Brian H. Wang

Senior Robotics Researcher, Perception & Autonomy · Draper Laboratory

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Education

Cornell University — *Ithaca, NY*

Ph.D. in Aerospace Engineering — *August 2016 - January 2022*

Advisor: Professor Mark Campbell
Thesis Title: Perception and Planning for Autonomous Navigation in Unstructured Environments
Thesis Committee: Profs. Mark Campbell, Kilian Q. Weinberger, and Silvia Ferrari
GPA: 4.09
Selected Coursework: Autonomous Mobile Robots, Human-Robot Interaction, Machine Learning for Intelligent Systems

Cornell University — *Ithaca, NY*

M.Eng. in Aerospace Engineering — *August 2015 - May 2016*

Advisor: Professor Mason Peck
Thesis Title: Optical Attitude Determination for Autonomous Spacecraft
GPA: 3.45
Selected Coursework: Feedback Control Systems, Multivariable Control Theory, Robotic Manipulation

Cornell University — *Ithaca, NY*

B.A. in Computer Science — *August 2011 - May 2015*

GPA: 3.60
Selected Coursework: Object-Oriented Programming and Data Structures, Systems Programming, Dynamics

Experience

Draper Laboratory — *Cambridge, MA*

Senior Robotics Researcher - Perception & Autonomy — *February 2022 - Present*

- Design algorithms and implement software, in Python/C++ using the Robot Operating System (ROS), to enable robust perception and guidance capabilities on autonomous unmanned aerial vehicles (UAV's).
- Plan and execute tests, using photorealistic 3D simulations as well as data collected on physical quadrotor UAV's, to validate performance of perception and autonomy algorithms.
- Support in-field flight tests of autonomy software on board quadrotor UAV platforms.

Autonomous Systems Lab — *Ithaca, NY*

Ph.D. Researcher — *September 2016 - January 2022*

- Research projects included vision- and lidar-based robotic perception, probabilistic tracking and estimation, and navigation in unstructured and uncertain environments.
- Conducted laboratory experiments using Clearpath Jackal mobile robots, Robot Operating System (ROS) software, and a Vicon motion capture system.

Draper Laboratory — *Cambridge, MA*

Ph.D. Student Intern — *July 2019 - October 2019*

- Supervisor: Dr. Gian Luca Mariottini
- Graduate student intern in the Perception & Autonomy group.
- Designed and implemented system architecture for autonomous vision-based navigation on resource-constrained quadrotor drones.
- Performed flight tests on a Parrot Bebop 2 drone.

NASA Langley Research Center — *Hampton, VA*

Engineering Intern — *June 2015 - August 2015*

- Supervisor: Dr. James Warner
- Worked alongside NASA Langley scientists in developing ScIFEN (SCalable Implementation of Finite Elements at NASA), a free-to-use finite element analysis program optimized for massively multicore supercomputers.
- Designed and implemented the graphical user interface for ScIFEN in the Python programming language, improving the usability of the program and facilitating its adoption by NASA researchers.

Cornell University Cislunar Explorer CubeSat *Ithaca, NY*

Attitude Determination and Control Subsystem Team *June 2014 - May 2016*

- Assisted with implementation of a computer-vision based attitude determination system on a Raspberry Pi computer board, enabling deep-space operations for a miniaturized, low cost lunar satellite which is schedule to launch on the NASA Orion spacecraft.

Publications

Journal Papers

- **Wang, B. H.**, Chao, W., Wang, Y., Hariharan, B., Weinberger, K. Q., and Campbell, M. "LDLS: 3-D Object Segmentation Through Label Diffusion From 2-D Images." *IEEE Robotics and Automation Letters*, vol. 4, no. 3, pp. 2902-2909, July 2019. *Presented at the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) in Macau, China.*

