Yuchen Rao

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

EDUCATION

PhD 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 Researcher, Technical University of Munich, Munich, Bavaria, Germany 01/2021-present

Research in 3D Computer Vision

- 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

- 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 solutionthat ignores hand movements

WORKING EXPERIENCE

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

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**
  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
3rd 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
3rd place in NEAR Speak Out for Engineering Competition (Asia-Pacific region)	09/2014