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Malsha V. Perera

I am a third-year Ph.D. student , supervised by Dr. Vishal Patel, at the Vision and Image Understanding (VIU) Lab in the Department of Electrical and Computer Engineering at Johns Hopkins University. My research spans the fields of computer vision and deep learning, with a primary focus on applying deep generative models to low-level vision applications, particularly in image restoration. Additionally, I am deeply interested in investigating issues related to data memorization and addressing fairness and bias problems within deep generative models.

Education

2021–present **Ph.D. in Electrical Engineering**, *Johns Hopkins University*, USA.
Highlighted Courses: Machine Perception, Machine Intelligence, Vision as a Bayesian Inference, Machine Learning for Signal Processing, Foundations of Probabilistic Machine Learning

2016–2020 : **B.Sc, Biomedical Engineering**, *University of Moratuwa*, Sri Lanka.
First Class Honors with a GPA of 4.06/4.20, Included in Dean's Honors List in all 8 consecutive semesters. Class Rank : 3rd among 117, Faculty Rank : 4th among 948 students.
Highlighted Courses: Signals and Systems, Machine Vision, Digital Signal Processing

Research Experience

2021- Present **Johns Hopkins University**, ***Baltimore***, **USA**, Graduate Research Assistant.
Research on computer vision and Generative AI. My current work revolves around the application of diffusion models in diverse image restoration tasks, including face restoration, Synthetic Aperture Radar (SAR) image despeckling, and weather restoration. Furthermore, I am delving into the analysis and mitigation of social biases and data memorization issues inherent in deep generative models.

Feb 2020 - Aug 2021 **University of Moratuwa**, **Sri Lanka**, Graduate Research Assistant.
Research on retinal vessel segmentation in fundus images using deep learning.
Research on deep learning based hand gesture classification algorithm using forearm sEMG signals.

June - Dec 2018 **Agency for Science Technology and Research (A*STAR)**, **Singapore**, Research Intern.
Research on deep learning frameworks for Brain hemorrhage segmentation in CT images.
Developed a fluorescent microscopy image based analytical system to automatically identify adipogenesis (browning of adipocytes) stages.
Advisor: Dr. Bhanu Prakash

Publications

Conference Papers

2023 **Malsha V. Perera** and Vishal M. Patel. Analyzing bias in diffusion-based face generation models. In *2023 IEEE International Joint Conference on Biometrics (IJCB)*, 2023.

2022 **Malsha V. Perera**, Wele Gedara Chaminda Bandara, Jeya Maria Jose Valanarasu, and Vishal M. Patel. Transformer-based sar image despeckling. In *2022 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, pages 751–754, 2022.

2022 **Malsha V. Perera**, Wele Gedara Chaminda Bandara, Jeya Maria Jose Valanarasu, and Vishal M. Patel. Sar despeckling using overcomplete convolutional networks. In *2022 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, pages 401–404, 2022.

2021 **Malsha V. Perera*** and Ashwin De Silva*. A joint convolutional and spatial quad-directional lstm network for phase unwrapping. In *ICASSP 2021-2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 4055–4059. IEEE, 2021.

2020 Asma M Naim, Kithmin Wickramasinghe, Ashwin De Silva, **Malsha V. Perera**, Thilina Dulantha Lalitharatne, and Simon L Kappel. Low-cost active dry-contact surface emg sensor for bionic arms. In *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, pages 3327–3332. IEEE, 2020.

2020 Ashwin De Silva*, **Malsha V. Perera***, Kithmin Wickramasinghe, Asma M Naim, Thilina Dulantha Lalitharatne, and Simon L Kappel. Real-time hand gesture recognition using temporal muscle activation maps of multi-channel semg signals. In *ICASSP 2020-2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 1299–1303. IEEE, 2020.

Journal Papers

2023 **Malsha V. Perera**, Nithin Gopalakrishnan Nair, Wele Gedara Chaminda Bandara, and Vishal M. Patel. Sar despeckling using a denoising diffusion probabilistic model. In *IEEE Geoscience and Remote Sensing Letters*, 2023.

Preprints

2021 Ashwin De Silva*, **Malsha V. Perera***, Navodini Wijethilake, Saroj Jayasinghe, Nuwan D Nanayakkara, and Anjula De Silva. A thickness sensitive vessel extraction framework for retinal and conjunctival vascular tortuosity analysis. *arXiv preprint arXiv:2101.00435*, 2021.

* denotes equal contribution.

Academic Achievements & Recognitions

2020 **Merit Award at SLAAS Awards** awarded by Sri Lanka Association for the Advancement of Science for the *best undergraduate project of Sri Lanka*

2019 **World Finalists at the IEEE ComSoc Student Competition** ranked among *the top 15 in the world*, Received an Honorable Mention

2019 **National Finalists at the Sri Lankan IoT Challenge** ranked among *the top 10 in the country*, Received an Honorable Mention

2018 **Singapore International Pre-Graduate Award** Awarded by Agency for Science, Technology and Research, Singapore for *top international students*

2017 **Second Runners-up in IEEE WIE Robotics Challenge - Sri Lanka** Awarded by IEEE Women in Engineering Chapter, Sri Lanka

2015 **International Physics Olympiad, Mumbai, India** Member of the National Team

2015 **Asian Physics Olympiad, Hangzshou, China** Member of the National Team

2015 **Dialog Merit Scholarship for Engineering Undergraduates** awarded by Dialog Axiata PLC for the students who excelled at the university entrance examinations

2015 **Mahapola Merit Scholarship for Engineering Undergraduates** awarded by the Government of Sri Lanka for the students who excelled at the university entrance examinations

2014 **Silver Medalist, Sri Lankan Physics Olympiad** Awarded by Institute of Physics, Sri Lanka

Teaching Experience

2022/'23 Fall **Teaching Assistant -EN.520.344: Introduction to Digital Signal Processing**, Johns Hopkins University.

2021 Spring **Teaching Assistant -EN 1060: Signals and Systems**, University of Moratuwa, Sri Lanka.

2020 Fall **Teaching Assistant -BM2101: Analysis of Physiological Systems**, University of Moratuwa, Sri Lanka.

2020 Fall **Teaching Assistant -BM4111: Medical Electronics and Instrumentation** , University of Moratuwa, Sri Lanka.

2020 Fall **Teaching Assistant -BM2011: Human Anatomy and Physiology** , University of Moratuwa, Sri Lanka.

2020 Spring **Teaching Assistant -EN3030 Circuits and Systems Design** , University of Moratuwa, Sri Lanka.

Technical skills

Programming Languages: Python (Proficient), MATLAB (Proficient), C/C++, Verilog HDL, LaTeX

Frameworks: PyTorch, Tensoflow, Keras, OpenCV, scikit-learn, ITK/VTK

Software: Quartus, Multisim, AutoCAD, Altium, Solidworks

Hardware: STM32 Family, Atmel AVR, Altera DE2, Raspberry Pi, Arduino

Leadership and Services

2016–2020 **IEEE Engineering in Medicine and Biology Student Branch Chapter**, *University of Moratuwa*, Sri Lanka.
Secretary (2018/2019), Director - Education (2017/2018)
Received the Most Outstanding EMB Student Branch Chapter Regional Award for the term 20118/19 (Asia-Pacific region)
Organizing Committee Member, Brainstorm BME Design Competition 2018 and 2019

2017–2019 **Student Representative**, *University of Moratuwa*, Sri Lanka.
Represented the undergraduate students of the class of 2020 at the Department of Electronic and Telecommunication Engineering, University of Moratuwa