Carlos Carrasquillo

(787) 668-8096 | ccarrasquillo3@gatech.edu | www.carloscarras.tech | U.S. Citizen

Education

Georgia Institute of Technology | GPA: 4.0 / 4.0 **Aug 2021 – Present**

- PhD, *Robotics* Expected May 2026
- Master of Science, *Computer Science*, Machine Learning Specialization Expected Dec 2024
- Master of Science, *Aerospace Engineering* Expected May 2025

University of Florida | GPA: 3.68 / 4.0 **Aug 2017 – May 2021**

- Bachelor of Science, *Mechanical Engineering*, Magna Cum Laude Honors May 2021
- Bachelor of Science, *Computer Engineering*, Magna Cum Laude Honors May 2021

Research Experience

Graduate Research Assistant **Aug 2021 – Current**

Institution: Georgia Institute of Technology, Institute for Robotics and Intelligent Machines
Location: Atlanta, GA
Lab: DART Lab and EPIC Lab
Advisors: Anirban Mazumdar, PhD, Aaron Young, PhD

Main Research:

- **[Ongoing]** *Generalized Exoskeleton Control*: Creating a metabolically optimal exoskeleton torque controller that generalizes across tasks. Steps: (1) Extract motion primitives from a large human biomechanics dataset. Currently using LSTM variational autoencoder to compress the data and using Gaussian Mixture Models to cluster the latent space. (2) Online motion primitive classification. (3) Human-in-the-loop optimization of a parametrized biological torque controller for each motion primitive.
- **[Ongoing]** *Exoskeleton Navigation*: Designed exoskeleton controller to help humans navigate around obstacles in low visibility environments. Fractional potential fields help steer wearers away from danger zones (high potentials) and toward safe zones (low potentials). Experiments conducted in virtual reality to minimize risk of personal injury. Potential field computation handled using the Unity game engine [1][3]. Ongoing research involves using smartphone LiDAR and GPS to help users navigate outdoors in totally blind conditions.
- **[Ongoing]** *Human Motion Planning*: Mentored a master's student in designing an integrated local (HCVO) and global (RRT*) path planner for humans navigating safely in a dynamic environment. Experiments conducted in virtual reality to minimize risk of personal injury. The game was simulated using the Unity game engine.
- **[Completed]** *Classical Exoskeleton Control*: Designed hip exoskeleton impedance controllers for lifting, level ground walking, ramp/stair ascent, etc. Experimentally validated controllers using indirect calorimetry [2].
- **[Completed]** *Exoskeleton Mechatronics*: Developed software libraries to and PCBs to interface with exoskeleton motor controllers, and sensors. Developed communication libraries for half-duplex communication between the exoskeleton and a master computer.

Research Side Projects

- **[Ongoing]** *Microprocessor Knee (MPK) Suggestion Algorithm*: Utilizing machine learning to suggest the best commercial microprocessor knee for a transfemoral amputees. This algorithm aims to assist clinicians in their evaluation in the absence of expensive laboratory equipment. Nested cross-validation was used to develop regression models to estimate patient performance in several different tasks and across several different MPKs. Predicted performance is used to suggest a knee. (Paper in progress)
- **[Completed]** *Landing Aircraft Using Reinforcement Learning*: Utilized a soft-actor critic (SAC) algorithm and a tuned reward function to land an aircraft in a field. Stable-Baselines3 was used for the SAC algorithm and Gymnasium was used for the environment.
- **[Completed]** *Bioreactor Control Box*: An electronics box designed to interface with all of the necessary pumps and sensors in a closed-loop bioreactor. Control box designed to meet clean room specifications. Additional circuitry was added to step up the control voltage relay control signals. Control box external ports support 4 pumps and 3 SPI sensors. Enclosure designed in Solidworks. PCB designed in Altium Designer.

Undergraduate Research Assistant **Jan 2019 – Aug 2021**

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Lab: ADAMUS Lab
Advisor: Riccardo Bevilacqua, PhD

- *Embedded Programming*: Wrote custom C++ libraries to interface with the D3 CubeSat's IMU, antenna, radio, and GPS avionics from a BeagleBone Black microcomputer [4].
- *Operating System Architecture Design*: Developed a C++ onboard radio framework to enable data uplink/downlink. Implemented command and data handling logic [5].
- *Mission Operations*: Created a ground station Python application to transmit telecommands and receive downlinked data over radio.

Research Interests: Applied Machine Learning, Autonomy, Applied Controls, Optimization, Robotics

Journal Publications

[1] **C. Carrasquillo,** A. Bajpai, D. Iyengar, K. Collins, A. Mazumdar, A. Young. "Enhancing Human Navigation Ability Using Active Wearable Exoskeletons". IEEE Transactions on Robotics. 2024. (Submitted)

[2] A. Bajpai, **C. Carrasquillo**, J. Carlson, J. Park, D. Iyengar, K. Herrin, A. Young, A. Mazumdar. "Design and Validation of a Versatile High Torque Quasi-Direct Drive Hip Exoskeleton". IEEE Transactions on Mechatronics. 2023.

