

Akshay Rangamani

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ACADEMIC POSITIONS	Massachusetts Institute of Technology <i>Postdoctoral Associate</i> at the Center for Brains, Minds and Machines Host: Prof. Tomaso A. Poggio	Feb 2020 - Present
RESEARCH INTERESTS	Science of Deep Learning, Deep Learning for Image & Signal Processing, Representation Learning, Associative Memories, Neural Assemblies, Assembly Calculus, Working Memory, Compressed Sensing and Sparse Signal Processing	
EDUCATION	Johns Hopkins University <i>Ph.D. Candidate in Electrical and Computer Engineering</i> Advisor: Prof. Trac D. Tran Dissertation: <i>Loss Landscapes and Generalization in Neural Networks: Theory and Applications</i> Indian Institute of Technology Madras, Chennai <i>B.Tech in Electrical Engineering, Minor: Biomedical Engineering</i> Final Project: <i>Low Cost Autofocus System for Optical Microscopes</i> guided by Dr. S. Mohanasankar	Sept 2013 - Dec 2019 GPA: 3.95/4 Aug 2009 - May 2013 GPA: 9.19/10
INDUSTRY EXPERIENCE	Research Intern, IBM Research, Yorktown Heights, NY Independent research with Dr. Nam H. Nguyen on Flat Minima in Deep Learning. Contributed software and ran experiments on Neural Methods for Time Series Analysis. Research Intern, Uplevel Security, NY Learning embeddings for relational graph nodes, handling missing data and attributes, with a focus on cybersecurity applications Visiting Student, Draper Laboratories, Cambridge, MA Discovering Common Weaknesses in Software using Deep Learning	Feb - Aug 2018 Jun - Aug 2016 Jun - Jul 2015
SKILLS	Python, PyTorch, Tensorflow, MATLAB	
SELECTED TALKS	<ul style="list-style-type: none">– <i>Towards Understanding Deep Classifiers through Neural Collapse</i> NJIT Data Science Seminar Belkin Group Meeting, UCSD– <i>To Interpolate or Not Interpolate?</i> Theory Day – Brains, Minds and Machines Summer School– <i>Supervised Learning with Assemblies of Neurons</i> Neural Systems Analysis Lab, Johns Hopkins University Center for Brain Inspired Computing, Purdue University– <i>Stability of Kernel Ridgeless Regression</i> TOPML Workshop 2021 Center for Brain Inspired Computing, Purdue University– <i>Loss Landscapes of Neural Networks and Generalization</i> Microsoft Applied Sciences, Redmond Microsoft Research India, Bangalore– <i>Learning Maliciousness in Cybersecurity Graphs</i> NeurIPS Workshop on Tensor Learning, Barcelona	April 2023 April 2023 Aug 2022 Nov 2021 Sept 2021 Apr 2021 Sept 2020 Apr 2021 May 2019 Dec 2016
SELECTED PUBLICATIONS AND PREPRINTS	<ul style="list-style-type: none">– <i>Feature Learning in Deep Classifiers through Intermediate Neural Collapse</i>, Rangamani, A., Lindegaard, M., Galanti, T., & Poggio, T. (2023) ICML– <i>Dynamics in Deep Classifiers trained with the Square Loss: normalization, low rank, neural collapse and generalization bounds</i>, Xu, M., Rangamani, A., Liao, Q., Galanti, T., & Poggio, T., (2023) RESEARCH– <i>Neural Collapse in Deep Homogeneous Classifiers and The Role of Weight Decay</i>. Rangamani, A., & Banburski-Fahey, A. (2022) IEEE ICASSP.– <i>For Interpolating Kernel Machines, Minimizing the Norm of the ERM Solution Maximizes Stability</i>, Rangamani, A., Rosasco, L., & Poggio, T., (2023) Analysis and Applications– <i>A Scale Invariant Flatness Measure for Deep Network Minima</i>, Rangamani, A., Nguyen, N.H., Kumar, A., Phan, D., Chin, S.H. & Tran, T.D., (2021) IEEE ICASSP– <i>Spectral gap extrapolation and radio frequency interference suppression using 1D UNets.</i>, Nair, A. A., Rangamani, A., Nguyen, L. H., Bell, M. A. L., & Tran, T. D. (2021) IEEE Radar Conference (RadarConf21)	

