

SIRISHA RAMBHATLA

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SKILLS AND INTERESTS	Statistical Machine Learning, Design of Provable Learning Algorithms, Knowledge Representations, Optimization, Interpretability in Deep Learning Models, Spatiotemporal Data Analysis.	
EDUCATION	<p>Doctor of Philosophy (Ph.D.) in Electrical Engineering Sep. 2014 - Sep. 2019 University of Minnesota – Twin Cities, USA (3.8) Thesis: <i>Provably Learning from Data: Algorithms for Matrix/Tensor Decompositions & Factorizations</i> Advisor: Prof. Jarvis Haupt Committee Members: Prof. Georgios B. Giannakis, Prof. Nikos Papanikolopoulos, Prof. Mingyi Hong</p> <p>Master of Science (M.S.) in Electrical Engineering Aug. 2010 - Dec. 2012 University of Minnesota – Twin Cities, USA (3.7) Thesis: <i>Semi-Blind Source Separation via Sparse Approximation & Online Dictionary Learning</i> Advisor: Prof. Jarvis Haupt</p> <p>Bachelor of Technology (B.Tech) in Electronics & Telecom. Engineering Aug. 2006 - May 2010 College of Engineering Roorkee (COER), India (81.4% (Honors)) (<i>University Bronze Medalist</i>)</p>	
EXPERIENCE	<p>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</p> <p>Focus: Machine learning for real-world spatiotemporal data analysis, interpretability of deep learning models, and physics informed machine learning.</p> <ul style="list-style-type: none">• 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 <i>sentiment analysis, image classification, and recommender systems</i>.• 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 intervention policy-aware compartmental disease spread model to predict COVID-19 spread outperforming the techniques used by Center for Disease Control (CDC); see https://usc-melady.github.io/COVID-19-Prediction-Site/.• 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. <p>Graduate Research Assistant Feb. 2011 – May 2012 & Aug. 2014 – Sept. 2019 Dept. of Electrical and Computer Eng. University of Minnesota – Twin Cities, Minneapolis, MN</p> <ul style="list-style-type: none">• 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 <i>fast, scalable, distributed algorithm with performance guarantees</i> using neural network 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 University of Minnesota – Twin Cities, Minneapolis, MN

- 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. Perform infringement analysis, including source code inspection.
- Design experiments to identify infringement. In a particular instance, developed an experiment on-the-fly in a client-facing meeting to prove infringement, **saving upwards of \$100,000 in chip tear-down costs** (and time).

Engineering Intern (R&D) Jun.– Aug. 2011 & Jun.– Oct. 2012

Technology and Engineering Division Ativa Medical Inc., St. Paul, MN

- Develop a 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

- Model and develop an alternating minimization algorithm for a matrix demixing task 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, <i>International Conference on Learning Representations (ICLR)</i> , 2019 Selected Presenter, <i>“Graduation Day” Session, Information Theory & Applications Workshop</i> , 2019 Finalist, Student Best Paper Award, <i>Asilomar Conference on Signals, Systems & Computers</i> , 2017 National Science Foundation (NSF) Travel Award, <i>GlobalSIP</i> , 2016 E. Bruce Lee Memorial Fellowship, <i>University of Minnesota – Twin Cities</i> , 2014 SciTechsperience Fellowship, <i>Minnesota High Tech Association</i> , 2012 Placed Third in Class of 2010 (Bronze Medal), <i>Uttarakhand Technical University, India</i> , 2010 Proficiency Award for Academic Excellence, <i>COER, India, Session 2009 – 10 & 2006 – 07</i>
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- PUBLICATIONS [1] **S. Rambhatla**, X. Li, J. Ren and J. Haupt, "A Dictionary-Based Generalization of Robust PCA With Applications to Target Localization in Hyperspectral Imaging," in *IEEE Transactions on Signal Processing*, vol. 68, pp. 1760 – 1775, 2020.
- [2] **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**
- [3] **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.
- [4] 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.
- [5] **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.**
- [6] **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.**
- [7] **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.

