Sirisha Rambhatla

Contact Information	321 Ronald Tutor Hall, 3710 McClintock Ave, Los Angeles, CA, USA	E-mail: sirishar@usc.edu Homepage: www.sirisharambhatla.com LinkedIn: www.linkedin.com/in/sirisharambhatla/

Research Focus Statistical Machine Learning, Design of Provable Learning Algorithms, Sparse Signal Processing, Optimization, Interpretability of Deep Learning Models, Spatiotemporal Data Analysis.

Education

Doctor of Philosophy (Ph.D.) in Electrical Engineering — Sep. 2014 - Sep. 2019
University of Minnesota – Twin Cities, USA (3.8)
Thesis: *Provably Learning from Data: New Algorithms for Matrix/Tensor Decompositions & Factorizations*
Advisor: Prof. Jarvis Haupt
Committee Members: Prof. Georgios B. Giannakis, Prof. Nikos Papanikolopoulos, Prof. Mingyi Hong

Master of Science (M.S.) in Electrical Engineering — Aug. 2010 - Dec. 2012
University of Minnesota – Twin Cities, USA (3.7)
Thesis: *Semi-Blind Source Separation via Sparse Approximation & Online Dictionary Learning*
Advisor: Prof. Jarvis Haupt
Committee Members: Prof. Zhi-Quan Luo, Prof. Arindam Banerjee

Bachelor of Technology (B.Tech) in Electronics & Telecom. Engineering — Aug. 2006 - May 2010
College of Engineering Roorkee (COER), India (81.4% (Honors)) (*University Bronze Medalist*)

Experience

Postdoctoral Scholar – Research Associate — Oct. 2019 – Present
Mentor: Prof. Yan Liu — Melady Lab, Computer Science Department
Viterbi School of Engineering — University of Southern California, Los Angeles, CA, USA

Focus: Machine learning for real-world spatiotemporal data analysis, interpretability of deep learning models, and physics informed machine learning.

- Develop a principled **feature attribution and interaction detection** technique to analyze the predictions by deep learning models, achieving state-of-the-art performance on attribution on real-world tasks such as *sentiment analysis, image classification, and recommender systems.*
- Develop a dashboard to analyze **COVID-19 misinformation spread** via information sharing patterns on Twitter; see `https://usc-melady.github.io/COVID-19-Tweet-Analysis/`.
- Develop an **explainable deepfake detection** technique leveraging temporal logic specifications and unnatural temporal dynamics in a deepfake video, achieving state-of-the-art results.
- Develop a physics-aware meta-learning-based algorithm to improve **spatiotemporal forecasting in limited data settings** encountered in **extreme weather** and **air quality prediction** applications.

Graduate Research Assistant — Feb. 2011 – May 2012 & Aug. 2014 – Sept. 2019
Dept. of Electrical and Computer Eng. — University of Minnesota – Twin Cities, Minneapolis, MN

- Analyzed **matrix/tensor factorization and demixing models** for machine learning applications by posing them as semi-supervised and unsupervised learning tasks.
- Develop **provable algorithms** for convex and non-convex optimization tasks leveraging tools from statistical signal processing and optimization, achieving state-of-the-art theoretical results.
- Develop and implement **fast, scalable, distributed algorithm with performance guarantees** using neural architectures.
- Develop a model for **target localization in hyperspectral images** using their spectral signatures.

- Develop an algorithm to build topological maps for vehicle navigation using **tensor decompositions from Lidar data for vehicle localization and navigation**, achieving 8300 times compression as compared to a full Lidar scan.

Explore Computer Science Research (ExplorCSR) Mentor Oct. 2018 – Feb. 2019
Volunteer Group Leader Google Research

- Identify, formulate, and design a research problem for from hedging strategies using optimization techniques for financial portfolio management.
- Successfully lead the team comprising of undergraduate students to present the findings at the 2019 Minnesota Women in Computing (MinneWIC) Conference.

Science Advisor Mar. 2013 – Jun. 2014
Intellectual Property (IP) and Technology Litigation Robins Kaplan LLP, Minneapolis, MN

- Strategize for various technical issues involved in **technology licensing and IP litigation**. Analyze potential IP cases to evaluate their validity and scope, and communicate the results both inside and outside the firm.
- Design experiments to identify infringement. In a particular instance, developed an experiment in a client-facing meeting to prove infringement, **eliminating the need for chip tear-down analysis**.

Engineering Intern (R&D) Jun.– Aug. 2011 & Jun.– Oct. 2012
Technology and Engineering Division Ativa Medical Inc., St. Paul, MN

- Develop data analysis algorithms to analyze, evaluate and identify potential issues with the flow-cytometry-based blood diagnostics (hematology) product.
- Develop an imaging based product, including a wavelet based focus-stacking algorithm to improve quality of images to enable identification of blood cells.

