

# Shuchin Aeron

CV

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## Professional Preparation

- 2002 **B. Tech. in Electrical Engineering**, *Indian Institute of Technology*, Kanpur, India.
- 2004 **M. S. in Electrical Engineering**, *Boston University*, Boston, USA.
- 2009 **PhD in Electrical Engineering**, *Boston University*, Boston, USA.
- 2009–2011 **Post Doctoral Research Scientist**, *Schlumberger Doll Research*, Cambridge, USA.

## Academic Appointments

- 2011-present **Assistant Professor**, *Department of Electrical and Computer Engineering*, Tufts University.
- 2014-present **Adjunct Assistant Professor**, *Department of Computer Science*, Tufts University.

## Research

- Technical foci Statistical Signal Processing, Pattern Recognition, Inverse Problems, Information Theory, Convex optimization, Machine Learning
- Application Areas Geophysical signal processing, Computer vision, Signal processing for bioinformatics and medicine, Network data analytics

## Awards, Honors and Grants

### Grants

- 2016 Tufts Collaborates Seed Funding: Using Biological Measures to Predict Treatment Response in Posttraumatic Stress Disorder (PTSD), Award: \$49,915, Role: Co-PI
- 2016 Department of Homeland Security sub-contract with EOS/Pendar Technologies. Negotiations on-going. Anticipated sub-award (total for three phases): \$280,000, Role: PI
- 2016–2021 NSF:CAREER “Advancing Multidimensional Data Science via New Algebraic Models and Scalable Algorithms”, Total award: \$526,157, Role: PI
- 2015-2016 Machine Learning for Geophysics, Schlumberger Doll Research grant, Award: \$45,000, Role: PI
- 2013–2016 NSF:CCF “Optimal sampling and recovery for multilinear signals and systems”, Total Award: \$509,287, Sub-award: NSF REU funding: \$25,900, Role: PI
- 2014–2015 Borehole Acoustic Imaging, Schlumberger Technology Corporation Research Grant, Award: \$50,000, Role: PI
- 2015 Mitsubishi Electric Research Lab research gift, Amount: \$10,000

## Awards and Fellowship

- 2004-2005 Dean's research fellowship, Boston University
- 2009 Best Thesis Award, College of Engineering, Boston University
- 2009 Best Thesis Award, Dept. of Electrical and Computer Engineering, Boston University
- 2007-2009 Schlumberger-Doll Research (SDR) fellowship
- 2016 NSF CAREER award

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## Teaching

- 2012-2016 EE 23: Linear Systems
- 2012-2016 EE 191: Graduate ECE Seminar
- 2012-2016 EE 127: Information Theory
- 2011 EE 229: Detection and Estimation Theory

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## Professional activities

- 2015-16 Lead Editor: Special Issue on Computational Imaging for Earth Sciences, IEEE Transactions on Computational Imaging.
- 2015 Senior Member, IEEE
- 2014 Designated Reviewer: Ad-hoc and sensor networking symposium, IEEE International Conference on Communications
- 2012-2016 Member: Technical Program Committee, Reviewer role, IEEE SSP workshop
- 2011-2016 Member: Technical Program Committee, Reviewer role, IEEE ICASSP
- 2015 Member: Technical Program Committee, General Symposium, 3rd Global Conference on Signal and Information Processing (GlobalSIP)
- 2015,2016 Member: Technical Program Committee, 23rd European Signal Processing Conference
- 2015 Organizer: Society of Exploration Geophysicists (SEG) workshop on algebraic methods in seismic signal processing
- 2014 Designated Reviewer: Ad-hoc and sensor networking symposium, IEEE International Conference on Communications
- 2013 Organizer: Special session on geophysical signal processing at the IEEE conference on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)
- 2012 Organizer: special session on geophysical signal processing at the IEEE Statistical Signal Processing (SSP) workshop
- 2011-present Reviewer for IEEE Transactions on Geoscience and Remote Sensing, SIAM Journal on Scientific Computing, IEEE Transactions on Information Theory, ACM transactions on Networking, Elsevier Signal Processing Journal, IEEE Transactions on Signal Processing

