Micah Corah

Active Perception · Multi-Robot Systems · Aerial Robotics

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Education

Carnegie Mellon University — *Pittsburgh, PA*

Ph.D. in Robotics — *December 2020*

M.S. in Robotics — *December 2017*

- Thesis (Ph.D.): *Sensor Planning for Large Numbers of Robots*
- Advisor: *Prof. Nathan Michael*

Rensselaer Polytechnic Institute — *Troy, NY*

B.S. in Computer Science — *May 2015*

B.S. in Mechanical Engineering — *May 2015*

Skills

Robotics Multi-robot systems, Aerial robots, Informative planning, Active sensing, Mapping, Exploration

Foundations Information theory, Control theory, Submodular optimization

Languages C++, Julia, Matlab, Python, LaTeX

Experience

Colorado School of Mines — *Golden, CO*

Assistant Professor of Computer Science — *Jan 2024–Present*

- Director of the Navigation, Aerial-robots, and Perception Planning Laboratory (NAPPLab)

Carnegie Mellon University — *Pittsburgh, PA*

Postdoctoral Fellow — *Jan 2022–Nov 2023*

Advisor: *Prof. Sebastian Scherer*

- Lead an NSF-sponsored project, developing teams of drones that film and reconstruction motion of groups of dynamic actors (link)
- Applications include sports videography, study of animal group behaviors, or capture of artistic and improvisational performances
- Focus on includes aerial multi-robot systems and planning and coordination for multi-robot teams
- Developed methods for planning for videography based on submodular maximization and optimizing views based on pixel densities

NASA Jet Propulsion Laboratory, California Institute of Technology — *Pasadena, CA*

Postdoctoral Researcher — *Dec 2020–Dec 2021*

Advisor: *Dr. Ali-akbar Agha-mohammadi*

- Member of team CoSTAR, competing in the DARPA Subterranean Challenge
- Responsibilities: aerial autonomy, coverage planning, radio communication, field test scouting and planning
- Our team placed 5^{th} (alongside very capable competition) in the DARPA Subterranean Challenge Finals

Carnegie Mellon University — *Pittsburgh, PA*

Research Assistant — *Aug 2015–Sept 2020*

Advisor: *Prof. Nathan Michael*

- Developed algorithms and analysis techniques for multi-robot sensing, coverage, exploration, and target tracking based on submodular maximization, higher-order monotonicity conditions, and spatial locality
- Design and analysis of a planner for exploration at high speed (2.25 m/s) with an aerial robot in collaboration with Kshitij Goel and Curtis Boirum. This system was tested in simulation and on a hexrotor robot, outdoors, on the CMU campus
- Developed a system for multi-robot exploration combining Cauchy-Schwarz mutual information for ranging sensors, Monte-Carlo tree search for path planning, and multi-robot planning via submodular maximization
- Implemented core components of a system providing control and autonomy for aerial robots. Contributions include trajectory representation and management and a modular finite state machine

Carnegie Mellon University (Internships) *Pittsburgh, PA*

Research Intern: Persistent Coverage *May–Aug 2014*

Advisor: *Prof. Nathan Michael*
- NSF Research Experience for Undergraduates (REU)
- Implemented minimum snap, collision free, multi-vehicle trajectory generation
- Implemented controller for tracking of discretized trajectories

Research Intern: Wing Assembly *May–Aug 2013*

Advisor: *Prof. Reid Simmons*
- Developed a simulation of multi-robot assembly of an airplane wing-ladder
- Implemented an autonomous behavior where a mobile robot attaches and aligns to an airplane wing spar

Rensselaer Polytechnic Institute *Troy, NY*

Independent Study: Robotic Catching *Aug–Dec 2013*

Advisor: *Prof. Jeff Trinkle*
- Modeling and simulation of contact-oriented catching of a sliding object

Undergraduate Researcher: Scientific Computing *Sept 2012–Dec 2013*
- Implemented threaded mesh I/O for the Parallel Unstructured Mesh Interface

Undergraduate Teaching Assistant (Computer Science 1) *Aug 2012–May 2013*
- Assisted students with lab work and graded results

Service

Departmental Service

Computer Science: CORE Committee *Mines*

Committee Member *Spring 2025*
- Community Outreach, Retention, and Ethics Committee

Computer Science: JEDI Committee *Mines*

Committee Member *Fall 2024*
- Justice, Equity, Diversity, and Inclusion Committee