Graduate Research Assistant Feb. 2011 – May 2011 & Aug. 2011 – May 2012
Dept. of Electrical and Computer Eng. University of Minnesota – Twin Cities, Minneapolis, MN

- Develop alternating minimization algorithms for matrix demixing, leveraging sparse representations.
- Leverage the demixing technique for a source separation task encountered while deploying electro-shock law enforcement devices.

Undergraduate Research Intern May 2009 – Jul. 2009
Networked Control Systems Lab Indian Institute of Technology Kanpur (IIT-K), Kanpur, India

- Develop a networked embedded test-bed for an all-wheel drive and steer prototype lunar rover.
- Design, test and document the distributed control algorithms on the test-bed for control of D.C. motors to facilitate its use for an undergraduate course at the institute.

Awards and Honors

Travel Award, *International Conference on Learning Representations (ICLR)*, 2019
Selected Presenter, "Graduation Day" Session, *Information Theory & Applications Workshop*, 2019
Finalist, Student Best Paper Award, *Asilomar Conference on Signals, Systems & Computers*, 2017
National Science Foundation (NSF) Travel Award, *GlobalSIP*, 2016
E. Bruce Lee Memorial Fellowship, *University of Minnesota – Twin Cities*, 2014
SciTechsperience Fellowship, *Minnesota High Tech Association*, 2012
University Merit List, Third Place – ECE (Bronze Medal), *Uttarakhand Technical University, India*, 2010
Proficiency Award for Academic Excellence, *COER, India*, Academic Year 2009 – 10
Proficiency Award for Academic Excellence, *COER, India*, Academic Year 2006 – 07
Second Prize at Embedded Systems Design Competition, *Indian Institute of Technology, Roorkee*, 2009

Publications

[1] **S. Rambhatla**, X. Li, and J. Haupt. Provable Online CP/PARAFAC Decomposition of a Structured Tensor via Dictionary Learning. *Neural Information Processing Systems (NeurIPS)*, 2020.

[2] M. Tsang, **S. Rambhatla**, Y. Liu. How does this interaction affect me? Interpretable attribution for feature interactions. *Neural Information Processing Systems (NeurIPS)*, 2020.

[3] **S. Rambhatla**, X. Li, J. Ren and J. Haupt. A Dictionary-Based Generalization of Robust PCA With Applications to Target Localization in Hyperspectral Imaging. *IEEE Transactions on Signal Processing*, vol. 68, pp. 1760 – 1775, 2020.

[4] **S. Rambhatla**, X. Li, and J. Haupt. NOODL: Provable Online Learning for Dictionary Learning and Sparse Coding. *International Conference on Learning Representations (ICLR)*, 2019. **Travel Award**

[5] **S. Rambhatla**, N. Sidiropoulos, and J. Haupt. TensorMap: Lidar-based Topological Mapping and Localization via Tensor Decompositions. *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, 2018.

[6] X. Li, J. Ren, **S. Rambhatla**, Y. Xu, and J. Haupt. Robust PCA via Dictionary Based Outlier Pursuit. *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. *Asilomar Conference on Signals, Systems, and Computers (Asilomar)*, 2017. **Student Best Paper Award Finalist**.

[8] **S. Rambhatla**, X. Li, and J. Haupt. A Dictionary Based Generalization of Robust PCA. *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, 2016. **National Science Foundation (NSF) Travel Award**.

[9] **S. Rambhatla** and J. Haupt. Semi-Blind Source Separation via Sparse Representations and Online Dictionary Learning. *Asilomar Conference on Signals, Systems, and Computers (Asilomar)*, 2013.

[10] L. Trinh, M. Tsang, **S. Rambhatla**, Y. Liu. Interpretable and Trustworthy Deepfake Detection via Dynamic Prototypes. (*Under review*), 2020.

[11] S. Seo, C. Meng, **S. Rambhatla**, Y. Liu. Physics-aware Spatiotemporal Modules with Auxiliary Tasks for Meta-Learning. (*Under review*), 2020.

[12] N. Kamra, Y. Zhang, **S. Rambhatla**, C. Meng, Y. Liu. PolSIRD: Modeling Epidemic Spread under Intervention Policies and an Application to the Spread of COVID-19. (*Under review*), 2020.

[13] K. Sharma, S. Seo, C. Meng, **S. Rambhatla**, Y. Liu. COVID-19 on Social Media: Analyzing Misinformation in Twitter Conversations. (*Under review*), 2020.

Preprints/reprints available on `axiv` and at `https://sirisharambhatla.com/publications.html`.

Software Packages Developed

`TensorNOODL`: Provable Online CP/PARAFAC Decomposition via Dictionary Learning (MATLAB).

`NOODL`: Provable Online Learning Algorithm for Dictionary Learning and Sparse Coding.
- Distributed implementations via MATLAB and TensorFlow.

`D-RPCA`: Dictionary-Based Generalization of Robust PCA. (MATLAB)
- Analysis of Theoretical Properties, and Target Localization in Hyperspectral Images.

