

# Xilun Zhang

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## EDUCATION

### Carnegie Mellon University

Pittsburgh, PA

*Master of Science in Mechanical Engineering - Research*

*Dec 2024*

- GPA 4.00/4.00 | CMU Safe AI Lab
- Current Projects : LLM for Curriculum Task Generation, Visual Sim-to-Real Transfer
- Courses: Introduction to Robot Learning(current); Machine Learning for Engineers(current); Self-driving Cars: Perception and Control; Trustworthy AI Autonomy; Introduction to Deep Learning

### Simon Fraser University

Vancouver, Canada

*Bachelor of Applied Science in Mechatronic Systems Engineering with Co-op with Distinction*

*Dec 2022*

- Major GPA 3.85/4.33 | SFU Autonomous and Intelligent Systems Lab
- Selected Courses: Advanced Kinematics for Robotic Systems; Flight Dynamics and Control of UAVs; Modern Control System; Optimization; Sensors and Actuators; Power Electronics and Machinery
- Awards: SFU Vice-President Undergraduate Research Award (Summer 2021, Fall 2022)

## RESEARCH PROJECTS

### Closing Sim-to-Real Gap via Differentiable Causal Discovery

Apr 2023 – Aug 2023

*Graduate Research Assistant @ CMU Safe AI Lab | PI: Prof.Ding Zhao*

*Pittsburgh, PA*

- Proposed an algorithm that learns a differentiable mapping from the environment parameters to the differences between simulated and real-world robot trajectories, which is governed by a simultaneously-learned causal graph.
- Reproduced paper results and Outperformed state-of-the-art Sim-to-real methods in trajectory alignments such as Gradient-based Methods (ExiNet), Sampling-based Methods (NPDR) and TuneNet
- Developed PPO/SAC training simulations/tasks from scratch using Mujoco and Robosuite; Improved causal discovery network structure and parameters
- Coded the algorithm's main framework including data collection, agent training, and causal model training
- Conducted extensive literature reviews in dynamical domain randomization, domain adaptation, sampling-based optimization methods, and gradient-based optimization methods

### Developing Robust Control for Learning-based Quadrotor Stabilization

Aug 2022 – Dec 2022

*Undergraduate Research Assistant @ SFU Multi-Agent Robotic System Lab | PI: Prof.Mo Chen*

*Vancouver, Canada*

- Developed adversarial control framework using Hamilton-Jacobi Reachability Analysis in simulation against the quadrotor stability; Generated value function and optimal disturbance under different control settings
- Set up simulation/training environment to stabilize small-scale quadrotor under disturbance using Proximal Policy Optimization
- Wrote Gym wrapper for quadrotor training environment, optimized reward function design and implemented curriculum learning during adversarial training
- Conducted extensive literature review on robot learning, robust reinforcement learning, guided policy search and Sim2Real transfer for quadrotor low-level control

### RoboTool: Creative Tool Use with Large Language Models

Aug 2023 – Oct 2023

*Graduate Research Assistant @ CMU Safe AI Lab (collaborated with Google Deepmind)*

*Pittsburgh, PA*

- Built creative tool use scenarios in table-top manipulation settings using robosuite and corresponding helper functions for objects manipulations
- Wrote API functions for transferring simulation results to real Kinova Gen3 Implementation
- Implemented OWL-ViT to perception system to get 2D pose of the objects and transformed position from camera coordination to robot coordination
- Conducted literature review on geometry understanding and creative reasoning using large language model

### Designing Driverless Car Using Artificial Intelligence

Jan 2022 – Aug 2022

*Student Researcher @ SFU Autonomous and Intelligent Systems Lab | PI: Prof.Ahmad Rad*

*Vancouver, Canada*

- Led a team of five to achieve optimal results by managing multiple design requirements and moderated internal/external meetings; managed project documentation including proposals, functional/design specifications
- Designed high-level controllers and tested them in CARLA Simulator, including finite state machines, trajectory rollout algorithms, trapezoidal velocity profiles, motion prediction and circle-based collision checking
- Implemented transfer learning to PilotNet with a pre-trained network to cater specific testing environment
- Implemented Stanley and Pure Pursuit Controller for vehicle lateral control and PID for longitudinal control

## PUBLICATION

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### 1. What Went Wrong? Closing the Sim-to-Real Gap via Differentiable Causal Discovery

Peide Huang, **Xilun Zhang\***, Ziang Cao\*, Shiqi Liu\*, Mengdi Xu, Wenhao Ding, Jonathan Francis, Bingqing Chen, Ding Zhao

2023 Conference on Robot Learning (CoRL 2023)

### 2. Continual Vision-based Reinforcement Learning with Group Symmetries

Shiqi Liu\*, Mengdi Xu\*, Peide Huang, **Xilun Zhang**, Yongkang Liu, Kentaro Oguchi, Ding Zhao

2023 Conference on Robot Learning (CoRL 2023) (oral, 6.6%)

### 3. Creative Robot Tool Use with Large Language Models

Mengdi Xu\*, Peide Huang\*, Wenhao Yu\*, Shiqi Liu, **Xilun Zhang**, Yaru Niu, Tingnan Zhang, Fei Xia, Jie Tan, Ding Zhao

arxiv. Under review

## TECHNICAL SKILLS

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**Engineering/software:** SIMULINK, Pytorch, TensorFlow, StableBaselines3, CARLA, Sklearn, OpenCV, LTspice, LabVIEW, Proteus, SolidWorks, Soldering

**Languages:** Python, MATLAB, C++, Assembly