Zili Wang

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EDUCATION

Boston University   **Boston, MA**
Ph.D. in Systems Engineering   *Expected May 2025*

Columbia University   **New York, NY**
M.S. in Mechanical Engineering   *Dec 2018*

University of Southampton   **UK**
B.Eng. in Electromechanical Engineering   *Jun 2016*

SKILLS

- **Interests:** Robotics, Machine Learning, Motion Planning and Control, Optimization, Computer Vision.
- **Programming:** Python, MATLAB, C/C++, PyTorch, TensorFlow, OpenCV, Simulink, Git, Linux
- **Robotics:** ROS, Gazebo, GTSAM, CVX, Gurobi

RESEARCH EXPERIENCE

Robotics Lab, Boston University   **Boston, MA, USA**
Advisor: Prof. Roberto Tron and Prof. Sean Andersson   *Jun 2020 - Present*

- **Controller Synthesis with Neural Network Verification**: Proposed a monotonic Lyapunov neural network and utilized Mixed Integer Linear Program (MILP) to synthesize controllers for nonlinear systems, reducing training time by 50% compared to baseline methods. Formulated an MILP to expand the Lyapunov level set, maximizing the region of attraction (ROA) while ensuring controller stability. Extending this framework to integrate collision avoidance in polygonal environments.
- **Box-based Robot Mapping and Navigation**: Designed a CNN-Transformer architecture in PyTorch to predict room and door boxes from geometric maps, enabling compact graph-based mapping with a quadratic reduction in storage. Developed an exploration strategy that reduced mean travel path length by 31% compared to frontier-based baselines. Supervised a Master's student in implementing Gazebo simulations.
- **Task-Driven Robot Navigation**: Created a multi-task encoder-decoder network in TensorFlow to infer semantic data from non-semantic measurements for navigation tasks. Developed a hybrid exit search strategy that reduced travel path length by 60%, combining data-driven estimation with traditional motion planning. Designed a map generation algorithm for producing topometric maps of structured environments.
- **Bearing-based Formation Control**: Formulated an optimization problem to tune a bearing-based formation controller for nonlinear systems, achieving a 66% reduction in traveled path length. Generalized the framework for varying robot topologies and initial conditions.
- **SLAM for Resource-Constrained Robots**: Trained a neural network in TensorFlow to predict relative poses and detect loop closures using ROS datasets. Evaluated a 2D LiDAR reconstruction algorithm and improved localization accuracy through Pose Graph Optimization (GTSAM).

Robotics and Rehabilitation (RoAR) Lab, Columbia University   **New York, NY**
Advisor: Prof. Sunil Agrawal   *Feb 2018 - Aug 2018*

- Developed a portable trunk tracking system for the Rehabilitative Trunk Support Trainer (TRuST) using HTC Vive Tracker, achieving low tracking errors in translation and rotation.
- Applied YOLO object detection with depth camera images to localize cable attachment points.

SMART BioSystems and Micromechanics (BioSyM), Nanyang Technological University   **Singapore**
Advisor: Prof. Justin Dauwels   *Oct 2016 - Apr 2017*

- Automated micropipette aspiration of biological cells using an XY translation stage and MATLAB-based GUI.

o Applied image processing techniques (e.g., K-means clustering, Kalman filter) to detect, segment, and track deformed white blood cells.

PUBLICATIONS

o **Z. Wang**, C. Allum, S. B. Andersson and R. Tron. "BoxMap: Efficient Structural Mapping and Navigation," *IEEE International Conference on Robotics and Automation (ICRA, submitted) 2025.* [Link]

o **Z. Wang**, S. B. Andersson and R. Tron. "Lyapunov Neural Network with Region of Attraction Search," *IEEE American Control Conference (ACC)*, pp. 3403-3410, 2024. [Link]

o **Z. Wang**, D. Threatt, S. B. Andersson, and R. Tron. "Do More with Less: Single-Model, Multi-Goal Architectures for Resource-Constrained Robots," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 1940-1946, 2023. [Link]

o **Z. Wang**, S. B. Andersson and R. Tron. "Bearing-Based Formation Control with Optimal Motion Trajectory," *IEEE American control conference (ACC)*, pp. 486-493, 2022. [Link]

o **Z. Wang**, S. B. Andersson, and R. Tron. "Task-Driven Navigation: Leveraging Experience using Deep Learning." *IEEE ICRA Workshop on Robotic Perception and Mapping: Emerging Techniques*, 2022. [Link]

INTERNSHIP EXPERIENCE

Siemens Technology   **Princeton, NJ**
Automation and Robotics Researcher/Engineer Intern   *Aug 2018 - Dec 2018*

o Conducted a study in edge computing technologies, analyzing their application.
o Collected and transmitted sensor data to a cloud platform for real-time analysis in plant power systems.
o Tested motion planning algorithms in an agricultural robot system, optimizing task execution efficiency.

TEACHING EXPERIENCE

Systems Engineering Division, Boston University   **Boston, MA**
Graduate Teaching Assistant   *Spring 2020 & 2021*

o **ME302 Engineering Mechanics II**: Led weekly discussions and office hours for 20 students, clarifying concepts and solving problems. Designed and facilitated labs for 90 students, graded reports, and exams.
o **EK381 Probability, Statistics, and Data Science for Engineers**: Conducted weekly discussions and office hours for 20 students, supporting probability and data science concepts. Proctored and graded exams.

HONORS & AWARDS

Grace Hopper Celebration Awards, Boston University	2022, 2023
Travel Award, IEEE ACC & IROS	2022, 2023
Distinguished Fellowship, Boston University	2019
First Class Honor, University of Southampton	2016
Zepler Prize (top 1), University of Southampton	2015

Leadership

Reviewer, IEEE ICRA/ACC/IROS/CDC	2022–Present
Volunteer, Learning to Trust Autonomy Workshop	2024
Student Host, CISE Seminar, Boston University	2021–2023
Mentor, Greater Boston Research Opportunities for Young Women	2022
Mentor, ME570 Robot Motion Planning, Boston University	2020–2022
Mentor, Research in Science & Engineering (RISE) Program	2021