

CALEB WAGNER

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BIO:

Bachelor of Science, Robotics Engineering and Computer Science
• Worcester Polytechnic Institute (WPI), **3.98 out of 4.0 GPA**

May 2020

Eagle Scout, Boy Scouts of America, Troop 410, Nashua, NH

Jan 2004-Present

RELEVANT EXPERIENCE:

JOURNAL PUBLICATIONS:

- C. Wagner et al., "**SMAC: Symbiotic Multi-Agent Construction**," in IEEE Robotics and Automation Letters, vol. 6, no. 2, pp. 3200-3207, April 2021, doi: 10.1109/LRA.2021.3062812.

JOB EXPERIENCE:

June 2020-Present

NASA AUTONOMY ENGINEER

NASA Jet Propulsion Laboratory

- Contributed to development of onboard AI planner for Europa Lander robot, including developing a means to support utility-based planning under uncertain conditions in C++ and ROS.
- Designed/implemented several controllers and simulations such as thermal and energy autonomics, various instrument simulations, and a scalable analytics pipeline that performs analysis on incoming data.
- Responsible for development of several dashboards and integration tools for discrete-event simulations.

June 2019-Aug 2019

NASA JPL ROBOTICS ENGINEERING INTERN

NASA Jet Propulsion Laboratory

- Contributed to development of multi-agent algorithm used to map the Moon with the PUFFER robots.
- Implemented geospatial database in ROS, Python, PostGIS to support merging/modification of map data.
- Developed open-source data driven software tracking system in React, NodeJS, and Elastic stack.

Nov 2018-May 2020

RESEARCH ASSISTANT (Swarm Robotics)

NEST Labs, WPI

- Led team of six in developing a robotic construction platform that resulted in a journal publication.
- Designed/implemented swarm control algorithms in Python, developed simulator for robotic construction.
- Assisted in graduate research by developing ranking algorithm for distributed consensus, assisted in development of VR app to control swarm to perform coordinated motions.

May-Aug 2018

SOFTWARE DEVELOPER

United Health Group (Optum), Boston, MA

- Led team of four in startup project that was bought by Optum and transitioned to a full-time team utilizing machine learning technology, pursued machine learning patent on technology.
- Leveraged ELK stack to track several million data points weekly over twenty different microservices.

June-Aug 2017

TECHNICAL INTERN (with Secret Clearance)

BAE Systems, Nashua, NH

- Designed fixtures for circuit cards and test equipment in Creo, Gerbtool for analysis of RF cables.
- Collaborated in team of four to design test stand for modules used in DC Burn-In Oven.

Aug 2016-Aug 2018

RESEARCH ASSISTANT (Biomimetic + Humanoid Robotics)

Popovic Labs, WPI Human Robotics Lab (WHRL), WPI

- Led team of four to design low-cost, all-terrain robotic quadruped using novel parallel elastic actuator.
- Programmed in C++ for basic motion of leg, developed algorithms used for characterizing several walking gaits and stabilized walking, as well as autonomous navigation in different environments.

ADDITIONAL:

ACTIVITIES:

Battle of the Rockets (Co-President), WPI

Aug 2016-Aug 2019

- Led team of ten to second place victory in competition to design a robot that had to deploy from a rocket, right itself on ground, take a panoramic picture autonomously, and then transmit the picture to a ground station.

Space Robotics Club (NASA Space Robotics Challenge), WPI

Oct 2016-June 2017

- Performed object recognition and motion planning in C++ using ROS, Gazebo, and OpenCV.

