Matthew Boler

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Education

- **Auburn University** — Auburn, AL
  Ph.D., Mechanical Engineering — *Anticipated May 2025*
  – Research Topic: Robust inertial navigation and optimal control
- **Auburn University** — Auburn, AL
  M.S., Mechanical Engineering — *May 2022*
  – Thesis: "Observability-Informed Measurement Validation for Visual-Inertial Navigation"
- **Auburn University** — Auburn, AL
  B.S. Mechanical Engineering, Computer Science Minor — *May 2019*

Publications available upon request

Experience

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

  RSSI-Aided Navigation
  – Implemented an error-state marginalized particle filter to aid an inertial navigation system with signal anomaly maps.
  – Developed nonparametric mapping methods using gaussian processes to update anomaly maps.
  – Analyzed sensitivity of navigators to map, sensor, and initialization errors using monte-carlo simulations.

  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 lighweight path planning node in ROS to generate optimal trajectories at 200Hz.

- **Sandia National Laboratories** — Albuquerque, NM
  Intern - GNC, Autonomy — *2020, 2022*
  – Developed a robust real-time lidar odometry for edge platforms using adaptive nonlinear smoothing
  – 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, LaTeX, Docker, Robot Operating System (ROS) 1 and 2