

SUMMARY

Researcher with 5 years of experience in the fields of high-dimensional data analysis, machine learning, signal processing, optimization. Around 30 papers (including 14 journal publications) published and/or submitted in various refereed journals and conferences.

CURRENT APPOINTMENT

Lawrence Livermore National Laboratory
Postdoctoral Researcher
Computing Applications and Research Department

September, 2016 - present

EDUCATION

Syracuse University, Syracuse, NY, USA *2012 - 2016*
Ph.D. in Electrical and Computer Engineering
Thesis: Distributed Inference and Learning with Byzantine Data (All University Doctoral Prize)
Advisor: Pramod K. Varshney

Syracuse University, Syracuse, NY, USA *2010-2012*
M.S. in Electrical Engineering

Nagpur University, Nagpur, India *2006 - 2010*
B.E. in Electrical Engineering

RESEARCH GRANTS

Co-PI, Robust Decentralized Signal Processing and Distributed Control of Autonomous Sensor Networks.
PI: Ryan Goldhahn, LLNL. DOE LDRD Exploratory Research. \$940,000/year, (*February, 2017 - present*).

SCHOLASTIC ACHIEVEMENTS

- All University Doctoral Prize for outstanding Ph.D. dissertation, Syracuse University, 2016
- Runner-up for Best Student Paper Award in IEEE Asilomar Conf. on Signals, Systems & Computers, 2014.
- Signal Processing Society Travel Grant Award at IEEE ICASSP'16, Shanghai, 2016.
- Graduate award for outstanding performance by Department of EECS, Syracuse University.
- 3rd place in LLNL postdoctoral poster symposium, 2017.
- Phi Beta Delta International Honor Society, inducted 2016.

WORK EXPERIENCE

Data Analysis Group, LAWRENCE LIVERMORE NATIONAL LAB, Livermore, CA.
Research Intern, Mentors: Jayaraman J. Thiagarajan and Peer-Timo Bremer, (June 2015– August 2015)

High Dimensional Irregular Sampling (Relevant publications: J(11-14)& C(8-10))

- Analyzed the impact of spectral sampling techniques on surrogate modeling.
- Proposed analysis and synthesis techniques for blue noise sampling for computer graphics applications.
- Established theoretical guarantees for Poisson disk sampling using pair correlation function.

Statistical Inference for High-Dimensional Data with Secrecy Guarantees

(Relevant publications: J(7,9)& C(5-7,11))

- Design of efficient signal processing techniques exploiting lower dimensional structures.
- Solution methodology exploits lower dimensional signal processing techniques to solve inference problems.
- Artificial noise injection techniques are used to improve the secrecy performance.

Multi-label Learning with Big and Dirty Data (Relevant publications: J(15))

- Conducted research on multi-label classification with data that is unprecedented in scale (amount of data and its dimensionality) as well as degree of corruption (noise, outliers and missing).
- Proposed multi-label classifier that is robust to missing and corrupted labels.
- Exploited label correlation to improve the inference performance.

Distributed Inference from Corrupted Data (Relevant publications: J(1-5)& C(1-4))

- Conducted research on design and analysis of robust inference systems (see Publications).
- Typical inference systems considered are detection, classification or estimation using distributed nodes.
- Existence of unreliable nodes (Byzantines) in the network result in degraded performance.
- Machine learning and statistical signal processing schemes are used to mitigate the effects of Byzantines.

