Permanent: 4080 Pinon Dr, Boulder CO, 80303
Email: levi@levicai.com
Web Portfolio: www.levicai.com

Levi "Veevee" Cai

Education

University of Washington *Aug. 2018 to Present*

Graduate Student in Aeronautics & Astronautics: Concentration in Controls
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
Thesis, advised by Prof. Lyle Ungar: "Sentiment Analysis of Citations for Research Papers"

Academic

Woods Hole Oceanographic Institution *Summer 2018*
Advised by Dr. Yogesh Girdhar, Guest Student

- Extended ROST (Real-time Online Spatiotemporal Topic modelling), an algorithm for unsupervised curiosity-driven learning, to mapping settings, conference publication submitted.
- Developed controls for underwater and surface vehicles, testing infrastructure, and in-tank localization.

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])*. Journal publication and conference presentations.
- 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. Multiple publications in journals and conferences.

Univ. of Pennsylvania, GRASP Lab *Summer to Fall 2015*
Advised by Prof. Daniel Lee, 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 to augment the M* algorithm.
- M* implementation acknowledgement in S. Tang and V. Kumar, *"A Complete Algorithm for Generating Safe Trajectories for Multi-Robot Teams"*. ISRR 2015.

Univ. of Pennsylvania, Modlab *Summer 2009 to 2012*
Advised by Prof. Mark Yim, Undergraduate Researcher

- Developed software for user control of modular robots (CKBots) based on Robotics Bus Protocol.

Univ. of Pennsylvania, GRASP Lab *Summer 2010*
Advised by Prof. Daniel Lee, Undergraduate Researcher

- Developed simple neural spike train and mutual information-based acoustic recognition algorithm.
- Presentation at the SUNFEST & Rachleff Scholars Symposium 2010.
- Funded by Rachleff Scholars Program.

Univ. of Colorado, Boulder: Intel. in Action Lab *Summer 2007/2008*
Advised by Prof. Gregory Grudic, Research Assistant

- Optimized MATLAB code for DARPA LAGR project (Learning Applied to Ground Robots) and individually built a mobile robot platform for use in future lab research.
- Funded by NSF Undergraduate Research Grant.

Publications and Presentations

Journal Articles

***** *Co-first author*

- 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*, 2018. (Accepted)
- 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

- 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. (Submitted for review)
- 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.***

Talks and Presentations

- "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 multi-agent composite tube fabrication." Provisional patent application US62/623,002.

Teaching

Univ. of Pennsylvania, Computer Science Dept.

Supervised by Prof. Lyle Ungar, Teaching Assistant

- CIS520, Intro. to Machine Learning, grad-level, created assignments and held office hours, Fall 2015
- CIS521, Intro. to AI, grad-level, created assignments and projects, Fall 2012

Professional

MasterStreet (startup) *2013 to 2014*

Software Engineer

- Built search engine for professional development classes using Ruby on Rails, ElasticSearch, and AWS

IBM *2012 to 2013*

Software Engineer

- Developed server management mobile app using Dojo/Cordova for iOS/BB/Android platforms

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
FIRST Robotics Mentor – NCSSM Team 900
UPenn Summer Mentorship Program – Full-time instructor for 6-week, high-school summer technology course
FIRST Lego League Coach – FACTS Middle School, afterschool robotics team coach

Awards and Honors

KUKA Young Potential Best Paper Award – RobArch 2018 Conference paper

UPenn Rachleff Scholar – Highly-selective undergraduate research program
IBM T. J. Watson Scholarship
UPenn Dean's List

Leadership and Extracurriculars

UPenn RoboCup SPL Vision *2009 to 2012*

Vision System Team Lead

- Developed basic vision algorithms (line and horizon detection), and led small group of undergraduates, to improve on vision system for humanoid robot soccer competition (using the Nao platform). Team placed as quarter-finalist/24 teams in 2010 RoboCup SPL competition.

UPenn FSAE Race Car *2010 to 2012*

Electrical System Team Lead

- Designed and constructed the electrical system for a competitive Formula-style race car, 1 of 4 core members, team placed 18th/108 at the 2011 Formula SAE competition.

Additional Skills

Programming	C/C++, ROS, CUDA, Java, MATLAB/MEX, Python, Ruby, Full Web Stack
Software	Eagle PCB CAD, SolidWorks, Adobe Illustrator