

Matthew Boler

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Education

- **Auburn University** Auburn, AL
Ph.D., Mechanical Engineering Anticipated May 2025
- **Auburn University** Auburn, AL
M.S., Mechanical Engineering August 2021
 - Thesis: "Observability-Informed Measurement Validation for Visual-Inertial Navigation"
 - Advisor: Dr. Scott Martin
- **Auburn University** Auburn, AL
B.S. Mechanical Engineering, Computer Science Minor May 2019

Experience

- **GPS and Vehicle Dynamics Laboratory** Auburn, AL
Graduate Research Assistant 2019 - Current

Multispectral Visual Navigation

- Developed a Multi-State Constraint Kalman Filter (MSCKF) with holonomic constraints and online extrinsic calibration for GPS-denied infrared+INS ground vehicle navigation.
- Designed a full-smoothing visual-inertial SLAM system using ISAM2 and a novel geometric validation module for robust feature initialization.
- Reduced sensitivity of visual SLAM systems to dynamic environments by adaptively segmenting static and dynamic image regions using YOLO and monitoring feature behavior.

Autonomous Tiger Racing

- Developed a robust ground-removal algorithm for LIDAR obstacle detection to handle large bank angles using a smoothed height-variance map in ROS and PCL.
- Developed a combined offline graph SLAM and online particle filter localization subsystem using LIDAR, wheel odometry, and IMU.
- Developed a lightweight path planning node in ROS to generate minimum-jerk trajectories at 200Hz.

- **Sandia National Laboratories** Albuquerque, NM
Intern - Navigation, Pointing, and Control 2020
 - Designed experiments to determine performance characteristics of image registration methods for multispectral/hyperspectral imaging systems.
 - Implemented modified Fourier-Mellin, SIFT, and other algorithms to improve registration performance between visual-spectrum and hyperspectral images.

Skills

Languages: C++, Python, Matlab, Julia

Software: Git, L^AT_EX, Docker, Robot Operating System (ROS) 1 and 2

Libraries: Numpy, SciPy, Pandas, OpenCV, PyTorch, Eigen, PCL, Open3D, GTSAM