

Zhihao Ruan

3131 Walnut St Unit #553, Philadelphia, PA 19104

ruanzh@grasp.upenn.edu • +1 (734) 881-4112 • <https://zhihaoruan.xyz>

EDUCATION

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| University of Pennsylvania | Philadelphia, PA |
| • General Robotics, Automation, Sensing & Perception (GRASP) Laboratory | May 2022 |
| Master of Science in Engineering in Robotics, projected | |
| University of Michigan | Ann Arbor, MI |
| • College of Engineering | May 2020 |
| Bachelor of Science in Computer Science Engineering, GPA: 3.89/4.00 | |
| Shanghai Jiao Tong University | Shanghai, China |
| • University of Michigan-Shanghai Jiao Tong University Joint Institute (UM-SJTU Joint Institute) | August 2020 |
| Bachelor of Science in Electrical and Computer Engineering, GPA: 3.56/4.00 | |

RELATED COURSEWORK

ECE: Honors Physics, Electromagnetics, Signals and Systems, Analog Circuits, Logic Circuits Design, Semiconductor Devices.

CSE: Embedded Systems, Machine Learning, Computer Vision, Autonomous Robotics, CUDA programming, Operating Systems.

SCHOLARSHIP AND HONORS

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| James B. Angell Scholar | Mar 2020 |
| University of Michigan Honors | Dec 2018, May 2019, Dec 2019 |
| University of Michigan "Dean's List" | Dec 2018, Apr 2019, Dec 2019 |
| 2018 SJTU Undergraduate Excellent Scholarship | Sept 2017 – June 2018 |
| UM-SJTU Joint Institute "Dean's List" | Sept 2016 – June 2017 |
| 2017 SJTU Undergraduate Excellent Scholarship | Sept 2016 – June 2017 |
| "Honorable Mention" of 2017 Interdisciplinary Contest in Modeling | April 2017 |

RESEARCH EXPERIENCE

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| Synthetic Health Sensor | Ann Arbor, MI |
| • Interactive Sensing and Computing Lab of Prof. Alanson Sample, University of Michigan | Jan 2019 – Dec 2019 |
| ◦ Built an embedded system with STM32 microprocessor and Panasonic's GridEye® 8 × 8 IR sensor using I ² C, UART and MATLAB signal processing that can collect, detect and visualize heat distribution in the room. | |
| ◦ Constructed a complete API from scratch for Panasonic's GridEye® 8 × 8 IR sensor for STM32 microprocessor. | |
| ◦ Implemented Direct Digital Synthesis (DDS) of a frequency-sweep ultrasonic sine wave from 39kHz to 41kHz with STM32 microprocessor and ultrasonic transducers. | |
| ◦ Implemented two different ultrasound distance measurement algorithms including FMCW (Frequency-Modulated Continuous Wave) algorithm and phase-based ranging algorithm with STM32 microprocessor and Python. | |
| ◦ Implemented breath rate detection from phase-based ranging algorithm with ultrasound transducers. | |
| Cost-Function Prediction Market Simulation with Bayesian Traders | Ann Arbor, MI |
| • ML Research Paper Reading Group of Prof. Sindhu Kutty, University of Michigan | May 2019 – August 2019 |
| ◦ Simulated cost-function based prediction market mechanism in Python, with its performance evaluated and compared with traditional machine learning algorithms. | |
| ◦ Reconstructed exponential-family prediction markets in theory with mathematical derivations. | |
| ◦ Explored exponential-family prediction markets with different probability distributions. | |

