Weihao Yuan

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EDUCATION & WORK

2016.09- Hong Kong University of Sci & Tech Hong Kong, China

- PhD Candidate in Robotics Institute, Department of Electronic & Computer Engineering
- Research Area: Deep Reinforcement learning, Robot Motion Planning, 3D Vision Depth Estimation
- Supervisor: Michael Yu Wang Co-supervisor: Qifeng Chen

2018.03-2018.09 KTH Royal Institute of Technology Stockholm, Sweden

- Visiting researcher in Robotics, Perception and Learning Lab, Centre for Autonomous Systems, School of Electrical Engineering and Computer Science.
- Supervisor: Danica Kragic

2017 Spring & Fall Teaching Assistant in Dept. ECE, HKUST Hong Kong, China

- Machine Learning and Information Processing for Robotic Perception (ELEC4010K), working with Prof. Ming Liu
- Control System Design (ELEC4010G), working with Prof. Li Qiu

2012.09-2016.06 Zhejiang University Hangzhou, China

- Bachelor of Engineering in Automation, Minor in Finance
- **GPA**：3.91/4 **Rank**：6/142

PROJECT EXPERIENCE

2019.12- A Unified Framework for Self-supervised Object Tracking and Segmentation

- Supervised object tracking, detection or segmentation suffer from laborious annotation work. On the contrary, we are employing the internal relationship in these task and underlying structure of images to do a self-supervised framework.

2019.03-2019.11 Unsupervised Learning for Stereo matching with Multiscopic Images

- We propose a new self-supervised framework for stereo matching utilizing multiple images captured at aligned camera positions. A cross photometric loss, a self-supervision loss, and a new smoothness loss are introduced to assist the network to learn to estimate the disparity map end-to-end without ground-truth depth information. Trained with only the indoor synthetic images, our network can perform better than all previous unsupervised methods in unseen outdoor KITTI dataset.

2018.12-2019.07 Towards Learning to Detect and Predict Contact Events on Vision-based Tactile Sensors

- We propose to classify and predict tactile signal using deep learning method, seeking to enhance the adaptability of the robotic grasp system to external disturbances. We develop a deep learning framework and collect tactile image sequence with vision-based tactile sensor, FingerVision. The neural network is integrated into a FingerVision-based robotic grasping system to detect the current and predict the future grasping state, e.g. rolling, slipping or stable contact.

2018.10-2019.06 MFuseNet: Robust Depth Estimation with Learned Multiscopic Fusion

- We design a multiscopic vision system that utilizes a monocular camera to acquire accurate depth estimation. Unlike multi-view stereo with images captured at unconstrained camera poses, the proposed system controls the motion of the camera to capture a sequence of images in horizontally or vertically aligned positions with the same parallax. We propose a new heuristic method and a robust learning-based method to fuse multiple cost volumes between the reference image and its surrounding images. Trained with the synthetic dataset we built, our method outperforms previous stereo and multiscopic approaches.

2018.06-2019.09 Sorting Cluttered Tabletop Using Improved Monte Carlo Tree Search

- In industrial environments, there are many tasks about sorting and rearranging different kinds of objects. Inspired by AlphaGo, we propose an improved MCTS to do this. We use the results of a classical MCTS to train a policy network and then use the network to guide the tree search.

2018.03-2018.09 Manipulation Using Deep Reinforcement Learning in Topology Space

- We model a whole arm manipulation task about holding as a deep reinforcement learning problem in order to provide a behavior that can directly respond to external perturbation and target motion. To improve the performance of deep learning in robotics application, we propose a new state as the input of the networks the topology representation. This state allows transferring the learned policy to various shapes, sizes and poses because they are the same in topology space. Compared to RGB image state or pose coordinates state, it can better describe the interaction state between the robot and environments.

2017.03-2018.05 Rearrangement Using Deep Reinforcement Learning and Transfer Learning

- In contrast to classic methods which can only handle static scene, as explicitly modeling the physical environment is not always feasible and involves various uncertainties, we learn a nonprehensile rearrangement strategy with deep reinforcement learning in simulation and then transfer the knowledge to reality. We propose potential field-based heuristic exploration and reply buffer curation to assist the training and propose a transfer method in Q-space to fill the gap between simulation and reality. The real robot handles the dynamic scene well with our approach.

2015.12-2016.05 Intelligent Forging Production Line with Industrial Robots Graduation Project

- Built a sensing system to acquire clear images of high-temperature forging; designed an algorithm to compute its size and pose for robot manipulation; developed the industrial software for the factory.

2014.05-2015.05 On-Road Lane Detection System Based on Machine Vision Member

- Detect the structured and unstructured road edge based on the gradient of brightness and the RGB information of the road to assist the driving of a Fuel Cells Go-Kart.

2013.09-2014.05 Ninth Robot Contest of Zhejiang Province Team leader

- Finished goalie task and shooting task. (4 tasks in total in the robot soccer game)
- Participated in designing the algorithm of path planning task and positioning task and got the second prize.

AWARDS & HONORS

2018	Overseas Research Awards, HKUST
2016	Outstanding Graduates of Zhejiang Province (and Zhejiang University)
2015	Excellent Student Awards; Alibaba New Media Scholarship
	Scholarship for Excellence in Research and Innovation
2014	First-Class Scholarship for Outstanding Students (Top 3%); Supcon Scholarship

PUBLICATION

[1] **Weihao Yuan**, Michael Y. Wang, Qifeng Chen, “Self-supervised Object Tracking and Segmentation with Cycle-consistent Siamese Networks”, submitted.

[2] **Weihao Yuan**, Yazhan Zhang, Bingkun Wu, Michael Y. Wang, Qifeng Chen, “Stereo Matching by Self-supervision of Multiscopic Vision”, submitted.

[3] **Weihao Yuan**, Rui Fan, Michael Y. Wang, Qifeng Chen, “MFuseNet: Robust Depth Estimation with Learned Multiscopic Fusion”, IEEE International Conference on Robotics and Automation (ICRA), published in IEEE Robotics and Automation Letters (RA-L), 2020.

[4] Yazhan Zhang, **Weihao Yuan**, Zicheng Kan, Michael Y. Wang, “Towards Learning to Detect and Predict Contact Events on Vision-based Tactile Sensors”, Conference on Robot Learning (CoRL), 2019. **Oral Presentation** (acceptation rate: 5.3%).

[5] **Weihao Yuan**, Kaiyu Hang, Danica Kragic, Michael Y. Wang, Johannes A. Stork, “End-to-End Nonprehensile Rearrangement with Deep Reinforcement Learning and Simulation-to-Reality Transfer”, Robotics and Autonomous Systems (RAS), 2019.

[6] **Weihao Yuan**, Kaiyu Hang, Haoran Song, Danica Kragic, Michael Y. Wang, Johannes A. Stork, “Reinforcement Learning in Topology-based Representation for Human Body Movement with Whole Arm Manipulation”, IEEE International Conference on Robotics and Automation (ICRA), 2019.

[7] **Weihao Yuan**, Johannes Andreas Stork, Danica Kragic, Michael Yu Wang, Kaiyu Hang, “Rearrangement with Nonprehensile Manipulation Using Deep Reinforcement Learning”, IEEE International Conference on Robotics and Automation (ICRA), 2018.