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 this work at top machine learning conferences, workshops, and journals (including NeurIPS, ICML, and TMLR), and won two best paper awards at AGI'25 and the 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/Self-supervised Learning, Generative Modeling, Continual Learning, Domain Adaptation, Transfer Learning, Computer Vision, Reinforcement Learning, Time-series Forecasting
- **Deep Learning**: Large Language Models (LLMs), Vision-Language Models (VLMs), Diffusion Models, GANs, VAEs, State-Space Models (S4, Mamba, etc.)
- **Large Language Models**: Pre-training, Fine-tuning (LoRA, DPO, PPO, GRPO), Retrieval-Augmented Generation (RAG), LLM Agents
- **Signal Processing**: Kalman Filtering, Sparse Recovery, Compressed Sensing, Filter Design
- **Programming**: Python, MATLAB, R, C++
- **Libraries**: PyTorch, HuggingFace, vLLM, LangChain, Chroma, Scikit-learn, TensorFlow, Pandas, OpenCV, Weights & Biases, Hydra
- **Software and Tools**: Linux, Git, AWS (EC2), LaTeX

Selected Publications

Yuxin Bai, Aranyak Acharyya, **Ashwin De Silva**, Zeyu Shen, James Hasset, and Joshua T. Vogelstein. Optimal Control of the Future via Prospective Foraging. *8th Annual Learning for Dynamics & Control Conference*, 2026.

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.

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)
- **Second runner-up, 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.