## Publications

[**TG**] = Tufts Graduate Student, [**TUG**]: Tufts Undergraduate Student

### [Journal Articles](#)

- [JA1] Eric Kernfeld [**TUG**], Shuchin Aeron, and Misha Kilmer. Tensor tensor decompositions using linear invertible transforms. *Linear Algebra and Its Applications*, 485 Pages:545–570, November 2015.
- [JA2] Bo Fan [**TG**], Gregory Ely, Shuchin Aeron, and Misha Kilmer. Exploiting algebraic and structural complexity for single snapshot computed tomography hyperspectral imaging systems. *IEEE Journal of Selected Topics in Signal Processing*, 9(6):990–1002, Sept. 2015.
- [JA3] Shuchin Aeron, Sandip Bose, and Henri Pierre Valero. Joint multi-mode dispersion extraction in frequency-wavenumber and space-time domains. *IEEE Transactions on Signal Processing*, 63(15):4115–4128, Aug. 2015.
- [JA4] Gregory Ely [**TG**], Shuchin Aeron, Ning Hao, and Misha Kilmer. 5-d seismic data completion and de-noising using a novel class of tensor factorizations. *Geophysics*, 80(4):V83DV95, June 2015.
- [JA5] Shuchin Aeron, Sandip Bose, and Henri Pierre Valero. Robust detection and estimation for logging while drilling monopole acoustic data. *IEEE Transactions on Signal Processing*, (12):3062D3075, May 2015.
- [JA6] Ehsan Ullah [**TG**], Shuchin Aeron, and Soha Hassoun. gEFM: An algorithm for computing elementary flux modes using graph traversal. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 13(1):122–134, Jan.-Feb 2015.
- [JA7] U. Khan and S. Aeron. Distributed subspace consensus in the presence of dynamic in-network disturbance. *IEEE Transactions on Control of Network Systems*, PP(99):1–1, 2015.
- [JA8] Xiao-Yang Liu, Shuchin Aeron, Vaneet Aggarwal, Xiaodong Wang, and Min-You Wu. Adaptive sampling of rf fingerprints for fine-grained indoor localization. *IEEE Transactions on Mobile Computing*, 2015.
- [JA9] Michael Trakimas [**TG**], Robert D’Angelo [**TG**], Shuchin Aeron, Timothy Hancock, and Sameer Sonkusale. A compressed sensing analog-to-information converter with edge-triggered sar adc core. *Circuits and Systems I: Regular Papers, IEEE Transactions on*, 60(5):1135–1148, 2013.
- [JA10] Shuchin Aeron, Sandip Bose, H-P Valero, and Venkatesh Saligrama. Broadband dispersion extraction using simultaneous sparse penalization. *Signal Processing, IEEE Transactions on*, 59(10):4821–4837, 2011.
- [JA11] Shuchin Aeron, Venkatesh Saligrama, and Manqi Zhao. Information theoretic bounds for compressed sensing. *Information Theory, IEEE Transactions on*, 56(10):5111–5130, 2010.
- [JA12] Shuchin Aeron, Venkatesh Saligrama, and David A Castanon. Efficient sensor management policies for distributed target tracking in multihop sensor networks. *Signal Processing, IEEE Transactions on*, 56(6):2562–2574, 2008.

- [JA13] Shuchin Aeron and Venkatesh Saligrama. Wireless ad hoc networks: Strategies and scaling laws for the fixed snr regime. *Information Theory, IEEE Transactions on*, 53(6):2044–2059, 2007.

### Articles Submitted/In Preparation/Pre-prints

- [JB1] Vaneet Aggarwal, Ajay Mahimkar, Walter Willinger, Zemin Zhang [TG], and Shuchin Aeron. Inferring smartphone service quality using tensor methods. In *12th International Conference on Network and Service Management*, 2016. Submitted under review.
- [JB2] Xiao-Yang Liu, Zemin Zhang [TG], Shuchin Aeron, Vaneet Aggarwal, and Xiaodong Wang. Low-tubal-rank tensor completion using alternating minimization. *To be submitted*, 2016.
- [JB3] Bo Fan [TG] and Shuchin Aeron. Fast and stable acoustic signal compression for borehole imaging. Submitted to *IEEE Transactions on Computational Imaging*, 2016.
- [JB4] Zemin Zhang [TG] and Shuchin Aeron. Exact tensor completion using t-svd. *submitted to IEEE Transactions on Signal Processing*, 2016.
- [JB5] Vaneet Aggarwal and Shuchin Aeron. Information-theoretic bounds on matrix completion under union of subspaces model. *CoRR*, abs/1508.03395, 2015.
- [JB6] Josh Girson [TUG], John Pothier [TUG], and Shuchin Aeron. An algorithm for online tensor prediction. <http://arxiv.org/abs/1507.07974>, 2015.
- [JB7] Eric Kernfeld [TUG], Shuchin Aeron, and Misha Kilmer. Clustering multi-way data: a novel algebraic approach. *arXiv preprint arXiv:1412.7056*, 2014. submitted.

