Ashwin De Silva

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Education

Ph.D. **Johns Hopkins University** | Baltimore, MD | Biomedical Engineering — Aug 2021 – Present
MINDS Fellowship (2024)
Advisors: Joshua T. Vogelstein, Pratik Chaudhari, Carey E. Priebe
Highlighted Courses: Probability, Statistical Theory, High-Dimensional Approximation, Machine Learning, Optimal Transport, Probabilistic Models of Visual Cortex, Compressed Sensing and Sparse Recovery, Neuroscience and Cognition
GPA: 3.97/4.00

M.S.E. **Johns Hopkins University** | Baltimore, MD | Applied Mathematics and Statistics — Aug 2021 – May 2024
Focus Area: Statistics and Statistical Learning
GPA: 3.97/4.00

B.Sc. **University of Moratuwa** | Sri Lanka | Biomedical Engineering — Jan 2016 – Jan 2020
Gold Medal for the Best Academic Performance, Dean's Honors List in every semester
Highlighted Courses: Real Analysis, Calculus, Differential Equations, Linear Algebra, Signals and Systems, Machine Vision, Data Structures and Algorithms
GPA: 4.09/4.20

Research Experience

Graduate Research Assistant | Johns Hopkins University | Baltimore, MD — Aug 2021 – Present

- Developed *prospective learning*, a first-principles mathematical framework that characterizes learning problems where the distributions of data, goals of the learner, and optimal hypotheses vary predictably over time.
- Designed and implemented *prospective* neural networks that significantly outperformed continual and online learning approaches on task sequences with predictable dynamics.
- Extended prospective learning to sequential decision-making, and designed time-aware reinforcement learning algorithms that learn optimal foraging policies in non-stationary environments.
- Discovered a counterintuitive phenomenon in domain adaptation, where the target risk can behave non-monotonically with respect to the amount of source (out-of-distribution) data in the training dataset.
- Presented the work in top machine learning conferences, workshops, and journals (including NeurIPS, ICML, and TMLR), and won 2 best paper awards at AGI'25 and ECCV'22 workshop on OOD generalization in computer vision.

Applied Scientist Intern | Amazon Web Services (AWS) AI | Santa Clara, CA — May 2025 – Sep 2025

- Interned with the Foundations Research Team (FRT) at AWS AI.
- Designed and implemented adaptive context recomposition methods for multi-turn tool-using AI agents to eliminate redundant information and improve context efficiency.
- Achieved a 50% reduction in input token usage without compromising performance on mathematical reasoning and software engineering tasks.
- Gained experience in AI agents, LLM reasoning, and LLM post-training approaches such as supervised fine-tuning and reinforcement learning (RL)-based fine-tuning (PPO and GRPO).

Applied Scientist Intern | Amazon Web Services (AWS) AI | Santa Clara, CA — Jun 2024 – Sep 2024

- Explored the use of state-space models (SSMs) for constrained text and program/code generation.
- Gained hands-on experience with structured state-space models (including HiPPO, S4, Mamba, and Mamba-2), an emerging class of sequence models that serves as a potential alternative to the Transformer architecture.

Junior Lecturer | University of Moratuwa | Sri Lanka — Jan 2020 – Aug 2021

- Designed and implemented a novel model architecture combining CNNs and LSTMs for phase unwrapping in images, which outperformed contemporary approaches (published in ICASSP'21).
- Developed computer vision algorithms to extract retinal and conjunctival biomarkers for diabetic retinopathy detection in collaboration with the University of Colombo Faculty of Medicine.
- Advised an undergraduate project that developed a computer vision algorithm for in-bed human pose estimation (Second runner-up at the IEEE Video and Image Processing Cup 2021).

- Conducted lectures and lab sessions in signals and systems, circuits and systems design, and analysis of physiological systems.

Undergraduate Researcher | University of Moratuwa | Sri Lanka Jan 2019 – Jan 2020

- Designed and implemented an online algorithm for recognizing hand gestures using forearm surface electromyography (sEMG) signals, which outperformed contemporary approaches (published in ICASSP'20).

Research Assistant | Florey Institute of Neuroscience and Mental Health | Australia Jun 2018 – Dec 2018

- Developed machine learning and signal processing algorithms for electrophysiological signal analysis, enabling large-scale data processing and biomarker extraction to quantify ion channel mutation effects in genetic epilepsy.
- Deployed the algorithms as a MATLAB package to support epilepsy research within the lab.

