H. Guo\*, and **N. Vaswani**, “Online (and Offline) Robust PCA: Novel Algorithms and Performance Guarantees”, *Proc. International Conf. Artificial Intelligence and Statistics (AISTATS)*, 2016. **Acceptance rate: 30.7%**
  8. **N. Vaswani** and J. Zhan\*, “Recursive Recovery of Sparse Signal Sequences From Compressive Measurements: A Review”, *IEEE Trans. Signal Processing*, 64 (13), 3523-3549, 2016 (Old title: Recursive Dynamic CS: Recursive Recovery of Sparse Signal Sequences from Compressive Measurements: A Review)
  9. K. Santra, J. Zhan\*, X. Song, E. Smith, **N. Vaswani** and J. Petrich, "What Is the Best Method to Fit Time-Resolved Data? A Comparison of the Residual Minimization and the Maximum Likelihood Techniques as Applied to Experimental Time-Correlated, Single-Photon Counting Data", *The Journal of Physical Chemistry*, B 120 (9), 2484-2490, 2016.
  10. J. Zhan\* and **N. Vaswani**, “Robust PCA with Partial Subspace Knowledge”, *IEEE Trans. Signal Processing*, July, 2015.
  11. J. Zhan\* and **N. Vaswani**, "Time Invariant Error Bounds for Modified-CS based Sparse Signal Sequence Recovery", *IEEE Trans. Information Theory*, March 2015.
  12. C. Qiu\*, **N. Vaswani**, B. Lois\* and L. Hogben, “Recursive Robust PCA or Recursive Sparse Recovery in Large but Structured Noise”, *IEEE Trans. Information Theory*, August, 2014.
  13. H. Guo\*, C. Qiu\* and **N. Vaswani**, “An Online Algorithm for Separating Sparse and Low-dimensional Signal Sequences from their Sum”, *IEEE Trans. Signal Processing*, vol. 62(16), pp 4284-4297, August 2014 [*this or its conference versions cited 70 times*].
  14. D. Xu, **N. Vaswani**, Y. Huang and J. U. Kang, “Modified Compressive Sensing Optical Coherence Tomography with Noise Reduction”, *Optics Letters*, vol. 37(20), 4209-4211, Oct 2012.
  15. W. Lu\* and **N. Vaswani**, “Exact Reconstruction Conditions for Regularized Modified Basis Pursuit (reg-mod-BP)”, *IEEE Trans. Signal Processing*, vol. 60 (5), pp. 2634-2640, May, 2012.
  16. S. Das\*, A. Kale, and **N. Vaswani**, “Particle Filter with Mode Tracker (PF-MT) for Visual Tracking across Illumination Changes”, *IEEE Trans. Image Processing*, vol. 21(4), pp. 2340-2346, April, 2012.

17. W. Lu\* and N. Vaswani, "Regularized Modified BPDN for Noisy Sparse Reconstruction with Partial Erroneous Support and Signal Value Knowledge", *IEEE Trans. Signal Processing*, vol. 60(1), pp. 182 – 196, Jan. 2012.
18. N. Vaswani, "LS-CS-residual (LS-CS): Compressive Sensing on the Least Squares Residual," *IEEE Trans. Signal Processing*, vol. 58(8), pp. 4108-4120, Aug. 2010.
19. N. Vaswani and W. Lu\*, "Modified-CS: Modifying Compressive Sensing for Problems with Partially Known Support," *IEEE Trans. Signal Processing*, vol. 58(9), pp. 4595-4607, Sep. 2010 [2014 IEEE Signal Processing Society Best Paper Award].
20. S. Das\* and N. Vaswani, "Nonstationary Shape Activities: Dynamic Models for Landmark Shape Change and Applications," *IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI)*, vol. 32(4), pp. 579-592, Apr. 2010.
21. N. Vaswani, Y. Rathi, A. Yezzi, A. Tannenbaum, "Deform PF-MT: Particle Filter with Mode Tracker for Tracking Non-Affine Contour Deformations," *IEEE Trans. Image Processing*, vol. 19(4), pp. 841-857, Apr. 2010.
22. N. Vaswani, "Particle Filtering Algorithms for Multimodal Observation Likelihoods and Large Dimensional State Spaces," *IEEE Trans. Signal Proc.*, vol. 56(10-1), pp. 4583-4597, Oct. 2008.
23. Y. Rathi, N. Vaswani, A. Tannenbaum, A. Yezzi, "Tracking Deforming Objects using Particle Filtering for Geometric Active Contours," *IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI)*, vol. 29(8), pp. 1470-1475, Aug. 2007.
24. Y. Rathi, N. Vaswani, A. Tannenbaum, "A Generic Framework for Tracking using Particle Filter with Dynamic Shape Prior," *IEEE Trans. Image Processing*, vol. 16(5), pp. 1370-1382, May 2007.
25. N. Vaswani, "Additive Change Detection in Nonlinear Systems with Unknown Change Parameters," *IEEE Trans. Signal Processing*, vol. 55(3), pp. 859-872, Mar. 2007.
26. #N. Vaswani, R. Chellappa, "Principal Component Null Space Analysis for Image and Video Classification," *IEEE Trans. Image Processing*, vol. 15(7), pp. 1816-1830, Jul. 2006.
27. #N. Vaswani, A. Roy Chowdhury, R. Chellappa, "Shape Activity: A Continuous State HMM for Moving/Deforming Shapes with Application to Abnormal Activity Detection," *IEEE Trans. Image Processing*, vol. 14(10), pp. 1603-1616, Oct. 2005.
28. A. Ramamoorthy, N. Vaswani, S. Chaudhury, S. Bannerjee, "Recognition of Dynamic Hand Gestures," *Pattern Recognition*, vol. 36(9), pp. 2069-2081, Sep. 2003.
29. B. Song, N. Vaswani, A. Roy-Chowdhury, "Closed-loop Tracking and Change Detection in Multi-Activity Sequences," in *Proc. IEEE Intl. Conf. Computer Vision and Pattern Recognition (CVPR)*, 2007. **Acceptance rate: 25%.**
30. Y. Rathi, N. Vaswani, A. Tannenbaum, A. Yezzi, "Particle Filtering for Geometric Active Contours and Application to Tracking Deforming Objects," in *Proc. IEEE Intl. Conf. Computer Vision and Pattern Recognition (CVPR)*, 2005, **Oral. Acceptance rate: 6%.**
31. N. Vaswani, "Bound on Errors in Particle Filtering with Incorrect Model Assumptions and its Implication for Change Detection," in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2004. **Acceptance: 40-50%, Paper selected as an outstanding paper (top 15% papers) in Signal Processing Theory and Methods category of ICASSP papers. Net acceptance: 6-7.5%**
32. #N. Vaswani, A. Roy-Chowdhury, R. Chellappa, "Activity Recognition Using the Dynamics of the Configuration of Interacting Objects," in *Proc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR)*, 2003. **Acceptance rate: 25%.**

