

Karena X. Cai

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EDUCATION

- 09/15-present **California Institute of Technology**, Pasadena, CA, Expected June 2020
PhD Candidate in Control and Dynamical Systems, GPA: 3.9
Advisors: Richard M. Murray and Soon-Jo Chung
- 09/11-06/15 **Princeton University**, Princeton, NJ
B.S.E. in Mechanical and Aerospace Engineering, Magna Cum Laude, Dept. GPA: 3.8
Minors in the Applications of Computing and Robotics and Intelligent Systems

HONORS AND AWARDS

- 10/18 **Simoudis Discovery Grant Recipient**, awarded funding to an outstanding student working on emerging projects at the intersection of big data, machine learning, and autonomy.
- 3/16-3/17 **National Science Foundation Honorable Mention**
- 06/15 **George Bienkowski Memorial Prize**, awarded to a senior student of sound academic standing and who has contributed to the department and engineering through their service during their career at Princeton.
- 06/15 **Morgan McKinzie 93 Senior Thesis Prize Honorable Mention**

CURRENT RESEARCH

- 05/17-present **Bayesian Estimation with Semantic Data**
- Augmenting Bayesian estimation algorithms with data from computer-vision based object classification algorithms.
 - Experimentally validating algorithms on aerial vehicle platforms.
- 06/18-present **Rules of the Road: Towards Guaranteeing Correct Behavior for Autonomous Vehicles**
- Derived a systematic procedure for generating prioritization over a set of rules for self-driving cars so correct and transparent behaviors can be guaranteed even when some not all rules can be satisfied simultaneously.

WORK EXPERIENCE

- 06/19-present **Software Engineering Intern at Lyft Level 5 Self-Driving**
- Leveraging semantic data to enhance computer-vision based generative machine learning models that predict the behaviors of agents in complex urban environments.

RESEARCH EXPERIENCE

- 09/14-06/15 **Senior Thesis:** The Modeling, Simulation, and Analysis of the Central Pattern Generator Involved in Cockroach Locomotion, Prof. Philip Holmes.
- Investigated the linearized Central Pattern Generator model to analyze the system's stability.
 - Linked mathematical analysis with experimental data on cockroach response to perturbations.
- 06/14-09/14 **ETH Zurich, Researcher**, Prof. Raffaello D'Andrea, Zurich, Switzerland
- Improved model for Blind Juggler Machine by rewriting the program in C to increase simulation speed by 4000.

- 06/13-09/13 **University of Pennsylvania, REU Researcher**, Prof. Daniel Koditschek, Philadelphia, PA
- Independently derived a model to simulate the dynamics of a flexible-spine quadruped.
 - Discovered a passive-hybrid limit cycle in the simulated bounding motion of the quadrupedal model.

TEACHING/MENTORSHIP EXPERIENCE

- 04/18-06/19 **BE 107 Exploring Biological Principles Through Bio-Inspired Design TA**, Caltech
- Designed series of robotics labs that integrated GoPiGo Robot platform, ROS software, and OptiTrack Motion Capture system.
 - Lectured on Robotics Operating System (ROS) and Linux fundamentals.
- 04/18-06/18 **CDS 110/CHE 105 Introduction to Feedback Control Systems TA**, Caltech
- Held office hours and graded assignments.
- 09/16-06/17 **Caltech Rise tutor**, Caltech
- Tutored economically disadvantaged high school students in Caltech afterschool program.

TECHNICAL PROJECTS

- 09/13-11/13 **Crane Design Project**
- Designed and fabricated lightweight (2.5-lb) crane structure that withstands a 500-lb load.
 - Optimized crane for strength and weight using finite element analysis in Pro/E.
- 02/13-06/13 **Pet-Owner Android Application**
- Developed an Android application allowing pet owners to monitor the physical activity and health of their pet with Arduino, Bluetooth, IMU, and force sensor.

LEADERSHIP EXPERIENCE

- 01/13-present **American Society of Mechanical Engineers, President, Student Outreach Chair**
- Organized Regional Engineering Olympics competition for high school students.
 - Hosted educational trip to co-generation plant, faculty panels, and guest speakers.

PROFESSIONAL TALKS

- 05/19 **SoCal Controls Workshop**
- Rules of the Road: Towards Assume Guarantee Profiles for Autonomous Vehicles

PEER-REVIEWED PUBLICATIONS

K. X. Cai, A. Harvard, R. M. Murray, and S. Chung. *Robust Estimation Framework with Semantic Measurements*. American Control Conference, 2019.

T. M. Phan*, K. X. Cai* and R. M. Murray. *Towards Assume-Guarantee Profiles for Autonomous Vehicles*. Conference on Decision and Control, 2019. *In review*.

TECHNICAL SKILLS

Computer: Python, MATLAB, C/C++, OpenCV, ROS, Arduino, Pro/ENGINEER, Tensorflow, and Adobe Illustrator.

Fabrication: Experience with most machining equipment and rapid prototyping tools.