BRENNAN CAIN

Software Engineer - Cloud, Embedded, Robotics
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EXPERIENCE

NODAR, Inc., Somerville, MA, USA
*Application Engineer***,** December 2024 - Present
- Streamlined manufacturing and release for Hardware Development Kit
- Integrated scalable node-locked, airgapped, scalable licensing for software distributions.
- Defined, designed, built, and maintained a Ground-Truth accurate stereo image processor in AWS in multiple regions.
- Supporting sales and customers through demonstrations and direct assistance

Storage Gateway Team, Amazon Web Services, Boston, MA, USA
*Software Development Engineer II***,** October 2024 - December 2024
*Software Development Engineer I***,** February 2022 - October 2024
- Designed and implemented a security update distribution system for hardware appliances.
- Migrated backend services from managed servers to AWS Lambda and ECS Fargate.
- Enabled CI/CD across multiple customer-impacting pipelines.
- Created systems to improve and automate region expansion.

*Software Development Engineer I Intern***,** May 2021 - July 2021
- Designed a Command-Line Interface for a hardware appliance.
- Created secure commands to interface with system-level processes.

Unmanned Systems and Robotics Lab, University of South Carolina, Columbia, SC, USA
Principal Investigator: Dr. Nikolaos Vitzilaios
*Undergraduate Research Assistant***,** September 2018 - December 2021
- Developed a cooperative system of aerial and surface vehicles.
- Integrated a fiducial tag library with ROS and completed a survey of fiducial tag libraries.

Autonomous Field Robotics Lab, University of South Carolina, Columbia, SC, USA
Principal Investigator: Dr. Ioannis Rekleitis
*Undergraduate Research Assistant***,** June 2017 - December 2021
- Improved robustness of ear-based exploration for an online Generalized Voronoi Graph mapper.
- Extended the capabilities of a UAV-UGV cooperative mapping system.
- Surveyed visual-inertial SLAM packages.
- Surveyed GPS drift and modeled multi-receiver errors.

3D Point Cloud Research Team, Teraki GmbH, Berlin, BE, Germany
*Data Science Intern***,** January 2020 - August 2020
- Developed low-power and embedded SLAM solutions for cars with LIDAR and phones with RGB-D.
- Participated in product specification, design, and implementation.

Congress-Bundestag Youth Exchange for Young Professionals, Radolfzell, BW and Berlin, BE, Germany
*Fellow***,** July 2019 - March 2020 (Curtailed by COVID)
- Year-long cultural and language exchange fellowship
- Studied two months at the Carl Duisberg Centrum language school in Radolfzell
- Attended the Winter Semester at TU Berlin

- Volunteered at the Berliner Obdachlosenhilfe e.V.
- Completed an internship at Teraki GmbH

Engineers for Exploration Group, University of California, San Diego, CA, USA
Principal Investigator: Dr. Ryan Kastner
*NSF Research Experience for Undergraduates Research Intern***,** June 2018 - September 2018
- Developed a novel, open-source hardware control system for a hex-rotor in a programmable logic fabric.
- Implemented and tested radio receiver and PID controller on PYNQ-Z1 SoC.

South Carolina Governor's School for Science and Mathematics, Hartsville, SC, USA
*Student Instructor***,** January 2017 - May 2017
- Developed the curriculum and petitioned for the first student-taught class in the school's history.
- Taught on basic controllers, computer vision, localization, and mapping.
- Successfully led students in developing an autonomous free-space mapping RACECAR.

Beaver Works Summer Institute, Massachusetts Institute of Technology, Cambridge, MA, USA
High School Participant, Summer 2016
- Implemented perception and control algorithms in Python on NVIDIA Jetson TX1.
- Placed 3rd of 9 teams in the final time trials and grand prix race.

EDUCATION

M.S. in Computer Science, Georgia Institute of Technology, August 2025-Present
Specialization in Computational Perception and Robotics

B.S.E in Computer Engineering with Honors, Leadership Distinction in Research, Math Minor, University of South Carolina, December 2021
GPA: 3.92/4.00
Extracurriculars: Research, ACM, IEEE, Ultimate Frisbee

High School Diploma with Distinction in Computer Science and Math, South Carolina Governor's School for Science and Math, May 2017
GPA: 4.646
Extracurriculars: Research, Boys & Girls Club Mentor, Robotics Club, Tennis

PUBLICATIONS

Conferences

[C3] **Brennan Cain**, Michail Kalaitzakis, Nikolaos Vitzlaios. "MK-RRT*: Multi-Robot Kinodynamic RRT* Trajectory Planning," 2021 **International Conference on Unmanned Aircraft Systems (ICUAS)**, Athens, Greece, 2021,pp. 868-876, https://doi.org/10.1109/ICUAS51884.2021.9476688.

[C2] Bharat Joshi, Sharmin Rahman, Michail Kalaitzakis, **Brennan Cain**, James Johnson, Marios Xanthidis, Nare Karapetyan, Alan Hernandez, Alberto Quattrini Li, Nikolaos Vitzilaios, and Ioannis Rekleitis, "Experimental Comparison of Open Source Visual-Inertial-Based State Estimation Algorithms in the Underwater Domain," **2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)**, Macau, China, 2019, pp. 7227-7233, https://doi.org/10.1109/IROS40897.2019.8968049.

