

# PATHIRANNAHELAGE MEVAN NILUMINDA WIJewardena

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## RESEARCH OVERVIEW

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I am driven by exploring how mathematics helps us develop analytical tools to solve impactful real-world problems, particularly in **optimization**, **learning theory** and **information theory**.

## EDUCATION

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**University of Southern California, Los Angeles, United States** Aug. 2022 - Present

Ph.D. in Electrical Engineering specializing on Communications

CGPA 4.0 out of 4.0

Advisor - Prof. Michael James Neely

**University of Moratuwa, Moratuwa, Sri Lanka** Oct. 2016 - July 2021

B.Sc. Engineering Honours Degree specialized in Electronic and Telecommunication Engineering

First Class Honors with a CGPA 4.06 out of 4.2 (Ranked **5** out of **101**)

Dean's List Placements - Semesters **1, 2, 3, 4, 7, 8**

**University of Auckland, New Zealand** June 2019 - Dec. 2019

Visiting Student

Augmented Human Lab

Worked on two research projects (MAGHair and AiSee) in Human Computer Interaction

## ACADEMIC ACHIEVEMENTS

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### International

- International Mathematical Olympiad (IMO) - **Bronze Medals** 2012, 2013, 2014, 2016  
[\[https://rb.gy/j50bjq\]](https://rb.gy/j50bjq)
- International Mathematics Competition for University Students - **Bronze Medal** 2018
- International Mathematics Competition (IMC) - **Bronze Medals** 2012, 2013
- IEEE Extreme Programming Competition - World Rank - **52**, Country Rank - **1** 2020
- Google Code Jam - World Rank - **1011**, Country Rank - **2** [\[https://rb.gy/uldq8a\]](https://rb.gy/uldq8a) 2019
- Google Hash Code - World Rank - **549**, Country Rank - **3** [\[https://rb.gy/pbjmp8\]](https://rb.gy/pbjmp8) 2020

### Asia/Asia Pacific

- Asia Pacific Mathematical Olympiad (APMO) - **Silver Medal** [\[https://rb.gy/y5houp\]](https://rb.gy/y5houp) 2016
- Asian Physics Olympiad (APhO) - **Participation** 2016

### Sri Lanka

- Sri Lanka Mathematical Olympiad (SLMO) - **Gold Medals** 2012, 2013, 2014, 2016
- Sri Lanka Physics Olympiad - **Gold Medal** 2015
- W.D.Gunarathne Memorial **Gold Medallist** 2012, 2014, 2016
  - Awarded to the best performer at the Sri Lanka Mathematical Olympiad.
- ACES Coders - **Runners Up** 2020
  - An Algorithmic Programming Competition organized by the Faculty of Engineering, University of Peradeniya.
- MoraXtreme - **Champions** 2017
  - An Algorithmic Programming Competition organized by the Computer Society - IEEE University of Moratuwa Student Branch.

- HackStat - **Second Runners Up** 2018
  - A Data Science Hackathon organized by the Stat Circle of the University of Colombo.

### Scholarships

- Mahapola Scholarship for Undergraduates awarded by the Government of Sri Lanka. 2016 - 2021

### PUBLICATIONS

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- **M. Wijewardena**, T. Samarasinghe, K. T. Hemachandra, S. Atapattu and J. S. Evans, “*Physical Layer Security for Intelligent Reflecting Surface Assisted Two-Way Communications*,” in IEEE Communications Letters, vol. 25, no. 7, pp. 2156-2160, July 2021. [<https://rb.gy/yqoa0m>]
- R. Boldu, **M. Wijewardena**, H. Zhang, and S. Nanayakkara, “*MAGHair: A Wearable System to Create Unique Tactile Feedback by Stimulating Only the Body Hair*,” in 22<sup>nd</sup> International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '20), Oct. 2020. [<https://rb.gy/rjjcd0>]
- **M. Wijewardena**, M. J. Neely, “*A Two-Player Resource-Sharing Game with Asymmetric Information*,” Games. 2023; 14(5):61. [<https://doi.org/10.3390/g14050061>]
- **M. Wijewardena**, and M. J. Neely, “*Multi-Player Resource-Sharing Games with Fair Reward Allocation*,” arXiv preprint arXiv:2402.05300 (2024).
- **M. Wijewardena**, and M. J. Neely, “*Online Multi-Player Resource-Sharing Games with Bandite Feedback*,” submitted to Dynamic games and Applications Journal [<https://shorturl.at/Y6RB1>]
- **M. Wijewardena**, and M. J. Neely, “*Automatic Link Selection in Multiple Access with Link Failures*,” under preparation

