



# Akshay Rangamani

Postdoctoral Associate, McGovern Institute for Brain Research, MIT

 <https://akshay-r.github.io>

 [arangam@mit.edu](mailto:arangam@mit.edu)

 +1 (410)220-2307

ACADEMIC POSITIONS	<b>Massachusetts Institute of Technology</b> <i>Postdoctoral Associate at the Center for Brains, Minds and Machines</i> Host: Prof. Tomaso A. Poggio	Feb 2020 - Present
RESEARCH INTERESTS	Science of Deep Learning, Representation Learning, Associative Memories, Neural Assemblies, Assembly Calculus, Working Memory, Compressed Sensing and Sparse Signal Processing,	
EDUCATION	<b>Johns Hopkins University</b> <i>Ph.D. Candidate in Electrical and Computer Engineering</i> Advisor: Prof. Trac D. Tran Thesis: <i>Loss Landscapes and Generalization in Neural Networks: Theory and Applications</i> <i>MSE in Electrical and Computer Engineering</i>	Sept 2013 - Dec 2019 GPA: 3.95/4  May 2015
	<b>Indian Institute of Technology Madras, Chennai</b> <i>B.Tech in Electrical Engineering, Minor: Biomedical Engineering</i> Thesis: <i>Low Cost Autofocus System for Optical Microscopes</i> guided by Dr. S. Mohanasankar	Aug 2009 - May 2013 GPA: 9.19/10
TALKS AND INVITED PRESENTATIONS	<ul style="list-style-type: none"><li>– <i>To Interpolate or Not to Interpolate?</i> Theory Day – Brains, Minds and Machines Summer School</li><li>– <i>Tutorials on Deep Learning and Signal Processing</i> Brains, Minds and Machines Summer School</li><li>– <i>Supervised Learning with Assemblies of Neurons</i> Neural Systems Analysis Lab, Johns Hopkins University Center for Brain Inspired Computing, Purdue University</li><li>– <i>Stability of Kernel Ridgeless Regression</i> TOPML Workshop 2021 Center for Brain Inspired Computing, Purdue University</li><li>– <i>Loss Landscapes of Neural Networks and Generalization</i> Microsoft Applied Sciences, Redmond Microsoft Research India, Bangalore</li><li>– <i>Sparse Coding and Autoencoders</i> ISIT 2018, Vail, CO, USA</li><li>– <i>A Greedy Pursuit Algorithm for Separating Signals from Nonlinear Compressive Observations</i> ICASSP 2018, Calgary, Canada</li><li>– <i>Learning Maliciousness in Cybersecurity Graphs</i> NeurIPS Workshop on Tensor Learning, Barcelona</li></ul>	Aug 2022  Aug 2022  Nov 2021 Sept 2021  Apr 2021 Sept 2020  Apr 2021 May 2019  June 2018  Apr 2018  Dec 2016
SELECTED PUBLICATIONS AND PREPRINTS	<ul style="list-style-type: none"><li>– <i>Feature Learning in Deep Classifiers through Intermediate Neural Collapse</i>, Rangamani, A., Lindegaard, M., Galanti, T., &amp; Poggio, T. in preparation</li><li>– <i>Emergence of associative memories in Assembly Calculus and their capacity</i>, Rangamani, A., Xie, Y., Li, Y., &amp; Poggio, T. Submitted to COSYNE 2023</li><li>– <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., &amp; Poggio, T., (2023) RESEARCH, To Appear</li><li>– <i>Neural Collapse in Deep Homogeneous Classifiers and The Role of Weight Decay</i>. Rangamani, A., &amp; Banburski-Fahey, A. (2022) IEEE ICASSP.</li><li>– <i>For Interpolating Kernel Machines, Minimizing the Norm of the ERM Solution Maximizes Stability</i>, Rangamani, A., Rosasco, L., &amp; Poggio, T., (2023) Analysis and Applications, To Appear</li><li>– <i>A Scale Invariant Flatness Measure for Deep Network Minima</i>, Rangamani, A., Nguyen, N.H., Kumar, A., Phan, D., Chin, S.H. &amp; Tran, T.D., (2021) IEEE ICASSP</li><li>– <i>Deep learning-based target tracking and classification for low quality videos using coded aperture cameras.</i>, Kwan, C., Chou, B., Yang, J., Rangamani, A., Tran, T.D., Zhang, J., &amp; Etienne-Cummings, R. (2019) Sensors</li><li>– <i>Sparse Coding and Autoencoders</i>, Rangamani, A., Mukherjee, A., Basu, A., Arora, A., Ganapathi, T., Chin, S.H. &amp; Tran, T.D., (2018) IEEE ISIT, Oral Presentation</li></ul>	

- [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

- [Feature Learning in Deep Classifiers through Intermediate Neural Collapse](#), [DEEPMATH 2022](#)
- [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 Over-parameterized 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](#)
- [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](#), [NeurIPS 2017 Workshop on Bridging Theory and Practice of Deep Learning](#)
- [Landmark Detection and Tracking in Ultrasound using a CNN-RNN Framework](#), NeurIPS 2016 Workshop on 3D Deep Learning

- 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 in IITJEE-2009

#### 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, Compressed Sensing and Sparse Recovery, Spring 2015, 2017 (JHU)
- Teaching Assistant, Introduction to Electrical and Computer Engineering, Fall 2015-2018 (JHU)

#### Direct Mentorship:

- Marius Lindegaard, CBMM Research Assistant Jun 2022 - Present
- 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

SELECTED  
WORKSHOP  
PRESENTATIONS

HONORS AND  
AWARDS

TEACHING,  
MENTORING,  
AND SERVICE

**IBM T.J. Watson Research Center, Yorktown Heights, NY**

**Feb - Aug 2018**

- 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**

**Jun - Aug 2016**

- 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 Uplevel's 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**

**Jun - Jul 2015**

- 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

REFERENCES

- Tomaso A. Poggio, Professor, Brain and Cognitive Sciences, Massachusetts Institute of Technology
- Rene Vidal, Professor, Biomedical Engineering, Johns Hopkins University
- Lorenzo Rosasco, Professor, DIBRIS, Università degli Studi di Genova
- Trac D. Tran, Professor, Electrical and Computer Engineering, Johns Hopkins University