### 3. Book Chapters

1. **N. Vaswani**, C. Qiu, B. Lois, H. Guo, J. Zhan, “Online (Recursive) Robust Principal Components’ Analysis”, in *Handbook on Robust Low-Rank and Sparse Matrix Decomposition: Applications in Image and Video Processing*, Eds. T. Bouwmans, CRC Press, Taylor and Francis Group, to appear
  2. **N. Vaswani** and W. Lu, “Recursive Reconstruction of Sparse Signal Sequences” in *Filtering from Undersampled Data with an Introduction to Compressed Sensing*, Springer, Eds M. Mihaylova, A. Carmi, S. Godsill, 2014
  3. W. Lu, I. Atkinson and **N. Vaswani**, “Recursive Reconstruction of Highly Undersampled Functional MRI Sequences”, in *Physics, Image Reconstruction, and Analysis*, Taylor and Francis, Eds A. Majumdar and R. Ward, to appear.
  4. **N. Vaswani**, A.K. Agrawal, Q. Zheng, R. Chellappa, “Moving Object Detection and Compression in IR Sequences,” in *Computer Vision Beyond the Visible Spectrum*, B. Bhanu and I. Pavlidis, Eds. New York: Springer, 2004, ch. 5, pp. 141-165.
4. **Peer-Reviewed Conference Proceedings, Bulletins, or Reports**  
(acceptance rate for most of the conferences listed below is around 45-50%)
1. P. Narayanamurthy\*, **N. Vaswani**, “Provable Dynamic Robust PCA or Robust Subspace Tracking”, ISIT 2018
  2. **N. Vaswani**, P. Narayanamurthy\*, “PCA in Sparse Data-Dependent Noise”, ISIT 2018
  3. Robust PCA and Robust Subspace Tracking: A Comparative Evaluation, SSP 2018
  4. P. Narayanamurthy\*, **N. Vaswani**, “A FAST AND MEMORY-EFFICIENT ALGORITHM FOR ROBUST PCA (MEROP)”, ICASSP 2018
  5. Zhengyu Chen, Gauri Jagatap, Seyedehsara Nayer, Chinmay Hegde, Namrata Vaswani, “Low Rank Fourier Ptychography”, ICASSP 2018
  6. Gauri Jagatap, Zhengyu Chen, Chinmay Hegde, Namrata Vaswani, “SUB-DIFFRACTION IMAGING USING FOURIER PTYCHOGRAPHY AND STRUCTURED SPARSITY”, ICASSP 2018.
  7. **N. Vaswani**, P. Narayanamurthy\*, “Finite Sample Guarantees for PCA in Non-Isotropic and Data-Dependent Noise”, *Proc. Allerton*, 2017 (**Invited**).
  8. S. Nayer\*, **N. Vaswani** and Y. Eldar, “Low Rank Phase Retrieval”, *Signal Processing with Adaptive Sparse Structured Representations (SPARS) Workshop*, 2017. Only abstracts.
  9. S. Nayer\*, **N. Vaswani** and Y. Eldar, “Low Rank Phase Retrieval”, *Proc. IEEE Intl. Conf. Acous. Speech. Sig. Proc. (ICASSP)*, 2017
  10. S. Nayer\* , **N. Vaswani** and Y. Eldar, “Low Rank Matrix Recovery From Column-Wise Phaseless Measurements”, IEEE Statistical Signal Processing (SSP) workshop, 2016
  11. H. Guo\* and **N. Vaswani**, “Video denoising via online sparse and low-rank matrix decomposition”, *IEEE Statistical Signal Processing (SSP) workshop*, 2016
  12. B. Lois\* and **N. Vaswani**, “Online Robust Matrix Completion”, *Signal Processing with Adaptive Sparse Structured Representations (SPARS) Workshop*, 2015, only abstracts
  13. B. Lois\* and **N. Vaswani**, “Online Matrix Completion and Online Robust PCA”, *Proc. IEEE Intl. Symp. Info. Theory (ISIT)*, 2015
  14. B. Lois\* and **N. Vaswani**, “A Correctness Result for Online Robust PCA”, *Proc. IEEE Intl. Conf. Acous. Speech. Sig. Proc. (ICASSP)*, 2015
  15. J. Zhan\* and N. Vaswani, Robust PCA with Partial Subspace Knowledge, *Proc. IEEE Intl. Symp. Info. Theory (ISIT)*, 2014
  16. J. Zhan\* and N. Vaswani, Performance Guarantees for ReProCS -- Correlated Low-Rank Matrix Entries Case, *Proc. IEEE Intl. Symp. Info. Theory (ISIT)*, 2014

