

Akshay Rangamani

PhD Candidate, Johns Hopkins University

PERSONAL INFORMATION

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RESEARCH INTERESTS

Representation Learning, Neural Networks, Theory of Deep Learning, Low Rank and Sparse Signal Processing, Compressed Sensing, Non-convex Optimization, Applications to Medical Imaging

EDUCATION

Johns Hopkins University

Sept 2013 - Present

Ph.D. Candidate in Electrical and Computer Engineering

GPA: 3.95/4

Advisor: Prof. Trac D. Tran

MSE in Electrical and Computer Engineering

May 2015

Indian Institute of Technology Madras, Chennai

August 2009 - May 2013

B.Tech in Electrical Engineering, Minor: Biomedical Engineering

GPA: 9.19/10

Thesis: *Low Cost Autofocus System for Optical Microscopes* guided by Dr. S. Mohanasankar

PUBLICATIONS

- *A Scale Invariant Flatness for Deep Network Minima*, Submitted to NeurIPS 2019, with Nam H. Nguyen, Abhishek Kumar, Dzung Phan, Sang H. Chin, Trac D. Tran, arXiv version at <https://arxiv.org/abs/1902.02434>. Code available at <https://github.com/akshay-r/scale-invariant-flatness>
- *Target tracking and classification using compressive sensing camera for SWIR videos*, Signal Image and Video Processing, 2019, with Chiman Kwan, Bryan Chou, Jonathan Yang, Trac Tran, Jack Zhang, Ralph Etienne-Cummings
- *Sparse Coding and Autoencoders*, IEEE ISIT 2018, with Anirbit Mukherjee, Amitabh Basu, Trac D. Tran, Sang H. Chin, arXiv version at <https://arxiv.org/abs/1708.03735>, *Oral Presentation*
- *A Greedy Pursuit Algorithm for Separating Signals from Nonlinear Compressive Observations*, IEEE ICASSP 2018, with Dung Tran, Trac D. Tran, Sang H. Chin, *Oral Presentation*
- *Reconstruction-free deep convolutional neural networks for partially observed images*, IEEE GlobalSIP 2018, with Arun Nair, Luoluo Liu, Sang H. Chin, Muyinatu A. Lediju Bell and Trac D. Tran, *Poster*
- *ChieF : A Change Pattern based Interpretable Failure Analyzer*, IEEE Big Data 2018, with Dhaval Patel, Lam Nguyen, Shrey Srivastava, and Jayant Kalagnanam
- *Predicting local field potentials with recurrent neural networks*, IEEE EMBC 2016, with Louis Kim, Jacob Harer, Sang H. Chin, *Poster*
- *Targeted Dot Product Representation for Friend Recommendation in Online Social Networks*, ASONAM 2015, with Minh Dao, Nam P. Nguyen, Trac D. Tran, Sang H. Chin, *Oral Presentation*

WORKSHOP PRESENTATIONS

- *A Scale Invariant Flatness for Deep Network Minima*, Berlin Mathematical School, Summer School on Mathematics of Deep Learning, 2019
- *A Scale Invariant Flatness for Deep Network Minima*, MIT Institute for Foundations of Data Science, Workshop on Non-convex Optimization and Deep Learning 2019
- *Sparse Coding and Autoencoders*, NIPS 2017 Workshop on Bridging Theory and Practice of Deep Learning
- *Landmark Detection and Tracking in Ultrasound using a CNN-RNN Framework*, NIPS 2016 Workshop on 3D Deep Learning
- *Learning Maliciousness in Cybersecurity Graphs*, NIPS 2016 Workshop on Tensor Learning, *Spotlight Presentation*
- *Modeling local field potentials with recurrent neural networks*, NIPS 2015 Workshop on Statistical Methods for Understanding Neural Systems
- *Learning Program Attributes in Control Flow Graphs*, Duke Workshop on Sensing and Analysis of High Dimensional Data, 2015