`TensorMap`: Lidar-based Mapping and Localization via Tensor Decompositions. (MATLAB)

Talks/ Posters

- "Provable Online Dictionary Learning and Sparse Coding" Jun. 2019
  — *CyberOptics Corporation, Minneapolis, MN.*
- "NOODL: Provable Online Dictionary Learning and Sparse Coding" May 2019
  — *International Conference on Learning Representations, New Orleans, LA.*
- "Provable Online Dictionary Learning and Sparse Coding" May 2019
  — *Department of Electrical and Computer Engineering, Georgia Tech., Atlanta, GA.*

- "Provable Online Dictionary Learning and Sparse Coding" Feb. 2019
  — *Information Theory and Applications (ITA) Workshop, San Diego, CA.*
- "Lidar-based Topological Mapping & Localization via Tensor Decompositions." Nov. 2018
  — *GlobalSIP 2018, Anaheim, CA.*
- "Provable Online Dictionary Learning and Matrix Factorization" Sept. 2018
  — *Digital Technology Center, Minneapolis, MN.*
- "Target-Based Hyper Spectral Demixing via Generalized Robust PCA." Mar. 2018
  — ECE Seminar on Signal Processing, Information Theory, and Communication,
  University of Minnesota – Twin Cities, Minneapolis, MN.
- "Provably Recovering Patterns from Data: Matrix to Tensors." Nov. 2017
  — *Yahoo! Research, San Jose, CA.*
- "Dictionary-based Generalization of Robust PCA." Dec. 2016
  — *GlobalSIP 2016, Washington D.C.*
- "Semi-Blind Source Separation via Sparse Approximation & Online Dictionary Learning."
  — *Asilomar Conference on Signals, Systems & Computers, Pacific Grove, CA.* Nov. 2013

Teaching Experience

- Guest Lecturer, CSCI 699 - Advanced Topics in Deep Learning Fall 2020
  — *University of Southern California, Atlanta, GA*
- Guest Lecturer, EE 3025 - Statistical Methods in Electrical and Computer Engineering Fall 2017
  — *University of Minnesota – Twin Cities*

Technical Service

- Organizer, AI for COVID-19 in LA Virtual Symposium (attended by over 350 participants) 2020
  — *University of Southern California, Los Angeles, CA*
- Ambassador, Women in Data Science (WiDS) 2020
  — *University of Southern California, Los Angeles, CA*
- Organizer, "Patent basics for Engineers and Researchers" 2019
  — *Digital Technology Center, University of Minnesota–Twin Cities, Minneapolis, MN*
- Session Co-Chair, Reinforcement Learning, and High-dimensional Statistics 2019
  — *Information Theory and Applications (ITA) Workshop 2019, San Diego, CA*
- Session Chair, Deep Learning-based Signal Processing for Wireless Communication 2018
  — *GlobalSIP 2018, Anaheim, CA*
- Reviewer, Neural Information Processing Systems (NeurIPS) 2020
- Reviewer, Association for the Advancement of Artificial Intelligence (AAAI) 2020
- Reviewer, International Conference on Machine Learning (ICML) 2020
- Reviewer, Journal of Selected Topics in Signal Processing (JSTSP) 2020
- Reviewer, International Conference on Artificial Intelligence & Statistics (AISTATS) 2018, 2016
- Reviewer, International Conference on Acoustics, Speech & Signal Processing (ICASSP) 2016, 2015
- Reviewer, Transactions on Signal Processing (T-SP) 2020, 2019, 2018, 2016, 2015, 2014
- Reviewer, Signal Processing Letters (SPL) 2017
- Reviewer, SIAM Journal of Imaging Sciences 2017
- Reviewer, Transactions on Industrial Informatics (T-II) 2017

Workshops

- "Frontiers in Machine Learning" 2020
  — *Microsoft Research*
- "IEEE Data Science Workshop (DSW)" 2019
  — *University of Minnesota Twin-Cities, Minneapolis, MN*
- "Information Theory & Applications Workshop (ITA)" 2019
  — *San Diego, CA*
- "Resource Trade-offs: Computation, Communication, and Information" 2016
  — *Institute of Mathematics and its Applications (IMA), Minneapolis, MN*

- "Sparsity and Computation" 2011
  — *Institute for Advanced Study, Princeton, NJ*

Skills

Scientific Computing:	MATLAB/Simulink and Mathematica.
Programming Languages:	Python (scikit-learn, statsmodels, pandas, etc.), C, and C++.
Deep Learning:	TensorFlow, PyTorch.
Embedded Programming:	dsPIC, ATMEGA16/32, and MPLAB.
Other skills:	Linux/Unix Shell, Supercomputing, and Version control.

Relevant Coursework

Tensor Decompositions, Machine Learning, Probability and Stochastic Processes, 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, and Linear Systems and Optimal Control.

Professional Memberships

Collegiate Member, *Society of Women Engineers (SWE)*, since 2018
Student Member, *IEEE Signal Processing Society (SPS)*, since 2018
Student Member, *IEEE*, since 2013
Member, *Eta Kappa Nu (HKN)*, since 2011