17. H. Guo\*, C. Qiu\* and **N. Vaswani**, “Practical ReProCS for Separating Sparse and Low-dimensional Signal Sequences from their Sum – Part 2”, *Proc. IEEE Global Conf. on Signal and Info. Processing (GlobalSIP)*, 2014
18. H. Guo\*, C. Qiu\* and **N. Vaswani**, “Practical ReProCS for Separating Sparse and Low-dimensional Signal Sequences from their Sum – Part 1”, *Proc. IEEE Intl. Conf. Acous. Speech Sig. Proc. (ICASSP)*, 2014
19. B. Lois\*, **N. Vaswani** and C. Qiu\*, Performance Guarantees for Undersampled Recursive Sparse Recovery in Large but Structured Noise, *IEEE Global Conf. on Signal and Info. Processing (GlobalSIP)*, 2013 **(invited)**
20. C. Qiu\* and **N. Vaswani**, Recursive Sparse Recovery in Large but Structured Noise - Part 2, *Proc. IEEE Intl. Symp. Info. Theory (ISIT)* 2013
21. J. Zhan\* and **N. Vaswani**, Time Invariant Error Bounds for Modified-CS based Sparse Signal Sequence Recovery, *Proc. IEEE Intl. Symp. Info. Theory (ISIT)* 2013
22. C. Qiu\*, **N. Vaswani** and L. Hogben, Recursive Robust PCA or Recursive Sparse Recovery in Large but Structured Noise, *Proc. IEEE Intl. Conf. Acous. Speech Sig. Proc. (ICASSP)*, 2013
23. J. Zhan\*, **N. Vaswani** and I. Atkinson, Separating Sparse and Low-Dimensional Signal Sequence from Time-varying Undersampled Projections of their Sums, *Proc. IEEE Intl. Conf. Acous. Speech. Sig. Proc. (ICASSP)*, 2013
24. R. Sarkar\*, **N. Vaswani** and S. Das, Tracking Sparse Signal Sequences from Nonlinear/Non-Gaussian Measurements and Applications in Illumination-Motion Tracking, *Proc. IEEE Intl. Conf. Acous. Speech. Sig. Proc. (ICASSP)*, 2013
25. C. Qiu\* and **N. Vaswani**, Recursive Sparse Recovery in Large but Correlated Noise,” *Proc. Allerton Conf. Communication, Control and Computing*, 2011
26. C. Qiu\* and **N. Vaswani**, Support Predicted Modified-CS for Recursive Robust Principal Components' Pursuit, *Proc. IEEE Intl. Symp. Info. Theory (ISIT)*, 2011
27. W. Lu\*, T. Li\*, I. Atkinson, **N. Vaswani**, Modified-CS-Residual for Recursive Reconstruction of Highly Undersampled Functional MRI Sequences, *Proc. IEEE Intl. Conf. Image Proc. (ICIP)*, 2011
28. F. Raisali\* and **N. Vaswani**, Stability (over time) of Regularized Modified-CS (noisy) for Recursive Causal Sparse Reconstruction, *Proc. Conf. Info. Sciences and Systems (CISS)*, 2011
29. **N. Vaswani**, “Stability (over time) of Modified-CS for Recursive Causal Sparse Reconstruction,” *Proc. Allerton Conf. Communication, Control and Computing*, 2010 **(invited)**.
30. C. Qiu\* and **N. Vaswani**, “Real-time Robust Principal Components' Pursuit”, *Proc. Allerton Conf. Communication, Control and Computing*, 2010.
31. W. Lu\* and **N. Vaswani**, “Exact Reconstruction Conditions and Error Bounds for Regularized Modified Basis Pursuit,” *Proc. Asilomar Conf. Signals, Systems and Computers*, 2010.
32. S. Das\* and **N. Vaswani**, “Particle Filtered Modified Compressive Sensing (PF-mod-CS) for tracking signal sequences,” *Proc. Asilomar Conf. Signals, Systems and Computers*, 2010 **(invited)**.
33. W. Lu\* and **N. Vaswani**, “Modified Basis Pursuit Denoising (Modified-BPDN) for Noisy Compressive Sensing with Partially Known Support,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2010.
34. W. Lu\* and **N. Vaswani**, “Modified Compressive Sensing for Real-time Dynamic MR Imaging,” in *Proc. IEEE Intl. Conf. Image Processing (ICIP)*, 2009.
35. **N. Vaswani** and W. Lu\*, “Modified-CS: Modifying Compressive Sensing for Problems with Partially Known Support,” in *Proc. IEEE Intl. Symp. Information Theory (ISIT)*, 2009.