### RESEARCH TALKS

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- University of Moratuwa - ENTC Research Seminar Aug. 2021
  - The monthly online research seminar organized by the Department of Electronic and Telecommunication Engineering, University of Moratuwa.
  - Topic: Physical Layer Security for Intelligent Reflecting Surface Assisted Two-Way Communications.

### WORK EXPERIENCE

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- University of Southern California, Los Angeles, USA** Aug. 2023 - Present
  - Teaching Assistant
  - Department of Electrical and Computer Engineering
    - EE-512- Stochastic Processes for Financial Engineering - (TA for Fall'23, Spring'24, Fall'24 and Spring'25)
    - EE-EES- Applied Linear Algebra for Engineering - (Course Producer for Summer'24)
- University of Moratuwa, Moratuwa, Sri Lanka** June 2021 - July 2022
  - Lecturer (On Contract)
  - Department of Electronic and Telecommunication Engineering
    - EN2073 - Analog and Digital Communications - Teaching Assistant.
    - EN2040 - Random Signals and Processes - Teaching Assistant.
    - EN2053 - Communication Systems and Networks - Teaching Assistant.
    - EN2090 - Laboratory Practice - II - Conducting laboratory sessions for Computer Organization.
    - EN2022 - Digital Electronics - Conducting laboratory sessions.
    - EN1094 - Laboratory Practice - I - Design of Laboratory Practicals for Telecommunications Section.

### PROJECTS

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- Automatic Link Selection in Multiple Access with Link Failures** April. 2024 - Present

- Here, I am considering a multiple-access scenario where multiple users are accessing multiple channels. The link assigning a user to a channel may fail with a given probability, and we do not know the link failure probabilities. Additionally, the user-channel pairs have to be assigned such that at most one user is assigned to each channel and at most one channel is assigned to each user. The goal is to maximize a concave function of time-average success vector, in the presence of bandit feedback on success/failures.
- I have developed two algorithms where the first algorithm is adaptive and the second algorithm has faster convergence.
- Currently I am working on distributed implementations of the algorithm.

#### **Fast Drift-Plus-Penalty Algorithm with Kullback-Leibler Divergence** Oct. 2023 - April 2024

- I worked on improving the conventional fast-drift plus penalty algorithm to achieve a better convergence rate.
- The conventional algorithm is used for deterministic convex optimization. I particularly focused on using the underlying structure of the optimization domain to achieve faster convergence.
- I improved the convergence using the ideas of Kullback-Leibler Divergence when the underlying set is a probability simplex.

#### **Multi-Player Resource-Sharing Games with Fair Reward Allocation** July. 2023 - February. 2024

- I am developing algorithmic approaches for the worst-case expected utility maximization of the first player of the multi-player resource-sharing game with fair reward allocation. I am also extending the work to scenarios with bandit feedback.
- I have explored certain special cases in which the problem can be solved explicitly and developed a novel algorithm for the scenario with bandit feedback.

#### **A Two-Player Resource-Sharing Game with Asymmetric Information** Aug. 2022 - Sept. 2023

- Through this project, I developed an algorithm for a player to maximize his private worst-case expected reward in the two-player resource-sharing game with asymmetric information.
- The worst-case analysis is useful when the incentives of the opponent are not known.
- I have developed a novel algorithm based on the drift-plus penalty method for the problem and explored special cases in which an explicit solution can be obtained.

