Udith Haputhanthri

uh2753@princeton.edu
https://udithhaputhanthri.github.io/

Research Interests

Natural and Artificial Intelligence, Computational Cognitive Science, Computational Neuroscience, Mechanistic Interpretability, AI Alignment, Computational Imaging

Research Experience

- **Graduate Researcher**, Department of Electrical and Computer Engineering, Princeton University, United States
  Advisor: Dr. Jonathan D. Cohen — Aug 2024 – Present
- **Visiting Student Researcher**, Department of Biology, Stanford University, United States
  Advisors: Dr. Mark Schnitzer — Jan 2024 – June 2024
- **Post-Baccalaureate Fellow**, Faculty of Arts and Sciences, Harvard University, United States
  Advisors: Dr. Dushan Wadduwage, Dr. Hidenori Tanaka — July 2022 – Dec 2023
- **Visiting Undergraduate Research Fellow (Remote)**, Faculty of Arts and Sciences, Harvard University, United States
  Advisors: Dr. Dushan Wadduwage — May 2021 – June 2022

Education

Ph.D. in Electrical and Computer Engineering, Princeton University, United States
Aug 2024 – Present

B.Sc. Eng (Hons.) in Biomedical Engineering, Department of Electronic & Telecommunication Engineering, University of Moratuwa, Sri Lanka — Oct 2017 – Dec 2022

- First Class Honours Degree (cGPA : 4.00/ 4.20)

Publications

1. **U Haputhanthri***, L Storan*, Y Jiang*, A Shai, H Akengin, M Schnitzer†, F Dinc†, H Tanaka†, "Why do recurrent neural networks suddenly learn? Bifurcation mechanisms in neuro-inspired short-term memory tasks," *Mechanistic Interpretability Workshop ICML* 2024. (view publication)
2. **U Haputhanthri***, L Storan*, A Shai*, S Ganguli, M Schnitzer, H Tanaka†, F Dinc†, "Enhanced associative memory in temporally consistent recurrent neural networks," *AMHN Workshop NeurIPS* 2023. (view publication)
3. **U Haputhanthri**, K Herath, R Hettiarachchi, H Kariyawasam, A Ahmad, B S Ahluwalia, C Edussooriya, and D N Wadduwage, "Towards Ultrafast Quantitative Phase Imaging via Differentiable Microscopy," *BOE*, 2023. (view publication)
4. M Afham*, **U Haputhanthri***, J Pradeepkumar*, M Anandakumar, A De Silva, and C Edussooriya, "Towards Accurate Cross-Domain In-Bed Human Pose Estimation," *International Conference on Acoustics, Speech, & Signal Processing*, 2022. (view publication)
5. H Arguello, J Bacca, H Kariyawasam, E Vargas, M Marquez, H Garcia, R Hettiarachchi, K Herath, **U Haputhanthri**, B S Ahluwalia, P So, D N Wadduwage, and C Edussooriya, "Deep Optical Coding Design in Computational Imaging," *IEEE Signal Processing Magazine*, 2022. (view publication)
6. S Herath and **U Haputhanthri**, "Topologically Optimal Design and Failure Prediction using Conditional Generative Adversarial Networks," *International Journal for Numerical Methods in Engineering*, 2021. (view publication)
7. R Hettiarachchi, **U Haputhanthri**, K Herath, H Kariyawasam, S Munasinghe, K Wickramasinghe, D Samarasinghe, A De Silva, and C Edussooriya, "A Novel Transfer Learning-Based Approach for Screening Pre-existing Heart Diseases Using Synchronized ECG and PCG Signals," *ISCAS 2021 - 2021 IEEE International Symposium on Circuits and Systems*, 2021. (view publication)
8. S Herath and **U Haputhanthri**, "Nonlinear Multiscale Modelling and Design using Gaussian Processes," *Journal of Applied and Computational Mechanics*, 2021. (view publication)

PATENT APPLICATIONS

1. D N Wadduwage, **U Haputhanthri**, H Kariyawasam, "Optical Transformers," Provisional Application - Harvard Case No.: HU 9391 - Apl. Serial Nos.: 63/456,416 & PCT/US24/22258, 2023.
2. K Herath*, **U Haputhanthri***, R Hettiarachchi*, H Kariyawasam*, A Ahmad, B S Ahluwalia, C Edussooriya, and D N Wadduwage, "Differentiable Microscopy Designs an All-Optical Quantitative Phase Microscope," Provisional Application - Harvard Ref. No. HU 8932 - F&L Ref. 098930-0366, 2022.

