Akshay Rangamani

Assistant Professor, Data Science, NJIT

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Academic Positions

New Jersey Institute of Technology Jan 2024 - Present
Assistant Professor, Department of Data Science, Ying Wu College of Computing

Massachusetts Institute of Technology Feb 2020 - Dec 2023
Postdoctoral Fellow at the K. Lisa Yang Integrative Computational Neuroscience Center
Postdoctoral Associate at the Center for Brains, Minds and Machines
Host: Prof. Tomaso A. Poggio

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 Sept 2013 - Dec 2019
Ph.D. in Electrical and Computer Engineering GPA: 3.95/4
MSE in Electrical and Computer Engineering May 2015
Advisor: Prof. Trac D. Tran
Dissertation: *Loss Landscapes and Generalization in Neural Networks: Theory and Applications*

Indian Institute of Technology Madras, Chennai Aug 2009 - May 2013
B.Tech in Electrical Engineering, Minor: Biomedical Engineering GPA: 9.19/10
Final Project: *Low Cost Autofocus System for Optical Microscopes* guided by Dr. S. Mohanasankar

Industry Experience

Research Intern, IBM Research, Yorktown Heights, NY Feb - Aug 2018
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 Jun - Aug 2016
Learning embeddings for relational graph nodes, handling missing data and attributes, with a focus on cybersecurity applications

Visiting Student, Draper Laboratories, Cambridge, MA Jun - Jul 2015
Discovering Common Weaknesses in Software using Deep Learning

Skills

Python, PyTorch, Tensorflow, MATLAB

Selected Talks

- *Towards Understanding Deep Classifiers through Neural Collapse*
  Google Research India, Bengaluru — Nov 2023
  IIT Madras RBCDSAI Seminar — Nov 2023
  NJIT Data Science Seminar — April 2023
  Belkin Group Meeting, UCSD — April 2023
- *To Interpolate or Not Interpolate?* — Aug 2022
  Theory Day – Brains, Minds and Machines Summer School
- *Supervised Learning with Assemblies of Neurons*
  Neural Systems Analysis Lab, Johns Hopkins University — Nov 2021
  Center for Brain Inspired Computing, Purdue University — Sept 2021
- *Stability of Kernel Ridgeless Regression*
  TOPML Workshop 2021 — Apr 2021
  Center for Brain Inspired Computing, Purdue University — Sept 2020
- *Loss Landscapes of Neural Networks and Generalization*
  Microsoft Applied Sciences, Redmond — Apr 2021
  Microsoft Research India, Bangalore — May 2019
- *Learning Maliciousness in Cybersecurity Graphs* — Dec 2016
  NeurIPS Workshop on Tensor Learning, Barcelona

Selected Publications

- *Feature Learning in Deep Classifiers through Intermediate Neural Collapse*, **Rangamani, A.**, Lindegaard, M., Galanti, T., & Poggio, T. (2023) *ICML*
- *Dynamics in Deep Classifiers trained with the Square Loss: normalization, low rank, neural collapse and generalization bounds*, Xu, M., **Rangamani, A.**, Liao, Q., Galanti, T., & Poggio, T., (2023) RESEARCH
- *For Interpolating Kernel Machines, Minimizing the Norm of the ERM Solution Maximizes Stability*, **Rangamani, A.**, Rosasco, L., & Poggio, T., (2023) Analysis and Applications

- *A Scale Invariant Flatness Measure for Deep Network Minima*, **Rangamani, A.**, Nguyen, N.H., Kumar, A., Phan, D., Chin, S.H. & Tran, T.D., (2021) IEEE ICASSP
- *Spectral gap extrapolation and radio frequency interference suppression using 1D UNets.*, 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*
- *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

Selected Workshop Presentations

- *Skip Connections Increase the Capacity of Variable Binding Mechanisms*, CNS 2023, CCN 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
- *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:

- Instructor, DS677 Deep Learning (NJIT)
- Co-instructor, Statistical Learning Theory, Fall 2020 - 23 (MIT)
- Teaching Assistant, Brains, Minds, and Machines Summer Course 2022, 2023
  Conducted tutorials on Deep Learning Theory and Signal Processing and mentored student projects.
- 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

Academic 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