Bo Fu

bofu@umich.edu https://bofu.page LinkedIn GitHub

EDUCATION

University of Michigan Ann Arbor, MI
Ph.D. in Robotics *Aug 2019-Present*
GPA: 4.00/4.00

Carnegie Mellon University Pittsburgh, PA
Master of Science in Mechanical Engineering *Aug 2017-May 2019*
GPA: 4.00/4.00
Courses: Computer Vision (rank 1/137), Engineering Optimization, Planning and Decision-making in Robotics, AI and Machine Learning in Engineering Design, Robot Localization and Mapping

Tongji University Shanghai, China
Bachelor of Engineering in Vehicle Engineering (Automotive Electronics) *Sep 2012-Jul 2017*
GPA:4.90/5.00 (rank 1/197)
Courses: Automatic Control Theory, Simulation and Design for Control Systems, Signal and System

SKILLS

Engineering: C/C++, Python, MATLAB/Simulink, LaTeX, ROS, OpenCV, Inventor**,** Autocad**,** Altium Designer
Languages: English (Fluent), German (Fluent), Mandarin (Native)

PUBLICATIONS

- **B. Fu**, T. Kathuria, D. Rizzo, M. Castanier, X. J. Yang, M. Ghaffari, and K. Barton, "Simultaneous human-robot matching and routing for multi-robot tour guiding under time uncertainty," Journal of Autonomous Vehicles and Systems, vol. 1, no. 4, p. 041005, 2021.
- M. Deng, **B. Fu**, and C. Menassa, "Room match: Achieving thermal comfort through smart space allocation and environmental control in buildings," in Proceedings of the 2021 Winter Simulation Conference (WSC). IEEE, 2021, pp. 1-11.
- **B. Fu**, W. Smith, D. Rizzo, M. Castanier, M. Ghaffari, and K. Barton, "Robust task scheduling for heterogeneous robot teams under capability uncertainty," arXiv preprint arXiv:2106.12111, 2021. [Under review]
- **B. Fu**, W. Smith, D. Rizzo, M. Castanier, and K. Barton, "Heterogeneous vehicle routing and teaming with Gaussian distributed energy uncertainty," in *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2020, pp. 4315-4322
- **B. Fu**, K. S. Shankar, N. Michael, "Rad-VIO: Rangefinder-aided downward visual-inertial odometry," in *2019 International Conference on Robotics and Automation (ICRA)*. IEEE, 2019, pp. 1841–1847.
- J. Hao, Z. Yu, Z. Zhao, X. Zhan, **B. Fu**, and P. Shen, "Development and optimization of energy management strategy for four-wheel-drive plug-in hybrid electric vehicle," *Mechatronics Journal*, 2018, no. 8, pp.12-19, 30.

RESEARCH PROJECTS

Resilient Vehicle Teaming in Uncertain Environments *June 2019-Present*

Advisor: Prof. Kira Barton, Prof. Maani Ghaffari, University of Michigan

- Establish a learning model to estimate the vehicle capabilities and task requirements for task allocation.
- Develop a planner that optimizes user-defined objectives and generates teams, routes, and schedules for tasks (*largest case tested:140 agents and 40 tasks, solved within 120 sec, optimality gaps < 10% for most cases*).
- Develop a replanning mechanism that partially updates the plan in real-time under uncertainty and disturbances.

Human-robot matching and routing for multi-robot tour guiding *June 2021-Present*

Advisor: Prof. Kira Barton, Prof. Maani Ghaffari, University of Michigan

- Develop a behavioral model that estimates reward functions based on human needs in tour guide scenarios
- Formulate a scalable algorithm that optimally matches humans with robots and generates the tour and schedules for tour guide tasks (*largest case tested: 50 robots, 250 humans, and 50 tour places, solved within 120 sec*)

Multirotor Downward Visual-Inertial Tracker *Sep 2017-May 2019*

Advisor: Prof. Nathan Michael, Carnegie Mellon University

- Built a quadrotor state estimator based on a downward camera, laser and IMU which operates at 150 Hz and can be used for high speed closed loop control
- Developed a homography based frame to frame visual tracking algorithm that improves the accuracy and robustness compared to related previous publications
- Investigated an Extended Kalman Filter model, which is suitable for camera, laser, IMU fusion on multirotor
  Video: https://youtu.be/6LGKj8MTYQ8

Control Strategy for 4WD Plug-in Hybrid Electric Car *Aug 2016-Jun 2017*

Advisor: Prof. Zhiguo Zhao, Tongji University

- Developed a rule-based control strategy, which achieved a 24.41% fuel consumption decrease in simulation compared to result of the original internal combustion engine vehicle
- Optimized strategy parameters based on genetic algorithm and achieved an additional 1.53% fuel consumption reduction
- Conducted hardware-in-the-loop test of hybrid control unit to prove the function, reliability, robustness

EXPERIENCE

Bosch Engineering GmbH/EPT-CN, Robert Bosch Investment (China) Ltd. *Aug-Dec 2016*

Intern, Software Group Shanghai, China

- Constructed, tested Simulink models for two hybrid electric vehicle structures, whose simulation results used for project bidding
- Built a hybrid control unit strategy of hybrid electric vehicle (including torque-limitation, torque-demand, torque-distribution blocks), which was used in a sample vehicle of a domestic automobile corporation

COURSE PROJECTS

H-infinity Control on the Cubli System *Mar-Apr 2020*

Guide: Prof. Peter Seiler, University of Michigan Ann Arbor, MI

- Implemented H-infinity control on the Cubli system and stabilize it to the upright unstable equilibrium points
- Developed a simulation platform for the Cubli that evaluates and visualizes the performance of the control system

  Demo link: https://youtu.be/wlQBQwDsPbM

Spider Legged Robot Climbing in 3D Block World *Oct-Dec 2018*

Guide: Prof. Maxim Likhachev, Carnegie Mellon University Pittsburgh, PA

- Developed algorithms for a simulated spider robot with sticky feet that climbs in a 3D block map with optimal global path and leg motion that avoids collision with the environment
- Implemented the global path planning with weighted A* search, footstep planning based on a list of motion primitives, leg motion planning with RRT* algorithm to achieve the functionality

  Demo link: https://youtu.be/5sN6tYRFDEo

Image Alignment Using Robust Loss Functions *Mar-May 2018*

Guide: Prof. Jeremy J. Michalek, Carnegie Mellon University Pittsburgh, PA

- Applied sequential quadratic programming with BFGS on a homography based image alignment problem using least squares, Huber, Tukey, and a Gaussian weighted cost functions
- Demonstrated that Tukey cost function with finite difference implementation generated the most robust alignment performance on images with noise and outliers that broke the planar assumption of the homography constraint

AWARDS/HONORS

Best Student Lightning Talk Finalist at Automotive Research Center Program Review (2021)
Shanghai Outstanding Graduate (2017)
Excellent Graduation Thesis of Tongji University (2017)
China National Scholarship (2015-2016/2014-2015/2012-2013)
Excellent Student of Tongji University (2015-2016/2014-2015/2013-2014/2012-2013)
First Class of Learning Scholarship of Tongji University (2015-2016/2014-2015/2012-2013)