Christopher J. Banks

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Education

Ph.D. Robotics. Georgia Institute of Technology 2017-2022
- **Title: Specification-Based Task Orchestration of Multi-Robot Aerial Teams**

M.S. Computer Science. Georgia Institute of Technology 2021
- **Specialization: Computational Perception and Robotics**

B.S. Physics, Computer Science Minor. Summa Cum Laude. Norfolk State University 2013-2017

Security Clearance Level

Top Secret (2022-present)

Research Interests

Swarm robotics, linear temporal logic, human-swarm interaction, control theory, machine learning

Work Experience

Senior Autonomy Engineer, Charles Stark Draper Laboratory October 2022 – present

- Contributed to $26M DoD grant proposal for remote Chemical Biological Radiation and Nuclear (CBRN) detection using **autonomous teaming drones** resulting in a 5-year contract through JPEO-CBRND
- Developed **mission planning** for multiple vehicle types using the All-Domain Execution and Planning Technology (ADEPT) Autonomy Framework
- Lead engineer in decentralized task allocation for **heterogeneous teaming** used in CBRN Sensor Integration on Robotic Platforms (CSIRP) Program
- Contributed to **rapid prototyping** of autonomy missions for various government sponsors
- Created **continuous integration (CI) pipeline** for deployment of software on arm64 processors. **Reduced** deployment and installation time of company software by **75 %.**

Research Experience

Ph.D. Student, Robotics, Georgia Institute of Technology August 2017 – December 2022

- Created end-to-end platform for the use of **temporal logic** formula in **trajectory generation** for quadrotors
- Developed a **novel** technique of online **task allocation** using **cross-entropy based optimization**
- Lead software developer for **quadrotor integration** into the **Robotarium**, a remotely accessible robotics testbed at Georgia Tech
- Member of the **Robotarium** team that manages user input to the system and software updates
- President, Robotics Graduate Student Association (2021-2022)

Research Intern, NASA Jet Propulsion Laboratory June 2019 – August 2019

- Participated in the Maritime and Multi-agent Autonomy group
- Focused on developing an algorithm that utilized **branch-and-bound** techniques for low-cost trajectory planning for aquatic vehicles

- Utilized **C++** and Object-Oriented programming

Research Intern, Thomas Jefferson National Accelerator Facility **October 2016 - July 2017**

- Studied conventional and hybrid meson structure through **photoproduction** experiments
- Analyzed the decay states of the **phi and omega mesons** to find resonance patterns, indicating possible particle production
- Used **Perl** and **Python** as a software development platform to contribute to creating a framework for **partial wave analysis**

Research Intern, Massachusetts Institute of Technology (MIT) **June 2016 – August 2016**

- Participated in **automated planning** artificial intelligence research
- Integrated a **human user** in the planning process of an automated planner to **improve** the plan's **efficiency**
- Used **C++** in a **Linux** environment to create a file handler and **automated planner generation environment** and **co-authored** 1 research paper

Awards

Tower Award (Georgia Tech) 2022

National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship 2017-2022

Dozoretz National Institute of Mathematics and Applied Science (DNIMAS) Scholar 2013-2017

OS & Programming Language Experience

Programming Languages - C++ | Python | MATLAB | Rust

OS experience – GNU/Linux (Ubuntu, Redhat) | Robot Operating System (ROS)

Selected Courses

CS 6601: Artificial Intelligence

CS 7641: Machine Learning

ECE 6550: Linear Systems and Control

ECE 6552: Non-Linear Systems and Control

Selected Publications

Kim, Joseph, **Christopher J**. **Banks**, and Julie A. Shah. "Collaborative Planning with Encoding of Users' High-Level Strategies." *AAAI*. 2017.

C. Banks, K. Slovak, S. Coogan, and M. Egerstedt. "Specification-Based Maneuvering of Quadcopters Through Hoops." 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2019.

C. Banks, S. Wilson, S. Coogan, and M. Egerstedt. "Multi-Agent Task Allocation using Cross-Entropy Temporal Logic Optimization." 2020 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2020.

C. Banks, A. Bono, and S. Coogan. "Physical Human-UAV Interaction via Differentially Flat Output Generation using Admittance Control". 2021 IFAC Modeling and Estimation and Control Conference (MECC). IFAC, 2021.

C. Banks, S. Coogan, and M. Egerstedt. "LTL Cross Entropy Optimization for Quadcopter Task Orchestration". 2022 Cyber-Physical Systems. IEEE, 2022.