36. **N. Vaswani**, “Analyzing Least Squares and Kalman Filtered Compressed Sensing,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2009.
37. C. Qiu\*, W. Lu\* and **N. Vaswani**, “Real-time Dynamic MR Image Reconstruction using Kalman Filtered Compressed Sensing,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2009.
38. S. Das\* and **N. Vaswani**, “Efficient importance sampling techniques for large dimensional and multimodal posterior computations,” in *Proc. IEEE Digital Signal Processing/SPE Workshop*, Miami FL, Jan 2009 (**invited**).
39. **N. Vaswani**, Kalman Filtered Compressed Sensing,” in *Proc. IEEE Intl. Conf. Image Processing (ICIP)*, 2008.
40. S. Das\* and **N. Vaswani**, “Model-based Compression of Nonstationary Landmark Shape Sequences,” in *Proc. IEEE Intl. Conf. Image Processing (ICIP)*, 2008.
41. A. Kale and **N. Vaswani**, Generalized ELL for Detecting and Tracking Through Illumination Model Changes,” in *Proc. IEEE Intl. Conf. Image Processing (ICIP)*, 2008.
42. **N. Vaswani** and S. Das, “Particle Filter with Efficient Importance Sampling and Mode Tracking (PF-EIS-MT) and its Application to Landmark Shape Tracking,” in *Proc. Asilomar Conf. Signals, Systems and Computers*, 2007 (**invited**).
43. **N. Vaswani**, “PF-EIS and PF-MT: New Particle Filtering Algorithms for Multimodal Observation Likelihoods and Large Dimensional State Spaces,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2007.
44. A. Kale, **N. Vaswani**, C. Jaynes, “Particle Filter with Mode Tracker (PF-MT) for Visual Tracking across Illumination Change,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2007.
45. **N. Vaswani**, A. Yezzi, Y. Rathi, A. Tannenbaum, “Time-varying Finite Dimensional Basis for Tracking Contour Deformations,” in *Proc. IEEE Conf. Decision and Control (CDC)*, 2006.
46. B. Song, **N. Vaswani**, A.K. Roy-Chowdhury, “Summarization and Indexing of Human Activity Sequences,” in *Proc. IEEE Conf. Image Processing (ICIP)*, 2006.
47. **N. Vaswani**, A. Yezzi, Y. Rathi, A. Tannenbaum, “Particle Filters for Infinite (or Large) Dimensional State Spaces – Part 1,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2006.
48. **N. Vaswani**, “Particle Filters for Infinite (or Large) Dimensional State Spaces – Part 2,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2006.
49. **N. Vaswani**, R. Chellappa, “NonStationary ‘Shape Activities,’” in *Proc. IEEE Conf. Decision and Control (CDC)*, 2005.
50. **N. Vaswani**, “The Modified CUSUM Algorithm for Slow and Drastic Change Detection in General HMMs with Unknown Change Parameters,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2005.
51. **N. Vaswani**, “Change Detection in Partially Observed Nonlinear Dynamic Systems with Unknown Change Parameters,” in *Proc. American Control Conf. (ACC)*, 2004.
52. **N. Vaswani**, R. Chellappa, “Classification Probability Analysis of Principal Component Null Space Analysis,” in *Proc. Intl. Conf. Pattern Recognition (ICPR)*, 2004.
53. **N. Vaswani**, A. Roy-Chowdhury, R. Chellappa, “Statistical Shape Theory for Activity Modeling,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2003.
54. **N. Vaswani**, R. Chellappa, “A Particle Filtering Approach to Abnormality Detection in Nonlinear Systems and its Application to Abnormal Activity Detection,” in *Proc. 3rd Intl. Workshop on Statistical and Computational Theories of Vision*, held in conjunction with ICCV, 2003.
55. **N. Vaswani**, “A Linear Classifier for Gaussian Class Conditional Distributions with Unequal Covariance Matrices,” in *Proc. Intl. Conf. Pattern Recog. (ICPR)*, 2002.

