

Yuchen Rao

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

EDUCATION

PhD Student of Computer Science, major in 3D Computer Vision	01/2021-present
Research advisor: Prof. Angela Dai	
3D AI Lab, Technical University of Munich, Munich, Bavaria, Germany	
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, a Project 985 University), Beijing, China	
GPA 3.88/4.00, Rank: 1/43	

RESEARCH EXPERIENCE

PhD Student, Technical University of Munich, Munich, Bavaria, Germany	01/2021-present
Research in 3D Computer Vision, and 3D Machine Learning	
<ul style="list-style-type: none">Proposed a 3D shape completion method, which learns effective shape priors based on multi-resolution local patches, and improves over state of the art in novel-category shape completion by 19.3% in chamfer distance on ShapeNet, and 9.0% for ScanNet	
Research Assistant, Tsinghua University, Beijing, China	10/2015-06/2016
Contributed to research in Natural Language Processing (NLP): extracted emotions of online users based on micro-blog articles	
<ul style="list-style-type: none">Developed software for emotion classification (happiness, sadness, surprise, disgust, anger, or fear) for online articles based on features of words and sentence structures using SVMPerf, improving accuracy by 15% over the previous solution that ignores sentence structure	
Research Assistant, Renmin University of China, Beijing, China	11/2014-09/2015
Contributed to research in Music Information Retrieval (MIR): music emotion classification (happiness, sadness, or neutral) during Èrhú performances (Èrhú: a traditional Chinese string instrument)	
<ul style="list-style-type: none">Proposed and worked on a new research direction: combined performer actions (such as bow speed and bow travel) with audio data to create classification features, improving accuracy by 9.4% over the previous solution that ignores hand movements	

WORKING EXPERIENCE

Robotics Software Engineer, Berkshire Grey, Massachusetts, United States	05/2019-12/2020
<ul style="list-style-type: none">Fine-tuned Mask RCNN on a custom dataset containing augmented real and simulated RGB images for grocery objects; achieving 92% accuracy for object instance segmentation during graspingContributed to the development of perception modules for ABB robots for object grasping<ul style="list-style-type: none">Improved system performance of tote detection, object segmentation, and bin content extraction, including optimization for imaging acquisition and perception to meet high computation requirements of real-time perception tasks with ENSENSO N35 3D cameraImproved system performance of grasped object pose estimation with RealSense D435 depth cameraPerformed calibration, parameter tuning, and camera driver modification on both RGBD camerasIndependently integrated existing perception system with modifications to fit the requirements for a customer picking project	
Robotics Software Engineer, Otsaw Digital Inc, California, United States	07/2018-05/2019
<ul style="list-style-type: none">Improved, tested and successfully delivered a mobile base navigation system on an Ackermann drive robot equipped with Velodyne Lidar for a customer in SingaporeCreated a recovery method to handle a navigational failure based on obstacle detectionDesigned a global path planner based on A* algorithmControlled the robot to follow a planned path using Pure Pursuit Control method	

Robotics Software Engineer Intern, Honda Research Institute USA, California, United States 02/2018-07/2018

- Simulated and implemented a system for decluttering a table on a Fetch robot with a Kinect RGB-D camera
- Detected centroid position of a cup based on point cloud data using Point Cloud Library (PCL)
- Designed arm movements using MoveIt! with consideration for obstacle avoidance and orientation constraints
- Fine-tuned "you only look once" (YOLO) network with custom data to detect plates and cups

Robotics Software Engineer Intern, Zoetic AI, California, United States 09/2017-11/2017

- Developed a system for blob motion detection and tracking by using Lucas-Kanade optical flow in OpenCV
- Created a machine learning pipeline for classifying user's facial expression based on face features

TEACHING EXPERIENCE

Teaching Assistant, Technical University of Munich, Munich, Bavaria, Germany

- Master Seminar: 3D Machine Learning Summer 2022
- 3D Scanning & Motion Capture Summer/Winter 2021

PUBLICATIONS

- **PatchComplete: Learning Multi-Resolution Patch Priors for 3D Shape Completion on Unseen Categories**
Yuchen Rao, Yinyu Nie, Angela Dai
Submitted to Advances in Neural Information Processing Systems (NeurIPS), 2022

PROJECTS

Robot Drawing Control Based on Detected Facial Emotion, Northwestern University 01/2017-04/2017

- Extracted facial features using OpenCV Haar Cascade and dense SIFT algorithm
- Developed machine learning pipeline capable of multi classification of users' real-time emotions (happy, sad, surprise, and disgust) using webcam
- Developed ROS software to control a Baxter Research Robot to draw images corresponding to results of emotion classification

Autonomous Path-Following Car Controlled by Android Phone, Northwestern University 04/2017-06/2017

- Designed and built a differential drive robot car using 3D printer and laser cutter
- Developed an image processing Android app for detecting the road with a phone camera
- Controlled motor with PIC microcontroller using custom PCB board and communication with Android over USB CDC protocol

Machine Learning Projects, Northwestern University 09/2016-07/2017

- Classified playing cards in real time using OpenCV and Convolutional Neural Net in TensorFlow
- Developed a musical instrument classifier using Mel-Frequency Cepstral Coefficients and SVM algorithm

Computer Vision Side-Projects 05/2019-07/2020

- Detected objects from video data using a well-trained Single Shot MultiBox Detector (SSD) model
- Implemented Generative Adversarial Networks (GANs) in PyTorch

SKILLS

- Proficient: C/C++, Python, Linux, GitHub, PyTorch, Tensorflow, Anaconda, Jupyter Notebook, ROS, OpenCV, PCL, CUDA, CMake, Gazebo, Rviz, Autoware, MoveIt!
- Experienced: Docker, Mathematica, MATLAB
- Knowledgeable: Computer Vision/Perception, Machine Learning, Deep Learning, Manipulation. Motion Planning

ACADEMIC & ACTIVITY 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
3 rd place in Freescale Cup: Intelligent Car Racing of North China region	05/2014-05/2015
Honorable Mention for Mathematical Contest in Modeling (MCM) (USA)	03/2015
3 rd place in NEAR Speak Out for Engineering Competition (Asia-Pacific region)	09/2014