Technical Skills

- **Machine Learning**: Supervised/Unsupervised Learning, Generative Modeling, Continual Learning, Domain Adaptation, Transfer Learning, Reinforcement Learning, Computer Vision
- **Deep Learning**: Large Language Models (LLMs), Vision-Language Models (VLMs), Diffusion Models, State-Space Models (S4, Mamba)
- **Programming**: Python, MATLAB, R, C++
- **Libraries**: PyTorch, HuggingFace, vLLM, scikit-learn, TensorFlow, pandas, OpenCV
- **Experiment Tracking**: Weights & Biases, Hydra
- **Software and Tools**: Linux, Git, AWS (EC2), LaTeX

Selected Publications

Jayanta Dey, Haoyin Xu, **Ashwin De Silva**, and Joshua T Vogelstein. Simple Calibration via Geodesic Kernels. *Transactions on Machine Learning Research*, 2025.

Yuxin Bai*, Cecelia Shuai*, **Ashwin De Silva***, Siyu Yu, Pratik Chaudhari, and Joshua Vogelstein. Prospective Learning in Retrospect. *Artificial General Intelligence (AGI)*, 2025.

Yuxin Bai, Aranyak Acharyya, **Ashwin De Silva**, Zeyu Shen, James Hasset, and Joshua T. Vogelstein. Optimal Control of the Future via Prospective Foraging. *Preprint*, 2025.

Ashwin De Silva*, Rahul Ramesh*, Rubing Yang*, Siyu Yu, Pratik Chaudhari, and Joshua T. Vogelstein. Prospective Learning: Learning for a Dynamic Future. *Neural Information Processing Systems (NeurIPS)*, 2024.

Hayden Helm, **Ashwin De Silva**, Joshua T. Vogelstein, Carey E. Priebe, and Weiwei Yang. Approximately Optimal Domain Adaptation with Fisher's Linear Discriminant. *Mathematics*, volume 12, 2024.

Ashwin De Silva*, Rahul Ramesh*, Carey E. Priebe, Pratik Chaudhari, and Joshua T. Vogelstein. The Value of Out-of-Distribution Data. *International Conference on Machine Learning (ICML)*, 2023.

Ashwin De Silva*, Rahul Ramesh*, Pratik Chaudhari, and Joshua T. Vogelstein. Prospective Learning: Principled Exploration to the Future. *Conference on Lifelong Learning Agents (CoLLAs)*, 2023.

Mohamed Afham, Udith Haputhanthri, Jathurshan Pradeepkumar, Mithunjha Anandakumar, **Ashwin De Silva**, and Chamira US Edussooriya. Towards Accurate Cross-Domain In-Bed Human Pose Estimation. *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2022.

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. 2021.

Malsha V Perera* and **Ashwin De Silva***. A Joint Convolutional and Spatial Quad-Directional LSTM Network for Phase Unwrapping. *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2021.

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. *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 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. *IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, 2020.

Selected Awards & Recognition

- **Best Student Paper Award** – 18th Annual Conference on Artificial General Intelligence (AGI-25), Reykjavík, Iceland (2026)
- **Member, Alpha Eta Mu Beta (AEMB)** – National Biomedical Engineering Honor Society. Invited for membership in recognition of academic excellence, ranking in the top third of the Biomedical Engineering PhD class (2025)
- **MINDS Fellowship** – Selected as a fellow of the Mathematical Institute of Data Science, Johns Hopkins University (2024)
- **Johns Hopkins School of Medicine Student Spotlight** – For research and academic accomplishments (2023)
- **Best Paper Award** – ECCV 2022 Workshop on Out-of-distribution Generalization in Computer Vision, Tel Aviv, Israel (2022)
- **2nd Runners-up of the IEEE Video and Image Processing Cup** – International Conference on Image Processing (ICIP) 2021, Anchorage, Alaska, USA (2021)
- **Prof. Pathuwathawithana Memorial Prize** – For attaining the *highest* GPA at the Faculty of Engineering, University of Moratuwa, Sri Lanka (2020)
- **Gold Medal** – For the *best* overall academic performance in the Biomedical Engineering Stream, University of Moratuwa (2020)
- **National Finalists at the Migara Ranatunga Awards** – Awarded by Institution of Engineers, Sri Lanka (IESL) for the *best* performance in the research internship (2020)
- **World Finalists at the IEEE ComSoc Student Competition** – ranked among the top 15 in the world (2019)
- **Merit Award at SLAAS Awards** – Awarded by the Sri Lanka Association for the Advancement of Science (SLAAS) for the *best* undergraduate project (2019)
- **National Finalists at the Sri Lankan IoT Challenge** – Ranked among the top 10 in the country (2019)
- **Runner-Up at the National Inter-University Statistics Quiz Competition** – University of Sri Jayewardenapura, Sri Lanka (2019)
- **Dialog Merit Scholarship for Engineering Undergraduates** – Awarded by Dialog Axiata PLC for the students who excelled in the university entrance examinations at the national level (2016)
- **Mahapola Merit Scholarship for Engineering Undergraduates** – Awarded by the Government of Sri Lanka for the students who excelled at the university entrance examinations (2016)
- **Darrel Medal** – For the most outstanding advanced level student, Richmond College, Sri Lanka (2015)