### Conference Articles: Peer Reviewed

- [CA1] Xiao-Yang Liu, Shuchin Aeron, Vaneet Aggarwal, Xiaodong Wang, and Min-You Wu. Tensor completion via adaptive sampling of tensor fibers: Application to efficient indoor RF fingerprinting. In *IEEE International Conference on Acoustics Speech and Signal Processing (ICASSP)*, 2016.
- [CA2] Bo Fan [TG] and Shuchin Aeron. Group invariant subspace learning for outlier detection. In *Proceedings of the IEEE Statistical Signal Processing (SSP) Workshop*, 2016. Accepted, To Appear.
- [CA3] Bo Fan [TG], Zemin Zhang [TG], and Shuchin Aeron. A novel tensor algebraic approach for high-dimensional outlier detection under data misalignment. In *IEEE International Conference on Image Processing*, 2016. Accepted, to appear.
- [CA4] Daniel Banco [TG], Shuchin Aeron, and Scott Hoge. Sampling and recovery of mri data using low rank tensor models. In *IEEE Engineering in Medicine and Biology Conference*, 2016. Accepted, to appear.

- [CA5] Zemin Zhang [TG] and Shuchin Aeron. Denoising and completion of 3d data via multidimensional dictionary learning. In *International Joint Conference on Artificial Intelligence (IJCAI)*, 2016. Accepted, To appear as a regular paper. **Acceptance rate: 25%**.
- [CA6] Zemin Zhang [TG], Dehong Liu, Shuchin Aeron, and Anthony Vetro. An online robust tensor pca algorithm for sequential 2-d data. In *In proceedings of IEEE International Conferences on Acoustics Speech and Signal Processing (ICASSP)*, 2016.
- [CA7] Eric Kernfeld [TUG], Nathan Majumder [TUG], Shuchin Aeron, and Misha Kilmer. Multilinear subspace clustering. <http://arxiv.org/abs/1512.06730>, 2016. Accepted, To appear in IEEE Statistical Signal Processing Workshop (SSP) 2016.
- [CA8] Wenqi Wang, Shuchin Aeron, and Vaneet Aggarwal. On deterministic conditions for subspace clustering under missing data. In *IEEE International Symposium on Information Theory*, 2016. Accepted, to appear.
- [CA9] Shuchin Aeron and Eric Kernfeld [TUG]. Group invariant subspace clustering. In *IEEE Allerton Conference on Communications, Control and Computing*, 2015.
- [CA10] Josh Girson [TUG] and Shuchin Aeron. Tensor completion via optimization on the product of matrix manifolds. In *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing*, 2015.
- [CA11] G. Liu [TG] and S. Aeron. First order methods for robust non-negative matrix factorization for large scale noisy data. In *2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 6746–6750, May 2014.
- [CA12] Usman A Khan and Shuchin Aeron. Distributed averaging in the presence of interference. In *Communications, Control and Signal Processing (ISCCSP), 2014 6th International Symposium on*, pages 32–35. IEEE, 2014.
- [CA13] Usman A Khan and Shuchin Aeron. Information alignment for consensus with interference. In *Acoustics, Speech and Signal Processing (ICASSP), 2014 IEEE International Conference on*, pages 7168–7172. IEEE, 2014.
- [CA14] Zemin Zhang [TG], Gregory Ely, Shuchin Aeron, Ning Hao, and Misha Kilmer. Novel methods for multilinear data completion and de-noising based on tensor-svd. In *Computer Vision and Pattern Recognition (CVPR), 2014 IEEE Conference on*, pages 3842–3849. IEEE, 2014. **Top Tier Computer Vision Conference**, Oral Presentation, **Acceptance rate: 6%**.
- [CA15] George Atia and Shuchin Aeron. Controlled sensing for sequential estimation. In *Global Conference on Signal and Information Processing (GlobalSIP), 2013 IEEE*, pages 125–128. IEEE, 2013.
- [CA16] Robert D’Angelo [TG], Michael Trakimas, Sameer Sonkusale, and Shuchin Aeron. Compressed sensing of eeg using a random sampling adc in 90nm cmos. In *Body Sensor Networks (BSN), 2013 IEEE International Conference on*, pages 1–5. IEEE, 2013.
- [CA17] Robert D’Angelo [TG], Michael Trakimas [TG], Shuchin Aeron, and Sameer Sonkusale. Experimental results on wideband spectrum sensing using random sampling adc in 90nm cmos. In *Circuits and Systems (ISCAS), 2013 IEEE International Symposium on*, pages 1970–1973. IEEE, 2013.

