Sirisha Rambhatla

325 8th Ave SE, Apt 306 – Minneapolis, MN 55414

+1 (215) 873 4767 • rambh002@umn.edu
sirisharambhatla.com • linkedin.com/in/sirisharambhatla/

Research Interests & Expertise

■ Machine learning ■ Optimization ■ Statistical Signal Processing ■ Probability and Statistics ■ Algorithms ■ Tensor Analysis ■ Natural Language Processing ■ Deep Learning ■ Topic Modeling ■ Text Mining

Experience

Research Assistant ***2014–Present, 2011–2012***
University of Minnesota–Twin Cities, *Minneapolis, MN*

Develop and analyze provable algorithms for statistical signal processing, optimization and machine learning tasks.

Science Advisor ***2013–2014***
Robins Kaplan L.L.P., *Minneapolis, MN*

Strategize for technical issues involved in various stages of intellectual property litigation and technology licensing.

Engineering Intern (R&D) ***Summer 2012, 2011***
Ativa Medical Inc., *St. Paul, MN*

Develop signal and image processing algorithms for analysis of flow–cytometric time series data with applications to medical diagnostics.

Education

Ph.D. in Electrical Engineering , *3.8* ***Sep 2014–Dec. 2019***
University of Minnesota–Twin Cities, *Minneapolis, MN*
Thesis Topic: Provably recovering patterns from data: matrix to tensors.

M.S. Electrical Engineering , *3.7* ***Dec. 2012***
University of Minnesota–Twin Cities, *Minneapolis, MN*
Thesis Title: Semi-blind source separation via sparse approximations and online dictionary learning.

B.Tech (Hons.) in Electronics and Telecommunication Engineering , *81.4%* ***May 2010***
College of Engineering Roorkee, *Uttarakhand Technical University, Roorkee, India*

Skills

Scientific Computing: MATLAB/Simulink (expert) and Mathematica (intermediate).
Programming Languages: Python(intermediate), C (intermediate), and C++(intermediate).
Authored Packages: `normalize-easy` – a python package to normalize rows or columns of a matrix.

Research Projects

Provable Matrix Factorization for Sparse Factor Models via Alternating Minimization
Research Project

- *Problem:* Develop a provable algorithm for online dictionary learning to recover both the dictionary and the sparse coefficients *exactly* [1].
- *How:* Design and analyze an algorithm for dictionary learning based on alternating minimization. Potential extension to high-rank matrix completion tasks problem.
- *Applications:* Dictionary Learning, Matrix Factorization, Collaborative Filtering, Recommender Systems, High-rank structured matrix completion tasks.

Exact Decomposition of a 3-way Structured Tensor via Dictionary Learning
Research Project

- *Problem:* Develop a provable algorithm for factorization of a structured tensor via dictionary learning. Here, two factors of the tensor factors are sparse, while the third follows some incoherence conditions.
- *How:* We pose the recovery of incoherent factor as a dictionary learning problem, and develop a stochastic proximal gradient-based algorithm to recover the sparse factors for this large scale optimization algorithm [2].
- *Applications:* User and community analytics in networks.

Dictionary-based Generalization of Robust PCA
Research Project

- *Problem:* Analyze a dictionary-based generalization of Robust PCA. Here, the data matrix is assumed to be formed via a superposition of a low-rank part and a component which is sparse is an *a priori* known dictionary.
- *How:* We develop a dual certificate based analysis to derive the conditions under which solving a convex optimization problem recovers the unknown components exactly [3–6].
- *Applications:* Target detection in hyper-spectral images [7], text mining, anomaly detection, and other information segmentation applications.

TensorMap: Lidar based Topological Map and Localization via Tensor Decompositions
Tensor Decompositions Course Project, May 2016

- *Problem:* Develop a Tucker-3 decomposition based technique to learn topological maps from Lidar data.
- *Result:*Achieve 8300 times compression as compared to the full Lidar scan.
- *Applications:* Navigation and localization of vehicles, secured location communication.

Semi-Blind Source Separation via Sparse Approximation and Online Dictionary Learning
Masters Thesis, Dec. 2012

- *Problem:* Analyze and develop an algorithm for a single channel semi-blind source separation task.
- *Applications:* Source separation applications in audio, image and video data analysis [8].

