

Hongrui Zheng

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Education

University of Pennsylvania

PH.D IN ELECTRICAL AND SYSTEMS ENGINEERING

Philadelphia, PA
May. 2020 - May. 2025

University of Pennsylvania

M.S.E IN ROBOTICS

Philadelphia, PA
Aug. 2017 - May. 2019

Georgia Institute of Technology

B.S. IN COMPUTER SCIENCE, B.S. IN MECHANICAL ENGINEERING

Atlanta, GA
Aug. 2012 - May. 2017

Experience

mLab (Real-Time and Embedded Systems Lab), University of Pennsylvania

RESEARCH ASSOCIATE & COURSE CO-INSTRUCTOR

Philadelphia, PA
May. 2019 - Present

- Developed a software-in-the-loop, light weight, and multi-agent simulator for 1/10th scale race cars in ROS and C++.
- Developed a OpenAI Gym wrapped, multi-agent, massively-parallelizable simulator for 1/10th scale race cars in Python and C++.

Sanus Solutions

MACHINE LEARNING ENGINEER

Atlanta, GA
Dec. 2017 - December 2019

- Developed a RESTful API server for a face recognition IoT network in a health-care environment in Python and Flask.
- Built and deployed service infrastructure utilizing Docker container, Tensorflow Serving, and AWS Rekognition at production scale.
- Prototyped IoT network nodes using Raspberry-pi and multiple sensors, and designed and manufactured enclosure for electronic components.

Georgia Tech Systems Research Lab

RESEARCH ASSISTANT

Atlanta, GA
Aug. 2014 - May. 2017

- Developed and improved an algorithm for human following using facial detection and optical flow on a miniature blimp with a monocular camera.
- Developed hallway detection algorithm using Hough transform and human detection to verify a dual expert learning algorithm focused on avoiding humans on Turtlebots with Kinect in ROS.
- Prototyped a rotating platform implementing control theories for better camera angles of Kinect on Turtlebots using Arduino and ROS.

Publications

FORMULAZERO: Distributionally Robust Online Adaptation via Offline Population Synthesis

ICML 2020

A. SINHA*, M. O'KELLY*, H. ZHENG*, R. MANGHARAM, J. DUCHI, R. TEDRAKE (*EQUAL CONTRIBUTION)

Developed a novel method for self-play based on replica-exchange Markov chain Monte Carlo, and proposed a distributionally robust bandit optimization procedure.

F1TENTH: An Open-source Evaluation Environment for Continuous Control and Reinforcement Learning

PMLR

M. O'KELLY, H. ZHENG, D. KARTHIK, R. MANGHARAM

NeurIPS 2019 Competition and
Demonstration Track

Presented three benchmark tasks and baselines in the setting of autonomous racing, demonstrating the flexibility and features of the proposed evaluation environment for reinforcement learning.

TUNERCAR: A Superoptimization Toolchain for Autonomous Racing

ICRA 2020

M. O'KELLY*, H. ZHENG*, A. JAIN*, J. AUCKLEY, K. LUONG, R. MANGHARAM (*EQUAL CONTRIBUTION)

Developed a toolchain that jointly optimizes racing strategy, vehicle parameters, planning methods, and control algorithms for an autonomous racecar.

Hygiene Monitoring System and Method

US20200126395A1

H. ZHENG, J. ZENG, L. ANTOLIC-SOBAN, J. WU

Patent Pending

Developed a system and method of monitoring the hand washing protocol of a person in contact with a medical patient.

Monocular vision-based human following on miniature robotic blimp

ICRA 2017

N. YAO, E. ANAYA, Q. TAO, S. CHO, H. ZHENG, F. ZHANG

Developed human following algorithm with facial detection/tracking on a miniature blimp.

Demonstrations and Competitions

F1TENTH Berlin Virtual Autonomous Grand Prix

IFAC World Congress 2020

H. ZHENG, M. O'KELLY, K. LUONG, R. MANGHARAM

Berlin, Germany

Hosted competition with 20+ participating teams from around the world. Developed a submission evaluation framework that accepts submissions online for autonomous racing agents.

F1TENTH: An open-source 1/10th scale platform for autonomous racing and reinforcement learning

NeurIPS 2019

M. O'KELLY, H. ZHENG, D. KARTHIK, R. MANGHARAM

Vancouver, Canada

Demonstrated a low-cost open-source 1/10th scale racecar and validated simulator which enables safe and rapid experimentation.

Projects

EV-FlowNet: Using Neural Network to predict Optical Flow using Event Based Camera

May. 2018 - Dec. 2018

- Improved code efficiency of existing algorithm by implementing the algorithm in Tensorflow and ROS in C++.
- Developed a optical flow prediction algorithm using non-linear least squares using C++, ROS, and Ceres Solver.

Autonomous Service Robot in a University Environment

Aug. 2017 - Dec. 2017

- Designed and developed a ROS control package for a low cost 5 DOF robot arm integrated with the Turtlebot.
- Developed a ROS package for grasp detection and selection algorithm using point cloud data, a neural network, and MoveIt!
- Designed and developed a data manager that collects and analyze sensor data of the Service Robot using MongoDB and ROS.

Information Visualization of an online video game's(DotA2) statistics

Jan. 2016 - May. 2016

- Collected and processed raw game data of over 500,000 matches using corresponding APIs in Python.
- Implemented an interactive information visualization (interactive circular graph and tree) with D3.js to show statistics on win rate with different game configuration, and recent trend in popular game configurations.

Gesture Controlled Nano-Quadcopter

Aug. 2015 - Dec. 2015

- Developed an algorithm that extracts user's skeletal pose information from Kinect's depth image data and sends command to the quadcopter.
- Designed and developed a ROS package that implements control theories to control a Nano-Quadcopter using the users' gesture input in C++.

Teaching

ESE 680-007, ESE 615: Autonomous Racing

University of Pennsylvania

CO-INSTRUCTOR AND TEACHING ASSISTANT

Fall 2019, Spring 2020

- Created lecture material and coding assignment for *Pose Representation and Transformation, Geometric Path Tracking, Motion Planning, Race line Optimization, and Model Predictive Control*.
- Graded above assignments and organized 3 races throughout the semester.
- Built and maintained the hardware platform and software stack used by students.

Skills

Programming Language Python, C++, MATLAB, \LaTeX

Framework & Toolkit ROS, numpy, numba, scipy, Eigen, ZeroMQ, ProtoBuf, Docker, Tensorflow, pyTorch, OpenCV, Flask

OS & Applications Linux, MacOS, Windows, Solidworks, Fusion360, AutoCAD

Awards

2019 **Best Demonstration Honorable Mention**, NeurIPS 2019

Vancouver, Canada