Kaleb Ben Naveed

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Research Interests

Safe Trajectory Planning under Model Uncertainty and External Disturbances, Spatiotemporal Informative Planning, Multi-Robot Coordination and Scheduling, and Long-Horizon or Persistent Mission Planning.

Education

University of Michigan, Ann Arbor *August 2022 – Present*
PhD in Robotics

- GPA: 3.86/4.0
- **Selected Coursework:** Maths for Robotics (ROB 501), Nonlinear Programming (MATH 663), Inference, Estimation, and Learning (AEROSP 567), Nonlinear Control (EECS 562), Robot Kinematics and Dynamics (ROB 510), and Mobile Robotics (ROB 530).

The Hong Kong Polytechnic University, Hong Kong *August 2018 – April 2022*
Bachelor of Engineering (Hons) in Electronic and Information Engineering (EIE)

- First Honors; CURI (College of Undergraduate Researchers and Innovators) Scholar
- Exchange semester at Pembroke College, University of Cambridge, England, UK.

Publications

1. **Provably Safe Stein Variational Clarity-Aware Informative Planning.**
   Kaleb Ben Naveed, Utkrisht Sahai*, Anouck Girard, Dimitra Panagou.*
   **Equal Contribution*
   Under Review

2. **A Formal `gatekeeper` Framework for Safe Dual Control with Active Exploration.**
   Kaleb Ben Naveed, Devansh R. Agrawal, Dimitra Panagou.
   Under Review

3. **Multi-Robot Allocation for Information Gathering in Non-uniform Spatiotemporal Environments.**
   Kaleb Ben Naveed, Haejoon Lee, Dimitra Panagou.
   Under Review

4. **Adaptive Ergodic Search with Energy-Aware Scheduling for Persistent Multi-Robot Missions.**
   Kaleb Ben Naveed, Devansh R. Agrawal, Rahul Kumar, Dimitra Panagou.
   Autonomous Robotics

5. **`meSch`: Multi-Agent Energy-Aware Scheduling for Task Persistence.**
   Kaleb Ben Naveed, An Dang, Rahul Kumar, Dimitra Panagou.
   2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

6. **Enabling Safety for Aerial Robots: Planning and Control Architectures.**
   Kaleb Ben Naveed, Devansh R. Agrawal*, Daniel M. Cherenson*, Haejoon Lee, Alia Gilbert, Hardik Parwana, Vishnu S. Chipade, William Bentz, Dimitra Panagou.*
   Workshop paper at the 2025 IEEE International Conference on Robotics and Automation (ICRA).

7. **Eclares: Energy-Aware Clarity-Driven Ergodic Search.**
   Kaleb Ben Naveed, Devansh R. Agrawal, Christopher Vermillion, Dimitra Panagou.
   2024 IEEE International Conference on Robotics and Automation (ICRA).

8. **Trajectory Planning for Autonomous Vehicles using Hierarchical Reinforcement Learning.**
   Kaleb Ben Naveed, Zhiqian Qiao, John M. Dolan.
   2021 IEEE International Intelligent Transportation Systems Conference (ITSC).

Skills

- **Programming Languages:** Python, Julia, C++, C, Matlab, LaTeX
- **Software & Packages:** PyTorch, JAX, ROS2, Gazebo, OpenCV
- **Technical Skills:** Docker, NVIDIA Jetson (Xavier NX, Orin NX), Linux, Blender, Adobe Suite (Premiere Pro, After Effects, Illustrator), GIT, Pixhawk flight controllers (PX4)

Experience

Distributed Autonomous Systems and Control Lab, UMich *Ann Arbor, MI*
Graduate Student Research Assistant *Sept 2022 – Present*
Advisor: Prof. Dimitra Panagou

- Conducting research in the areas of long-horizon energy-constrained planning, informative planning in spatiotemporal environments, and planning under uncertainty. More details on the research questions I have addressed so far can be found here: Research Questions.

AirLab, Robotics Institute, CMU *Pittsburgh, PA*
Visiting Scholar *May 2021 – Aug 2021*
Advisor: Prof. Sebastian Scherer

- Proposed and developed Prioritized-FUEL (Fast UAV Exploration), a hierarchical framework for informative path planning for applications related to reconnaissance missions, such as search and rescue
- Proposed method showed 2 times faster Data Acquisition (test metric) with the same exploration time compared to the existing approach.

Argo AI, Robotics Institute, CMU *Pittsburgh, PA*
Visiting Scholar *May 2020 – April 2021*
Advisor: Prof. John M. Dolan

- Proposed and developed Robust-HRL, a hierarchical reinforcement learning (HRL) based framework for trajectory planning for autonomous vehicles.
- Robust-HRL showed at least 7% higher success rate than the existing state-of-the-art RL and rule-based approaches.

STEM Outreach & Leadership

CMU Robotics Outreach Working Group Pittsburgh, PA
Robotics Institute, Carnegie Mellon University *Sept 2021 – Present*

- Designed and launched a website for students and teachers to learn about robotics. The website includes free learning resources and lists of opportunities in robotics education.

Graduate Student Instructor for Math for Robotics (ROB 501) Ann Arbor, MI
Department of Robotics, University of Michigan, Ann Arbor *Fall 2023 & Fall 2024*

- Led biweekly discussion sessions and held weekly office hours.

Honor & Awards

- **Robotics PhD Departmental Fellowship:** Awarded first-year fellowship for the PhD studies by the Department of Robotics, University of Michigan, Ann Arbor, MI.
- **Undergraduate Summer Research Abroad Sponsorship (USRA):** Awarded 5000 USD to participate in the Robotics Institute Summer Scholars Program at Carnegie Mellon University in May 2021.
- **Honored Global Student Ambassador:** Awarded highest-level ambassadorship for organizing intercultural events.
- **Oxbridge Program Subsidy:** Awarded 6500 USD to attend an exchange semester at the University of Cambridge.
- **Entry Scholarship by The Hong Kong Polytechnic University:** Full scholarship (valued at nearly 160%) for 4 years of BEng (Hons) in Electronic and Information Engineering. The scholarship covers full tuition, accommodation, and personal expenses.

Professional Service & Mentorship

- **Review Service:** TRO, RAL, ICRA, IROS, CDC, ACC, ITSC, MRS.
- **Mentoring:** Rahul Kumar (UMich Robotics M.S.; now at Dexmate), Utkrisht Sahai (UMich Robotics M.S.), Manveer Singh (UMich Robotics M.S.), Elida Sensoy (UMich EECS B.S.), Rahul Sunil (UMich Aerospace M.S.).