

Zixuan Huang

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EDUCATION

University of Michigan, Ann Arbor

Sept. 2022 - Now

PhD in Robotics, advised by Prof. Dmitry Berenson

Carnegie Mellon University

Sept. 2020 – Aug. 2022

M.S. in Robotics, advised by Prof. David Held

City University of Hong Kong

Sept. 2016 – May. 2020

B.S in Computer Science

PUBLICATION

Task-aware Model Selection for Planning

In progress

- Designed an algorithm to dynamically select the model with appropriate level of abstraction for planning. The model selection process is guided by a reachability model, which captures the likelihood of reaching the goal by planning on a specific model.

Self-supervised Cloth Reconstruction via Action-conditioned Cloth Tracking

Zixuan Huang, Xingyu Lin, David Held

IEEE International Conference on Robotics and Automation 2023

- Designed a self-supervised algorithm for estimating the full mesh of occluded cloth in real-world, which is backed by an action-conditioned tracking method. The proposed tracking method uses an imperfect cloth dynamics model to produce initial solution, which is then refined by gradient-based optimization.
- Implemented the algorithm in Nvidia Flex and pytorch and deployed it on Franka Panda arm and showed that it improves the performance of cloth manipulation in real world.

Mesh-based Dynamics with Occlusion Reasoning for Cloth Manipulation

Zixuan Huang, Xingyu Lin, David Held

Robotics, Science and system 2022

- Designed an algorithm to tackle the partial observability in cloth manipulation by explicitly reconstructing the full mesh using neural networks and test-time finetuning. Coupled the learned dynamics model with sampling-based planner and show that occlusion reasoning not only improves the accuracy of dynamics model but also provides more informative reward signal, compared to the baseline without explicit occlusion reasoning.

Learning Visible Connectivity Dynamics for Cloth Smoothing

Xingyu Lin, Yufei Wang*, Zixuan Huang, David Held*

Conference on Robot Learning 2021

- Developed a particle-based dynamics model for cloth by graph neural networks and smooths the cloth by planning.
- Designed a novel algorithm, graph imitation, to accommodate the issue of partial observability: an asymmetric learning approach that let the student model with partial observations to imitate a teacher model with full-state information.
- It can generalize to cloths with novel shapes and real world in a zero-shot manner.

PROJECT

Learning Trajectory Prior for Planning

Carnegie Mellon University

- Hand-crafted heuristic function can be sub-optimal. Instead, we designed a data-driven approach to learn a prior of expert trajectory and guide the planning process.
- I collected an offline dataset of expert trajectories by PRM and A*. A neural network is trained to approximate the distribution of expert trajectories. At test-time, it will guide the expansion of RRT.
- The algorithm is evaluated on a 6D manipulator planning problem. And the learned heuristic function greatly improve the quality of found path in given time.

Privacy-preserving Machine Learning as a Service on SGX

City University of Hong Kong

- Wrote a C++ based inference pipeline to deploy a Keras model in SGX, a CPU-only trusted execution environment with memory constraint.
- Manually managed a memory pool to avoid frequent OS level memory operation and share memory.
- Implemented a customized Conv1D module by AVX2 intrinsics and cache optimization, which increases speed for 37.3% compared to using BLAS library Eigen.

World Model with Rank-preserved Pseudo Rewards

Zixuan Huang, Xingyu Lin, David Held

- Modeling the absolute value of rewards by predictive estimation is overly constrained for planning since we only care about the ordering of candidate plans.
- Proposed a ranking-based reward learning method that only models the pairwise relationship over different trajectories.

Experience

Robot Perceiving and Doing Lab, CMU

Research Assistant, Sept. 2020- Aug. 2022

- Research in the intersection of computer vision, reinforcement learning and robot manipulation.
- Design, implement and evaluate machine learning model in both simulation and real-world environment.

Siemens, Hong Kong

Student intern, Sept. 2018–June 2019

- Built a video-based real-time violence detection system by I3D model. Tackled with sparsely labeled data by multiple instance learning.
- Developed data dashboard by Angular and Spring Boot. Retrieve data from PostgreSQL and visualized them in accordance with the business logic.

Hong Kong Applied Science and Technology Research Institute

Student intern, June 2018–July 2018

- Learned and study the source code of Caffe for customization.
- Implemented toolkits for machine learning platform by C++. For example, BN Merger, a tool for merging the computation of Batch Normalization into previous Conv or FC layers on deploy for faster inference.

• SKILLS

- **Courses:** Reinforcement Learning, Planning, Probabilistic Graphical Model, Computer Vision, Deep Learning
- **Programming:** Python, C++
- **Frameworks:** Pytorch, Pytorch3D, ROS, OpenCV, Linux, Git