Malintha Fernando

Ph.D. Candidate/Researcher

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Overview

I am a robotics researcher with an extensive background in software engineering, practical robotics experimentation, and excellent verbal and written communication skills. My research focuses on developing scalable, collaborative multi-robot autonomy for aerial mobility systems leveraging deep reinforcement learning and game theory. Compared to conventional task allocation, such interaction-based learning enables the operating of large-scale heterogeneous robot teams in highly challenging environments under limited actuation and perception. The applications of this research include but are not limited to, space exploration and urban air mobility systems.

Education

Indiana University, Bloomington — ***Fall 2017 - Present***

Ph.D. in Intelligent Systems Engineering
M.S. in Intelligent Systems Engineering — *Fall 2021*
Advised by: Prof. Martin Swany

Major: Computer Engineering
Minor: Mathematics

University of Moratuwa, Sri Lanka — ***2011 - 2015***

B.Sc.(Hons.) in Information Technology — *December 2015*

Royal College, Sri Lanka — ***2002 - 2010***

GCE Advanced Level (Physical Sciences) — *2010 (**Top** 5% **Nationwide**)*
GCE Ordinary Level — *2007 (10 out of 10 'A' Passes)*

Work Experiences

Open Robotics — ***Summer 2019***
Mountain View, California

Engineer Intern — *Mentor: Tully Foote*

Contributions: Designed a framework for aerial swarm control supporting trajectory optimization and receding horizon planning (RHP).

WSO_2 — ***2014, 2016 - 2017***
Colombo, Sri Lanka

Software Engineer — *January 2016 - July 2017*
Software Engineer Intern — *January - June 2014*

Contributions: Enhanced the integration of WSO_2 *IOT Server*, *Governance Registry*, and *Identity Server* frameworks with client APIs, web services, and IOT devices. — ***Open Source Committer***

Skills

Robotics: Robot Operating System (ROS), ROS2, Gazebo, RViz, Kinematics and Dynamics Simulation, Control and State Estimation, Aerial Vehicle Systems, Path Planning, Trajectory Optimization, Model Predictive Control (MPC)

Machine Learning: PyTorch, Ray, Deep Graph Library, Deep Reinforcement Learning, Gym, Probabilistic Graphical Models

Embedded Systems: Real Time Operating Systems (RTOS), Low-level implementation and debugging

Programming Languages: C/C++, Java, Python, MATLAB

Research: Multi-Robot Systems, Multi-Agent Systems, Markov Decision Processes (MDP), Game Theory, Urban Mobility, Connected Robot Fleets

Soft Skills: Excellent verbal and written communication, Ability to lead research projects under minimal to no supervision, Critical thinking, Problem-solving

Teaching

Indiana University — ***Associate Instructor***

ENGR-533: Deep Learning Systems — *Fall 2022*

ENGR-210: Cyber-Physical Systems — *Spring 2022*
ENGR-321: Advanced Cyber-Physical Systems — *Fall 2021*
Co-conducted lectures, designed lecture materials, assignments on linear dynamical systems simulation and control.*

ENGR-210: Cyber-Physical Systems — *Spring 2021*
ENGR-523: Internet of Things — *Spring 2019*
ENGR-511: Machine Learning and Signal Processing — *Fall 2018*
ENGR-599: Autonomous Robotics — *Fall 2017*

** Self developed course materials: Github Link.*

Publications

Fernando, Malintha, Ransalu Senanayake, Ariful Azad, Martin Swany, "Graphical Games for UAV Swarm Control Under Time-Varying Communication Networks", *Intelligent Aerial Robotics: From Autonomous Micro Aerial Vehicles to Sustainable Urban Air Mobility and Operations, ICRA 2022.*

Fernando, Malintha, Ransalu Senanayake, Martin Swany, "CoCo Games: Graphical Game-Theoretic Swarm Control for Communication-Aware Coverage.", *IEEE Robotics and Automation Letters (RA-L), March, 2022*, [Paper][Video][Project Webpage]

Fernando, Malintha "Online Flocking Control of UAVs with Mean-Field Approximation.", *International Conference on Robotics and Automation, (ICRA), Xi'an, China, 2021*, [Paper][Video][Code]

Z. Chen, **M. Fernando** and L. Liu, "A Visual Feature based Obstacle Avoidance Method for Autonomous Navigation," *IEEE Applied Imagery Pattern Recognition Workshop, 2019*.

