

Chandima Fernando

Ph.D.

Brookhaven National Laboratory
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Curriculum Vitae

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EDUCATION AND EMPLOYMENT HISTORY

Education History

- | | |
|--|------------------------|
| University of Nebraska-Lincoln | Lincoln, NE |
| <i>Ph.D., Computer Science</i> | Jan 2023 |
| Thesis: Design and Deployment of Resource-Aware Distributed Multi-Agent Algorithms | |
| Advisers: Dr. Justin Bradley and Dr. Carrick Detweiler | |
| Area of Study: Multi-Agent Systems, Distributed Control, Active-Learning | |
|
North Dakota State University |
Fargo, ND |
| <i>M.S., Computer Science</i> | May 2016 |
| Thesis: Blood Glucose Prediction Models for Personalized Diabetes Management | |
| Adviser: Dr. Jen Li | |
|
University of Colombo - School of Computing |
Colombo, Sri Lanka |
| <i>B.S., Computer Science</i> | February 2014 |
| Thesis: Topic Model Approach to Mood-Based Song Classification Using Lyrics | |
| Adviser: Dr. Ruwan Weerasinghe | |
|
Chartered Institute of Management Accountants (CIMA), UK |
Online |
| <i>Advanced Diploma in Management Accounting</i> | February 2011 |

Employment History

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|---|---------------------------|
| Brookhaven National Lab | Upton, NY |
| <ul style="list-style-type: none">Post Doctoral Research Associate | January 2023 – Present |
| Manager/Supervisor: Dr. Phil Maffettone | |
| National Synchrotron Light Source II (NSLS-II) | |
| Role: Design and implement controllers for a UR3E 6-DOF robot arm + hand-e gripper to pick and place sample holders. Uses Moveit library in ROS2 for control and Bluesky to integrate the designed controllers into the existing scientific experimental workflow. Incorporate computer vision and ML to further automate the experiment procedure. | |
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University of Nebraska |
Lincoln, NE |
| <ul style="list-style-type: none">Graduate Research Assistant | August 2017 – August 2022 |
| School of Computing | |
| Graduate researcher for the NIMBUS Lab | |
| Role: Design and implement distributed controllers and learning algorithms for multi-agent Unmanned Aerial Systems(UAS). Team member of the project to deploy a multi-agent UAS | |

system controlled under hierarchical reinforcement learning.

- **Graduate Teaching Assistant** Spring 2017 and Fall 2021
School of Computing
Teaching assistant for undergraduate classes
Role: Design course material, conduct lectures, and grade student assignments.

North Dakota State University

Fargo, ND

- **Graduate Research Assistant** June 2015 – May 2016
Department of Computer Science
Role: Research on machine learning approaches for the detection of blood glucose levels through the smartphone. Software development of autonomous signature detection.
- **Graduate Teaching Assistant** Jan 2015 - Dec 2016
Department of Computer Science
Teaching assistant for undergraduate classes.
Role: Conduct lab sessions and grade student assignments.

RESEARCH ACCOMPLISHMENTS

Publication Record

Peer Reviewed Journal Publications

- [J1] **C. Fernando**, C. Detweiler, and J. Bradley, “Co-regulated consensus of cyber-physical resources in multi-agent unmanned aircraft systems,” *Electronics*, vol. 8, no. 5, p. 569, 2019
- [J2] M. R. Carbone, H. J. Kim, **C. Fernando**, S. Yoo, D. Olds, H. Joress, B. DeCost, B. Ravel, Y. Zhang, and P. M. Maffettone, “Flexible formulation of value for experiment interpretation and design,” *Matter*, vol. 7, no. 2, pp. 685–696, 2024 (**Contribution:10%**)

