

VINDULA JAYAWARDANA

PERSONAL INFORMATION

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RESEARCH INTERESTS

I am broadly interested in *learning-enabled autonomy*. In light of this, I am interested in making multi-agent reinforcement learning seamlessly generalize across problem variations (solving Contextual MDPs). Real-world application-wise, I am interested in planning for autonomous vehicles with problem variations. In the past, I have also worked on mathematical programming for combinatorial optimizations and natural language processing for information extraction.

EDUCATION

Massachusetts Institute of Technology, Cambridge, USA Sep 2019-May 2025
Ph.D. Electrical Engineering and Computer Science (GPA: 4.9/5.0)

Massachusetts Institute of Technology, Cambridge, USA Sep 2019-Sep 2022
M.S. Electrical Engineering and Computer Science (GPA: 4.9/5.0)
Thesis: *An Invisible Issue of Task Underspecification in Deep Reinforcement Learning Evaluations*

University of Moratuwa, Colombo, Sri Lanka Mar 2014 -Dec 2017
B.S. Computer Science and Engineering (GPA: 4.08/4.2)
Thesis: *Ontology-based Legal Information Extraction*

RELEVANT EXPERIENCE

Massachusetts Institute of Technology, Cambridge, USA Sep 2019-May 2025
Ph.D. Candidate

- Working with Prof. Cathy Wu at Laboratory for Information and Decision Systems.
- Research on improving robustness and generalization in reinforcement learning, specifically when solving Contextual MDPs [1, 3, R1, F3, W1].
- Model and build large-scale traffic simulations that span over ten major US cities and nearly three million traffic scenarios for impact assessment of cooperative eco-driving [R1, 7, W1].
- Conduct studies validating the efficacy of reinforcement learning for real-world problems, including large-scale eco-driving [4, R1], socially compatible driving [5], traffic smoothing [2, 6], and combinatorial optimizations [F4].

Toyota Motor North America, Mountain View, USA June 2023-Aug 2023
Research Intern

- Worked with Dr. Yashar Farid and Mr. Kentaro Oguchi in the Advance Development and Planning group at Toyota InfoTech Labs.
- Improved generalization in multi-agent reinforcement learning across problem variations by combining model-based policies with learning-based policies. Paper published at ICRA 2024 [1].
- Conducted experiments to validate the effectiveness of the proposed method on eco-driving across 600 signalized intersections [1, W1].
- Proposed a hierarchical policy architecture aiming for continual learning for eco-driving across signalized intersections. The patent is in submission [R2].

University of Moratuwa, Colombo, Sri Lanka Jan 2018-July 2019
Research Assistant

- Worked with Dr. Shehan Perera and Dr. Uthayasankar Thayasivam.
- Conducted ride-sharing simulations with integer programming for request-driver matching.
- Conducted ride-pooling with meeting points simulations based on integer programming formulations for request-driver-meeting point matching.
- Analyzed the optimality gaps between heuristic methods and optimal methods for ride-pooling with meeting points problem [9].

Digital Mobility Solutions Lanka, Colombo, Sri Lanka Jan 2018-July 2019
Consultant Researcher

- Built numerical simulations of ride-sharing in major Sri Lankan cities based on real-world data.
- Evaluated the effectiveness of ride-sharing in select cities with large-scale numerical simulations.

Research Intern

- Worked with Prof. Samitha Samaranayake.
- Built an open source ride pooling simulator in C++ for large-scale ride pooling with integer programming based driver-passenger matching.
- Formulated Integer programming models for ride pooling with meeting points problem [9].

WSO2, Colombo, Sri Lanka

July 2016-Dec 2016

Software Engineering Intern

- Developed an open-source library Charon for SCIM 2.0 support following IETF specifications.
- Integrated SCIM 2.0 support for the WSO2 Identity server.