Service to Research Community & Outreach

Robotics: Science and Systems 2026: Organizing Committee *Sydney, Australia*

Website Co-Chair *Fall 2025–Summer 2026*
- Conference to be held July 2026

International Conference on Intelligent Robots and Systems 2026 *Pittsburgh, Pennsylvania*

Associate Editor *Spring 2026*
- Conference to be held Fall 2026

RSS Pioneers 2022: Organizing Committee *N/A*

Program Committee Member *July 2021–July 2022*
- After participating in RSS Pioneers 2021, I am looking forward to contributing to the organization of the program for the 2022 edition

AAAI 2022 Student Abstract and Poster Program *N/A*

Program Committee Member *Fall 2021*
- As a committee member, I was responsible for reviewing several abstracts submitted by early career researchers

RSS 2018: Graduate Student Volunteer *Pittsburgh, PA*

Industry Reception *May 2017–June 2017*
- Coordinated logistics and placements for the industry reception in the foyer of the Carnegie Music Hall

First LEGO League (FLL) Championship fo Western PA

Pittsburgh, PA

Judge: Robot Design — *Dec 2022*

- I will be returning to judge for FLL in 2022

Judge: Project — *Dec 2018*

- Student groups (primary school) presented projects to judges via prepared presentations (along with posters and props) according to that year's theme, *Into Orbit*
- Deliberated with judging team and assessed projects according to notes and scoring rubric

Teaching

Introduction to Artificial Intelligence (CSCI 404/571)

Mines

Instructor — *Spring 2024, 2025, 2026*

- Senior level undergraduate computer science course
- Textbook: *Artificial Intelligence a Modern Approach* by Stuart Russell and Peter Norvig

Planning for Perception (CSCI 533)

Mines

Instructor — *Fall 2024, 2025*

- Graduate level computer science course
- Course spanning active perception for robots, informative path planning, and submodular optimization applied to these topics
- Approved to be added to course catalog in Fall 2025 (expected to be taught beginning Fall 2026)
- Formerly taught as special topics (CSCI598) under the same name (2025) and as *Autonomous Sensing & Perception* (2024)

Robot Mobility on Air, Land, & Sea (16-665)

CMU

Co-Instructor — *Fall 2022*

- Core course in the Masters in Robotics Systems Development (MRSD) program
- Gave two lectures of the *Aerial Mobility* component: *Model Predictive and Adaptive Control* and *Trajectory Generation and Tracking*
- Revised and expanded material for each lecture. Improved emphasis on concrete applications and introduced discussion of autonomy system design and safe navigation with respect to flatness-basd trajectory generation
- Collaborated with TAs to port section project from Matlab to Python

Mathematical Fundamentals for Robotics (16-811)

CMU

Teaching Assistant — *Aug–Dec 2017*

Instructor: *Prof. Michael Erdmann*

- Course: Mathematical Fundamentals for Robotics (16-811)
- Responsibilities: grading assignments, holding office hours
- Prepared and gave a lecture on submodular maximization

Mentorship & Advising

Graduate Advising (Theses)

Oluwatosin Oseni

Colorado School of Mines

Ph.D. Robotics — *Fall 2024–Ongoing*

Sharfi Rahman

Colorado School of Mines

Ph.D. Robotics — *Summer 2024–Ongoing*

Carole Bouy

Colorado School of Mines

M.S. Robotics — *Fall 2024–Ongoing*

Peter Rubatscher

Johannes Kepler University Linz

Visiting Master's Student (Mines) — *Fall, 2024*

- Peter won a *Marshall Plan Scholarship* (via the Austrian Marshall Plan Foundation) to perform his Master's thesis work under my supervision as a visiting student at Mines
- Thesis: *Innovating Aerial Videography with Natural Language Instructions*
- *Although my role was not formally as advisor or committee member, I was intensely involved in the advising of Peter's thesis in actuality.*

Thesis Committee Membership

Klaus Pacheco Hague

Colorado School of Mines

Ph.D. Mining Engineering, Thesis Committee (Chair) — *Ongoing*

Mark Higger — *Colorado School of Mines*

Ph.D. Robotics, Thesis Committee — *Ongoing*

- Proposed Spring 2026
- Thesis: *Applying Mental Models of Users' Cognitive States to Natural Language Generation for Collaborative Robots*

Seungchan Kim — *Robotics Institute, CMU*

Ph.D. Robotics, Thesis Committee — *Ongoing*

- Proposed December 2024
- Thesis: *Spatial Reasoning and Semantic Representations for Intelligent Multi-Robot Exploration and Navigation*
- Seungchan and I have also collaborated and published together.

