

Levi “Veevee” Cai

Education

- Massachusetts Institute of Technology and Woods Hole Oceanographic Institution** *June 2019 to Present*
Graduate Student in Applied Ocean Science and Engineering & Electrical Engineering and Computer Science
Co-advised by Dr. Yogesh Girdhar, Dr. Dana Yoerger, and Prof. Daniela Rus
- University of Washington** *Sept. 2018 to June 2019*
Graduate Student in Aeronautics and Astronautics
Co-advised by Prof. Kristi Morgansen and Dr. Sarah Webster (UW APL)
- Massachusetts Institute of Technology** *May 2016 to May 2018*
Master of Science in Media Arts and Sciences, GPA: 5.0/5.0
Thesis, advised by Prof. Neri Oxman: “On-site Autonomous Fabrication at Architectural Scales”
- University of Pennsylvania** *Sept. 2008 to Dec. 2015*
Master of Science in Engineering in Robotics, 2015, GPA: 3.94/4.0
Bachelor of Science in Engineering in Computer Science, Minor in Mathematics, 2012, GPA: 3.35/4.0

Academic

- Woods Hole Oceanographic Institution** *2018 to Present*
Advised by Dr. Yogesh Girdhar, Dr. Dana Yoerger, and Prof. Daniela Rus
- Extended ROST (Realtime Online Spatiotemporal Topic modeling), an algorithm based on hierarchical Dirichlet processes to create “curiosity-driven” learning, to mapping settings. Used on underwater autonomous vehicles for exploring novel environments and classifying regions of interest into topics.
 - Developed controls for underwater and surface vehicles, testing infrastructure, and in-tank localization.
 - Researching machine learning and vision-based methods for autonomous marine animal tracking.
- University of Washington** *Fall 2018 to 2019*
Advised by Prof. Kristi Morgansen (UW Aero&Astro) and Dr. Sarah Webster (UW APL), Graduate Researcher
- Studied automated tuning strategies for Kalman filters used on UW Seaglidors, resulted in publication.
- MIT Media Lab, Mediated Matter Group** *May 2016 to 2018*
Advised by Prof. Neri Oxman, Graduate Research Assistant
- Designed controls, simulation, and software architecture for large-scale, mobile, autonomous robotic platform used for construction. Performed real-world demonstration of system by printing 14.6m diameter half-dome. Supported by *Alphabet’s X (formerly Google [x])*.
 - Developed all electronics, software, and controls for swarm-based robots that fabricate tubular fiberglass structures, experimentally verified by creating 20 robots, each autonomously built structures that were 4-meters tall.
- Univ. of Pennsylvania, GRASP Lab** *2009 to 2015*
Advised by Prof. Daniel Lee and Prof. Mark Yim, Graduate Research Assistant
- Developed a provably optimal algorithm for any-angle path planning by applying a novel overestimate heuristic to the Fast Marching Method. Additionally investigated heuristic strategies for multi-robot settings.
 - Developed software for user control of modular robots (CKBots) based on Robotics Bus Protocol.

Publications and Presentations

* Co-first author

Journal Articles

- Markus Kayser*, Levi Cai*, Sara Falcone, Christoph Bader, Nassia Inglessis, Barrak Darweesh, João Costa, Neri Oxman. “FIBERBOTS: An Autonomous Swarm-based Robotics System for Digital Fabrication of Fiber-based Composites.” *Springer Construction Robotics*, Dec. 2018.
- Markus Kayser*, Levi Cai*, Sara Falcone, Christoph Bader, Nassia Inglessis, Barrak Darweesh, Neri Oxman. “Design of a multi-agent, fiber composite digital fabrication system.” *Science Robotics*, Sept. 2018.

- Steven J. Keating, Julian C. Leland, Levi Cai, and Neri Oxman. "Toward site-specific and self-sufficient robotic fabrication on architectural scales." *Science Robotics*, Apr. 2017.

Conference Proceedings

- Levi Cai*, Burak Boyacıoğlu*, Sarah E. Webster, Kristi Morgansen. "Towards Auto-tuning of Kalman Filters for Underwater Gliders based on Consistency Metrics." *OCEANS MTS/IEEE*, 2019.
- Yogesh Girdhar, Levi Cai, Stewart Jamieson, Nathan McGuire, Genevieve Flaspohler, Stefano Suman, Brian Claus. "Enabling Co-Robotic Scientific Exploration of Unknown Environments over a Low Bandwidth Communication Channel." *IEEE International Conference on Robotics and Automation (ICRA)*, 2019.
- Markus Kayser, Levi Cai, Christoph Bader, Sara Falcone, Nassia Inglessis, Barrak Darweesh, João Costa, Neri Oxman. "FIBERBOTS: Design and Digital Fabrication of Tubular Structures Using Robot Swarms." *ROBARCH*, Aug. 2018. **KUKA Young Potential Best Paper Award.**

Additional Talks and Presentations

- "WARPAUV: A low-cost, vision-guided AUV for robotics research." Northeast Robotics Colloquium 2019. Poster.
- "Digital Construction Platform." Northeast Robotics Colloquium 2017. Poster.
- "Digital Construction Platform." MIT Robocon, 2017. Presentation.

Patents

- Markus Kayser, Levi Cai, Sara Falcone, Neri Oxman. "Methods and apparatus for tube fabrication." Patent application, Appl. No. US16/260,149.

Teaching

Univ. of Pennsylvania, Computer Science Dept.

Supervised by Prof. Lyle Ungar, Teaching Assistant

- CIS520, Intro. to Machine Learning, grad-level, Fall 2015
- CIS521, Intro. to AI, grad-level, Fall 2012

Professional

MasterStreet (startup), *Software Engineer*

2013 to 2014

IBM, *Software Engineer*

2012 to 2013

Awards and Honors

NDSEG Fellow 2019

Link Ocean Engineering Fellowship 2019 – Declined for NDSEG (4 awarded annually)

KUKA Young Potential Best Paper Award – For RobArch 2018 Conference paper

UPenn Rachleff Scholar – Highly-selective undergraduate research program

IBM T. J. Watson Scholarship

Service and Outreach

Robotics: Science and Systems Conference (RSS) 2017 Volunteer

MIT RoboCon Organizer – Helped organize an MIT/Boston-area robotics conference (<http://robocon.mit.edu/>)

IBM Extreme Blue Technical Mentor – Mentored team of engineering undergraduates and an MBA student

UPenn Summer Mentorship Program – Full-time instructor for 6-week, high-school summer technology course

Leadership and Extracurriculars

UPenn RoboCup SPL Vision, *Vision System Team Lead*

2009 to 2012

UPenn FSAE Race Car, *Electrical System Team Lead*

2010 to 2012