Fernando, Malintha, and Lantao Liu. "Formation Control and Navigation of a Quadrotor Swarm." *International Conference on Unmanned Aircraft Systems (ICUAS), Atlanta, Georgia, 2019.* [Video]

Fernando, Malintha, and Lantao Liu. "Swarming of Aerial Robots with Markov Random Field Optimization", 2020, [arXiv.]

Fernando Malintha, Cooray A.V.S, Indeewara T.G.H, Fernando S., "Semi-supervised Learning Framework for Knowledge Extraction in Cricket Domain", *ITRU research symposium (2015), University of Moratuwa, Sri Lanka.*

"Graph Attentive Games for Decentralized Urban Air Mobility on Demand" – *Ongoing Work*, Extension of *graphical games* with graph neural networks to coordinate a UAV fleet in an *urban air mobility*.

Open Source Contributions

MavSwarm
A ROS-based UAV swarm simulator with quadrotor dynamic simulation, low-level control, and trajectory optimization [50+ Github Stars]. ***Primary Contributor***

ROSNS3
A *Network Simulator* (NS-3) bridge for ROS to simulate wireless communication aspects of networked robot systems [Github Link]. ***Primary Contributor***

Mozilla Firefox
Contributed by bug fixes and feature improvements to the browser core. ***Contributor, 2013-2014***

Talks

IEEE International Conference on Robot & Human Interactive Communication (RO-MAN), August 2022

Invited Talk at University of Sydney - 2022 June

Workshop for Intelligent Aerial Robotics: From Autonomous Micro Aerial Vehicles to Sustainable Urban Air Mobility and Operations, ICRA 2022.

Guest Lecture on "UAV Swarm Simulation and Control", ENGR-321, Indiana University, 2021.

"Online Flocking Control of UAVs with Mean-Field Approximation" ICRA 2021 [Video].

Invited talk at Indiana University Executive AI Summit - 2020.

Guest Lecture on "Trajectory Optimization for UAVs", ENGR-599, Indiana University, 2019.

"Formation Control and Navigation of a Quadrotor Swarm" - ICUAS 2019.

Professional Service

Reviewer

International Conference on Robotics and Automation (ICRA)

International Conference on Intelligent Robots and Systems(IROS)

IEEE Transaction on Robotics (T-RO)

IEEE Robotics and Automation Letters (RA-L)

International Symposium on Multi-Robot and Multi-Agent Systems (MRS)

Stanford Learning for Control and Dynamics Conference (L4DC)

Mentor

Undergraduate Research Opportunities in Computing (UROC) Program

Ben Siefers - Neural Network based Autonomous UAV Navigation *2020*

Eric Tatman - Simulating UAV Swarm Dynamics *2020*

Zach Seliger - Trajectory Generation and Control of a Crazyflie Drone *2018*

Leadership

IEEE Indiana University Student Branch *Founder, Vice Chair 2022/23*

IEEE Region 4 (Midwest) Student Activity Committee (SAC) *2019*

IEEE Region 10 (Asia/Pacific) Student Activity Committee (SAC) *2016*

IEEE Sri Lanka Section Executive Committee *Section Student Representative 2015/16*
Highlights: *Membership numbers increased by 30% during my tenure.*

IEEE Region 10 Student, Young Professional, Women in Engineering (SYW) Congress *Promotions Lead, 2015*
Highlights: *The congress attracted 200+ foreign student delegates across the region.*

IEEE University of Moratuwa Student Branch *Vice Chair, 2013/14*
Highlights*: Won IEEE Darrel Chong Platinum and Gold Awards.*

Awards

Luddy Travel Award, Indiana University *2022*

Graduate Student Fellowship, Indiana University *2017 - 2022*

United Nations Development Program (UNDP) Hackathon - Sri Lanka *2016, Runners Up*

Google Summer of Code *2014, Mozilla*
For contributing to Mozilla Thunderbird's Calendar protocol for updating it to the latest RFC standards.

Institute of Engineers - Sri Lanka (IESL) Hackathon *2014, Winner*

References

Prof. Martin Swany
Chair, Dept. Intelligent Systems Engineering
Indiana University
Bloomington, IN, 47401

Dr. Ransalu Senanayake
Dept. Computer Science
Stanford University
Stanford, CA, 94305

Prof. Bryce Himebaugh
Dept. Intelligent Systems Engineering
Indiana University
Bloomington, IN, 47401

Prof. Minje Kim
Dept. Intelligent Systems Engineering
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