Yuhan Liu

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RESEARCH INTERESTS

- **Reinforcement Learning**: Generalization, Multi-task Learning, Meta Learning, Inverse RL.
- **Robotics**: Autonomous Driving, Physical Understanding through Interaction, Sensor Fusion, Motion Planning, Visual SLAM;
- **Computer Vision**

EDUCATION

Master of Science in Computer Science (GPA: 3.95/4.00) June 2021
University of California, San Diego (UCSD) San Diego, U.S.
Bachelor of Engineering in Electronic Information Engineering June 2019
The Chinese University of Hong Kong, Shenzhen (CUHKSZ) Shenzhen, China

- GPA: 3.67/4.00 (rank top 5%).
- Selected awards: Academic Scholarship (2017 & 2016); Dean's List under School of Science and Engineering (2019 & 2018 & 2017 & 2016); Undergraduate Research Award (2018 & 2017).
- Visiting student to University of Cambridge (July 2017-Sept 2017)

PUBLICATIONS

[1] **Liu, Y.***, Han, Y.*, Paz, D., and Christensen, H. "Auto-calibration Method Using Stop Signs for Urban Autonomous Driving Applications." In ICRA 2021.
[2] Li, Z., Yu, T., Sang, S., Wang, S., Song, M., **Liu, Y.**, Yeh, Y., Zhu, R., Gundavarapu, N., Shi, J., Bi, S., Xu, Z., Yu, H., Sundavalli, Kalyan., Hasan, M., Ramamoorthi, R., Chandraker, M. "OpenRooms: An End-to-End Open Framework for Photorealistic Indoor Scene Datasets." In CVPR 2021. (Oral)

RESEARCH EXPERIENCE

Physics-Aware Reinforcement Learning in Simulated Indoor Scenes Sept 2020 - Present
Graduate Research Assistant to Prof. Manmohan Chandraker UCSD

- Participated in a project that proposed a novel energy-based reward which encourages learning the physical understanding of mass and friction coefficients; Demonstrated its effectiveness on two novel and challenging indoor rearrangement tasks unifying navigation and object interaction skills.
- Designed and derived the translational and rotational energy, normalized with historical values to have scale-free effect on the reward, which is one of the principal technical contribution.
- Proposed the novel "variable mass pushing task" to test the agent's physical understanding of mass, of which the results clearly and intuitively matched human expectations.
- Carried out experiments and ablation studies; Showed decrease of energy consumptions in both tasks with our method.
- Open-source libraries and platforms include: RLlib, iGibson, PyBullet, OpenRooms, and PyTorch; RL algorithm used: PPO (Schulman et. al., 2017).
- Paper [2] accepted by CVPR 2021 (Oral).
- Paper submitted to NeurIPS 2021.

Auto-calibration for Urban Autonomous Driving Applications Sept 2019 - Sept 2020
Graduate Research Assistant to Prof. Henrik Christensen, Autonomous Vehicle Lab UCSD

- Designed and implemented an autonomous pipeline for camera intrinsic calibration using ubiquitous stop signs as references; Techniques include: object detection with neural networks, sub-pixel edge detection, SVD, RANSAC, shape matching, planar object calibration, temporal updates with a Kalman filter.
- Experimented on cameras mounted on an autonomous vehicle driving around the UCSD campus; Showed

convergences (to zero) on the relative errors of the intrinsic parameters; Achieved lowest relative errors comparable to those of the widely accepted checkerboard calibration method (Zhang, 2000).

- Paper [1] accepted by ICRA 2021.

Course Design: AI and Robotics Apr 2019 – July 2019

Research Assistant to Prof. Tinlun Lam, Shenzhen Research Institute of AI and Robot CUHKSZ

- Designed and implemented an experimental high school robot course consisted of image recognition, voice detection, and auto navigation, based on robot operating system (ROS).
- Organized the projects into convenient API's for different course designs and various course levels.
- Documented the algorithms (e.g. perceptron, back propagation), principles (e.g. topic/service programming, synchronized/asynchronized communication), and implementation procedures into a thorough instruction manual.

Picture Prediction on Historical Radar Reflection Images Jan 2018 – Nov 2018

Research Assistant to Prof. Xiaoguang Han, Shenzhen Research Institute of Big Data CUHKSZ

- Participated in the Global A.I. Challenge on Meteorology sponsored by IEEE International Conference on Data Mining (ranked 11/1739).
- Proposed a solution: converting temporal information into spatial information, treating historical image sequences as one single image, and generating future sequences based on it.
- Added ConvLSTM on top of the traditional picture generation algorithm for radar reflection images implemented in TensorFlow, achieving a 7% increase in Heidke Skill Score.

WORK EXPERIENCE

Huawei Technologies Co., Ltd. June 2018 – Aug 2018

Technology Research Engineer (Internship) Shenzhen, China

- Increased the recognition rate of pedestrians' clothing and ages on surveillance videos, by empowering loss functions of a deep neural network, constructed in Caffe and CUDA.
- Clothing Color Recognition: Added a label-smoothing strategy to the one-hot labeled loss function and observed a 5% increase of recognition rate for the multi-labeled algorithm on recognizing ragged clothes.
- Age Recognition: Introduced expectation and variance to the loss function of the age identification network and demonstrated its effectiveness: mean absolute error (MAE) dropped by 1.42 years old from the original model.

TEACHING EXPERIENCE

Electricity and Magnetism Feb 2018 – May 2018

Teaching Assistant, School of Science and Engineering CUHKSZ

- Guided 10-15 junior students in reviewing and practicing learned content from lectures.
- Added extra materials to tutorials and explained challenging content in a weekly seminar.
- Held office hours per week for answering questions.

TECHNICAL SKILLS

- **Programming Languages**: Python, C++, C, ROS, MATLAB, R, CUDA
- **Software and Platforms**: PyTorch, RLlib, iGibson, PyBullet, OpenCV, TensorFlow, Caffe
- **Development Board**: ARM Cortex M3, FPGA