MAX B. RUDOLPH

mrudolph8@gatech.edu ◇ http://maxrudolph1.github.io/

EDUCATION

Georgia Institute of Technology *2020 - present*
M.S. in Electrical and Computer Engineering, Concentration in Machine Learning and Robotics

Georgia Institute of Technology *May 2020*
B.S. in Electrical Engineering (Highest Honors), Minor in Robotics GPA: 3.9/4.0

RESEARCH EXPERIENCE

Robot Autonomy and Interactive Learning Lab August 2020 - Present
Georgia Tech *Advisor: Prof. Sonia Chernova*

- Use evolutionary and imitation learning algorithms to learn low-level controllers for heterogeneous multi-agent teams
- Develop methods to learn high-level multi-agent coordination policies
- Optimize controller parameters for multi-task objective in ablation study to confirm efficacy of learning pipeline

Robotics and Intelligent Systems Lab August 2018 - December 2019
Georgia Tech *Advisors: Prof. Magnus Egerstedt, Dr. Sean Wilson*

- Implement novel extension of Lloyd's algorithm for coverage control to leverage heterogeneous systems of robots
- Design algorithms for optimal control of swarming robots with limited sensing ranges
- Validate algorithms on real-world robots using the *Robotarium*

Robot Learning Lab August 2018 - May 2020
Georgia Tech

- Developed genetic cost-function optimization algorithm for speed maps used in model predictive controller
- Created dynamics models for use in Model Predictive Controller extension to PyTorch
- Study effect of cost-function hyper parameters on autonomous algorithm performance and stability

Mechatronics, Robotics, and Controls Laboratory May 2017 - August 2017
New York University *Advisor: Prof. Vikrim Kapila*

- Designed, prototyped and built robotic finger actuator to aid in stroke rehabilitation
- Taught basic robotics and mechatronics to 60 New York high schoolers as part of a study on the effect of robotics education on students' problem-solving skills

CONFERENCE PUBLICATIONS

3. Desperate Times Call for Desperate Measures:Towards Risk-Adaptive Task Allocation
Rudolph, M., Chernova, S., Ravichandar, H.
IEEE International Conference on Intelligent Robots and Systems (IROS) 2021

2. Heterogeneous Multi-agent Coverage Control for Range Limited Robots
Rudolph, M., Wilson, S., Egerstedt, M.
IEEE International Conference on Robotics and Automation (ICRA) 2021

1. Learning and Zero-Shot Generalization of Heterogeneous Multi-Agent Coordination
   Ravichandar, H., Pierpaoli, P., Bohannon, A., Waytowich, N., **Rudolph, M.**, Egerstedt, M., Chernova, S.
   under submission

WORK EXPERIENCE

Autonomous Systems Intern May 2020 – August 2020
Jet Propulsion Laboratory

- Validated guidance and control algorithms for the Psyche spacecraft
- Developed analysis algorithms for Monte Carlo simulations of spacecraft pointing algorithms
- Built dynamic system to update spacecraft simulation with ever-changing spacecraft properties

Flight Software Lead January 2019 – January 2020
Georgia Tech Yellow Jacket Space Program (YJSP)

- Developed software for state estimation and control of TIAT, YJSP's testbed rocket
- Wrote C++ code to read gyro and accelerometer values for a second order state-estimator
- Designed PID controller to control the attitude canards on the rocket

Mars 2020 Software System Testbed Intern May 2019 – August 2019
Jet Propulsion Laboratory

- Developed test procedures for the Mars 2020 System Testbed
- Wrote automation scripts in Python for the Remote Sensing Mast (RSM) on the Mars 2020 Rover
- Automated image acquisition tests by developing procedures to interface with Ground Data System
- Ran flight software tests on the engineering model of Mars 2020 rover to detect software failures
- Performed range of motion tests for azimuth and elevation actuators for RSM

Intern in Science and Tech May 2018 – August 2018
National Security Agency

- Repaired and operated small Unmanned Aerial Systems (UAS) for antenna elevation
- Analyzed flight data from Pixhawk flight controller using MATLAB to validate Real Time Kinematic (RTK) algorithms
- Built and tested RF-Fiber Optic communication systems
- Performed load analysis on analog RF and fiber components

AWARDS

Stand-up Comedy Opener, *Georgia Tech Comedy Show* 2018
Idea2Prototype Award, *Georgia Tech, Create-X* 2018
Student Faculty Program *Jet Propulsion Labrotory, Caltech* 2019,2020
Faculty Honors *Georgia Tech* 2016-2020
Dean's List *Georgia Tech* 2016-2020

POSTER PRESENTATIONS

- **Rudolph, M.**, Wilson, S., Egerstedt, M. *Heterogeneous Multi-agent Coverage Control* Poster presented at the 2020 Undergraduate Research Program, Georgia Tech

- **Rudolph, M.**, Shah, B., Zhang, F. *FLYIR: An Integrated solution for Simultaneous Localization and Mapping in Disaster Scenarios* Poster presented at 2018 Idea2Prototype Convention
- Mishra, V., **Rudolph, M.**, Zhang, F. *NanoBlimp: A Platform for Multi-Agent Systems Research* Poster presented at 2018 Vertically Integrated Projects Poster Session

COMPUTER SKILLS

Programs & Languages: python, Matlab, , PyTorch, scikit-learn, Java, C++
Software: git, LaTeX, Microsoft Office, ROS, Robotarium, AutoDesk Inventor, OnShape

TEACHING EXPERIENCE

- **ECE 3084: Signals and Systems** Georgia Tech 2020-2021
- **PHYS 2211: Intro to Physics** Georgia Tech 2017-2020

RELEVANT COURSEWORK

Statistical ML	Mathematical Foundations of ML	Applications of DSP
Linear Systems and Control	Networked Control	Deep Learning
Digital Image Processing	Machine Learning	Modern System Theory
Signals and Systems	Dynamics of Rigid Bodies	Advanced DSP