Conference Papers

- **Wang, B. H.**, Diaz-Ruiz, C., Banfi, J., and Campbell, M. "Detecting and Mapping Trees in Unstructured Environments with a Stereo Camera and Pseudo-Lidar." *International Conference on Robotics and Automation (ICRA), 2021.*
- Wang, Y., Lai, Z., Huang, G., **Wang, B. H.**, van der Maaten, L., Campbell, M., and Weinberger, K. Q. "Anytime Stereo Image Depth Estimation on Mobile Devices". *International Conference on Robotics and Automation (ICRA), 2019.*
- **Wang, B. H.**, Wang, Y., Weinberger, K. Q., and Campbell, M. "Deep Person Re-identification for Probabilistic Data Association in Multiple Pedestrian Tracking". *Arxiv preprint.*
- Gemerek, J. R., Ferrari, S., **Wang, B. H.**, and Campbell, M. "Video-guided Camera Control for Target Tracking and Following". *IFAC Conference on Cyber-Physical and Human Systems, 2018.*

Leadership and Service

Asian Pacific American Employee Resource Group at Draper *Cambridge, MA*

Professional Development Co-Lead *October 2022 - Present*

Reviewer

Reviewed conference paper submissions for:

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2019
- IEEE International Conference on Robotics and Automation (ICRA), 2021 and 2022

Debates on the Future of Robotics Research: Conference Workshop *Online Event*

Organizing Committee (2019-2021), Technical Chair (2021) *September 2019 - June 2021*

- Organized series of debates on the impacts and direction of robotics research, held as online workshops at ICRA 2020 and 2021.

SiGMA: Sibley Graduates in Mechanical and Aerospace *Ithaca, NY*

Treasurer *August 2018 - May 2021*

Cornell AI Driving Olympics Team *Ithaca, NY*

Co-founder, Project Supervisor *September 2018 - May 2020*

Sport Taekwondo at Cornell *Ithaca, NY*

President (2014-2015), Treasurer (2013-2014) *August 2011 - May 2017*

Teaching and Mentorship

Draper Laboratory — *Cambridge, MA*

Draper Scholar Mentor — *December 2022 - Present*

- Supervise master's student research on reinforcement learning for robot collision avoidance, as a Draper Scholar mentor.
- Advise research direction and machine learning software implementation.

Autonomous Systems Lab — *Ithaca, NY*

Student Mentor — *August 2017 - May 2021*

- Mentor for undergraduate and master's student projects in the Autonomous Systems Lab, including:
  - 3-D object detection-based SLAM.
  - Aerial robot simulation in Unreal Engine.
  - Object detection, particle filter localization, and lane following for autonomous driving on miniature robotic cars.
  - Embedded system design for a stereo camera data collection sensor package.

eCornell: Autonomous Mobile Robots — *Ithaca, NY*

Course Content Developer — *June 2020 - March 2021*

- Course instructor: Prof. Hadas Kress-Gazit
- Developed slides, animations, and coursework on robotics algorithms, for an online version of Cornell's Autonomous Mobile Robots course to be offered through the eCornell certificate program.

MAE 5180: Autonomous Mobile Robots — *Ithaca, NY*

Teaching Assistant — *January 2020 - May 2020*

- Course instructor: Prof. Hadas Kress-Gazit
- Graduate-level course on algorithms for autonomous robots.
- Taught students fundamental robotics algorithms for localization, mapping, SLAM, and path planning.
- Led lab sessions, recitations, and office hours, and assisted with designing course materials.

CS 3410: Systems Programming — *Ithaca, NY*

Teaching Assistant — *January 2015 - May 2016*

- Core computer science class on computer architecture and the hardware-software interface.
- Led weekly recitations and office hours, and graded exams and programming projects.

Skills

Technical Skills: Software

- **Programming languages:** Experienced with Python. Proficient with C++, MATLAB.
- **Software tools:** Robot Operating System (ROS, including ROS 1 and ROS 2), NumPy, Numba, OpenCV, StereoLabs ZED SDK, Git, Linux.

Technical Skills: Hardware

- **Robot platforms:** Clearpath Robotics Jackal, Rethink Robotics Baxter, iRobot Create, Parrot Bebop 2.
- **Embedded systems:** Raspberry Pi, Arduino, Nvidia Jetson.
- **Sensors:** Stereolabs ZED camera, Velodyne VLP-16 lidar, Intel RealSense RGBD camera.

Languages

- **English** (native speaker)
- **Korean** (conversant)
- **Mandarin Chinese** (basic knowledge)