PREPRINTS

1. **U Haputhanthri***, L Storan*, Y Jiang*, T Raheja, A Shai, O Akengin, N Miolane, M Schnitzer, F Dinc†, H Tanaka†, "Understanding and controlling the geometry of memory organization in RNNs," 2025. (in preparation for journal publication)
2. **U Haputhanthri**, H Kariyawasam, and D N Wadduwage, "Differentiable Microscopy ($\partial\mu$) as a Generalized Paradigm of Optics and Optical System Design," 2024. (in preparation for journal publication)
3. K Herath, **U Haputhanthri***, R Hettiarachchi*, H Kariyawasam*, R N Ahmad, A Ahmad, B S Ahluwalia, C Edussooriya, and D N Wadduwage, "Differentiable Microscopy Designs an All-Optical Quantitative Phase Microscope," *Nature Machine Intelligence*, 2024. (under review)

ONGOING PROJECTS

- F Dinc, **U Haputhanthri**, H Tanaka, M Schnitzer (no specific author order), "Large-scale neural modeling via convex optimization methods," 2024.

HONORS AND AWARDS

- 3^{rd} **place (International rank) - Video and Image Processing Cup (VIP Cup) 2021** (Computer Vision Competition)
- 2^{nd} **place (National rank) - Datastorm 1.0V 2020** (Data Science Competition)
- 1^{st} **place (National rank) - Intellihack 2019** (Machine Learning Competition)
- **Ceylinco Life - Pranama Scholarship (National award)** 2017 for best academic performance in the GCE Advanced Level (University Entrance) examination.
- **Mahapola Merit Scholarship (National award)** for best academic performances in the GCE Advanced Level (University Entrance) examination.
- **Best All-Rounder of the Year 2017**, Dharmaraja College, Sri Lanka for excellence in both academic and extra-curricular activities.
- **Award for highest Z-score (2.7069) of the Year 2016** for GCE Advanced Level Examination (University Entrance), Dharmaraja College, Sri Lanka (out of $\sim$ 400 candidates).
- **Dagoba Award for Chess** - The highest color for a sport/ game (Chess) one can obtain as a student of Dharmaraja College, Sri Lanka. Awarded based on national-level championships in the years 2012, 2013, and 2014.

SELECTED INVITED/ CONFERENCE TALKS

- "Differentiable Microscopy ($\partial\mu$) as a Generalized Paradigm of Optics and Optical System Design," *Optica Biophotonics Congress: Optics in the Life Sciences 2023*, Canada (invited) April 2023
- "From Hours to Seconds: Towards 100x Faster Quantitative Phase Imaging via Differentiable Microscopy," *Quantitative Phase Imaging IX*, SPIE Photonics West 2023, United States Jan 2023
- "Differentiable Microscopy for Content and Task Aware Compressive Fluorescence Imaging," *High-Speed Biomedical Imaging and Spectroscopy VIII*, SPIE Photonics West 2023, United States Jan 2023
- "Machine Learning in Action," Informatics Institute of Technology, Sri Lanka Jan 2022
- "Differentiable DEEP TFM," Rowland Summer Student Seminar, Rowland Institute at Harvard University, United States Aug 2021

VOLUNTEER/ OUTREACH ACTIVITIES

- **Teaching Assistant** (volunteer), Department of Electronic and Telecommunication Engineering, University of Moratuwa, Sri Lanka (EN2550 - Fundamentals of Image Processing and Machine Vision, EN3900 - Seminar (Geometric Deep Learning, Signal Processing on Graphs)).
- **Reviewer** (CVPR 2022, ECCV 2022)
- **Outreach Activities**: "Soyuru Sathkara"- a high school ordinary-level workshop series that aimed to improve the quality of education in rural villages, Mentored a team of undergraduate students toward the MICCAI 2021 competition.