Yee Shen Teoh — *Colorado School of Mines*

M.S. Robotics, Thesis Committee — *Spring 2025*

John Phillips — *Colorado School of Mines*

M.S. Computer Science, Thesis Committee — *Spring 2025*

Johnathan Diller — *Colorado School of Mines*

Ph.D. Computer Science, Thesis Committee — *Fall 2025*

Michael Tatum — *Robotics Institute, CMU*

M.S. Robotics, Thesis Committee — *2020*

- Thesis: *Communications Coverage in Unknown Underground Environments*
- I met with Michael regularly while he performed his thesis work
- Michael's thesis developed greedy methods for placing communication nodes to maximize coverage in the DARPA Subterranean Challenge

Graduate Advising (Non-Thesis and Other)

Lael Lum — *Colorado School of Mines*

M.S. Computer Science (Non-Thesis) — *Fall 2025–Ongoing*

Noa Chapman — *Colorado School of Mines*

M.S. Robotics (Non-Thesis) — *Fall 2025*

- Independent Study

Undergraduate Mentorship and Advising

Andrew Young — *Colorado School of Mines*

FIRST Scholar — *Spring 2025*

Aden Cohen-Smith — *Colorado School of Mines*

FIRST Scholar — *Spring 2025*

James Slopey — *Colorado School of Mines*

Undergraduate Research Assistant — *Fall 2025–Ongoing*

Rudy Hollis — *Colorado School of Mines*

Undergraduate Research Assistant — *Spring 2025–Ongoing*

- Inclusive of RA position during Summer 2025.

Tim Churchill — *Colorado School of Mines*

Undergraduate Research Assistant — *Spring 2025–Ongoing*

Edward Gibson — *Colorado School of Mines*

Undergraduate Research Assistant (Work Study) — *Fall 2024–Ongoing*

Michael Hargraves, Bryce Huffaker, Sharif Islam, James Slopey — *Colorado School of Mines*

Mines Field Session — *Summer 2025*

- Project: *Multi-person Tracking for Autonomous Sports Videography*
- The team implemented planar tracking and simulation tools that NAPPLab continues to use and develop.
- James Slopey continued as an undergraduate RA.

John Takatz — *Colorado School of Mines*

Undergraduate Research Assistant — *Spring 2025*

Krishna Suresh — *Robotics Institute, CMU*

Robotics Institute Summer Scholars — *Summer 2023*

- Krishna's REU project involved developing a multi-robot planner for aerial videography with awareness of collisions and occlusions
- We presented a conference paper based on this work at ICRA, 2024

Micah Nye — *Robotics Institute, CMU*

Robotics Institute Summer Scholars — *Summer 2023*

- Micah's project involved developing an integrated system for trajectory generation, and control for aerial robots based on NVIDIA Isaac Sim

Skyler Hughes — *Robotics Institute, CMU*

Robotics Institute Summer Scholars — *Summer 2022*

- Skyler is an undergraduate intern from the *New Mexico Institute of Mining and Technology* working on greedy, submodular coordination for multi-robot filming
- We presented a conference paper based on this work at CDC, 2024

Hannah Noh, Andrew (Yifan) Su — *Robotics Institute, CMU*

Summer Undergraduate Research Apprenticeship — *Summer 2022*

- Andrew and Hannah are rising sophomores on the multi-robot filming project. They have been developing RTK-GPS tracking backpacks that will transmit locations of actors being filmed as well as contributing to several other areas of our systems

Honors & Awards

2021 **RSS Pioneers,** Research statement accepted into prestigious workshop for early-career roboticists — *Virtual Workshop*

Select Presentations

Research Discussion (Computer Science Department) — *Colorado School of Mines*

Multi-Robot Active Perception: Toward Autonomous Sports Videography and More — *March 2024*

- Seminar talk on multi-robot active perception including discussion of recent publications on coordinating multiple drones for videography tasks.

JKU Institute of Computer Graphics — *Virtual*

Active Perception for Robot Teams: From Visual Search to Videography, Micah Corah — *March 2024*

- Seminar talk on active perception for multi-robot videography tasks. Details. Video.

Talking Robotics — *Virtual*

Active perception and exploration with teams of robots: From simulation to subterranean — *Oct 2021*

- Seminar on active perception for one or more robots and lessons learned from the Subterranean Challenge. Video.