TALKS AND PRESENTATIONS	<ul style="list-style-type: none"> • <i>Towards Understanding Neural Networks</i> Microsoft Research India, Bangalore 	May 2019
	<ul style="list-style-type: none"> • <i>Towards Understanding Neural Networks</i> JHU Electrical and Computer Engineering Seminar 	Nov 2018
	<ul style="list-style-type: none"> • <i>Sparse Coding and Autoencoders</i> ISIT 2018, Vail, CO, USA 	June 2018
	<ul style="list-style-type: none"> • <i>A Greedy Pursuit Algorithm for Separating Signals from Nonlinear Compressive Observations</i> ICASSP 2018, Calgary, Canada 	Apr 2018
	<ul style="list-style-type: none"> • <i>Learning Maliciousness in Cybersecurity Graphs</i> NeurIPS Workshop on Tensor Learning, Barcelona 	Dec 2016
TEACHING EXPERIENCE	<ul style="list-style-type: none"> • Machine Learning, Spring 2017 	
	<ul style="list-style-type: none"> • Compressed Sensing and Sparse Recovery, Spring 2015, 2017 	
	<ul style="list-style-type: none"> • Networked Dynamical Systems, Fall 2016 	
	<ul style="list-style-type: none"> • Medical Imaging Systems, Fall 2014 	
	<ul style="list-style-type: none"> • Introduction to Electrical and Computer Engineering, Fall 2015-2018 	
SCHOLASTIC ACHIEVEMENTS	<ul style="list-style-type: none"> • Johns Hopkins University Payback Fellowship, 2013 	
	<ul style="list-style-type: none"> • IIT Madras Governor's Prize for the student with all round proficiency in Curricular and Extracurricular activities, 2013 	
	<ul style="list-style-type: none"> • DAAD-WISE fellowship, 2012 for an internship at the University of Luebeck, Germany 	
	<ul style="list-style-type: none"> • Finalist at the TI India Analog Design Contest 2011, among the top 25 projects out of 300 	
	<ul style="list-style-type: none"> • IIT Madras Merit Certificate for placing 89th nationwide in IITJEE-2009 	
	<ul style="list-style-type: none"> • Ranked 43rd in India in the 2009 All India Engineering Entrance Examination 	
	<ul style="list-style-type: none"> • National Top 1%, National Standard Examinations in Physics, Chemistry and Astronomy 2008-09 out of 35000, 29000 and 8000 respectively 	
SKILLS	Caffe, Torch, PyTorch, Tensorflow, MATLAB, C, Python, L ^A T _E X	
INTERNSHIPS AND VISITS	IBM T.J. Watson Research Center, Yorktown Heights, NY	Feb - Aug 2018
	<ul style="list-style-type: none"> • Worked on Deep Learning techniques for Time Series Analysis, and contributed to an IBM framework for applying machine learning to data from manufacturing and other heavy industries 	
	Uplevel Security, New York, NY	June - Aug 2016
	<ul style="list-style-type: none"> • Uplevel Security is building an cybersecurity incident response platform to help automate investigation of suspicious events. • In the duration of my internship we developed a new ontology for Uplevels cybersecurity graph and implemented an ingestor pipeline to process artifacts • We also implemented a version of RESCAL, an algorithm to learn embeddings for nodes in relational graphs, and adapted it to handle missing data and attributes. 	
	Draper Laboratories, Cambridge, MA	June - Jul 2015
	<ul style="list-style-type: none"> • We performed scalable analysis of software programs to discover Common Vulnerabilities and Exposures by extracting a number of structural features from code, like Control Flow Graphs, Use-Def graphs, etc. • We achieved good performance on the SATE-IV database of programs for testing CVEs 	

PAST RESEARCH
PROJECTS

Low Cost Autofocus System for Optical Microscopes

August 2012 - June 2013

Work with: Dr. S. Mohanasankar, IIT Madras & Dr. Niranjana Joshi, Healthcare Technology Innovation Centre (HTIC)

- Designed and machined mechanical components for controlling coarse and fine adjustments
- Implemented an autofocus algorithm in MATLAB to focus microscope on slides placed on the stage

Artifact Removal from EEG by Adaptive Information Filtering

May - July 2012

Work with: Dr. Ulrich Hofmann & Mehrnaz Hazrati, University of Luebeck

- Implemented an Adaptive Information Filter which uses Entropy as a cost function to remove ocular artifacts from EEG.
- Performance was found to be better than a Mean-Squared Error adaptive filter

Low Cost Pulse Oximeter that measures Respiratory Rate

Sept 2011 - Feb 2012

Work with: Dr. Nitin Chandrachoodan, IIT Madras

- Designed and constructed a pulse oximeter to measure respiratory rate for non-invasive screening of pneumonia
- Implemented time and frequency domain algorithms to measure respiratory rate in MATLAB
- Designed and constructed an embedded system to implement the algorithms on a TMS320 DSP

Screening Tool for Anterior Visual Pathway Diseases

Sept 2010 - July 2011

Work with: Dr. S. Mohanasankar, IIT Madras & Dr. Rashmin Gandhi, Sankara Nethralaya

- Designed, built and evaluated a test for screening optic nerve diseases based on red desaturation
- More sensitive than current diagnostic tests

COURSE
PROJECTS

Online Learning in the Bandit Setting: A Review

April 2015

Course: Statistical Machine Learning, Instructor: Dr. Raman Arora

- Read literature and prepared a review paper describing the Bandit Online Learning problem in the multi-armed bandit and continuum-armed bandit settings.

Recovery of Neural Recordings via Structured Dictionary Learning

April 2014

Course: Compressed Sensing & Sparse Recovery, Instructor: Prof. Trac D. Tran

- Designed a dictionary learning scheme to recover neural recordings from compressed measurements. The structured dictionary learning scheme incorporated a group sparsity structure that helped classify neural signals.

Data-driven Removal of Ocular Artifacts from EEG using Wavelets

Nov 2013

Course: Wavelets & Filter Banks, Instructor: Prof. Trac D. Tran

- We analyzed performance of different mother wavelets in the denoising of EEG signals.

VOLUNTEER
POSITIONS

- Reviewer for IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Image Processing
- Founding Vice-President of the Electrical and Computer Engineering Graduate Students Association, 2015-17
- President of the Indian Graduate Students Association at Johns Hopkins University, 2015
- Volunteer for the Association for India's Development, JHU Chapter 2014-15

REFERENCES

- Trac D. Tran, Professor, Electrical and Computer Engineering, Johns Hopkins University
- Amitabh Basu, Associate Professor, Applied Mathematics and Statistics, Johns Hopkins University
- Raman Arora, Assistant Professor, Computer Science, Johns Hopkins University
- Sang (Peter) Chin, Research Professor, Computer Science, Boston University
- Nam H. Nguyen, Research Staff Member, IBM T.J. Watson Research Center
- Abhishek Kumar, Research Scientist, Google Brain