Brendon Forsgren

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LinkedIn Profile

EDUCATION

Brigham Young University, Provo, Utah, USA

- PhD candidate in Mechanical Engineering (5th year) — Aug 2023
  - Graduate GPA: 3.93/4.0
- B.S. in Mechanical Engineering — Apr 2018
  - Cumulative GPA: 3.86/4.0
- Graduate Coursework
  - Autonomous Systems
  - Mathematics of Signals and Systems
  - Stochastic Processes
  - Robotic Vision
  - Optimization Techniques
  - Linear System Theory
  - Nonlinear System Theory
  - CAE Software Development
  - Deep Learning
  - Flight Dynamics and Controls

EXPERIENCE

VectorNav Technologies, Dallas, Texas, USA

- Navigation Engineer — Sep 2023–Present
  - Developed an EKF for airspeed-aided inertial navigation in GPS-denied environments
  - Implemented a forward-backward smoother to generate a truth reference used to evaluate INS performance in GPS-denied/degraded environments
  - Ported a Hard/Soft Iron calibration routine from C to modern C++

Brigham Young University, Provo, Utah, USA

- Graduate Research Assistant, BYU MAGICC Lab — Apr 2018–Aug 2023
  - Research in cooperative GPS-denied navigation
  - Robust outlier detection in high outlier regimes for multi-agent SLAM
  - Robust pose graph optimization techniques

Air Force Research Laboratory, Munitions Directorate, Eglin Air Force Base, FL

- NSF-AFRL Graduate Research Intern — Oct 2022–Apr 2023
  - Implemented a MSCKF for accurate GPS-denied navigation of high flying vehicles
  - Team lead role in preparation for real-time flight test of MSCKF
  - Developing a novel cooperative navigation framework that scales with the number of vehicles and requires low communication bandwidth
- AFRL Scholars Intern, Secret Security Clearance — Jun 2021– Aug 2021
  - Implemented a cooperative pose graph optimization algorithm
  - Demonstrated cooperative pose graph optimization algorithm in a real-time hardware demonstration

Near Earth Autonomy, Pittsburgh, PA, USA

- Robotics Engineering Intern — May 2019 – Aug 2019
  - IMU evaluation for GPS enabled missions
  - Integrated external IMU system with existing hardware in several autonomous flights
  - Evaluation of IMU noise characteristics
  - Wrote post processing scripts to evaluate performance

SKILLS

Computer Programming

- Languages: C++, Python, Matlab
- Familiarity with OpenCV, ROS, and Eigen libraries
- Event driven programming in C

Computer Vision

- Used stereo vision to track and catch a baseball traveling at 40mph
- Implemented a tightly-coupled visual-inertial odometry algorithm
- Demonstrated a lane following algorithm on a small scale self-driving car
- Developed optical flow and visual servoing controllers on a quadrotor in simulation

State Estimation

- Familiar with Kalman filters, Particle filter, and SLAM algorithms
- Familiarity with factor graphs and non-linear optimization techniques over Lie Groups
- Implemented a Moving Horizon Estimator in real time on Turtlebot data
- Familiarity with Ceres and GTSAM software libraries
- Developed a UAV flight simulator in ROS using Python and C++

Sensors

- Familiarity with IMU sensors (accelerometers, gyroscopes, and magnetometers)
- Image processing and calibration for RGB/RGB-D cameras
- Airspeed Sensors and pressure altimeters
- GNSS receivers and signals

Control and Path Planning

- Familiar with PID, loop shaping, state space, MPC and LQR controllers
- Implemented PID and state space controllers on hardware
- PID, Loop shaping, and State Space controllers on multiple systems in simulation and hardware
- Implemented Model Predictive Control and LQR control on a multirotor UAV in simulation
- Implemented RRT and Differential Flatness based path planners
- Implemented a spanning tree path planning algorithm for robot coverage of an unknown space

Deep Learning

- Using and training Convolutional, Recurrent and GAN neural networks
- Training an RNN to estimate wind speed from a UAV

Mechatronics

- Created an autonomous robot with a Pic24 microcontroller and a variety of sensors
- Created a mobile robotic arm with an Arduino and Raspberry Pi

PUBLICATIONS

- *Direct Relative Edge Optimization, a Robust Alternative for Pose Graph Optimization*, IEEE Robotics and Automation Letters, 2019
- *Group-k Consistent Measurement Set Maximization for Robust Outlier Detection*, IEEE IROS 2022
- *Incremental cycle bases for cycle-based pose graph optimization*, IEEE Robotics and Automation Letters, 2023
- *Cooperative Navigation of Autonomous Vehicles in Challenging Environments*, BYU Scholars Archive, 2023
- *Group-k consistent measurement set maximization vis maximum clique over k-uniform hypergraphs for robust multi-robot map merging*, International Journal of Robotics Research, 2024

VOLUNTEER EXPERIENCE

The Church of Jesus Christ of Latter Day Saints, Cuiaba, Brazil

- Full Time Volunteer Missionary: Portuguese Speaking — Jul 2013– Jun 2015
  - Developed strong communication skills with people from various cultures
  - Gave weekly training in goal setting and time management to groups of 20 missionaries