Publications

Thesis

Micah Corah. **Sensor planning for large numbers of robots**. PhD thesis, Carnegie Mellon University, 2020. Video.

Journal

Benjamin Morrell, Kyohei Otsu, Ali Agha, David D Fan, et al. **An addendum to NeBula: Towards extending team CoSTAR's solution to larger scale environments**. *IEEE Transactions on Field Robotics*, 2024.

Seungchan Kim, **Micah Corah**, John Keller, Graeme Best, and Sebastian Scherer. **Multi-robot multi-room exploration with geometric cue extraction and circular decomposition**. *Robotics and Automation Letters*, 2023.

Micah Corah and Nathan Michael. **Distributed matroid-constrained submodular maximization for multi-robot exploration: theory and practice**. *Autonomous Robots*, 2019.

Micah Corah, Cormac O'Meadhra, Kshitij Goel, and Nathan Michael. **Communication-efficient planning and mapping for multi-robot exploration in large environments**. *Robotics and Automation Letters*, 2019. Video.

Erik Nelson, **Micah Corah**, and Nathan Michael. **Environment model adaptation for mobile robot exploration**. *Autonomous Robots*, 2018.

Conference

Krishna Suresh, Aditya Rauniyar, **Micah Corah**, and Sebastian Scherer. **Greedy perspectives: Multi-drone view planning for collaborative coverage in cluttered environments**. *International Conference on Intelligent Robots and Systems*, 2024. Web.

Skyler Hughes, Rebecca Martin, **Micah Corah**, and Sebastian Scherer. **Multi-robot planning for filming groups of moving actors leveraging submodularity and pixel density**. *Conference on Decision and Control*, 2024.

Micah Corah and Nathan Michael. **Scalable distributed planning for multi-robot, multi-target tracking**. *International Conference on Intelligent Robots and Systems*, 2021. Presentation.

Micah Corah and Nathan Michael. **Volumetric objectives for multi-robot exploration of three-dimensional environments**. *International Conference on Robotics and Automation*, 2021. Presentation.

Hyungho Chris Choi, Inhwan Wee, **Micah Corah**, Sahand Sabet, Taeyeon Kim, Thomas Touma, David Hyunchul Shim, and Ali-akbar Agha-mohammadi. **BAXTER: Bi-modal aerial-terrestrial hybrid vehicle for long-endurance versatile mobility**. *Proc. of the Intl. Sym. on Exp. Robot.*, 2021.

Kshitij Goel, **Micah Corah**, Curtis Boirum, and Nathan Michael. **Fast exploration using multirotors: Analysis, planning, and experimentation**. *Field and Service Robotics*, 2019. Videos: Sim, Real.

Micah Corah and Nathan Michael. **Distributed submodular maximization on partition matroids for planning on large sensor networks**. *Conference on Decision and Control*, 2018.

Micah Corah and Nathan Michael. **Efficient online multi-robot exploration via distributed sequential greedy assignment**. *Robotics: Science and Systems*, 2017.

Micah Corah and Nathan Michael. **Active estimation of mass properties for safe cooperative lifting**. *International Conference on Robotics and Automation*, 2017.

Wennie Tabib, **Micah Corah**, Nathan Michael, and Red Whittaker. **Computationally efficient information-theoretic exploration of pits and caves**. *International Conference on Intelligent Robots and Systems*, 2016.

Derek Mitchell, **Micah Corah**, Nilanjan Chakraborty, Katia Sycara, and Nathan Michael. **Multi-robot long-term persistent coverage with fuel constrained robots**. *International Conference on Robotics and Automation*, 2015.

Select Preprints and Workshop Papers

Micah Corah and Sebastian Scherer. **On performance impacts of coordination via submodular maximization for multi-robot perception planning and the dynamics of target coverage and cinematography**. *RSS 2022 Workshop on Envisioning an Infrastructure for Multi-Robot and Collaborative Autonomy Testing and Evaluation*, 2022.

Micah Corah. **A simple bound for resilient submodular maximization with curvature**. *arXiv preprint arXiv:2105.04793*, 2021.

Other

Benjamin Morrell and **Micah Corah**. **Space exploration underground: A report on tests by NASA's Jet Propulsion Laboratory in Wells Cave, KY**. *The Kentucky Caver*, pages 14–21. Blue Grass Grotto, 2021.