Peer Reviewed Conference Proceedings

- [C1] **C. Fernando**, C. Detweiler, and J. Bradley, “Co-regulated information consensus with delays for multi-agent uas,” in *2020 59th IEEE Conference on Decision and Control (CDC)*. IEEE, 2020, pp. 180–187
- [C2] **C. Fernando**, C. Detweiler, and J. Bradley, “Co-regulating communication for asynchronous information consensus,” in *2018 IEEE Conference on Decision and Control (CDC)*. IEEE, 2018, pp. 6994–7001
- [C3] J. Li and **C. Fernando**, “Smartphone-based personalized blood glucose prediction,” *ICT Express*, vol. 2, no. 4, pp. 150–154, 2016
- [C4] S. Udalagama, L. Sahabandu, L. Samarkoon, **D. Fernando**, P. Chanthirasegaran, S. Udana, D. Asanga, **C. Fernando**, C. Keppetiyagama, and C. Ranasinghe, “A sustainable mechanism for gathering road traffic data using smart-phones,” in *International Conference on Advances in ICT for Emerging Regions (ICTer2012)*. IEEE, 2012, pp. 224–224
- [C5] M. R. Carbone, H. J. Kim, **C. Fernando**, S. Yoo, D. Olds, H. Joress, B. DeCost, B. Ravel, Y. Zhang, and P. M. Maffettone, “Emulating expert insight: A robust strategy for optimal experimental design,” *arXiv preprint arXiv:2307.13871*, 2023 (**contribution:10%**)

- [C6] G. Phillips, J. M. Bradley, and **C. Fernando**, “A deployable, decentralized hierarchical reinforcement learning strategy for trajectory planning and control of uav swarms,” in *AIAA SCITECH 2024 Forum*, 2024, p. 2761
- [C7] **C. Fernando**, D. Olds, S. I. Campbell, and P. M. Maffettone, “Facile integration of robots into experimental orchestration at scientific user facilities,” in *2024 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2024, pp. 9578–9584

Abstracts and Technical Reports: Other than Peer Reviewed

- [C8] **C. Fernando**, E. Zaman, P. a. Q. B. Dawar, and J. Li, “A machine learning - based blood glucose prediction model for personalized diabetes management,” *The 10th International Workshop on Information Search, Integration, and Personalization (ISIP)*, 2015
- [C9] M. Phillip, **C. Fernando**, T. Caswell, D. Gavrilov, P. Shafer, Allan, Daniel, and S. Campbell, “Human-in-the-loop control of adaptive and autonomous experiments with bluesky,” *Workshop "Accelerating Discovery in Natural Science Laboratories with AI and Robotics" at 2024 IEEE International Conference on Robotics and Automation (ICRA 2024)*, 2024 (***Best paper award**)

Publications Accepted

- [J3] **C. Fernando**, E. Basha, C. Detweiler, and J. Bradley, “Consensus enabled active learning for multi-agent systems in ground classification of wetlands,” *Journal of Aerospace Information System*

Publications In Preparation

- [J4] **C. Fernando**, C. Detweiler, and J. Bradley, “Analysis on co-regulating communication for asynchronous information consensus.”

Reviewer Record

- AIAA Journal of Aerospace Information Systems (JAIS) 2024.
- IEEE Computer Magazine 2022.
- Multidisciplinary Digital Publishing (MDPI) 2021.
- IEEE Conference on Control Technology and Applications (CCTA) 2021.
- IEEE Transactions on Automatic Control (TAC) 2021.
- IEEE Conference on Control Technology and Applications (CCTA) 2020.
- IEEE Conference on Decision and Control (CDC) 2020.
- IEEE Transactions on Control of Network Systems (TCNS) 2020.
- American Control Conference (ACC) 2020.

Significant Project Involvements

Development of co-regulation techniques for multi-agent UASs

Jan 2017- Jan 2023

Introduced novel controllers on top of the consensus algorithms to co-regulate the communication rate and inter-agent connectivity in the distributed multi-agent system to achieve the desired level of performance in convergence time and resource utilization. The proposed controllers are robust to communication and controller delay found in real systems. Key contributions include:

- Develop theorems to provide stability and convergence guarantees on proposed co-regulated controllers for consensus algorithms.

- Conduct simulation experiments to measure the effectiveness of the proposed controllers.
- Implement the proposed controllers on a 4-agent UAS system and conduct field experiments.

Development of Consensus Enabled Active Learning

August 2019 - May 2020

Led the algorithm design and implementation in a collaboration between the University of Nebraska-Lincoln and the University of the Pacific. The introduction of distributed consensus algorithms into traditional multi-agent deep active learning techniques drastically reduces the cost of communication and the cost of re-training the network. Key contributions include:

- Analyze the existing deep active learning algorithms to select the best acquisition function for consensus-based algorithms.
- Pre-process acquired real-world image data.
- Implement the proposed algorithm in NVIDIA Jetson Xavier NX single-board processor in Python.
- Conduct simulation experiments to quantify the advantages of the proposed method over traditional active learning methods.