56. **N. Vaswani**, R. Chellappa, “Best View Selection and Compression of Moving Objects in IR Sequences,” in *Proc. IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP)*, 2001.

#### 5. Formally Invited Lectures and Presentations at Universities and Companies

- **Memory-Efficient Dynamic Robust PCA**
  - **ITA 2018**
- **Dynamic Structured (Big) Data Recovery**
  - KLA-Tencor, February 2018
- **Memory-Efficient Dynamic Robust PCA**
  - ISN Seminar, ECE dept, Cornell University, Ithaca, NY, December 2017
- **Dynamic Structured (Big) Data Recovery**
  - ECE Dept. Seminar, Texas A&M (TAMU), College Station, TX, April 2017
- **Dynamic Robust PCA**
  - ECE Dept. Seminar, University of Rochester, Rochester, NY, March 2017
- **Online Dynamic Robust PCA**
  - Dept. Seminar, IIT-Bombay, March 2016
  - Dept. Seminar, IIT-Delhi, March 2016
  - Dept. Seminar, University of Southern California (USC), February 2016
- **Online Robust PCA or Online Sparse + Low-Rank Matrix Recovery**
  - Networks and DSP seminar, UC Berkeley, October 2015
  - Seminar in Communication Theory and Systems, UC San Diego (UCSD), Oct 2015
  - Information Systems Lab (ISL) Colloquium, Stanford University, October, 2015
  - EE Dept. seminar, Heriott-Watt University, Edinburgh, UK, June 2015
  - CSP seminar, University of Michigan, Ann Arbor, MI, March 2015
  - Michigan State University, East Lansing, MI, March 2015
  - DSP Seminar, University of Illinois, Urbana-Champaign (UIUC), March 2015
  - ECE Department Seminar, Carnegie Mellon University (CMU), Pittsburgh, PA, February 2015
  - California Institute of Technology (Caltech), Pasadena, CA, February 2015
  - Rice University, Houston, TX, November 2014
  - University of Texas at Austin (UT-Austin), TX, November 2014
  - Texas A&M University (TAMU), College Station, TX, November 2014
  - University of Iowa, Iowa City, IA, October 2014
- **Dynamic Structured Signals’ Recovery and Applications in Bioimaging**
  - Northwestern University, April 2014
  - ECE Department Colloquium at University of Illinois, Urbana-Champaign (UIUC), December 2013
- **Recursive Sparse Recovery and Applications in Dynamic Imaging**
  - Department Seminar at Engineering division at Brown University, Providence, RI, February 2011
- **Recursive Reconstruction of Sparse Signal Sequences**
  - Iowa State Mathematics Dept Colloquium, October 2012
  - Indian Institute of Science (IISc), Bangalore, India, September 2011
  - University of Maryland, College Park, MD, March 2011
  - California Institute of Technology (Caltech), May 2010
  - Princeton University, May 2010
  - Johns Hopkins University (JHU), Baltimore, MD, March 2011
  - Mitsubishi Electric Research Labs (MERL), Boston, MA, May 2011
  - University of California, Santa Barbara (UCSB), May 2010

- University of California, Los Angeles (UCLA), May 2010
- Northwestern University, May 2010
- University of California, San Diego (UCSD), October 2009

## 6. Formally Invited Lectures and Presentations at Workshops and Conferences

### Invited Conference or Workshop Short Talks

- Nearly Optimal Robust Subspace Tracking
  - CISS 2018
- Dynamic Robust PCA
  - ICCV 2017 Workshop on Robust Subspace Learning
- Finite Sample Guarantees for PCA in Non-Isotropic and Data-Dependent Noise
  - Allerton 2017
- Improved Performance Guarantees for Correlated-PCA: PCA when Data and Noise are Correlated
  - Information Theory and Applications (ITA) workshop, San Diego, CA, February 2017
- Online and Offline Robust PCA: Novel Algorithms and Performance Guarantees
  - Information Theory and Applications (ITA) workshop, San Diego, CA, February 2016
- A Correctness Result for Online Robust PCA
  - Information Theory and Applications (ITA) workshop, San Diego, CA, February 2015
- A Correctness Result for Online Sparse + Low-Rank Matrix Recovery
  - International Conference on Signal Processing and Communications (SPCOM), Indian Institute of Science (IISc), Bangalore, India, July 2014
- Recursive Robust PCA or Recursive Sparse Recovery in Large but Structured Noise
  - Information Theory and Applications (ITA) workshop, San Diego, CA, February 2014
- Performance Guarantees for Undersampled Recursive Sparse Recovery in Large but Structured Noise
  - IEEE Global Conf. on Signal and Info. Processing (GlobalSIP), December 2013
- Stability (over time) of Modified-CS for Recursive Causal Sparse Reconstruction
  - Allerton Conf. on Communications, Control and Computing, 2010
- Particle Filtered Modified Compressive Sensing for tracking signal sequences
  - Asilomar Conf. Signals, Systems and Computers, 2010.
- Causal and Recursive Reconstruction of Sparse Signal Sequences
  - Institute for Operations Research and Management Sciences (INFORMS) Annual Meeting, Compressed Sensing Special Session, San Diego, CA, October 2009
- Efficient importance sampling techniques for large dimensional and multimodal posterior computations
  - DSP Workshop, 2009
- Particle Filter with Efficient Importance Sampling and Mode Tracking (PF-EIS-MT) and its Application to Landmark Shape Tracking
  - Asilomar Conf. Signals, Systems and Computers, 2007