PUBLICATIONS

JOURNAL PREPRINTS

- [16] **B. Kailkhura**, and P. K. Varshney, “Multi-label Classification with Incomplete and Corrupted Data”, to be submitted to *Journal of Machine Learning Research (JMLR)*.
- [15] **B. Kailkhura**, J. J. Thiagarajan, P. Bremer, and P. K. Varshney, “Theoretical guarantees for Poisson disk sampling using pair correlation function”, to be submitted to *SIAM/ASA Journal on Uncertainty Quantification (JUQ)*.
- [14] **B. Kailkhura**, J. J. Thiagarajan and P. Bremer, “Cursed Zero Regions: The Hunt for Optimal Spectral Sampling in High Dimensions”, *ACM Transactions on Graphics, 2016*, under review.
- [13] **B. Kailkhura**, L. N. Theagarajan, and P. K. Varshney, “Subspace-aware Index Coding”, to appear in *IEEE Wireless Communications Letters*.
- [12] Q. Li, **B. Kailkhura**, J. J. Thiagarajan, Z. Zhang, and P. K. Varshney, “Influential Node Detection in Implicit Social Networks using Multi-task Gaussian Copula Models,” *Journal of Machine Learning Research proceedings*, vol 55, (NIPS 2016 Time Series Workshop).
- [11] **B. Kailkhura**, Thakshila Wimalajeewa, and P. K. Varshney, “Collaborative Compressive Detection with Physical Layer Secrecy Constraints,” *IEEE Trans. Sig. Process.*, vol. 65, no. 4, pp. 1013-1025, Feb.15, 15 2017.
- [10] **B. Kailkhura**, J. J. Thiagarajan, P. Bremer, and P. K. Varshney, “Stair Blue Noise Sampling,” *ACM Trans. Graph.* 35, 6, Article 248 (November 2016).
- [9] P. Khanduri, **B. Kailkhura**, J. J. Thiagarajan, and P. K. Varshney, “Universal Collaboration Strategies for Signal Detection: A Sparse Learning Approach,” *IEEE Signal Process. Lett.*, vol. 23, no. 10, pp. 1484-1488, Oct. 2016.
- [8] **B. Kailkhura**, S. Brahma, and P. K. Varshney, “Data Falsification Attacks on Consensus-Based Detection Systems,” *IEEE Transactions on Signal and Information Processing over Networks*, vol. 3, no. 1, pp. 145-158, March 2017.

- [7] **B. Kailkhura**, S. Liu, Thakshila Wimalajeewa, and P. K. Varshney, "Measurement Matrix Design for Compressive Detection with Secrecy Guarantees," *IEEE Wireless Commun. Lett.*, vol. 5, no. 4, pp. 420-423, Aug. 2016.
- [6] **B. Kailkhura**, V. Sriram Siddhardh (Sid) Nadendla, and P. K. Varshney, "Distributed Inference in the Presence of Eavesdroppers: A Survey," *IEEE Commun. Mag.*, vol. 53, no. 6, pp. 40 - 46, June, 2015.
- [5] **B. Kailkhura**, S. Brahma, B. Dulek, Y. S. Han, and P. K. Varshney, "Distributed Detection in Tree-based Topologies: Byzantines and Mitigation Techniques," *IEEE Trans. Inf. Forensics Security.*, vol. 10, no. 7, pp. 1499 - 1512, July, 2015.
- [4] **B. Kailkhura**, Y. S. Han, S. Brahma, and P. K. Varshney, "Distributed Bayesian Detection with Byzantine Data," *IEEE Trans. Signal Process.*, vol. 63, no. 19, pp. 5250 - 5263, Oct 1, 2015.
- [3] **B. Kailkhura**, A. Vempaty, and P. K. Varshney, "Distributed Inference in Tree Networks using Coding Theory," *IEEE Trans. Signal Process.*, vol. 63, no. 14, pp. 3715 - 3726, July 15, 2015.
- [2] **B. Kailkhura**, Y. S. Han, S. Brahma, and P. K. Varshney, "Asymptotic Analysis of Distributed Bayesian Detection with Byzantine Data," *IEEE Signal Process. Lett.*, vol. 22, no. 5, pp. 608-612, May 2015.
- [1] **B. Kailkhura**, S. Brahma, Y. S. Han, and P. K. Varshney, "Distributed Detection in Tree Topologies with Byzantines," *IEEE Trans. Signal Process.*, vol. 62, no. 12, pp. 3208-3219, June 15, 2014.

