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 BiologyML for ScienceMulti-modal Learning (Genomics+Imaging)Research Directions :Combinatorial OptimizationUncertainty QuantificationGraph 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 Thesis Title: "Hardware Accelerated Imaging Cytometry Modality Using 3 	CGPA : 3.96/4.2 (First Class) 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.
Ост 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, <u>R. Hettiarachchi</u>*, 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, <u>R. Hettiarachchi</u>, 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] <u>R. Hettiarachchi</u>, Avi Swartz, S. Ovchinnikov, "Differentiable Search of Evolutionary Trees" J
 ▶ 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] <u>R. Hettiarachchi</u>, 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.

 $\hookrightarrow \boxed{\text{Transfer-learning}} \boxed{\text{ECG} \leftrightarrow \text{PCG}} \boxed{\text{CNN}}$

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

K. Herath^{*}, U. Haputhanthri^{*}, <u>R. Hettiarachchi</u>^{*}, 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 CommunicationsFEB - JUNE, 2021Supervisor : Dr. Prathapasinghe Dharmawansa, University of Moratuwa.Feb - June, 2021

► Developed an alternative optimization procedure based on a genetic algorithm and the adaptive moment estimation optimizer to find optimized IRS configurations in a 2⁴⁰⁹⁶ 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

JUL - Nov, 2019

Realtime Sign Language Translation to Speech

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 - <i>Team</i> 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	
Mahapola Merit Scholarship - Awarded for students who excelled at the university entrance exam	
Sri Lankan Team Reserve - International Olympiad in Informatics (IOI)	

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.

February, 2024