### Invited Workshop Talks (long talks)

- PF-EIS and PF-MT: Particle Filtering with Efficient Importance Sampling and with Mode Tracking and Applications in Deformable Contour Tracking
  - SAMSI Sequential Monte Carlo Mid-Program Workshop, Raleigh, NC, February 2009
- Particle Filters for Large Dimensional State Spaces with Multimodal Observation Likelihoods

- SAMSI Sequential Monte Carlo Opening Workshop, Raleigh, NC, September 2008
- Deformable Contour Tracking
  - SAMSI Workshop on Geometry and Statistics of Shape Spaces, Raleigh, NC, July 2007
- Deformable Contour Tracking
  - IPAM Workshop on Image Processing for Random Shapes, Los Angeles, CA, May 2007
- Deformable Contour Tracking
  - IMA Workshop on Shape Spaces, Minneapolis, MN, April 2006

## B. Funded Grants and Contracts

- **CIF: Small: Structured High-dimensional Data Recovery from Phaseless Measurements**
  - PI: Namrata Vaswani, Co-PI: Chinmay Hegde
  - Agency: National Science Foundation (CCF - CIF)
  - October 2018 – September 2021, amount \$499,041
- **Unrestricted Grant (Gift) for research in outlier detection via robust PCA**
  - PI: Namrata Vaswani, co-PI: none
  - Agency: KLA-Tencor
  - Jan - Dec 2018, amount ~ \$68,100
- **CIF: Small: Online Algorithms for Streaming Structured Big-Data Mining,**
  - PI: Namrata Vaswani, Co-PI: None
  - Agency: National Science Foundation (CCF - CIF)
  - October 2015 – September 2018, amount - \$442,385
- **Distributed Recursive Robust Estimation: Theory, Algorithms and Applications in Single and Multi-Camera Computer Vision**
  - PI: Namrata Vaswani, Co-PI: Nicola Elia.
  - Agency: National Science Foundation (Engineering - ECCS)
  - July 2015 – June 2019, amount: \$250,000
- **Novel Machine Learning Approaches for Low-light Image or Video Denoising**
  - PI: Namrata Vaswani, Co-PI: Soumik Sarkar
  - Agency: Rockwell Collins and matching funds from Regents Innovations Fund
  - January 2015-- May 2017 (after extension), amount - \$200,000, my share - \$100,000
- **IDBR Type A – High-Throughput, Large-Scale Plant Phenotyping Platform**
  - PI: Liang Dong, co-PIs: Maneesha Aluru and Namrata Vaswani
  - Agency: National Science Foundation (Division of Biological Infrastructure)
  - March 2014 – February 2017, amount ~ \$697,550, my share ~ \$180,000
- **CIF: Small: Recursive Robust Principal Components Analysis (PCA)**
  - PI: Namrata Vaswani, co-PI: Fritz Keinert
  - Agency: National Science Foundation (CCF - CIF)
  - September 2011 – August 2015, amount - \$396,659, my share ~ \$366,000
- **RI: Small: Exploiting Correlated Sparsity Pattern Change in Dynamic Vision Problems**
  - PI: Namrata Vaswani, co-PI: none.
  - Agency: National Science Foundation (IIS-RI)
  - September 2011 – August 2015, amount - \$204,395.
- **CCF (CIF): Small: Recursive Reconstruction of Sparse Signal Sequences**
  - PI: Namrata Vaswani, co-PI: none
  - Agency: NSF (CCF)
  - July 2009 – June 2013, amount - \$279,279 + \$12,000 (REU supplement)
- **Change Detection in Nonlinear Systems and Applications in Shape Analysis**

- PI: Namrata Vaswani, co-PI: none.
- Agency: National Science Foundation (Engineering - ECCS)
- August 2007 – July 2011, amount - \$265,529 + \$12,000 (REU supplement)
- **Internal (Iowa State) Grants**
  - **Greenhouse on a Chip: A Fully Integrated Microfluidic Platform for Large-scale High-throughput Plant Phenomics,**
    - PI: Liang Dong, co-PI: Maneesha Aluru and Namrata Vaswani, my share ~ \$10,000
    - Agency: Plant Sciences Institute, Iowa State University
    - July 2012 - June 2013, amount~\$52,000
  - **New Faculty Grant Development Award**
    - PI: Namrata Vaswani, co-PI: none
    - Agency: Vice Provost for Research Office, Iowa State University
    - June – August 2006, amount – \$12,000

