

Shobhita Sundaram

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EDUCATION

Massachusetts Institute of Technology (MIT) Cambridge, MA
S.B. Computer Science, S.B. Mathematics; GPA: 4.9/5.0 2018–2022
Current relevant coursework: *Natural Language Processing, Discrete Mathematics.*

EXPERIENCE

Center for Brains, Minds, and Machines, MIT Cambridge, MA
Undergraduate Researcher September 2019 - Present

Building Deep Neural Network (DNN) models for vision capable of learning generalizable representations of fundamental visual features with long-range spatial dependencies.

Project #1: Representing “insideness” with deep neural networks September 2019 - June 2020
Advised by Prof. Tomaso Poggio and Dr. Xavier Boix

- Developed stacked Convolutional LSTM models capable of learning a general rule for classifying pixels as inside or outside closed regions.
- Improved accuracy in segmenting shapes unseen during training by 50% compared to feed-forward DNNs.
- Discovered a simple visual routine learned by recurrent models, opening paths for future research in using recurrent networks to learn generalizable rules for handling visual long-range dependencies.

Project #2: Symmetry perception with deep neural networks August 2020 - Present
Advised by Prof. Pawan Sinha and Dr. Xavier Boix

- Led a project comparing DNN models for symmetry detection in synthetic and natural images.
- Designed synthetic datasets to experimentally show that object recognition networks (e.g. DenseNet, ResNet, etc) experience performance drops of up to 50% for unseen image families.
- Tested architectures and mechanisms (atrous convolutions, recurrence, transformers) for facilitating learning long-range dependencies.
- Developed recurrent models that detect symmetry with 100% accuracy across all synthetic datasets and mirrored natural images (outperforming comparison networks).
- Uncovered a mechanism of generalization involving propagating from the axis of symmetry.

The D. E. Shaw Group* New York, NY
Quantitative Research Intern June - August 2021

- Explored Deep Reinforcement Learning (RL) approaches to stock trading.
- Built a full RL pipeline to run large-scale experiments and hyperparameter searches.
- Derived baseline theoretical trading models using optimal control theory (Linear Quadratic Regulation).
- Trained RL models that outperformed theoretical baselines in trading simulations and uncovered interpretable insights for learned policies.

Apple* Cupertino, CA
Machine Learning Intern June - August 2020

- Built Gradient Boosting Tree models to predict battery drain from iPhone time series usage data, enabling intelligent power management.
- Achieved high accuracy with low false positive rate in classifying users using a novel training scheme.

*Cannot disclose further information (e.g. specific performance metrics) due to confidentiality restrictions.

- Deployed end-to-end machine learning pipeline on-device for power optimization, aiming to release to consumer iPhones; selected from 15 interns to present to SVP of Software Engineering based on impact.

Two Sigma Investments

Houston, TX

Software Engineering Intern

May - August 2019

- Developed a RESTful Flask service and UI to create and maintain collections of instruments for trading.
- Tool is now used by 4 teams to track over 20,000 instruments with unique trading characteristics.

Digital Humanities Lab, MIT

Cambridge, MA

Undergraduate Researcher

September - December 2018

- Collaborated on open-source project: “Computational Reading of Gender in Novels, 1770-1992”.
- Designed and implemented Python tools to quantify distances between male/female instances in 4,200 novels.
- Applied part-of-speech-tagging to find the top 20 adjectives associated with each gender across the corpus.

PUBLICATIONS

- [1] **S. Sundaram**, D. Sinha, M. Groth, T. Sasaki, and X. Boix, “Symmetry perception by deep networks: Inadequacy of feed-forward architectures and improvements with recurrent connections”, 2021, (*under review*). arXiv: 2112.04162.
- [2] **S. Sundaram** and N. Hulkund, “Gan-based data augmentation for chest x-ray classification”, in *KDD - Applied Data Science for Healthcare Workshop*, 2021.
- [3] **S. Sundaram**, D. Sinha, M. Groth, and X. Boix, “Recurrent connections facilitate learning symmetry perception”, in *ICLR - Generalization Beyond the Training Distribution in Brains and Machines Workshop*, 2021.
- [4] K. Villalobos, V. Štih, A. Ahmadinejad, **S. Sundaram**, J. Dozier, A. Francl, F. Azevedo, T. Sasaki, and X. Boix, “Do Neural Networks for Segmentation Understand Insideness?”, *Neural Computation*, vol. 33, no. 9, pp. 2511–2549, Aug. 2021, ISSN: 0899-7667.

AWARDS

Undergraduate Research and Innovation Scholar	2020
Burchard Scholar <i>Competitive award honoring MIT students who excel in the humanities.</i>	2020

EXTRACURRICULAR ACTIVITIES

Tutor, MIT Math Learning Center	September 2021 - Present
– Tutor undergraduate students in single and multi-variable calculus, linear algebra, probability, and statistics.	
Associate Editor & Founding Member, MIT Science Policy Review	September 2019 - Present
– Associate editor of a review that publishes 10-15 peer-reviewed pieces/year distilling complex science policy issues for the public.	
– Edited and solicited peer reviewers for pieces on quantum information science, the implications of cryptocurrency on US fiat currency, and regulation of digital advertisements.	
VP of Campus Relations, MIT Society of Women Engineers	January 2019 - February 2021
– Oversaw 10 department chairs and 12 events per semester, connecting 100+ SWE members with professors, research opportunities, and other campus resources.	
– Conceived and organized inaugural “Undergraduate Research Mixer” to connect 90+ freshmen & sophomores from underrepresented groups with research opportunities.	

SKILLS & INTERESTS

Skills: TensorFlow, Keras, PyTorch, sklearn, CoreML, SQL, OpenAI Gym/Stable Baselines.

Interests: Hiking, tennis, singing, violin, creative writing, jewelry design, skiing.