

Zhihao Ruan

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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: 3.9/4.0 | |
| 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: 3.5/4.0 | |

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 development board 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. | |
| 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 different probability distributions mathematically . | |

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
- **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
- **Grader for MATH 417: Matrix Algebra** Ann Arbor, MI
Department of Mathematics, University of Michigan Jan 2019 – April 2019
- **Teaching Assistant for VY 200: Academic Writing II** Shanghai, China
Center for Teaching and Learning, UM-SJTU Joint Institute Mar 2018 – May 2018

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.
- **Concurrent File Server Implementation** Ann Arbor, MI
ECS 482: Introduction to Operating Systems May 2020 – Apr 2020
 - Built an connection API for client requests using **Berkeley sockets**.
 - Emulated Unix-style file system on disk with inodes and directory entries in C++.
 - Incorporated reader/writer locks from **Boost library** to ensure safe concurrency.
- **Linux Thread Library Implementation on x86 PCs** Ann Arbor, MI
EECS 482: Introduction to Operating Systems Jan 2020 – Feb 2020
 - Implemented mutual exclusion & conditional variables using **context switching API in Linux kernel library**.
 - Implemented yield and join functions of thread class.
 - Provided mutual exclusion on both uniprocessor and multiprocessor systems with **interrupt handling** and **CPU guard**.
- **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.
 - Built a **controller and trajectory follower in ROS 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 an interactive user 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.
- **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 designated 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