### III. TEACHING / EDUCATION ACTIVITIES

#### A. Instruction for ISU

- **Graduate courses**
  - Special Topics: Statistical Machine Learning (EE 520): Fall 2015, Fall 2016
  - Special Topics: Compressive Sensing and Matrix Completion (EE 520): Spring 2013
  - Special Topics: Compressive Sensing (EE 520): Spring 2009
  - Estimation and Detection Theory (EE 527): Spring 2008, Spring 2010, Spring 2012, Spring 2014, offered to off-campus students in all years
  - Digital Signal Processing (EE 524): Fall 2010
  - Digital Image Processing (EE 528): Spring 2007, Fall 2009
  - Special Topics: Computer Vision (EE 520): Fall 2005
- **Undergraduate courses**
  - Probabilistic Methods for Electrical Engineers (EE 322): Fall 2006, 2007, 2008, Spring 2009, 2011, Fall 2014
  - Introduction to Digital Signal Processing (EE 424): Spring 2012
  - Signals and Systems (EE 224, Recitations or/and Labs): Spring 2014, Fall 2013, Fall 2011, Spring 2010 and Fall 2006

#### B. Curriculum Development Activity for ISU

- Special topics course on Statistical Machine Learning (EE 520)
  - [http://www.ece.iastate.edu/~namrata/MachineLearning\\_class/](http://www.ece.iastate.edu/~namrata/MachineLearning_class/)
- Special topics course on Matrix Completion and Compressive Sensing (EE 520)
  - [http://www.ece.iastate.edu/~namrata/MC\\_CSclass](http://www.ece.iastate.edu/~namrata/MC_CSclass)
- Special topics course on Compressive Sensing (EE 520)
  - <http://www.ece.iastate.edu/~namrata/CSclass>
- Digital Image Processing (EE 528)
  - <http://www.ece.iastate.edu/~namrata/EE528>
- Estimation and Detection Theory (EE 527)
  - Updated the material on Bayesian estimation – MMSE estimation and Kalman filtering
  - Included a detailed discussion of laws of large numbers and Chernoff bounding based inequalities
- Added appropriate level modules on sparse recovery and compressive sensing (at appropriate levels) to various undergraduate and graduate courses

- Signals and Systems I (EE 224) – lab on compressive sensing (beyond Nyquist)
- Introduction to DSP (EE 424) – lab on undersampled MRI image reconstruction
- Estimation and Detection Theory (EE 527) – two lectures on sparse recovery, compressive sensing problem definition, algorithms and applications
- DSP (EE 524)

#### C. Service as Major Professor on Graduate Student Committees

- **Graduated Ph.D. students**

1. Jinchun Zhan, Ph.D., Fall 2015. **Received the Research Excellence Award.**
  - Now at Google, Bay Area, California
2. Brian Lois, Ph.D., Summer 2015 (co-advised with Prof. Leslie Hogben, Mathematics major, EE co-major). **Received the Research Excellence Award**
  - Data Scientist at AT&T, Dallas
3. Man Basnet, Ph.D., Summer 2013 (co-advised with Prof. Fritz Keinert, Mathematics major, EE co-major),
  - Lecturer in Mathematics dept. at ISU
4. Chenlu Qiu, Ph.D., Summer 2013,
  - Scientist at Traffic Management Research Institute, China
5. Wei Lu, Ph.D., Fall 2011,
  - Senior Algorithms Engineer at KLA-Tencor, San Jose, CA
6. Samarjit Das, Ph.D., Fall, 2010, Received the **Teaching Excellence Award.**
  - Senior Research Scientist at Bosch North America Research Labs, Pittsburgh

- **Graduated M.S. students**

1. Rituparna Sarkar, M.S., Fall 2012
2. Fardad Raisali, M.S. Spring 2012
3. Taoran Li, M.S. Summer 2011

- **Current Ph.D. Students**

1. Han Guo, Ph.D. student, started Fall 2012
2. Sara Nayer, Ph.D. student, started Spring 2015
3. Praneeth Kurpad, Ph.D. student, starting Spring 2016
4. Zhengyu Chen, Ph.D. student, started Fall 2016
5. Vaheed Daneshpajoo, Ph.D. student, started Spring 2017

#### D. Supervision of Undergraduate Research and Independent Study

- Christopher Sheafe (ECE), Trevor Steil (Math), Jonathan Lai (Math), REU students, Summer 2013, studied modified-CS and weighted CS using simulations as well as theoretical analysis.
- Tyler Stapler, REU student, Summer 2012
- Matt Boyce, REU student, Summer 2011
- Jennifer Nixon, REU student, Summer 2010
- Matt Rich, REU student, Spring 2010
- Xiang Li, undergraduate research student, Spring and Summer 2008

## IV. EXTENSION/PROFESSIONAL PRACTICE ACTIVITIES

#### A. Editorial Service for Journals

- Area Editor (Special Issues), IEEE Signal Processing Magazine January 2018 – present
- Chief Guest Editor of a forthcoming (2018) Proceedings IEEE Special Issue on
  - “Rethinking PCA for Modern Datasets: Theory, Algorithms and Applications” (co-editors: Yuejie Chi and Thierry Bouwmans)

