

# Yuchen Rao

Tel: +49 15732234642

Email: [yuchen.rao@tum.de](mailto:yuchen.rao@tum.de), [yuchenrao9467@gmail.com](mailto:yuchenrao9467@gmail.com)

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

## EDUCATION

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- 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

## PUBLICATIONS

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

## RESEARCH EXPERIENCE

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- Research Internship, Huawei London Research Center, London, United Kingdom** 11/2022-05/2023
- Research in Neural Radiance Fields (NeRF) for human body
- Research Assistant, Technical University of Munich, Munich, Bavaria, Germany** 01/2021-11/2022  
Research in 3D Computer Vision, and 3D Machine Learning; Research advisor: Prof. Angela Dai,
- Proposed a 3D shape completion method *PatchComplete* based on learned effective multi-resolution patch priors, 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
- 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)
- 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

## TEACHING EXPERIENCE

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- Teaching Assistant, Technical University of Munich, Munich, Bavaria, Germany**
- Master Seminar: 3D Machine Learning Summer 2022
  - 3D Scanning & Motion Capture Summer/Winter 2021

## WORKING EXPERIENCE

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- Robotics Software Engineer, Berkshire Grey, Massachusetts, United States** 05/2019-12/2020
- 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 grasping
  - Contributed to the development of perception modules for ABB robots for object grasping
    - 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 camera
    - Improved system performance of grasped object pose estimation with RealSense D435 depth camera
    - Performed calibration, parameter tuning, and camera driver modification on both RGBD cameras

- Independently 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

- Improved, tested and successfully delivered a mobile base navigation system on an Ackermann drive robot equipped with Velodyne Lidar for a customer in Singapore
- Created a recovery method to handle a navigational failure based on obstacle detection
- Designed a global path planner based on A\* algorithm
- Controlled 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

## **PROJECTS**

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**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

**Related Machine Learning Projects** 09/2016-12/2020

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

## **SKILLS**

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- 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**

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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 <sup>rd</sup> 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