Conference Papers

[3] **C. Carrasquillo**, A. Bajpai, D. Iyengar, K. Collins, A. Young, A. Mazumdar. "Enhancing Human Navigation Ability Using an Active Wearable Exoskeleton". American Society of Biomechanics. 2023. (Submitted)

[4] **C. Carrasquillo**. "A Versatile and Open-Source Radio Framework for the D3 CubeSat Mission". Small Satellite Conference. 2021. (Student Competition Best Paper Honorable Mention)

[5] S. Buckner, **C. Carrasquillo**, M. Elosegui, R. Bevilacqua. "A Novel Approach to CubeSat Flight Software Development Using Robot Operating System (ROS)". Small Satellite Conference. 2021.

Industry Experience

Computer Science / Mechanical Engineering Intern **May 2021 – May 2022**

Company: Raytheon Intelligence & Space
Location: Dallas, TX
Supervisors: Chris Bender, Malia Kawamura

- *Web App Development*: Created a web application from scratch to find components on printed circuit boards by search and mouseover. Developed using MERN stack.
- *Database Management:* Created five Splunk dashboards and ~10 process programs for production-grade machinery.
- *Local App Development*: Wrote a desktop application to log and track material testing using VBA.

Teaching Experience

Vertically Integrated Projects Mentor — Aug 2021 – Current

Institution: Georgia Institute of Technology, Institute for Robotics, and Intelligent Machines
Location: Atlanta, GA
Professor: Aaron Young, PhD
Team: Robotic Human Augmentation, VR Exo Subteam

- Mentor a group of 4-6 students that support our research group.
- Teach students how to use tools for game development, biomechanics analysis, and electronics to produce, validate, and iterate on our team's exoskeletons, vibrotactile devices, and supplemental hardware.

Design and Manufacturing Lab, Senior Teaching Assistant — May 2019 – May 2021

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Professor: Mike Braddock

- Taught small groups of 4-5 students about the principles of design for manufacturing related to competition robots.
- Performed several robot design reviews and held feedback sessions for sketches, SolidWorks models, and drawings.
- Taught students to use machine shop equipment (lathes, mills, welding, waterjets, sheet metal brakes, CNC, etc.).
- Supervised machine shop. Helped researchers and student design teams create specialty parts using shop equipment.
- Held quarterly seminars on advanced manual machining methods.
- Mentored incoming teaching assistants by helping them be more effective leaders and communicators.

Dynamics and Control Systems Design Lab, Teaching Assistant — Aug 2020 – Dec 2020

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Professor: Prabir Barooah, PhD, Shannon Ridgeway, PhD

- Lectured before each of 6 lab sessions to educate students on how to apply their classical control systems knowledge to real-world systems.
- Helped students understand principles of system ID, implement and tune closed-loop PID controllers on microcontrollers, and implement and debug computer vision algorithms from scratch.
- Taught students how to use LabVIEW software to control actuated closed-loop control systems.

Thermal Sciences Design and Lab Teaching Assistant — Aug 2020 – Dec 2020

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Professor: John Abbitt, PhD

- Lectured on the thermodynamics and operating principles of internal combustion engines in lecture and office hours.
- Held brainstorming and design review sessions to help students design mathematical models for internal combustion engines as part of a final project.
- Held formal in-class exam reviews.

Numerical Methods Teaching Assistant — May 2019 – Aug 2020

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Professor: Jonathan Brooks, PhD, Georges Akiki, PhD

- Lectured on topics including iterative algorithms, linear algebra, numerical derivatives and integrals, Fourier analysis, polynomial regression, splines, etc.
- Created homework solutions, software solutions, and grading rubrics.
- Held formal in-class exam reviews.

Fellowships and Awards

University Center of Exemplary Mentoring (UCEM) Fellow **Aug 2023 – Current**

National Defense Science and Engineering Graduate (NDSEG) Fellow **Aug 2022 – Current**

Florida Academic Scholars Award **Aug 2017 – May 2021**

SwampHacks VI Infinite Energy's Best Hack Award **Jan 2020**

Extracurriculars

Student Pilot @ Skybound Aviation **July 2023 – Current**

Georgia Tech Marching Band/Drumline: Snare Drum **July 2023 – Current**

Skills

- *CAD*: SolidWorks (CAD, FEA), Fusion 360 (CAD, CAM), Inventor (CAD)
- *Programming*: Arduino, C/C++, C#, Java, JavaScript, LabVIEW, MATLAB, Python, Simulink, VBA, VHDL
- *Technical Software*: Altium Designer, Gymnasium, LaTeX, Linux, LTSpice, MERN Stack, OpenMDAO, OpenSim, ROS, Splunk, Unity, Vicon
- *Technical Hardware*: Shop Equipment, (Lathes, Mills, Waterjets, Welding, etc.), Electronics Equipment, (oscilloscopes, waveform generators, microscopes, etc.), rapid prototyping
- *Certifications*: Amateur Radio Technician (KN4ZUC), Nvidia Computer Vision Certificate of Competency, SolidWorks Associate, Student Pilot
- *Personal Projects*: 12-DOF Quadruped Robot, Desktop Lathe, MIPS CPU, Personal Website, PC Builds
- *Languages:* English and Spanish

Community Involvement

2024 Georgia Tech Robotics Summer Scholars (GTRSS) Summer Camp Organizer **Jan 2024 – Current**

2023 Georgia Tech Robotics Summer Scholars (GTRSS) Summer Camp Organizer **Jan 2023 – Jul 2023**

Elementary School Science Fair Judge **Nov 2022, Nov 2023**

Atlanta Science Festival Volunteer **Mar 2023**

American Controls Conference Volunteer **Jun 2022**

National Biomechanics Day Organizer **Feb 2022 - Apr 2022**