Vindula Jayawardana

Personal Information

Cambridge, United States
vindula@mit.edu +1 857-701-8316
www.vindulaj.com
in/vindulajayawardana

Research Interests

Learning for autonomy with the goal of making multi-agent reinforcement learning seamlessly generalize across scenarios. Applications in planning for autonomous vehicles and sustainable cities. Past research on mathematical programming for combinatorial optimizations and natural language processing for information extraction.

Relevant Experience

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

- Work 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, R1].
- 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 [W4, 6].
- Conduct computational studies validating the efficacy of reinforcement learning for eco-driving [2, W4], autonomous vehicle planning [3], and traffic smoothing [5].

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

- Improved generalization in multi-agent reinforcement learning across scenarios by combining nominal-model-based policies with learning-based policies [R1].
- Conducted experiments to validate the effectiveness of the proposed method on eco-driving across 600 signalized intersections [R1].
- Proposed a hierarchical policy architecture aiming for continual learning for eco-driving across signalized intersections [R3].

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

- 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 [7].

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.

Cornell University, Ithaca, USA *June 2018-Aug 2018*
Research Intern

- Built at 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 [7].

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.

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)

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

Selected Publications

[1] V. Jayawardana, C. Tang, S. Li, D. Suo, C. Wu. *The impact of task underspecification in evaluating deep reinforcement learning*, NeurIPS'22.
[2] V. Jayawardana, C. Wu. *Learning eco-driving strategies at signalized intersections*, ECC'22. **MIT News Spotlight, NPR and Tech Crunch featured**.
[3] S. Jayawardana, V. Jayawardana*, K.Vidanage, C. Wu*. *Multi-behavior learning for socially compatible autonomous driving*, ITSC'23. *** equal supervision**
[4] V. Jayawardana, A. Landler, C. Wu. *Mixed autonomous supervision in traffic signal control*, ITSC'21.
[5] D. Zhuang, Y. Huang, V. Jayawardana, J. Zhao, D. Suo, and C. Wu, *The braess paradox in dynamic traffic*, ITSC'22.
[6] Qu, A. Valiveru, C. Tang, V. Jayawardana, B. Freydt, and C. Wu, *What is a typical signalized intersection in a city ?* TRB'22.
[7] 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*, '21.
* More on Google Scholar.

Work in Review/ Preparation

[R1] V. Jayawardana, S. Li, C. Wu, Y. Farid, K. Oguchi. *Generalizing eco-lagrangian control via multi-residual task learning*, In review ICRA'24.
[R2] V. Jayawardana, D. Suo, C. Wu, *Learning corridor clearance: A near term deployment perspective*, In review T-ITS'23.
[R3] V. Jayawardana, Y. Farid, K. Oguchi. *Eco-driving at signalized intersections*, In review U.S patent.
[W4] V. Jayawardana, B. Freydt, A. Qu, C. Hickert, E. Sanchez, C. Tang, S.Chandrasiri, A. Valiveru, J. He, D. Suo, B.Leonard, C. Wu, *Assessing no-stop intersections for low carbon transportation using deep reinforcement learning*, In preparation (Nature)
[W5] Y. Kim, V. Jayawardana, S. Samaranayake, *Choice modeling in high-capacity ride-pooling with deep reinforcement learning*, In preparation (TR-C)

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 Summeer 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 (Insititute of Engineers Sri Lanka)	2017/2018
Digital Mobility Solutions Lanka Fellowship (Digital Mobility Solutions Lanka)	2018
Dean's Honor List (University of Moratuwa)	2017
Finalists 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

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	*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*
AAAI 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
Rotaract Club of Alumni of the University of Moratuwa 2017-2019
Old Royalists Engineering Professionals' Association Student Chapter 2015-2018
Rotaract Club of University of Moratuwa 2014-2016

Teaching

Teaching Assistant
1.041/1.200 - Transportation: Foundations and Methods **(MIT EECS Teaching Excellence Award)** *MIT Fall 2020, 2021*
CS2022 - Data Structures and Algorithms *UoM Spring 2019*
CS4622 - Machine Learning *UoM Fall 2018*
CS3042 - Database Systems *UoM Fall 2018*
CS2052 - Computer Architecture *UoM Spring 2018*
CS2062 - Object Oriented Software Development *UoM Spring 2018*
CS3962 - Research and Report Writing *UoM Fall 2017*
CS2963 - Presentation Skills *UoM Fall 2017*

Mentorship

Graduate Students
Jessica Ding: MIT
- Co-authoring a paper on residual transfer learning for traffic control.

Baptiste Freydt: ETH Zurich (Now: software engineer)
- Co-authoring a paper on large-scale eco-driving using deep reinforcement learning [W4].

Undergraduates
Anna Landler: MIT (Now: software engineer at Crusoe)
- Co-authored paper on autonomous traffic signal supervision [4].

Catherine Tang: MIT (Now: sophomore at MIT)
- Co-authored papers on task underspecification in deep reinforcement learning [1] and learning vehicular emission models.

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-authoring a paper on large-scale eco-driving using deep reinforcement learning [W4].

Sunera Chandrasiri: University of Moratuwa (Now: co-founder of iXD Labs)
- Co-authoring a paper on large-scale eco-driving using deep reinforcement learning [W4].

Sanjula Jayawardana: University of Wesminitser (Now: software engineer at IFS)
- Co-authoring a paper on socially compatible autonomous driving [3].

Media

MIT News spotlight: On the road to cleaner, greener, and faster driving
Techcrunch: Perceptron: Risky teleoperation, Rocket League simulation, and zoologist multiplication
NPR: Green Driving
ADAS & Autonomous Vehicle International Magazine: A greener way to negotiate traffic lights