Curriculum Vitae

Zhihao Ruan

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Education

- **University of Michigan** — Ann Arbor, MI
  Bachelor of Science in Computer Science Engineering, ***GPA: 3.88/4.00*** — *May 2020*
- **University of Michigan-Shanghai Jiao Tong University Joint Institute** — Shanghai, China
  Bachelor of Science in Electrical and Computer Engineering, ***GPA: 3.52/4.00*** — *August 2020*

Related Coursework

ECE: Honors Physics, Electromagnetics, Signals and Systems, Analog Circuits, Logic Circuits Design
CSE: Embedded Systems, Machine Learning, Computer Vision, Autonomous Robotics, CUDA programming, Operating Systems.

Scholarship and Honors

University of Michigan Honors — *Dec 2018, May 2019*
University of Michigan "Dean's List" — *Dec 2018, Apr 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

- **Synthetic Health Sensor** — Ann Arbor, MI
  Interactive Sensing and Computing Lab of Prof. Alanson Sample, University of Michigan — *Jan 2019 – Present*
  - Building a multi-person breath rate detection system with Teensy® microprocessor and ultrasonic transducers.
  - Built an embedded system with STM32 microprocessor and Panasonic's GridEye® 8×8 IR sensor using I^2C, UART and MATLAB signal processing that can detect and visualize heat distribution as well as collect data 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 fequency-sweep ultrasonic sine wave from 39kHz to 41kHz with STM32 microprocessor and ultrasonic transducers.
  - Implemented 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 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 the 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 the 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

- **MXNet Optimization** Ann Arbor, MI
  EECS 498: Applied GPU Programming *Nov 2019 – Dec 2019*
  - Optimized convolutional layer in MXNet in CUDA using tiled convolution with shared and constant memory.
- **DOAPP: Dynamic Object Avoidance and Path Planning** Ann Arbor, MI
  Undergraduate Major Design Experience in Autonomous Robotics *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.
  - 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 using Java for customized image editing as well as 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 with C/C++ program and batch scripts: switching PPT slides, moving and dragging mouse cursor.
- **The 9th SJTU Freshman Innovative Mechanical Competition** Shanghai, China
  Leader of Champion Team *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