[C1] **Brennan Cain**, Zain Merchant, Indira Avendano, Dustin Richmond, and Ryan Kastner, "PynqCopter - An Open-source FPGA Overlay for UAVs," **2018 IEEE International Conference on Big Data (Big Data)**, Seattle, WA, USA, 2018, pp. 2491-2498, https://doi.org/10.1109/BigData.2018.8622102.

Journals

[J2] Michail Kalaitzakis, **Brennan Cain,** Sabrina Carroll, Anand Ambrosi, Camden Whitehead, Nikolaos Vitzilaios. Fiducial Markers for Pose Estimation: Overview, Applications and Experimental Comparison of the ARTag, AprilTag, ArUco and STag Markers. **Journal of Intelligent & Robotic Systems (JINT).** 2021; 101: 71. https://doi.org/10.1007/s10846-020-01307-9

[J1] Michael Kalaitzakis, **Brennan Cain**, Nikolaos Vitzilaios, Ioannis Rekleitis, Jason Moulton. A marsupial robotic system for surveying and inspection of freshwater ecosystems. **Journal of Field Robotics (JFR)**. 2020; 38: 121-138. https://doi.org/10.1002/rob.21957

SKILLS

Computer Languages – Bash, C, C++, Java, MATLAB/Octave, Python, TypeScript
Softwares – Boost, DJI SDK, Eigen, Git, L/XAMPP, NumPy, OpenCV, Robot Operating System, TensorFlow, Vivado HLS
AWS Technologies - CDK, CloudFormation, CloudWatch, Lambda, EC2, ECS, Storage Gateway, VPC, and more!
Languages- English (Native), German (Intermediate - B1.2)

COURSEWORK

Computing – Artificial Intelligence, Communication Networks, Computational Physics, Computer Architecture, Cyber-Physical Systems, Data Structure & Algorithms, Digital Logic Design, Operating Systems, Robotics, Software Engineering
Math – Differential Equations, Discrete Math, Linear Algebra, Proofs, Statistics, Vector Analysis
Electrical Engineering – Circuits, Electrical Science, Electronics Physics: Electricity and Magnetism, Signals and Systems
Mechanical Engineering – Control Theory, Inertial Sensor Fusion, Multivariable Control Systems

German - UofSC: A1-A2.1, Carl Duisberg Centrum: A2.2-B1.2, TU Berlin: B1, Tutor: B1.2, UofSC: B2
Italian - New England Language School Italian A1
Japanese - New England Language School Japanese A1
Spanish - High School Spanish A2.1

MEMBERSHIPS

Upsilon Pi Epsilon
- **International Honor Society for the Computing and Information Disciplines -** Joined May 2019

SCGSSM Alumni Board
- **Award Committee -** Joined June 2017, re-elected June 2018

IEEE
- **Oceanic Engineering Society -** Joined September 2018
- **Robotics and Engineering Society -** Joined September 2018

AWARDS AND COMPETITIONS

2021 **South Carolina Honors College Science Undergraduate Research Fellowship -** Awarded by the University of South Carolina's Honors College to fund my work in robotic path planning.

2020 **USC Magellan Scholars -** Awarded by the University of South Carolina to fund my work in cooperative robotic systems.

2019 **Congress Bundestag Youth Exchange for Young Professionals -** International exchange fellowship between the US and Germany. Provided language school at the Carl Duisberg Centrum Radolfzell, a semester at the Technical University of Berlin, volunteering opportunities, and an internship opportunity.
USC McNair Junior Fellows - Awarded by the College of Engineering and Computing at the University of South Carolina to fund my work in cooperative robotic systems.

2018 **NSF Research Experience for Undergraduates -** Internship opportunity supported by the National Science Foundation and hosted at UCSD.
USC Honors College Travel Grant - Permitted me to travel to IEEE Big Data 2018 to present my work.

2017 **FTC Regional Champions -** Team captain of one of the three winning teams in regional high school competition robotics.
GSSM Engineering and Robotics Award - Recognizing achievement in computing and robotics. Awarded to one senior per year.

2016 **1st Place ASGSR Capillary Flow Challenge -** Designed and manufactured a nozzle to eject silicon oil droplets when dropped in microgravity..
3rd Place Beaver Works Summer Institute Final Challenge - My team developed algorithms for high-speed collision avoidance and navigation which led us to a 3rd place finish in the time trials and grand prix challenge of 9 teams.
Eagle Scout - Completed all requirements in the Boy Scouts of America toward the rank of Eagle Scout. My project was to bridge a 10m-wide span for tractors and emergency vehicles to cross.
RIT Computing Medal Award - Recognizing achievement in computing. Awarded to two Juniors per year.

COMMUNITY SERVICE

Berliner Obdachlosenhilfe e.V. (Berlin Homeless Assistance Club)- Volunteered at a local food bank and kitchen to prepare and distribute food and clothing to the homeless people of Berlin around Alexanderplatz, Leopoldplatz, and Kottbusser Tor. Very frequent use of German.
Tutor: Physics, Computer Science, Chemistry, Calculus - Volunteered in the tutoring center. Helped students struggling with problem subjects and lectured on common problem areas.
First Lego League Mentor - Volunteered as a mentor for a local Lego robotics competition team. Taught programming and simple controls to elementary school students.
Student to Student: Skills - Developed and led a mentorship program for the local Boys and Girls Club focusing on increased understanding of computer programming and robotics.