

Yuchen Rao

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Portfolio: <https://yuchenrao.github.io/Portfolio/>

EDUCATION

Master of Science in Robotics	09/2016-12/2017
Northwestern University, Evanston, IL, United States (GPA 3.90/4.00)	
Bachelor of Science in Mechanical and Electrical Engineering	09/2012-07/2016
China Agricultural University (CAU) , Beijing, China (GPA 3.88/4.00, Rank: 1/43)	

ACADEMIC AWARDS

Outstanding graduate of Beijing, China	05/2016
Outstanding graduate of CAU	05/2016
Excellent Student Award granted by the Ministry of Education with Scholarship, China, twice	09/2013-07/2014
Excellent Student Award with Scholarship, CAU	09/2014-07/2015
Excellent Student Award in Academics Grade 1 with Scholarship, CAU, three times	09/2013-07/2015
Excellent Student Award, CAU, twice	09/2013-07/2014
School Outstanding Members	09/2013-07/2012
The Honorable Mention for Mathematical Contest in Modeling (MCM) (America)	03/2015
The 3rd place in NEAR Speak Out for Engineering Competition (Asian-Pacific region)	09/2014

WORK EXPERIENCE

Robotics Software Engineer, Otsaw Digital Inc, California, United States	07/2018- present
<ul style="list-style-type: none">Tested a mobile base navigation system on an Ackermann drive robotCreated a recovery method for dealing with navigational failureDesigned a global path planner based on A* algorithm	
Robotics Software Engineer Intern, Honda Research Institute USA, California, United States	02/2018-07/2018
<ul style="list-style-type: none">Simulated a Fetch robot decluttering a table of multiple cups in Gazebo, and implemented it on a real Fetch robotDetected centroid position of a cup based on point cloud data using Point Cloud Library (PCL)Designed arm movement by using MoveIt!, considering obstacle avoidance and orientation constraintsRetrained "you only look once" (YOLO) network with custom data to classify specific bowls	
Robotics Software Engineer Intern, Zoetic Inc., California, United States	09/2017-11/2017
<ul style="list-style-type: none">Developed a system for blob motion detection and tracking by using Lucas-Kanade optical flow in OpenCVCreated a machine learning pipeline for classifying user's facial expression based on face features	

PROJECTS

Robot Drawing Control Based on Detected Facial Emotion, Northwestern University	01/2017-04/2017
<ul style="list-style-type: none">Extracted facial features using OpenCV Haar Cascade and dense SIFT algorithmDeveloped machine learning pipeline capable of multi classification of user's real-time emotion (happy, sad, surprise, and disgust) using webcamDeveloped ROS software to control a Baxter Research Robot to draw images corresponding to result of emotion classification	
Simulation Tool for Decentralized Multi-Robot Co-op Manipulation, Northwestern University	09/2017-12/2017
<ul style="list-style-type: none">Used a dynamic simulation library developed by Northwestern (trep) to develop kinematic and torque control strategies for the system, which allows the robots to manipulate the object through different desired trajectoriesEach robot consists of a four-mecanum wheeled mobile base and delta robot arm attachment	
Autonomous Path-Following Car Controlled by Android Phone, Northwestern University	04/2017-06/2017
<ul style="list-style-type: none">Designed and built a differential drive robot car using 3D printer and laser cutterDeveloped an image processing Android app for detecting the road with the phone's camera	

- Motor controlled by PIC microcontroller on custom PCB communicating with Android over USB CDC protocol
- Machine Learning Projects, Northwestern University** 09/2016-07/2017
- Real time playing card recognition with OpenCV and Convolutional Neural Net in TensorFlow
 - Developed a musical instrument classifier by using Mel-Frequency Cepstral Coefficients and SVM algorithm
- Control and Dynamics Projects, Northwestern University** 09/2016-07/2017
- Dynamic simulation of multi-body mechanical systems in generalized coordinates involving friction, impacts and external forcing using Mathematica
 - Simulation and synthesis of optimal control for a Pendubot using a functional gradient technique
- Freescale Cup: Intelligent Car Racing (Electromagnetism Group), Beijing, China** 05/2014-05/2015
- Team Leader of Freescale Cup: Intelligent Car Racing of North China region (3rd place finish)
- Created software for controlling a car to follow a wire with PIC microcontroller
 - Improved an adaptive PID algorithm to maintain steady velocity, and refined steering angle PD algorithm in greater stability and accuracy of turning angle
 - Designed fuzzy controller and filtering scheme to determine set point for low-level steering angle controller

RESEARCH EXPERIENCE

- Research Assistant, Tsinghua University, Beijing, China** 10/2015-06/2016
- Contributed to research about Natural Language Processing (NLP): extract emotions of online users based on the micro-blog article
- Developed software for emotion classification (happy, sad, surprise, disgust, angry and afraid) for online articles based on words and structure features of sentences using SVMPerf, improving accuracy by 15% over previous solution that ignores sentence structure
- Research Assistant, Renming University, Beijing, China** 11/2014-09/2015
- Contributed to research about Music Information Retrieval (MIR): music emotion classification (happy, sad and natural) for Èrhú performance (Èrhú is a traditional Chinese string instrument)
- Proposed and worked on a new research direction: combined performer's actions (such as hand movements feature: bow speed and bow travel) and audio data as classification features, improving accuracy by 9.4% over previous solution that ignores hand movements

SKILLS

- Proficient: C/C++, Python, Linux, Git/GitHub, ROS, Gazebo, Rviz, MoveIt!, Mathematica, MATLAB, AutoCAD, SOLIDWORKS
- Experienced: Eagle, V-REP, Weka, MPLAB, CodeWarrior, Android Studio
- Knowledgeable: Machine Learning, Navigation, Manipulation, Perception, Convolutional Neural Network (CNN), Computer Vision, Computational Geometry, Forward and Inverse Kinematics, PIC Microcontroller, PCB Design, Android Development, Optimal Control of Nonlinear Systems

EXTRACURRICULAR ACTIVITIES

- Participated as an Èrhú performer in Stanford Chinese Music Chamber Orchestra, CA, United States 09/2018-present
- Volunteered in Community Animal Rescue Effort, Chicago, United States 07/2017-01/2018
- Participated as an Èrhú performer in CAU Chinese Music Chamber Orchestra, Beijing, China 07/2012-09/2015
- Received The Solver Award of Chinese National Music Alliance's International Chinese Music Chamber Orchestra Competition 08/2013
 - Received The First Award of Beijing University Students Performance about Chinese Music Chamber Orchestra Competition 11/2014
- Worked as a volunteer for teaching, cleaning library and helping pupils, Beijing, China 09/2012-09/2014
- Investigated the promotion of democracy at the grass-roots level, Hebei, China 09/2014
- Received the second place of photography competition, CAU, China 10/2013
- Member of Student Union of Engineering College, CAU, China 09/2012-09/2013
- League Branch Secretary, CAU, China 09/2012-09/2013