Awards and Honors

- Finalist, Student Best Paper Award, *Asilomar Conf. on Signals, Systems and Computing, 2017*.
- National Science Foundation (NSF) Travel Award, *GlobalSIP, 2016*.
- E. Bruce Lee Memorial Fellowship, *University of Minnesota–Twin Cities, 2014*.
- SciTechsperience Fellow, *Minnesota High Tech Association (MHTA), 2012*.
- Placed third in the graduating class of 2010, *Uttarakhand Technical University, Dehradun, India*.
- Proficiency Award for Academic Excellence, Sessions 2006-7 and 2009-10, *College of Engineering Roorkee*.

Talks

- "Target-Based Hyper Spectral Demixing via Generalized Robust PCA", *ECE Seminar on Signal Processing, Information Theory, and Communication, University of Minnesota–Twin Cities, Mar. 2018*.
- "Provably Recovering Patterns from Data: Matrix to Tensors", *Yahoo! Research, San Jose, CA, Nov. 2017*.
- "Dictionary based Generalization of Robust PCA", *IEEE GlobalSIP Conference, Washington D.C., Dec. 2016*.
- "Semi-Blind Source Separation via Sparse Approximation and Online Dictionary Learning", *Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, Nov. 2013*.

Professional Service

- Reviewer, Intl. Conference on Artificial Intelligence and Statistics (AISTATS) 2018

- Reviewer, Signal Processing Letters (SPL), 2017
- Reviewer, SIAM Journal of Imaging Sciences, 2017
- Reviewer, IEEE Transactions on Industrial Informatics (T-II) 2017
- Reviewer, IEEE Transactions on Signal Processing (T-SP) 2016
- Reviewer, IEEE Intl. Conference on Acoustics, Speech and Signal Processing (ICASSP) 2016
- Reviewer, International Conference on Artificial Intelligence and Statistics (AISTATS) 2016
- Reviewer, IEEE Transactions on Signal Processing (T-SP) 2015
- Reviewer, IEEE Intl. Conference on Acoustics, Speech and Signal Processing (ICASSP) 2015
- Reviewer, IEEE Transactions on Signal Processing (T-SP) 2014

Relevant Coursework

■ Tensor Decompositions ■ Machine Learning ■ Adaptive Digital Signal Processing ■ Optimization Theory ■ Detection and Estimation ■ Collaborative and Social Computing ■ Introduction to Nonlinear Optimization ■ Multirate and Multiscale Signal Processing ■ Image Processing and Applications ■ Robust Control System Design ■ Robotics ■ Linear Systems and Optimal Control ■ Probability and Stochastic Processes.

Publications

[1] S. Rambhatla and J. Haupt. Provable online matrix factorization for sparse factor models via alternating minimization. *In preparation*, 2018.

[2] S. Rambhatla, D. Xiao, J. Haupt, and N. Sidiropoulos. Exact recovery of multiple sparse CPD/PARAFAC factors of a tensor via dictionary learning. *In preparation*, 2018.

[3] S. Rambhatla, X. Li, and J. Haupt. A dictionary based generalization of robust PCA. In *2016 IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, pages 1315–1319, Dec 2016.

[4] S. Rambhatla, X. Li, and J. Haupt. A dictionary based generalization of robust pca. *Journal in preparation*, 2018.

[5] S. Rambhatla, X. Li, and J. Haupt. Hyperspectral demixing via a dictionary based generalizations of robust pca. *Journal in preparation*, 2018.

[6] X. Li, J. Ren, S. Rambhatla, Y. Xu, and J. Haupt. Robust pca via dictionary based outlier pursuit. In *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2018.

[7] S. Rambhatla, X. Li, and J. Haupt. Target-based hyperspectral demixing via generalized robust PCA. In *Asilomar Conference on Signals Systems and Computers*, 2017.

[8] S. Rambhatla and J.Haupt. Semi-Blind Source Separation via Sparse Representations and Online Dictionary Learning. *In Proceedings of the 47th Asilomar Conference on Signals Systems and Computers*, 2013.