#### **Non-Intrusive Real-Time Power Monitor** Feb. 2020 - July 2021

- Through this project, our group aimed at developing a low-cost system to reduce household energy wastage by providing real-time feedback on appliance-level power consumption by only measuring the aggregate power consumption.
- I contributed by developing the algorithm for the task, which included experimenting with machine learning models such as additive factorial hidden Markov models and attention-based neural networks.
- The algorithm achieved superior real-time performance compared to the state-of-the-art algorithms.

#### **Secrecy of an IRS Assisted Two-Way Communication System** Nov. 2019 - Nov. 2021

GitHub - [\[https://github.com/Mevan1996/Secrecy-of-two-way-IRS\]](https://github.com/Mevan1996/Secrecy-of-two-way-IRS)

- This is a project investigating the exploitation of an intelligent reflecting surface (IRS) to communicate securely in a two-way communication system consisting of an untrusted user.
- I developed a semi-definite programming-based alternating optimization algorithm to maximize the sum-secrecy of the system, which yielded gains reaching 120% compared to partially optimized schemes.

## **GRADUATE COURSES**

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- EE503 - Probability for Electrical and Computer Engineers (USC, Fall'22)
- EE510 - Linear Algebra for Engineering (USC, Fall'22)
- EE562 - Random Processes in Engineering (USC, Spring'23)
- MATH 425B - Fundamental Concepts of Analysis (USC, Spring'23)

- EE649 - Stochastic Network Optimization and Adaptive Learning (USC, Fall'23)
- EE550 - Data Networks (USC Spring'24)
- ISE633 - Large Scale Optimization and Machine Learning (USC Spring'24)
- CSCI678 - Theoretical Machine Learning (USC Fall'24)

## SERVICES AND LEADERSHIP

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### Mathematics Society of the University of Moratuwa (UoM), Sri Lanka 2018 - 2019

- President (2018/19).
- Organized **M-Talks** (monthly research talks on mathematics).

### Electronic Club (E-Club), UoM, Sri Lanka 2016 - 2021

- The official student body of the Department of Electronic and Telecommunication Engineering, UoM.
- Sri Lanka Robotics Challenge (SLRC) - The annual robotics challenge organized by the E-Club
  - The competition is held under two categories, school and undergraduate, and is open to all the students from Sri Lanka.
  - Conducted **robotics workshops** for the school category of SLRC 2018.
- uMora - The annual online mathematics competition organized by the E-Club
  - The competition is held under three categories, middle school, high school, and undergraduate, and is open to all the students from Sri Lanka.
  - I was a **problem setter** and an **organizer** for all three categories of uMora 2020.
- Expose - An exhibition organized by the E-Club
  - Conducted the **digital signal processing stall** of Expose 2019.

### Computer Society - IEEE University of Moratuwa Student Branch 2017 - 2021

- MoraXtreme - An annual algorithmic programming competition
  - The competition is open to all undergraduate students in Sri Lanka.
  - Conducted an **algorithmic programming workshop** for the participants of MoraXtreme 2021 and was a **problem setter** for MoraXtreme 2019.

### IEEE Engineering in Medicine and Biology Student Branch Chapter at UoM 2021

- The affiliated student body which works in collaboration with the Biomedical Engineering specialization in the Department of Electronic and Telecommunication Engineering, University of Moratuwa.
- IEEE EMBS International Student Conference
  - I was a **paper reviewer** for the 2021 edition (Reviewer ID - R015).

### IEEE Student Branch University of Jaffna 2024

- YarlXtreme 1.0 : Pre-Xtreme campaign (An algorithmic programming competition)
  - I conducted a session on **problem solving techniques**

## OUTREACH

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### Rotaract Club of University of Moratuwa (Rotaract Mora) 2016-2020

- Grama Prabodhaya - A community service project to develop a selected rural village in Sri Lanka
  - Conducted **English workshops** for selected rural schools for Grama Prabodhaya 2017.

### Engineering Faculty Students Union, University of Moratuwa 2016-2021

- Soyuru Sathkaraya - A community service project
  - Conducted **Mathematics workshops** for selected rural schools for Soyuru Sathkaraya 2018.