Sirisha Rambhatla

CONTACT
INFORMATION

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RESEARCH
INTERESTS

Statistical Signal Processing, Machine Learning, Convex and Nonconvex Optimization, Design of Provable Learning Algorithms, Deep Learning, Natural Language Processing, and their applications.

EDUCATION

Doctor of Philosophy (Ph.D.) in Electrical Engineering   Aug. 2014 - May 2019 (*expected*)
University of Minnesota–Twin Cities (3.8)
Thesis Topic: Provable Algorithms for Matrix Decompositions & Factorization
Advisor: Professor Jarvis Haupt

Master of Science (M.S.) in Electrical Engineering   Aug. 2010 - Dec. 2012
University of Minnesota–Twin Cities (3.7)
Thesis: Semi-Blind Source Separation via Sparse Approximation & Online Dictionary Learning
Advisor: Professor Jarvis Haupt

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

AWARDS AND
HONORS

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
Placed Third in Class of 2010 (Bronze Medal),	Uttarakhand Technical University, India, 2010
Proficiency Award for Academic Excellence,	COER, India, Session 2009-10 & 2006-07

EXPERIENCE

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

Theoretical Focus:
- Analyzed 5 matrix/tensor factorization and demixing models for machine learning applications by posing them as semi-supervised and unsupervised learning tasks. Developed provable algorithms for these learning tasks using convex and non-convex formulations. Designed and implemented experiments to analyze the performance of these algorithms using high performance computing tools. Analyzed the algorithms theoretically using tools from statistical signal processing and optimization.
- Developed a fast, scalable, distributed algorithm with performance guarantees for recovering the factors of the dictionary learning (a matrix factor) model. Designed and implemented the algorithm as a neural network to be run on graphical processing unit (GPU)s via TensorFlow.
- Developed an algorithm for tensor factorization based on the dictionary learning technique.

Applications Focus:
- Identified applications (and analyzed performance) of the developed techniques on real-world applications. For instance, developed a technique for localizing targets based on their spectral signatures in hyperspectral images.
- Developed a technique to build maps from Lidar data using tensor decompositions for vehicle navigation.

Science Advisor   Mar. 2013 – Jun. 2014

Intellectual Property (IP) and Technology Litigation   Robins Kaplan LLP, Minneapolis, MN

- Strategized for various technical issues involved in technology licensing and IP litigation. Analyzed potential IP cases to evaluate their validity and scope. Performed infringement analysis, including source code inspection (Android, iOS, JAVA, C++, C and Objective-C code).
- Designed experiments to identify infringement. In a particular instance, developed an experiment on-the-fly in a client facing meeting to save upwards of $100,000 in chip tear-down costs (and time) to prove infringement.

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

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

- Developed signal & data analysis algorithms for instrumentation of flow-cytometry-based blood diagnostic product.
- Collaborated with the team to develop an imaging based blood diagnostics product. Designed a wavelet based focus-stacking algorithm to improve quality of images to enable identification of blood cells.

Undergraduate Research Intern   May 2009 – Jul. 2009

Networked Control Systems Lab   Indian Institute of Technology Kanpur (IITK), Kanpur, India

- Developed a networked embedded test-bed for an all-wheel drive and steer prototype lunar rover.
- Designed, 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

CONFERENCE PUBLICATIONS

[1] **S. Rambhatla**, X. Li, and J. Haupt. Provable Online Learning for Dictionary Learning and Sparse Coding. (*submitted*)

[2] **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.

[3] 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.

[4] **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**

[5] **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**

[6] **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.

JOURNAL PUBLICATIONS

[7] **S. Rambhatla**, X. Li, J. Ren, and J. Haupt. Dictionary-based Generalization of Robust PCA: Theoretical Analysis. *Journal in Preparation*, 2018.

[8] **S. Rambhatla**, X. Li, J. Ren, and J. Haupt. Dictionary-based Generalization of Robust PCA with Applications to Target Localization in Hyperspectral Images. *Journal in Preparation*, 2018.

[9] **S. Rambhatla**, X. Li, and J. Haupt. Provable Online Learning for Dictionary Learning and Tensor Factorization. (*Journal in preparation*)

PACKAGES DEVELOPED	NOODL:	A Provable Online Learning Algorithm for Dictionary Learning and Sparse Coding.

PACKAGES DEVELOPED

NOODL: A Provable Online Learning Algorithm for Dictionary Learning and Sparse Coding.
S. Rambhatla
- Distributed implementation across CPUs via MATLAB,
- Distributed neural network implementation across GPUs via TensorFlow)

TensorMap: Lidar-based Topological Mapping and Localization via Tensor Decompositions.
S. Rambhatla (MATLAB)

normalize-easy: A Python Package to Normalize Rows or Columns of a Matrix.
S. Rambhatla (Python)

TALKS

- "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

TECHNICAL SERVICE

- Session Chair, Deep learning-based Signal Processing for Wireless Communication, IEEE Global Conference on Signal and Information Processing (GlobalSIP) 2018
- International Conference on Artificial Intelligence & Statistics (AISTATS) 2018, 2016
- International Conference on Acoustics, Speech & Signal Processing (ICASSP) 2016, 2015
- Transactions on Signal Processing (T-SP) 2018, 2016, 2015, 2014
- Signal Processing Letters (SPL) 2017
- SIAM Journal of Imaging Sciences 2017
- Transactions on Industrial Informatics (T-II) 2017

MENTORING ACTIVITIES

ExplorCSR Mentor Sept. 2018 – Present
- Introduce undergraduate women majoring in math and statistics to research in data science and machine learning.
- Identify, formulate, and design a research problem with applications to hedging in financial portfolios.

Other Mentoring/Training Activities
Conduct intra-group training sessions on:
- Utilizing the supercomputing resources at the university in order to significantly speed-up various computational tasks;
- Identifying patentable technologies and filing for appropriate legal protections.
- Organize a workshop on Intellectual Property protection for the researchers at Digital Technology Center, University of Minnesota – Twin Cities. (*Scheduled for Feb.* 2019)

Skills

Scientific Computing:	MATLAB/Simulink and Mathematica.
Programming Languages:	Python, C, and C++.
Deep Learning Tools:	TensorFlow, PyTorch.
Embedded Programming:	dsPIC, ATMEGA16/32, MPLAB and Eclipse IDE.
Other skills:	Proficient with Linux/Unix Shell; Leveraging Supercomputing resources; 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, Robust Control System Design, Robotics, 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