- [CA18] Gregory Ely [TG] and Shuchin Aeron. Methods for large scale hydraulic fracture monitoring. In *Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP), 2013 IEEE 5th International Workshop on*, pages 272–275. IEEE, 2013.
- [CA19] Gregory Ely [TG], Shuchin Aeron, Ning Hao, and Misha E Kilmer. 5d and 4d pre-stack seismic data completion using tensor nuclear norm (TNN). *Society of Exploration Geophysicists (SEG) workshop*, 2013. **Top Tier Geophysics Conference: Oral Presentation.**
- [CA20] Gregory Ely [TG], Shuchin Aeron, and Eric L Miller. Exploiting structural complexity for robust and rapid hyperspectral imaging. In *Acoustics, Speech and Signal Processing (ICASSP), 2013 IEEE International Conference on*, pages 2193–2197. IEEE, 2013.
- [CA21] Jason Gejie [TG] Liu and Shuchin Aeron. Robust large scale non-negative matrix factorization using proximal point algorithm. In *Global Conference on Signal and Information Processing (GlobalSIP), 2013 IEEE*, pages 1127–1130. IEEE, 2013.
- [CA22] Ehsan Ullah [TG], Calvin Hopkins, Shuchin Aeron, and Soha Hassoun. Decomposing biochemical networks into elementary flux modes using graph traversal. In *Proceedings of the International Conference on Bioinformatics, Computational Biology and Biomedical Informatics*, page 211. ACM, 2013. **Flagship conference for ACM SIGBio.**
- [CA23] Shuchin Aeron, Sandip Bose, and H-P Valero. Robust detection of weak acoustic signals in noise using near optimal shrinkage in radon domain. In *Statistical Signal Processing Workshop (SSP), 2012 IEEE*, pages 13–16. IEEE, 2012.
- [CA24] [TG] Gregory Ely and Shuchin Aeron. Robust hydraulic fracture monitoring (HFM) of multiple time overlapping events using a generalized discrete radon transform. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, pages 622–625, 2012.
- [CA25] Shuchin Aeron, Sandip Bose, H-P Valero, and Venkatesh Saligrama. Sparsity penalized reconstruction framework for broadband dispersion extraction. In *Acoustics Speech and Signal Processing (ICASSP), 2010 IEEE International Conference on*, pages 2638–2641. IEEE, 2010.
- [CA26] Shuchin Aeron, Sandip Bose, and H-P Valero. Automatic dispersion extraction using continuous wavelet transform. In *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 2405–2408, 2008.
- [CA27] Shuchin Aeron, Manqi Zhao, and Venkatesh Saligrama. Algorithms and bounds for sensing capacity and compressed sensing with applications to learning graphical models. In *Information Theory and Applications Workshop, 2008*, pages 303–309. IEEE, 2008.
- [CA28] George Atia, Shuchin Aeron, Erhan Ermis, and Venkatesh Saligrama. On throughput maximization and interference avoidance in cognitive radios. In *5th IEEE Consumer Communications and Networking Conference (CCNC)*, pages 963–967, 2008.
- [CA29] Shuchin Aeron, Manqi Zhao, and Venkatesh Saligrama. Information theoretic bounds to sensing capacity of sensor networks under fixed snr. In *Information Theory Workshop, 2007. ITW'07. IEEE*, pages 84–89. IEEE, 2007.
- [CA30] Shuchin Aeron, Manqi Zhao, and Venkatesh Saligrama. On sensing capacity of sensor networks for a class of linear observation models. In *Statistical Signal Processing, 2007. SSP'07. IEEE/SP 14th Workshop on*, pages 388–392. IEEE, 2007.