SELECTED
PUBLICATIONS

- [1] V. Jayawardana, S. Li, C. Wu, Y. Farid, K. Oguchi. *Generalizing eco-lagrangian control via multi-residual task learning*, IEEE International Conference on Robotics and Automation (ICRA) 2024.
- [2] D. Suo*, V. Jayawardana*, C. Wu, *Model-free learning corridor clearance: A near term deployment perspective*, IEEE Transactions on Intelligent Transportation Systems (T-ITS) 2023. * **equal contribution**.
- [3] V. Jayawardana, C. Tang, S. Li, D. Suo, C. Wu. *The impact of task underspecification in evaluating deep reinforcement learning*, Advances in Neural Information Processing Systems (NeurIPS) 2022.
- [4] V. Jayawardana, C. Wu. *Learning eco-driving strategies at signalized intersections*, European control Conference (ECC) 2022. **MIT News Spotlight, NPR, and Tech Crunch featured**.
- [5] S. Jayawardana, V. Jayawardana*, K. Vidanage, C. Wu*. *Multi-behavior learning for socially compatible autonomous driving*, IEEE International Conference on Intelligent Transportation Systems (ITSC) 2023. * **equal supervision**
- [6] D. Zhuang, Y. Huang, V. Jayawardana, J. Zhao, D. Suo, and C. Wu, *The braess paradox in dynamic traffic*, IEEE International Conference on Intelligent Transportation Systems (ITSC) 2022.
- [7] Qu, A. Valiveru, C. Tang, V. Jayawardana, B. Freydt, and C. Wu, *What is a typical signalized intersection in a city?* Transportation Research Board (TRB) 2022.
- [8] V. Jayawardana, A. Landler, C. Wu. *Mixed autonomous supervision in traffic signal control*, IEEE International Conference on Intelligent Transportation Systems (ITSC) 2021.
- [9] M. Mounesan, V. Jayawardana, Y. Wu, S. Samaranayake, H. T. Vo, *Fleet management for ride-pooling with meeting points at scale: A case study in the five boroughs of New York City*, 2021.
- * More on [Google Scholar](#).

WORK IN
REVIEW/ FINAL
PREPARATIONS

- [R1] V. Jayawardana, B. Freydt, A. Qu, C. Hickert, E. Sanchez, C. Tang, S. Chandrasiri, M. Taylor, B. Leonard, C. Wu, *Mitigating metropolitan vehicular carbon emissions with semi-autonomous vehicles using deep reinforcement learning*, In peer-review stage at Nature (Nature).
- [R2] V. Jayawardana, Y. Farid, K. Oguchi. *Systems and methods for vehicles navigating roads using a control model trained with residual policies*, In review (U.S patent).
- [F3] V. Jayawardana, J. Cho, C. Wu. *When to transfer in deep reinforcement learning*, In preparation (ICML 2024).
- [F4] Y. Kim, V. Jayawardana, S. Samaranayake, *Choice modeling in high-capacity ride-pooling with deep reinforcement learning*, In final preparation (TR-C).

WORKSHOP
PAPERS

- [W1] V. Jayawardana, S. Li, C. Wu, Y. Farid, K. Oguchi. *Robust Driving Across Scenarios via Multi-residual Task Learning*, In Generalization in Planning workshop at Advances in Neural Information Processing Systems (NeurIPS) 2023 and Machine Learning for Autonomous Driving Symposium 2023.
- [W2] V. Jayawardana, C. Wu. *Reinforcement Learning for Eco-Lagrangian Control at Intersections*, In Robotics for Climate Change workshop at IEEE International Conference on Robotics and Automation (ICRA) 2022.

SKILLS AND
PROJECTS

Technical Skills: Python (Numpy, PyTorch), C++, Java, C#, JavaScript/CSS/HTML, SQL, Bash, Linux, VSCode, Latex, Gurobi, Mosek, SUMO

Research Skills: Reinforcement learning, planning for autonomous vehicles, numerical simulations, intelligent transportation systems, machine learning, control theory, optimizations, traffic engineering, and data analytics.

Selected Research Projects: [Greenwave](#) (AI-driven eco-driving) - Project lead for 14-member team

Open Source Projects

[Open Ridepool Simulator](#) - Co-main contributor

[SCIM 2.0 Compliance Test Suite](#) - Main contributor (Google Summer of Code 2017)