CONFERENCE/WORKSHOP PAPERS

- [13] R. Anirudh, **B. Kailkhura**, J. J. Thiagarajan, and P. Bremer "Poisson Disk Sampling on the Grassmannian: Applications in Subspace Optimization" to appear in *Diff-CVML workshop, CVPR, 2017*.
- [12] J. J. Thiagarajan, **B. Kailkhura**, P Sattigeri, and K. N. Ramamurthy "TreeView: Peeking into Deep Neural Networks Via Feature-Space Partitioning", *Interpretable ML for Complex Systems NIPS 2016 Workshop, arXiv preprint arXiv:1611.07429 (2016)*.
- [11] J. J. Thiagarajan, P Sattigeri, K. N. Ramamurthy, and **B. Kailkhura** "Robust Local Scaling using Conditional Quantiles of Graph Similarities", *2016 IEEE 16th International Conference on Data Mining Workshops (ICDMW), Barcelona, 2016, pp. 762-769*.
- [10] S. Kafle, **B. Kailkhura**, T. Wimalajeewa, and P. K. Varshney, "Decentralized Joint Sparsity Pattern Recovery with 1-bit Compressive Sensing", *2016 IEEE Global Conference on Signal and Information Processing (GlobalSIP), Washington, DC, 2016, pp. 1354-1358*.
- [9] **B. Kailkhura**, J. J. Thiagarajan, P. Bremer, and P. K. Varshney, "Impact of Spectral Sampling Techniques on Surrogate Modeling", *SIAM conference on uncertainty quantification, 2016*.
- [8] **B. Kailkhura**, J. J. Thiagarajan, P. Bremer, and P. K. Varshney, "Theoretical guarantees for Poisson disk sampling using pair correlation function", *2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Shanghai, 2016, pp. 2589-2593*.
- [7] V. Gupta, **B. Kailkhura**, T. Wimalajeewa, and P. K. Varshney, "Joint Sparsity Pattern Recovery with 1-bit Compressive Sensing in Distributed Sensor Networks", *2015 49th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, 2015, pp. 1472-1476*.
- [6] **B. Kailkhura**, L. Shen, T. Wimalajeewa, and P. K. Varshney, "Distributed Compressive Detection with Perfect Secrecy", *2014 IEEE 11th International Conference on Mobile Ad Hoc and Sensor Systems, Philadelphia, PA, 2014, pp. 674-679*.
- [5] **B. Kailkhura**, S. Brahma, and P. K. Varshney, "On Performance Analysis of Data Fusion schemes with Byzantines," *2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Florence, 2014, pp. 7411-7415*.
- [4] **B. Kailkhura**, Y. S. Han, S. Brahma, and P. K. Varshney, "On Covert Data Falsification Attacks on Distributed Detection Systems," *2013 13th International Symposium on Communications and Information Technologies (ISCIT), Surat Thani, 2013, pp. 412-417*.

- [3] **B. Kailkhura**, S. Brahma, Y. S. Han, and P. K. Varshney, "Optimal Distributed Detection in the Presence of Byzantines," *2013 IEEE International Conference on Acoustics, Speech and Signal Processing, Vancouver, BC, 2013*, pp. 2925-2929.
- [2] **B. Kailkhura**, S. Brahma, and P. K. Varshney, "Optimal Byzantine Attacks on Distributed Detection in Tree-based Topologies," *2013 International Conference on Computing, Networking and Communications (ICNC), San Diego, CA, 2013*, pp. 227-231.

INVITED CONFERENCE PAPERS

- [1] **B. Kailkhura**, T. Wimalajeewa, and P. K. Varshney, "On Physical Layer Secrecy of Collaborative Compressive Detection," 48th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, 2014, pp. 51-55. (**Runner-up Best Student Paper Contest**)

SERVICE & PROFESSIONAL ACTIVITIES

- **Session Organizer/Chair:** IEEE Asilomar Conf. on Signals, Systems and Comp. (Asilomar CSSC).
- **Member:** IEEE, IEEE Signal Processing Society, IEEE Communications Society.
- **Reviewer:** IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, IEEE Communications Letters, IEEE Transactions on Information Forensics and Security, IEEE International Conference on Communications (ICC).

PROGRAMMING & SOFTWARE SKILLS

Programming & Software: MATLAB, C/C++, Python, Java, Verilog/VHDL.

Operating Systems: Linux, Microsoft Windows.

REFERENCES

Available upon request.