TEACHING & WORKING EXPERIENCE

- **Grader for EECS 445: Introduction to Machine Learning** Ann Arbor, MI
Department of Electrical Engineering and Computer Science, University of Michigan
Jan 2020 – April 2020
 - Assisted professor to grade all projects and assignments.
- **Grader for EECS 373: Introduction to Embedded Systems Design** Ann Arbor, MI
Department of Electrical Engineering and Computer Science, University of Michigan
Sept 2019 – Dec 2019
 - Assisted professor to grade all labs and assignments.
- **Grader for MATH 417: Matrix Algebra** Ann Arbor, MI
Department of Mathematics, University of Michigan
Jan 2019 – April 2019
 - Assisted professor to grade all assignments.
- **Teaching Assistant for VY 200: Academic Writing II** Shanghai, China
Center for Teaching and Learning, UM-SJTU Joint Institute
Mar 2018 – May 2018
 - Assisted professor to organize group discussion and group presentation in class.
 - Held office hours every week to help students with writing academic essays.
 - Helped to grade course quizzes and essays.

PROJECT EXPERIENCE

- **Real-Time On-Device Flow Statistics Detection and Prediction** Shanghai, China
Undergraduate Major Design Experience, UM-SJTU Joint Institute
June 2020 – Aug 2020
 - Built a system which detects human traffic flow, automatically analyzes & detects entrances on Raspberry Pi 4B, stores data on a server, visualizes analyzed data on a self-designed front-end website in real time.
 - Implemented object tracking & people counting with self-designed Kalman filter tracker, automatic entrance detection with density-based clustering algorithm — DBSCAN.
- **DOAPP: Dynamic Object Avoidance and Path Planning** Ann Arbor, MI
Undergraduate Major Design Experience, University of Michigan
Oct 2019 – Dec 2019
 - Implemented a GPU-accelerated motion planning algorithm by Chonhyon Park, et al. on an Nvidia's GPU with CUDA parallel programming & optimization.
 - Constructed a 3-D combined pointcloud from three separate Intel RealSense® cameras and converted it into an occupancy grid for obstacle detection.
 - Built a ROS controller and trajectory follower from scratch for Dynamixel motors on robot arm.
- **PatchMatch: Implementation and Applications** Ann Arbor, MI
EECS 442: Computer Vision, University of Michigan
Oct 2019 – Dec 2019
 - Implemented PatchMatch algorithm from Adobe Research from scratch in Python.
 - Applied PatchMatch algorithm on image context-aware filling and image retargeting.
 - Applied PatchMatch algorithm on image context-aware filling in both constrained and unconstrained cases.
 - Created a user interactive interface in Java Swing for customized image editing & algorithm visualization.
- **Interactive Game: Step on White Tiles** Ann Arbor, MI
EECS 373: Introduction to Embedded Systems Design, University of Michigan
March 2019 – April 2019
 - Visualized black & white tiles flow by driving a projector with FPGA by programming VGA protocols in Verilog.
 - Decoded signals from Nintendo controller in Verilog.
 - Built a complete menu selection user interface on an LCD display with SmartFusion® microprocessor and Nintendo controller.
 - Achieved stepping detection on projected tiles through SPI communication with Pixy® camera.
 - Enabled sound effects using SmartFusion® microprocessor, Adafruit® Audio Sound Board and Dell® stereos.
- **Gesture-Based Mouse Cursor Control System** Shanghai, China
Team Leader, VG 100: Introduction to Engineering, UM-SJTU Joint Institute
June 2017 – Aug 2017
 - Detected the motion of user's hands using MPU-9250, an inertia measurement unit.
 - Achieved data transmission between the control system and PC using an HC-06 Bluetooth transmitter.
 - Delivered three features on PC in C/C++ & batch scripts: switching PPT slides, moving and dragging mouse cursor.

- **The 9th SJTU Freshman Innovative Mechanical Competition**

Shanghai, China

- ***Champion Team Leader***

April 2017

- Designed, programmed and assembled a robot car which collected blocks and piled them up in a designate order. The project used AutoCAD, C program and STC microcontrollers.
- Competed with other 47 teams with strategies and skills and won the championship.

SKILLS

Programming Languages: C/C++, Python, MATLAB, Verilog.

Development Tools: STM32CubeMX, OpenCV, PyTorch, Scikit-Learn, LCM (Lightweight Communications and Marshalling), ROS (Robotics Operating System), CUDA