[Charon 3.0: SCIM 2.0 Implementation](#) - Main contributor

AWARDS AND ACHIEVEMENTS	Harold L. Hazen Teaching Award (MIT)	2022
	NeurIPS Scholar Award (NeurIPS)	2022, 2023
	Migara Ranathunga Trust Award (Institute of Engineers Sri Lanka)	2017/2018
	Digital Mobility Solutions Lanka Fellowship (Digital Mobility Solutions Lanka)	2018
	Dean's Honor List (University of Moratuwa)	2017
	Finalist at NASA International Space Apps (NASA)	2017
	Gold Award at National Best Quality ICT Awards (Sri Lanka Sector of British Computer Society)	2017
	Silver Medal, Junior Science Olympiad Sri Lanka (Sri Lankan Junior Science Olympiad)	2010
RESEARCH TALKS	LIDS Climate Tea Talks, Cambridge, USA	2023
	Toyota R&D, Mountain View, USA	2023
	MIT CEE Annual Research Day, Cambridge, USA	2023
	Neural Information Processing Systems Conference, New Orleans, USA	2022
	European Control Conference, London, UK	2022
	Robotics for Climate Change (Spotlight talk), Philadelphia, USA	2022
	MIT CEE Annual Research Day, Cambridge, USA	2022
	University of Moratuwa, Moratuwa, Sri Lanka	2021
	MIT-IBM Watson AI Lab Open House, Cambridge, USA	2021
	Data Drives - Data science applications in technology-based industries, Colombo, Sri Lanka	2019
	Innovative Computing Technology Conference, London, UK	2017
SERVICES	Transactions on Robotics (T-RO) - Reviewer	2023
	Neural Information Processing Systems Conference (NeurIPS)- Reviewer (Top 10% Reviewer)	2023
	AAAI Conference on Artificial Intelligence (AAAI) - Reviewer	2023
	Physica A: Statistical Mechanics and its Applications (Physica A) - Reviewer	2023
	International Conference on Robotics and Automation (ICRA) - Reviewer	2020, 2022
	Transactions on Intelligent Systems and Technology (T-IST) - Reviewer	2022
	Transportation Research Board (TRB) - Reviewer	2022
	Moratuwa Engineering Research Conference (MERCon) - Reviewer	2020, 2021
	NeurIPS Tackling Climate Change with Machine Learning - Reviewer	2023
	AAAI When Machine Learning meets Dynamical Systems: Theory and Applications - Reviewer	2022
	Representation Learning for Responsible Human-Centric AI - Area Chair (Top Area Chair)	2022
	MIT CEE faculty hiring student committee	2023
	President, Sri Lankan Students' Association at MIT	2019-2023
	Volunteer, Neural Information Processing Systems Conference	2023
	Director, Rotaract Club of Alumni of the University of Moratuwa	2017-2019
	Director, Old Royalists Engineering Professionals' Association Student Chapter	2015-2018
	Volunteer, Rotaract Club of University of Moratuwa	2014-2016
TEACHING	Teaching Assistant	
	1.041/1.200 - Transportation: Foundations and Methods (MIT EECS Teaching Excellence Award)	
	<i>MIT Fall 2020, 2021</i>	
	CS2022 - Data Structures and Algorithms	<i>UoM Spring 2019</i>
	CS4622 - Machine Learning	<i>UoM Fall 2018</i>
	CS3042 - Database Systems	<i>UoM Fall 2018</i>
	CS2052 - Computer Architecture	<i>UoM Spring 2018</i>
	CS2062 - Object Oriented Software Development	<i>UoM Spring 2018</i>
MENTORSHIP	CS3962 - Research and Report Writing	<i>UoM Fall 2017</i>
	Graduate Students	
	<i>Jessica Ding</i> : MIT	
	• Co-authoring a paper on residual transfer learning for traffic control.	
	<i>Baptiste Freydt</i> : ETH Zurich (Now: software engineer)	
	• Co-authored a paper on large-scale eco-driving using deep reinforcement learning [R1].	

Undergraduates

Anna Landler: MIT (Now: software engineer at Crusoe)

- Co-authored paper on autonomous traffic signal supervision [8].

Catherine Tang: MIT (Now: sophomore at MIT)

- Co-authored papers on task underspecification in deep reinforcement learning [3].

Anirudh Valiveru: MIT (Now: sophomore at MIT)

- Co-authored paper on data processing pipeline for open street maps.

Ammar Fayad: MIT (Now: junior at MIT)

Jiaxin He: Vanderbilt University (Now: master student at UC San Diego)

- Co-authored a paper on large-scale eco-driving using deep reinforcement learning [R1].

Sunera Chandrasiri: University of Moratuwa (Now: co-founder of iXD Labs)

- Co-authored a paper on large-scale eco-driving using deep reinforcement learning [R1].

Sanjula Jayawardana: University of Westminster (Now: software engineer at IFS)

- Co-authored a paper on socially compatible autonomous driving [5].

MEDIA

MIT News **spotlight**: [On the road to cleaner, greener, and faster driving](#)

Techcrunch: [Perceptron: Risky teleoperation, Rocket League simulation, and zoologist multiplication](#)

National Public Radio (NPR): [Green Driving](#)

ADAS & Autonomous Vehicle International Magazine: [A greener way to negotiate traffic lights](#)