Assistant Student Teacher, WPI Computer-Aided Manufacturing Course

Nov 2017-Nov 2019

Software Developer, WPI NASA Centennial CubeQuest Challenge

Aug 2016-Nov 2017

SKILLS:

Programming Languages: C++, C, Java, Python, MATLAB, JavaScript (ReactJS, ExpressJS, NodeJS), SQL

Software/Frameworks: ROS, ELK Stack, PostGIS, MongoDB, Kafka, Docker, OpenCV, Amazon Web Services (AWS)

PROJECTS:

MULTI-AGENT ROBOTIC CONSTRUCTION

- Led team of six in developing and building novel robots and planning algorithms for autonomous collective construction.
- Developed scalable multi-agent algorithms in Python for planning construction, the collective assignment of robots, task partitioning/claiming of construction tasks, and multi-agent path planning throughout constrained 3D environment.
- Designed differential control algorithms for navigation and lifting capabilities of robots.
- Implemented custom simulator for visualization/analysis of inchworm-inspired robots and intelligent building materials.

SURGICAL CONTINUUM ROBOT FOR IMAGE-GUIDED SURGERY

- Calculated differential kinematics for concentric-tube cannula robot in MATLAB.
- Performed point registration using fiducial markers in CT scan for guiding robot through human larynx.
- Developed NIH proposal for VR-based control of continuum robots.

AUTONOMOUS MARS ROVER AND ROCKET

- Developed rover for competition to be launched from a rocket at several thousand feet and land safely on the ground.
- Modeled camera system and wheel base in SOLIDWORKS and then fabricated in machine shop.
- Programmed control system to navigate over rough terrain and transmit telemetry from peripherals including temperature sensors and GPS using C++, assisted in programming ground station using Python.

AUTONOMOUS MAZE MAPPING AND PATHFINDING

- Utilized ROS, ROS Navigation stack, and LIDAR in Ubuntu to control a Turtlebot to perform SLAM within a maze.
- Performed path planning to navigate between points after map had been constructed.
- Recognized by professor for development and use of a pure pursuit planner to generate smooth movements between points.

3 DOF ROBOTIC ARM MANIPULATION

- Implemented forward and inverse kinematics for both joint and task space level control.
- Generated trajectories between task space coordinates for smooth motion between setpoints.
- Recognized by professor for use of artificial intelligence to have the robot play a board game with a human.

FIRE EXTINGUISHING ROBOT

- Designed, built, and programmed an autonomous flame extinguishing robot.
- Implemented position tracking to localize the robot within an unseen maze.
- Developed algorithm to locate a flame within the maze with an I2C IR camera and robot inertial odometry.

NUCLEAR FUEL ROD CONTAINMENT ROBOT

- Designed, built, and programmed an autonomous robot to complete a mock nuclear reactor challenge.
- Designed 4-bar linkage mechanism in SOLIDWORKS to acquire and place “fuel rods.”
- Programmed Arduino for control system of robot (PID) as well as for point-to-point navigation.

SELF-DRIVING CAR

- Developed a self-driving car utilizing the Udacity Self-Driving Car Simulator and ROS.
- Utilized several control methods including model predictive control, behavioral cloning, and deep learning.
- Programmed path planning algorithm capable of changing lanes on the road amidst other cars.

AUTONOMOUS SORTING ROBOT

- Programmed 6DOF Kuka KR210 robot in ROS to autonomously sort colored objects into bins.
- Implemented velocity-based (Jacobian) inverse kinematics control of robot for trajectory generation.

SELF-FOLLOWING DRONE

- Trained fully convolutional network to identify a target individual from a simulated drone camera feed.
- Developed control algorithm for drone to follow target individual from a set distance.

WEBSITE DESIGN FOR DANISH NON-PROFIT

- Travelled to Denmark to perform data collection and website design for environmentally-focused NGO.

SHARK RECOGNITION WITH NEURAL STYLE TRANSFER

- Employed neural style transfer to augment dataset for classification of shark fins in YOLOv3 to stop shark finning.

REINFORCEMENT LEARNING BOMBERMAN GAME

- Utilized reinforcement learning to develop agent capable of beating all levels of a game of Bomberman.
- Recognized by professor for effectiveness of algorithm and achieving success in all levels.

TRAFFIC SIGN CLASSIFIER

- Developed traffic sign classifier for a self-driving car using a deep learning model developed in Keras.