Ramith Hettiarachchi

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Summary

I'm interested in developing algorithms and fusing insights from machine learning (ML) to advance biology and healthcare, while striving for robustness and interpretability.

Research Interests : Computational Biology | ML for Science | Multi-modal Learning (Genomics+Imaging)
Research Directions : Combinatorial Optimization | Uncertainty Quantification | Graph Theory/Representation Learning

Education

University of Moratuwa — Sri Lanka
B.Sc. Eng(Hons.) Electronic & Telecommunication Engineering — *Oct 2017 - June 2022*

– Dean's List: Semesters 1,2,3,4,6,7,8 — **CGPA : 3.96/4.2 (First Class)**
Thesis Title: "Hardware Accelerated Imaging Cytometry Modality Using Diffractive Deep Neural Networks"

Research Experience

July 2022 - Present — **Post Baccalaureate Fellow, Division of Science, Harvard University**
With the guidance of Dr. Sergey Ovchinnikov, my research focused on two projects related to Computational Biology : 1) A new method for phylogenetic tree search, 2) probing protein dynamics information using representations of the AlphaFold model and data from nuclear magnetic resonance (NMR) experiments.
Furthermore, I developed quantization-aware training methods and robust optical neural networks with the guidance of Dr. Dushan Wadduwage.

Oct 2020 - Mar 2021 — **Research Intern at CSIRO Data61, Australia**
Developed a robot capable of 3D reconstruction from Intel Realsense D435 camera data and performing dynamic obstacle avoidance using the D* lite algorithm.

Journal Publications

[1] A. Ahmad, R. Hettiarachchi*, A. Khezri*, B. S. Ahluwalia, D.N. Wadduwage, R. Ahmad, "Highly sensitive quantitative phase microscopy and deep learning complement whole genome sequencing for rapid detection of infection and antimicrobial resistance," ***Frontiers in Microbiology (2023).*** doi.org/10.3389/fmicb.2023.1154620
↪ Antimicrobial Resistance | Genomics and Imaging

[2] H. Arguello, J. Bacca, H. Kariyawasam, E. Vargas, M. Marquez, R. Hettiarachchi, H. Garcia, K. Herath, U. Haputhanthri, B. S. Ahluwalia, P. So, D. N. Wadduwage, C. U. S. Edussooriya, "Deep Optical Coding Design in Computational Imaging". ***IEEE Signal Processing Magazine, Jan 2023.*** doi.org/10.1109/MSP.2022.3200173
↪ Tutorial Paper

Conference/Workshop Publications

[1] R. Hettiarachchi, Avi Swartz, S. Ovchinnikov, "Differentiable Search of Evolutionary Trees"
► Accepted to **International Conference on Machine Learning (ICML) 2023 - Workshops :** "Sampling and Optimization in Discrete Space" (SODS) and "Differentiable Almost Everything" (DiffAE).
doi.org/10.1101/2023.07.23.550206 ↪ Evolutionary Biology | Soft Combinatorial Optimization | Graph Theory

[2] R. Hettiarachchi, U. Haputhanthri, K. Herath, H. Kariyawasam, S. Munasinghe, K. Wickramasinghe, D. Samarasinghe, A. C. De Silva and C. U. S. Edussooriya, "A Novel Transfer Learning Based Approach for Screening Pre-existing Heart Diseases using Synchronized ECG Signals and Heart Sounds," *IEEE International Symposium on Circuits and Systems (ISCAS)*, 2021, pp. 1-5, doi.org/10.1109/ISCAS51556.2021.9401093.
↪ Transfer-learning | ECG ↔ PCG | CNN

Invited Talks

[1] "Towards Realizable Optical Meta-surfaces through Physics-informed Quantization Aware Training", Northeast Symposium on Biomedical Optics - Nov, 2022 - MIT, Lansdowne St. [link]

[2] "Towards Realizable D2NN Designs Through Quantization Aware Training", Nano-SymBioSys workshop at UiT, The Arctic University of Norway - Sep, 2022 - Tromsø, Norway. [link]

Patent Applications

[1] K. Herath* , U. Haputhanthri*, R. Hettiarachchi*, H. Kariyawasam*, A. Ahmad, B. S. Ahluwalia, C. U. S. Edussooriya and D. Wadduwage, "Provisional Application – Harvard Ref. No. HU 8932 - F&L Ref. 098930-0366 "Differentiable Microscopy Designs an All-Optical Quantitative Phase Microscope".

Other Research Projects

Configuring an Intelligent Reflecting (IRS) Surface for Wireless Communications | Feb - June, 2021
Supervisor : Dr. Prathapasinghe Dharmawansa, University of Moratuwa.

- Developed an alternative optimization procedure based on a genetic algorithm and the adaptive moment estimation optimizer to find optimized IRS configurations in a 2^{4096} search space. It provided the best data rate and computational cost trade-off, and was the winning solution of the IEEE Signal Processing Cup 2021.
  Genetic algorithm based optimization | Mathematical Modeling

Realtime Sign Language Translation to Speech | Jul - Nov, 2019
Self supervised project.

- Developed a solution capable of mapping the EMG signals obtained by an arm to sign language gestures using an ML model. For high-performance inference, the DE-10 Nano field-programmable gate array is used. Project won the Iron Award at the APAC Finals of innovate FPGA, a global FPGA design contest organized by Intel.
  Electromyography (EMG) | Pattern Recognition

Honors, Awards, and Competitions

Scholar - 2022 Princeton Pathways to Graduate School program	2022
Winner - IEEE Signal Processing Cup, ICASSP - *Team* T^3	2021
1st in Sri Lanka, 48th in the World - IEEEXtreme 13.0 Competitive Programming - *Team Siraa* [link]	2019
Asia–Pacific - Iron Award - InnovateFPGA - Global FPGA Design Contest by Intel	2019
Mahapola Merit Scholarship - Awarded for students who excelled at the university entrance exam	2017
Sri Lankan Team Reserve - International Olympiad in Informatics (IOI)	2015

Volunteering / Leadership

Project Aya, Cohere For AI	Contributing to Sinhala Language Datasets	2023
IEEE Signal Processing Society, UoM.	Vice-Chairman, Chairman	2020 - 2022
Rotaract Club of Univ. of Moratuwa	Volunteer, Senior Director - IT	2019 - 2021
Sustainable Education Foundation	Assistant Program Manager - ScholarX	2020 - 2021
Socratic.org	Helping students with Chemistry & Math	2014 - 2016

Programming Proficiency

Languages:	C/C++, Python, Scilab, MATLAB, Mathematica.
Visualization/Technical:	Javascript, Processing, Git, LaTeX.
Libraries:	JAX, OpenCV, PyTorch.

Relevant Coursework

Signal Processing:	Genomic Signal Processing BM4321 (**A+**), Digital Signal Processing EN2570 (**A**), Random Signals and Processes EN2040 (**A**), Signals and Systems EN1060 (**A-**)
Mathematics:	Calculus MA2023 (**A+**), Graph Theory MA2053 (**A+**), Linear Algebra MA2033 (**A+**)
Computer Vision	Fundamentals of Image Processing and Machine Vision EN2550 (**A**), Machine Vision EN4553 **(A+)**, Advances in Machine Vision EN4583 **(A+)**

References available upon request. December, 2023