- *Deep learning-based target tracking and classification for low quality videos using coded aperture cameras.*, Kwan, C., Chou, B., Yang, J., **Rangamani, A.**, Tran, T.D., Zhang, J., & Etienne-Cummings, R. (2019) Sensors
- *Sparse Coding and Autoencoders*, **Rangamani, A.**, Mukherjee, A., Basu, A., Arora, A., Ganapathi, T., Chin, S.H. & Tran, T.D., (2018) IEEE ISIT, *Oral Presentation*
- *A Greedy Pursuit Algorithm for Separating Signals from Nonlinear Compressive Observations*, Tran, D. **Rangamani, A.**, Chin, S.H., Tran, T.D., (2018) IEEE ICASSP *Oral Presentation*
- *Reconstruction-free deep convolutional neural networks for partially observed images*, Nair, A., Liu, L., **Rangamani, A.**, Chin, S.H., Bell, M.A.L., & Tran, T.D., (2018) IEEE GlobalSIP
- *Chief: a change pattern based interpretable failure analyzer.* Patel, D., Nguyen, L.M., **Rangamani, A.**, Shrivastava, S., & Kalagnanam, J. IEEE Big Data 2018
- *Predicting local field potentials with recurrent neural networks.* Kim, L., Harer, J., **Rangamani, A.**, Moran, J., Parks, P.D., Widge, A., Eskander, E., Dougherty, D. & Chin, S.P., IEEE EMBC 2016
- *Targeted Dot Product Representation for Friend Recommendation in Online Social Networks*, Dao, M.D., **Rangamani, A.**, Chin, S.H., Nguyen, N.P., & Tran, T.D., ASONAM 2015, IEEE/ACM, *Oral Presentation*

SELECTED
WORKSHOP
PRESENTATIONS

- *Skip Connections Increase the Capacity of Variable Binding Mechanisms*, [CNS 2023](#)
- *Feature Learning in Deep Classifiers through Intermediate Neural Collapse*, [DEEPMATH 2022](#), [MSML 2023](#)
- *Neural Collapse in Deep Homogeneous Classifiers with the Square Loss*, [DEEPMATH 2021](#)
- *For Interpolating Kernel Machines, Minimizing the Norm of the ERM Solution Optimizes Stability*, [Theory of Overparameterized Machine Learning \(TOPML\) Workshop 2021](#)
- *Supervised Learning with Brain Assemblies*, [NeurIPS 2020 Beyond Backpropagation Workshop](#)
- *A Scale Invariant Flatness for Deep Network Minima*, [Berlin Mathematical School, Summer School on Mathematics of Deep Learning, 2019](#)
- *Sparse Coding and Autoencoders*, [NeurIPS 2017 Workshop on Bridging Theory and Practice of Deep Learning](#)
- *Learning Maliciousness in Cybersecurity Graphs*, [NeurIPS 2016 Workshop on Tensor Learning](#)

TEACHING,
MENTORING,
AND SERVICE

Courses:

- Co-instructor, [Statistical Learning Theory](#), Fall 2020 - 22 (MIT)
- Teaching Assistant, [Brains, Minds, and Machines Summer Course 2022](#)
Conducted tutorials on Deep Learning Theory and Signal Processing. Mentored a student on a project linking Assembly Calculus and Associative Memories
- Teaching Assistant, Machine Learning, Spring 2017, 2019 (JHU)
- Teaching Assistant, Introduction to Electrical and Computer Engineering, Fall 2015-2018 (JHU)

Direct Mentorship:

- Marius Lindegaard, CBMM Research Assistant Jun 2022 - Dec 2022
- Yi (Eva) Xie, MIT UROP Student Jan 2022 - Present
- Anshula Gandhi, CBMM Research Assistant Feb 2020 - Apr 2021

Reviewer for NeurIPS (*Outstanding Reviewer Top 8% 2021*), ICML, ICLR, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Image Processing, IEEE Transactions on Pattern Analysis and Machine Intelligence

SCHOLASTIC
ACHIEVEMENTS

- K. Lisa Yang Integrative Computational Neuroscience Center Fellowship, 2023
- Johns Hopkins University Payback Fellowship, 2013
- IIT Madras Governor's Prize for the student with all round proficiency in Curricular and Extracurricular activities, 2013
- DAAD-WISE fellowship, 2012 for an internship at the University of Luebeck, Germany
- Finalist at the TI India Analog Design Contest 2011, among the top 25 projects out of 300
- IIT Madras Merit Certificate for placing 89th nationwide (out of over 300,000) in IITJEE-2009