Teaching Experience

- EN.580.697 Biomedical Data Design, Johns Hopkins University, USA (Fall 2025)
- EN 1060 Signals and Systems, University of Moratuwa, Sri Lanka (Fall 2021)
- EN 3030 Circuits and Systems Design, University of Moratuwa, Sri Lanka (Spring 2020)
- BM 4111 Medical Electronics and Instrumentation, University of Moratuwa, Sri Lanka (Spring 2020)
- BM 2101 Analysis of Physiological Systems, University of Moratuwa, Sri Lanka (Fall 2020)
- BM 2011 Human Anatomy and Physiology, University of Moratuwa, Sri Lanka (Fall 2020)

Reviewing Activities

- **Reviewer**: NeurIPS 2025, Conference on Language Models (COLM) 2025, Moratuwa Engineering Research Conference (MERCon) 2024

Selected Talks

- *Prospective Learning*, Center for Imaging Science (CIS) Retreat, Johns Hopkins University, MD, USA (Dec. 2024)
- Critique on *Invertible Neural Networks for Graph Predictions*, Theorinet Retreat, Simons Foundation, NY, USA (Sep. 2022)
- *The Value of Out-of-distribution Data*, ECCV 2022 workshop on Out-of-distribution Generalization in Computer Vision, Tel Aviv, Israel (Oct. 2022)

Selected Poster Presentations

- *Prospective Learning: Learning for a Dynamic Future*, NeuroAI 2025, Allen Institute, Seattle, WA, USA (Jul. 2025)
- *Prospective Learning: Learning for a Dynamic Future*, Johns Hopkins Data Science and AI Institute Spring 2025 Symposium, Baltimore, MD, USA (Apr. 2025)
- *Prospective Learning: Learning for a Dynamic Future*, NeurIPS 2024 Workshop on NeuroAI: Fusing Neuroscience and AI for Intelligent Solutions, Vancouver, Canada (Dec. 2024)
- *Prospective Learning*, Mathematical and Scientific Foundations of Deep Learning Annual Meeting (MoDL), Simons Foundation, NY, USA (Sep. 2024)
- *The Value of Out-of-distribution Data*, NeurIPS 2022 Workshop on distribution shifts (DistShift), New Orleans, LA, USA (Dec. 2022)
- *Kernel Density Networks*, From Neuroscience to Artificially Intelligent Systems (NAISys), Cold Spring Harbor Laboratory, NY, USA (Apr. 2022)

Outreach

Mentor | Johns Hopkins BMEAAP | Baltimore, MD 2024

- Mentored and supported prospective PhD students in biomedical engineering, providing guidance on research pathways and academic preparation.

Co-Founder | Richmond to University (R2U) | Sri Lanka 2018 – Present

- An alumni-run organization aimed at organizing career guidance programs for the students of Richmond College, Sri Lanka.

Chairperson | IEEE EMBS Student Branch Chapter, University of Moratuwa | Sri Lanka 2019 – 2020

- Received the *Most Outstanding EMB Student Branch Chapter Regional Award* for the term 2019/20 (Asia-Pacific region).
- Received the *IEEE Darrel Chong Award (Silver Category)* for the term 2019/20.