Michael S. Lee

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I research how **AI and robotic agents can summarize and convey their reward functions (and subsequent policies) to humans** using **informative demonstrations**, toward transparency, value/AI alignment, and explainable AI.

Education

PhD in Robotics, *Carnegie Mellon University* Expected Aug 2023
Advisers: Prof. Reid Simmons, Prof. Henny Admoni
Undergraduate research mentee: Vignesh Rajmohan (Everyday Robots / Google X intern)

Master of Science in Robotics, *Carnegie Mellon University* Aug 2018
Advisers: Prof. Red Whittaker, Prof. Nathan Michael
Thesis: Radiation Source Localization using a Gamma-ray Camera

BSE in Mech. & Aero. Engineering, Minor in Computer Science, *Princeton University* May 2016
Advisers: Prof. Robert Stengel, Prof. Nathan Michael
Thesis: Modeling Uncertainty in Stereo Vision for Precise and Robust State Estimation

Research Experience

Carnegie Mellon University

***Machine Teaching for Human Inverse Reinforcement Learning** (R. Simmons, H. Admoni)* Aug 2018 –
- Developing algorithms for teaching robot policies to humans through informative demonstrations, toward transparency and accurate prediction of robot behavior by humans in unseen scenarios.
- Modeling humans as inverse reinforcement learners and using learning techniques (e.g. scaffolding) to incrementally increase human knowledge with demonstrations of appropriate informativeness & difficulty.

***Radiation Source Localization using Gamma Camera** (R. Whittaker, N. Michael)* Aug 2016 – Aug 2018
- Developed novel gamma radiation map representation and source localization algorithm for efficient and autonomous radiological characterization of nuclear facilities using a gamma-ray camera equipped robot.

***Physically-assisted Navigation of the Elderly and Visually-Impaired** (Ralph Hollis)* Jun – Aug 2016
- Designed and implemented a ROS SMACH state machine for a dynamically stable ballbot toward hand-assisted leading of the elderly and the visually impaired.
- Integrated voice control of the state machine using Google Speech API toward the study of joint speech and force-based communication in navigation assistance tasks.

***Predicting Feature-Based Visual Odometry Failure using Saliency** (Nathan Michael)* Jun – Aug 2015
- Identified and characterized three classes of sparse visual odometry failures through a suite of visual metrics that extracted relevant saliency information from incoming images.
- Trained classifiers to anticipate and label imminent visual odometry failures in support of robust visual state estimation and autonomous UAV flight.

Jet Propulsion Laboratory (NASA)

***Estimating Forest Biomass using Quadcopter** (Roland Brockers, Stephan Weiss, Adam Wolf)* Jun – Aug 2014
- Collected forest microclimate data using a custom sensor suite onboard a quadcopter, and developed interactive ecology maps over Google Earth based on the completed surveys.
- Extracted correlations between microclimate data and first-order estimates of forest biomass based on tree diameters estimated from stereo images.

Representative Publications

- **M. Lee**, H. Admoni, R. Simmons, *Reasoning about Counterfactuals to Improve Human Inverse Reinforcement Learning*, International Conference on Intelligent Robots and Systems (IROS), 2022.
- **M. Lee**, H. Admoni, R. Simmons, *Machine Teaching for Human Inverse Reinforcement Learning*, Frontiers in Robotics and AI, 2021.
- Z. Han, D. Giger, J. Allspaw, **M. Lee**, H. Admoni, H. Yanco, *Building the Foundation of Robot Explanation Generation using Behavior Trees*, ACM Transactions on Human-Robot Interaction, 2021.
- **M. Lee**, *Self-Assessing and Communicating Manipulation Proficiency Through Active Uncertainty Characterization*. Pioneers Workshop at ACM/IEEE Conference on Human-Robot Interaction, 2019.
- **M. Lee**, *Active Learning of Manipulation Skill Parameters.* Northeast Robotics Colloquium, 2019 (poster).
- **M. Lee**, D. Shy, R. Whittaker, N. Michael, *Active Range and Bearing-based Radiation Source Localization*. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018.

Leadership & Service

Reviewer

- IROS (2022), Pioneers Workshop at RSS (2022), AAAI Undergraduate Consortium (2022), Pioneers Workshop at HRI (2020-2022), AAAI Fall Symposium (2021)

Undergraduate AI Mentorship, *Mentor* Jan 2019 –

- Matched with an undergraduate woman and/or minority interested in pursuing a career in AI research.
- Provide guidance on relevant coursework and experiences for graduate school through monthly meetings.

Teaching Assistant (Carnegie Mellon University) Jan – May 2020, 2021

- Created/graded assignments, advised projects for these classes: human-robot interaction, computer vision

Robotics Institute Summer Scholars Admissions Committee, *Reviewer* Feb – Mar 2017, 2019

- Assisted in reviewing over 680 applicants for the Summer Scholars program, an eleven-week research experience for 30 undergraduates hosted by the Robotics Institute at Carnegie Mellon University.

RISS Working Papers Journal Committee, *Managing Editor* Jun – Dec 2015

- Oversaw the production and review of the 2015 Robotics Institute Summer Scholars (RISS) Working Papers Journal, a collection of research papers written by summer scholars.

Princeton Robotics Club, *Quadcopter Control Subteam Leader* Sep 2013 – Jun 2015

- Co-led a team of eight students in building a quadcopter from scratch, by researching and implementing the hardware assembly, dynamics, and PID control for stable quadcopter flight.

Outdoor Action Orientation Program, *Week-long Backpacking Trip Leader* Jan 2014 – Jun 2015

Honors & Awards

HRI Pioneers Workshop, *Member* 2019

- Identified as a promising student researcher in the area of Human-Robot Interaction, and presented research at the Pioneers Workshop at ACM/IEEE International Conference on Human-Robot Interaction.

National Defense Science and Engineering Graduate (NDSEG) Fellowship, *Finalist* 2018

Sigma Xi, *Associate Member* 2016 – 2017

- Nominated for induction into the honor society by the Mech. & Aero. Eng. Department at Princeton Univ.

Robotics Institute Summer Scholars Program, *Member* Jun – August 2015, 2016

Technical Skills

Languages: Python, MATLAB, C++, HTML5, CSS, JS | **Tools**: User studies, psiTurk, Prolific, ROS, Git