- [CA31] G. Atia, E. Ermis, S. Aeron, and V. Saligrama. On cooperative spectrum sensing in cognitive radios. In *45th Annual IEEE Allerton Conference on Communication, Control and Computing*, 2007.
- [CA32] Manqi Zhao, Shuchin Aeron, and Venkatesh Saligrama. Sensing capacity and compressed sensing: Bounds and algorithms. *Forty-Seventh Annual Allerton Conference on Communication, Control, and Computing, Allerton Retreat Center, Monticello, Illinois*, 2007.
- [CA33] Shuchin Aeron, Venkatesh Saligrama, and David Castanón. Distributed target tracking and localization in multi-hop networks. In *Information Sciences and Systems, 2006 40th Annual Conference on*, pages 990–995. IEEE, 2006.
- [CA34] Shuchin Aeron, Venkatesh Saligrama, and David A Castanon. Energy efficient policies for distributed target tracking in multihop sensor networks. In *Decision and Control, 2006 45th IEEE Conference on*, pages 380–385. IEEE, 2006.
- [CA35] Shuchin Aeron, Manqi Zhao, and Venkatesh Saligrama. Fundamental tradeoffs between sparsity, sensing diversity and sensing capacity. In *Signals, Systems and Computers, 2006. ACSSC'06. Fortieth Asilomar Conference on*, pages 295–299. IEEE, 2006.
- [CA36] Shuchin Aeron and Saligrama Venkatesh. Capacity scaling in wireless ad-hoc networks with p e. In *Information Theory, 2004. ISIT 2004. Proceedings. International Symposium on*, page 469. IEEE, 2004.
- [CA37] M Alanyali, S Venkatesh, O Savas, and S Aeron. Distributed bayesian hypothesis testing in sensor networks. In *American Control Conference, 2004. Proceedings of the 2004*, volume 6, pages 5369–5374. IEEE, 2004.
- [CA38] V Saligrama, M Alanyali, O Savas, and S Aeron. Classification in sensor networks. *IEEE International Symposium on Information Theory*, pages 251–251, 2004.
- [CA39] Saligrama Venkatesh, Murat Alanyali, Onur Savas, and Shuchin Aeron. Classification in sensor networks. In *Information Theory, 2004. ISIT 2004. Proceedings. International Symposium on*, page 251. IEEE, 2004.
- [CA40] S Aeron and S Venkatesh. Scaling laws and operation of wireless ad-hoc and sensor networks. In *Statistical Signal Processing, 2003 IEEE Workshop on*, pages 367–370. IEEE, 2003.

### [Conference Articles: Invited](#)

- [CB1] Xiao-Yang Liu, Shuchin Aeron, Vaneet Aggarwal, and Xiaodong Wang. Low-tubal-rank tensor completion using alternating minimization. *Proceedings of the SPIE*, 9848:984809–984809–11, 2016.
- [CB2] Shuchin Aeron, Sandip Bose, and Henri-Pierre Valero. Space-time methods for robust slowness estimation for monopole logging while drilling. *Proceedings of Meetings on Acoustics*, 19(1):045053, 2013.
- [CB3] George Atia and Shuchin Aeron. Asymptotic optimality results for controlled sequential estimation. In *Communication, Control, and Computing (Allerton), 2013 51st Annual Allerton Conference on*, pages 1098–1105. IEEE, 2013.

- [CB4] Gregory Ely [TG] and Shuchin Aeron. Complexity penalized hydraulic fracture localization and moment tensor estimation under limited model information. *Proceedings of International Congress on Acoustics*, 19(1):045051, 2013.
- [CB5] Henri-Pierre VALERO, Sandip Bose, SHUCHIN Aeron, Toshihiro KINOSHITA, et al. Extracting dispersion curve and filtering of acoustic data with wavelet transform. *Acoustics 2012 Nantes*, 2012.

## [Patents](#)

- [PT1] Bo Fan [TG], Shuchin Aeron, Henri-Pierre Valero, Adam Pedrycz, Hadrien Dollfus, Jean-Christophe Auchere, and Hiroshi Hori. System and method for acoustic signal compression of ultrasonic images. US Patent, February 2016. Filed, in process. Serial No. 62/297121, (Docket No. IS15.1336 US PSP).
- [PT2] Shuchin Aeron, Sandip Bose, Henri-pierre Valero, and Venkatesh Saligrama. Automatic dispersion extraction of multiple time overlapped acoustic signals, May 9 2013. US Patent 20,130,114,376.
- [PT3] Shuchin Aeron, Sandip Bose, and Henri-Pierre Valero. Method and apparatus for waveform processing. International Patent Application, December 2012. Filed, in process. Attorney Docket: IS110827 US NP. Serial number: 13/712971.
- [PT4] Sandip Bose, Henri-Pierre Valero, and Shuchin Aeron. Dispersion extraction for acoustic data using time frequency analysis, January 19 2010. US Patent 7,649,805.