Preprints and Manuscripts Under Review:

- [8] **S. Rambhatla**, X. Li, and J. Haupt. Provable Online CP/PARAFAC Decomposition of a Structured Tensor via Dictionary Learning. (*Manuscript under review*), 2020.
- [9] M. Tsang, **S. Rambhatla**, Y. Liu. How does this interaction affect me? Interpretable attribution for feature interactions. (*Manuscript under review*), 2020.
- [10] L. Trinh, M. Tsang, **S. Rambhatla**, Y. Liu. Interpretable Deepfake Detection via Dynamic Prototypes. (*Manuscript under review*), 2020.
- [11] S. Seo, C. Meng, **S. Rambhatla**, Y. Liu. Physics-aware Spatiotemporal Modules with Auxiliary Tasks for Meta-Learning. (*Manuscript 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. (*Manuscript under review*), 2020.
- [13] K. Sharma, S. Seo, C. Meng, **S. Rambhatla**, Y. Liu. Coronavirus on Social Media: Analyzing Misinformation in Twitter Conversations. (*Preprint*), 2020.

Preprints/reprints available on [arxiv](https://arxiv.org/) and at www.sirishambhatla.com/about.

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” — <i>CyberOptics Corporation, Minneapolis, MN.</i>	Jun. 2019
	• “NOODL: Provable Online Dictionary Learning and Sparse Coding” — <i>International Conference on Learning Representations, New Orleans, LA.</i>	May 2019

	<ul style="list-style-type: none"> • “Provable Online Dictionary Learning and Sparse Coding” May 2019 — <i>Department of Electrical and Computer Engineering, Georgia Tech., Atlanta, GA.</i> • “Provable Online Dictionary Learning and Sparse Coding” Feb. 2019 — <i>Information Theory and Applications (ITA) Workshop, San Diego, CA.</i> • “Lidar-based Topological Mapping & Localization via Tensor Decompositions.” Nov. 2018 — <i>GlobalSIP 2018, Anaheim, CA.</i> • “Provable Online Dictionary Learning and Matrix Factorization” Sept. 2018 — <i>Digital Technology Center, Minneapolis, MN.</i> • “Target-Based Hyper Spectral Demixing via Generalized Robust PCA.” Mar. 2018 — ECE Seminar on Signal Processing, Information Theory, and Communication, <i>University of Minnesota – Twin Cities, Minneapolis, MN.</i> • “Provably Recovering Patterns from Data: Matrix to Tensors.” Nov. 2017 — <i>Yahoo! Research, San Jose, CA.</i> • “Dictionary-based Generalization of Robust PCA.” Dec. 2016 — <i>GlobalSIP 2016, Washington D.C.</i> • “Semi-Blind Source Separation via Sparse Approximation & Online Dictionary Learning.” Nov. 2013 — <i>Asilomar Conference on Signals, Systems & Computers, Pacific Grove, CA.</i>
TECHNICAL SERVICE	<ul style="list-style-type: none"> • Organizer, AI for COVID-19 in LA Virtual Symposium 2020 — <i>University of Southern California, Los Angeles, CA</i> • Ambassador, Women in Data Science (WiDS) 2020 — <i>University of Southern California, Los Angeles, CA</i> • Session Co-Chair, Reinforcement Learning, and High-dimensional Statistics 2019 — <i>Information Theory and Applications (ITA) Workshop 2019, San Diego, CA</i> • Session Chair, Deep Learning-based Signal Processing for Wireless Communication 2018 — <i>GlobalSIP 2018, Anaheim, CA</i> • Reviewer, Neural Information Processing Systems (NeurIPS) 2021 • Reviewer, International Conference on Machine Learning (ICML) 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
SKILLS	<p>Scientific Computing: MATLAB/Simulink and Mathematica.</p> <p>Programming Languages: Python (scikit-learn, pandas, etc.), C, and C++.</p> <p>Deep Learning: TensorFlow, PyTorch.</p> <p>Embedded Programming: dsPIC, ATMEGA16/32, and MPLAB.</p> <p>Other skills: Linux/Unix Shell, Supercomputing, and Version control.</p>
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, Robust Control System Design, Robotics, and Linear Systems and Optimal Control.
PROFESSIONAL MEMBERSHIPS	<p>Collegiate Member, <i>Society of Women Engineers (SWE)</i>, since 2018.</p> <p>Student Member, <i>IEEE Signal Processing Society (SPS)</i>, since 2018.</p> <p>Student Member, <i>IEEE</i>, since 2013.</p>