# Tao, Yiran (Elaine)

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## Research Interests

Robot learning, human-robot interaction (HRI), assistive healthcare robotics, computer vision

## Education

**Carnegie Mellon University (CMU),** Pittsburgh, PA                     Aug. 2023 - Aug. 2025 (expected)
- **Master of Science in Robotics (MSR)**                                                GPA: 4.0/4.0
  Advisor: Prof. Zackory Erickson, Prof. Dan Ding (University of Pittsburgh)

**Wuhan University (WHU)**, Wuhan, China                                          Sept. 2019 - Jun. 2023
- **Bachelor of Engineering in Computer Science and Technology**                      GPA: 3.87/4.0
  Thesis Advisor: Prof. Zhenzhong Chen
- **Bachelor of Arts in English**                                                             GPA: 3.86/4.0

**Harvard College,** Cambridge, MA                                                   Jan. 2022- May. 2022
- **Visiting Undergraduate Student Program (Concentration: Computer Science)**        GPA: 4.0/4.0
- **Cross-registered at Massachusetts Institute of Technology (MIT)**                 GPA: 5.0/5.0

## Publications

- **Yiran Tao**, Guixiu Qiao, Dan Ding, Zackory Erickson. "Incremental Learning for Robot Shared Autonomy". in submission.
- **Yiran Tao\***, Jehan Yang\*, Dan Ding, Zackory Erickson. "LAMS: LLM-Driven Automatic Mode Switching for Assistive Teleoperation". accepted to HRI 2025 (Best Paper Finalist).
- **Yiran Tao**, Yaosi Hu, Zhenzhong Chen. "Memory-Guided Representation Matching for Unsupervised Video Anomaly Detection". Journal of Visual Communication and Image Representation, 2024.
- Weijian Ruan\*, **Yiran Tao\***, Linjun Ruan, Xiujun Shu,  Yu Qiao. "Temporal Weighting Appearance-Aligned Network for Nighttime Video Retrieval". IEEE Signal Processing Letters, 2022.
- **Yiran Tao**, Yaosi Hu, Zhenzhong Chen. "Learn to Look Around: Deep Reinforcement Learning Agent for Video Saliency Prediction". IEEE International Conference on Visual Communications and Image Processing, 2021.

## Research Experience

**RA, Robotic Caregiving and Human Interaction Lab, CMU**                     Pittsburgh, PA, US
Advisor: Prof. Zackory Erickson, Prof. Dan Ding (University of Pittsburgh)

**Project 1: VLM-based Intent Recognition for Assistive Manipulation (Ongoing)**     Jan. 2025-Present
- Developing a VLM-based framework for recognizing sub-task intentions after object grasping, enhancing task completion in shared control scenarios.
- Investigating the integration of VLM predictions with SOTA intent recognition methods for more robust and adaptive user intent inference.

**Project 2: LLM-Driven Automatic Mode Switching for Assistive Teleoperation**     May 2024-Sep. 2024
- Developed an LLM-driven framework for automatic mode switching that eliminates the need for task-specific demonstrations or predefined rules and continuously improves through user interaction.
- Implemented the method to control a Kinova robotic arm using a single joystick.
- Organized and conducted a user study subject to a university-approved IRB protocol with 10 participants.
- Had a first-author paper accepted to HRI 2025, which has been nominated for best paper.

## [Project 3: Incremental Learning for Robot Shared Autonomy](#)  Oct. 2023-Jul. 2024

- Developed an incrementally learned shared autonomy framework that improves an imitation learning-based shared control policy through user interaction, eliminating the need for expert demonstrations.
- Implemented the method on a Kinova robotics arm.
- Organized and conducted a user study subject to a university-approved IRB protocol with 20 participants.
- Authored a first-author paper, which is now in submission.

### RA, Visual Computing Group, Harvard University  Cambridge, MA, US
Advisor: Prof. Hanspeter Pfister

**Semi-supervised Edge-Guided Cell Instance Segmentation for Embryo Images**  Mar. 2022-Oct. 2022

- Implemented baseline methods to analyze key morphokinetic features of human embryo images.
- Developed a semi-supervised edge detection model that aligns edges in unlabeled images with edge patterns captured from labeled images, enhancing embryo cell segmentation performance.

### RA, Intelligent Information Processing Lab, Wuhan University  Wuhan, China
Advisor: Prof. Zhenzhong Chen

**Project 1: Representation Matching for Unsupervised Video Anomaly Detection**  Dec.2021-Jun. 2022

- Developed a novel unsupervised model to detect video anomalies by capturing normal event representation patterns and identifying anomalies based on mismatches in event representations.
- Published a first-author paper in Journal of Visual Communication and Image Representation.

**Project 2: Crowd Counting for UAV RGB-T Images (ICCV 2021 Challenge)**  May 2021-Jul. 2021

- Designed a novel model to extract multi-scale features from RGB-T modalities and generate adaptive crowd density maps for crowd counting.
- Ranked $1^{st}$ and $2^{nd}$ on two metrics in the Crowd Counting Track of VisDrone 2021 Challenge at ICCV 2021, receiving the Runner-Up team award.

**Project 3: Video Saliency Prediction with Deep Reinforcement Learning**  Aug. 2020-Jun. 2021

- Developed a reinforcement learning agent with deep Q-learning to identify frames with the most correlated information, enhancing temporal information extraction and saliency prediction accuracy.
- Published a first-author paper in IEEE VCIP 2021.

### RA, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences  Shenzhen, China
Advisor: Dr. Weijian Ruan

**Nighttime Video-based Person Re-identification**  Aug. 2021-Dec. 2021

- Built a dataset for video-based person re-identification during nighttime.
- Developed a novel person re-identification model that enhances video representations by aligning features across video frames and weighting frames based on quality.
- Published a co-first author paper in IEEE Signal Processing Letters.

## Scholarships & Awards

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| Luojia Excellent Overseas Communication Scholarship of Wuhan University | 2022 |
| First-class Excellent Student Scholarship of Wuhan University (top 5%) | 2021 |
| Yugang-Songxiao Special Scholarship of Wuhan University (top 1%) | 2021 |
| Runner-up, Crowd Counting Track, ICCV 2021 VisDrone Challenge | 2021 |

## Skills

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| **Programming:** | Python, C/C++, Java, Matlab, R |
| **Libraries/Frameworks:** | Pytorch, Tensorflow, ROS, MuJoCo |
| **Robots:** | Kinova, xArm, Stretch |
| **Languages:** | English (Advanced), Chinese (Native), Japanese (Intermediate), French (Intermediate) |