Multi-Agent deployment of Hierarchical Reinforcement Learning

August 2020- present

Led the algorithm design and implementation in a group project funded through US Army Research Labs to implement a hierarchical reinforcement learning-based linear quadratic integral controller on a swarm of quad-copters. Key contributions include:

- Identify and implement solutions for implementation-specific issues when transferring an algorithm from a simulation-based to a robotic hardware-based.
- Develop code to implement linear quadratic integral controller on a single board computer.
- Pilot remotely controlled quad-copter during the trial phase and field deployment phase.

TEACHING ACCOMPLISHMENTS

University of Nebraska - Lincoln, Undergraduate

TA for CSCE 101L: Fundamentals of Computing. This lab sessions-based course is designed to introduce the basics of computer programming for undergraduates whose major is not computer science. The emphasis is on variables, data structures, conditional statements, and functions. Responsibilities included conducting introductory lectures, designing lab sessions, and grading lab sessions.

(Term: Fall 2021, Student Count: 14)

TA for CSCE 378: Human-Computer Interaction. Knowledge and techniques useful in the design of computing systems for human use.

(Term: Spring 2017)

North Dakota State University, Undergraduate

TA for CSCI 160: Computer Science 1. This lab session-based course introduces Microsoft tools to freshman and sophomore students. The focus is on Microsoft Word, Excel, and PowerPoint. Responsibilities included conducting lectures, helping students to complete lab assignments, and grading the lab sessions.

(Terms: Spring 2015 | Fall 2015 | Fall 2016, Student Count: 30)

Mentorship Experience

- University of Nebraska-Lincoln

Summer 2019

Mentored one undergraduate student under the Research Experiences for Undergraduates (REU) and one visiting undergraduate student under the collaboration between the University of Nebraska Lincoln - Yachay Tech University (Ecuador) over the summer of 2019. Topics included research methods, Robot Operating Systems (ROS), multi-copter construction, multi-copter flight operations, multi-drone deployment, and consensus algorithms.

- University of Nebraska-Lincoln Summer 2022
Mentored two undergraduate students under the Research Experiences for Undergraduates (REU) over the summer of 2022. Topics included research methods, Robot Operating System (ROS), Docker-based code distribution on multi-agents, multi-copter construction, multi-copter flight operations, multi-drone deployment, and designing multi-purpose landing gear for multi-copters.
- Brookhaven National Lab Summer 2023
Mentored one undergraduate student under the Research Experiences for Undergraduates (REU) over the summer of 2023. Topics Robot Operating System 2 (ROS2), Moveit2 robotic arm control library, path planning for robotic arms, and testing of robotic systems.

OTHER ACCOMPLISHMENTS

Academic and Project Awards

- Graduate Student Teaching Fellowship 2021-2022
Recipient of the competitive scholarship to participate in the Graduate Student Teaching Fellowship program by the College Of Engineering at UNL. The program focuses on evidence-based teaching methods for graduate students who are currently teaching at the post-secondary level.
- Georgia Tech Internet of Things summer school 2018
Recipient of a scholarship to attend the summer school organized by Georgia Institute of Technology on the Internet of Things.
- TrafficMate: Innovative Android OS-based software for mobile phones that uses the accelerometer and the GPS sensors on the mobile device to identify & inform traffic congestion 2012
Runners up, National Best Quality Software Awards, Sri Lanka, 2012.
Country Representation, World Summit Awards, UAE, 2012.
Country Representation Asia Pacific Information and Communications Technology Award, Brunei, 2012.

Outreach and Teamwork

- NIMBUS Lab representation 2018 - 2019
Represented the NIMBUS Lab at the UNL Hour of Code Interactive Tech Fair to educate the participants on the importance of robotics and demonstrate how the research at the NIMBUS Lab provides robotic solutions to manage prescribed fires, monitor critically challenged wetlands, and bring user-specific robots through human-robot interaction.
- Volunteer at SL2college 2013 - 2015
SL2college is a global community that provides free advice and guidance to Sri Lankan students. SL2college was envisioned in 2005 with the primary goal of helping Sri Lankan students access relevant information that would assist them in making informed decisions about their education goals overseas.