- Guest Editor of a forthcoming (2018) Signal Processing Magazine Feature Cluster on “Exploiting Structure in Big Data Analytics – Sparse and Low-Rank Structures”
- Associate Editor, IEEE Transactions on Signal Processing  
March 2017 – present  
October 2009 – February 2013

#### B. Offices Held in Professional Societies

- Chair of Women in Signal Processing Committee of IEEE Signal Processing Society, January 2018 – present
- Steering Committee Member, Data Science Initiative of Signal Processing Society, April 2017 – present
- Elected member of the Signal Processing Theory and Methods technical committee of the IEEE Signal Processing Society, January 2016 – present
- Elected member of the Image Video and Multidimensional Signal Processing (IVMSP) technical committee of the IEEE Signal Processing Society, January 2015 – Dec. 2017
- Member of the Women in Signal Processing Committee of the IEEE Signal Processing Society, April 2015 – present

#### C. Tutorial Presentation, Workshop and Symposium Organization

- **Invited Short-Course Lecturer for a Global Initiatives of Academic Networks (GIAN) Course sponsored by the Government of India** in Delhi in December 2017
  - PCA and Robust PCA for Modern Datasets: Theory, Algorithms, and Application
- **Tutorial at ICASSP 2017**
  - tutorial on Big Data Mining in Large but Structured Noise – in planning
- **Symposium and Workshop Organization (as Co-Chair)**
  - Robust Subspace Learning and Applications in Computer Vision Workshop at ICCV 2017 (IEEE Intl. Conf. on Computer Vision)
  - Big Data Analysis and Challenges in Medical Imaging at GlobalSIP 2016
  - Robust Subspace Learning Workshop at ICCV 2015 (IEEE Intl. Conf. on Computer Vision)
  - Information Processing in Big Data Symposium at GlobalSIP 2014
  - Compressed Sensing and Matrix Completion Min-symposium at ILAS 2017 (Meeting of the International Linear Algebra Society) – in planning
- Area Chair for interpolation for IEEE Intl. Conf. Image Processing (ICIP), 2009
- Tutorials Chair for IEEE Intl. Conf. Image Processing (ICIP), 2008

#### D. Grant Review Panels

- National Science Foundation Panelist, 2008, 2010, 2011, 2012, 2016
- Served as an ad hoc reviewer for Israel Science Foundation

#### E. Other Extension/Professional Practice Activities

- Technical Program Committee Member, IEEE Intl Conf. Sig. Proc. and Comm (SPCOM), IISc, Bangalore, 2012 and 2014
- Technical Program Committee Member, IEEE Statistical Signal Processing (SSP) Workshop 2012
- Organized Special Sessions at
  - Asilomar 2010: Recursive reconstruction of sparse signal sequences
  - ICIP 2008: Landmark shape sequence analysis
- Performed book proposal reviews for Cambridge University Press and others
- Program Committees: IEEE Intl. Conf. Comp. Vis. Pattern Recog. (CVPR), 2008, 2009; European Conf. Comp. Vis. (ECCV), 2008; IEEE Intl. Conf. Comp. Vis. (ICCV), 2007

- Journal Reviewing:
  - IEEE Trans. Signal Proc. (TSP), IEEE Trans. Information Theory, IEEE Trans. Image Processing (TIP), IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI), EURASIP Journal on Applied Signal Processing, IEEE Trans. Auto. Control, and Automatica
- Conference Reviewing:
  - IEEE Intl. Conf. Acoustics, Speech and Signal Processing (ICASSP), IEEE Intl. Conf. Image Processing (ICIP), IEEE Intl. Conf. Comp. Vision (ICCV), IEEE Conf. Dec. and Control (CDC), Globecom, Milcom
- Consulted for Zenph Sound Innovations in 2010
- Thesis Examiner for a Ph.D. student from University of Newcastle, Australia, 2011

## V. INSTITUTIONAL SERVICE ACTIVITIES

### A. College-Level Service

- Member of College of Engineering's Diversity Committee, Fall 2010 – Fall 2015

### B. Department-Level Service

- Member of the department chair search committee, 2015-2016
- Actively participated in recruiting faculty candidates for the Presidential Hiring Initiative on Big Data (not on search committee)
- Academic Area Chair for Communications and Signal Processing, 2013-present
- Member of Graduate Committee, 2013-present (except in Spring 2010 due to FPDA)
- Strategic Area Chair for Bioengineering, 2011-2012
- Course Coordinator for EE 322 (Probabilistic Methods for Electrical Engineers) and EE 528 (Digital Image Processing)
- Member, Graduate Admissions Committee, 2008-2009
- Member, Elections Committee, 2006-2008
- Member, Strategic Planning Committee, 2005-2006, 2009, 2012, 2013
- Member, Promotion and Tenure Committee, 2008-2009
- Member, Distinguished Lectures Committee, 2009-2010