ZIXING LEI

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EDUCATION

Shanghai Jiao Tong University, Department of Electronic Engineering   **Shanghai, China**
Bachelor of Engineering, Class of Outstanding Engineers.   *Sept 2017 - June 2021*

Shanghai Jiao Tong University, Cooperative Medianet Innovation Center   **Shanghai, China**
Master of Engineering, supervised by Prof. **Siheng Chen**   *Sept 2021 - Mar 2024*

RESEARCH INTERESTS

Computer Vision for Embodied AI, Multi-Agent Autonomous System

PUBLICATION

[1] Hu, Yue, Shaoheng Fang, **Zixing Lei**, Yiqi Zhong, and Siheng Chen. **Where2comm: Communication-efficient collaborative perception via spatial confidence maps** in Neural Information Processing Systems(NeurIPS), 2022. (**Spotlight Presentation**)

[2] **Zixing Lei**, Shunli Ren, Yue Hu, Wenjun Zhang, and Siheng Chen. **Latency-aware collaborative perception.** in European Conference on Computer Vision(ECCV), 2022.

[3] **Zixing Lei**, Zhengyang, Ni, Ruize Han, Shuo Tang, Chen Feng, and Siheng Chen. **Robust Collaborative Perception without External Localization and Clock Devices**. (IEEE International Conference on Robotics and Automation (ICRA) 2024, Under review)

[4] **Zixing Lei**, Yiming Zhang, Yuxin Xiong, and Siheng Chen. **Emergent Communication through Interactive Sketch Question Answering** in Neural Information Processing Systems(NeurIPS), 2023.

[5] Shunli Ren, **Zixing Lei**, Zi Wang, Mehrdad Dianati, Yafei, Wang, Siheng Chen, and Wenjun Zhang. **Interruption-Aware Cooperative Perception for V2XCommunication-Aided Autonomous Driving**. (IEEE transaction on Intelligent vehicle, Under review)

RESEARCH EXPERIENCE

Robust Multi-agent Collaborative Perception   Shanghai Jiao Tong Univerisity
Gradudate student, working with Prof. Siheng Chen   *Sept. 2021 - Now*

- Multi-agent collaborative perception could significantly upgrade the perception performance by enabling agents to share complementary information with each other via communication to overcome occlusion and long range issues.

- In practical scenarios, collaborative perception are facing three significant issues: i) trade-off between performance and communication bandwidth; ii) communication and computation latency. iii) accurate spatial-temporal alignment.

- To address bandwidth issues, [1] proposed a spatial confidence map, which reflects the spatial heterogeneity of perceptual information, empowering agents to only share spatially sparse, yet perceptually critical information. Our approach achieves more than $100\times$ lower communication volume and still outperforms previous SOTA solutions.

- To address latency issues, [2] proposed the first latency-aware collaborative perception system, which actively adapts asynchronous perceptual features from multiple agents to the same time stamp, promoting the robustness and effectiveness of collaboration. Our method outperforms the state-of-the-art collaborative perception method by 15.6%.

- To address spatial-temporal alignment issues, [3] constructs a salient object graph for each agent based on its detected boxes and uses a GNN to identify common subgraphs between agents, leading to accurate alignment without External Localization and Clock Devices. It performs comparably to systems relying on precise localization and clock devices.

Multi-round Interactive Emergent Communication   Shanghai Jiao Tong Univerisity
Gradudate student, working with Prof. Siheng Chen   *Aug. 2022 - Now*

- Emergent communication aims for a better understanding of human language evolution and is a promising direction for achieving human-like communication between intelligent agents.

- We proposed a novel task setting, whose goal is to promote multi-round, bilateral, interactive communication between a pair of a sender and a receiver. To achieve this goal, our proposal has three unique characteristics: information disparity, triangle evaluation, and feedback mechanism.

- We built a vision-language architecture to create information disparity between agents and design a gradient based feedback mechanism to achieve efficient information exchange.

Foundation model empowered vision-language capability of Robots   University of Carlifornia, San Diego
Research assistant, working with Prof. Xiaolong Wang and Dr. Jiarui Xu   *Jul. 2023 - Now*

- Leveraging large scale noisy data to enhance the vision-language models on open-vocabulary panoptic segmentation.
- Integrating diffusion backbone with segmentation model to combine generation and discrimination tasks.
- Proposing new matching method in segmentation to cover masks with different scales.

INDUSTRIAL EXPERIENCES

Intel, Intel's architecture, graphics and software (IAGS) group.   Shanghai, China
Graphic software engineering intern   *Jul 2020 - May 2021*

- Developed an automatic tools for Intel DG2 GPU to test the quality of encoded gaming video and adaptively adjust encoding parameters for Intel cloud gaming and live-streaming experience.
- Developed VMAF for gaming, a machine learning model to evaluate encoded video by learning human audience judgement specifically tuning on videos of popular gaming such as league of legends and overwatch.

HYCAN, Automated Valet Parking(AVP)   Shanghai, China
Graduate Student and Engineer   *Sept. 2021 - May 2022*

- Full stack engineering experience including pointcloud data preprocessing, multi-lidars communication system development, collaborative perception system intergrating and 3D detection models deployment.
- Our multi lidars collaborative perception system. Achieving above 95% in mAP@0.7 for AVP scenarios,.

PATENT

Siheng Chen, **Zixing Lei**, Shunli Ren, Yue Hu, Wenjun Zhang, A robust collaborative perception method for communication latency, Innovation patent, CN115243289A, authorized.

TECHNICAL SKILLS

Math(grade):
Linear algebra(A), matrix theory(A), probability and statistics(A), optimization theory(A), math foundation for AI(A+), calculus(A-), Graph and Network(A-)

Program:
Python, C/C++, Matlab and ROS.

Hardware and Engineering:
Operation and maintenance of linux cluster(serve as the administrator of GPU servers in CMIC, SJTU);
UAV related skills, including flying and embeded programing; deployment and data collection of lidar.

PUBLIC SERVICE

Video ReID of Endangered Amur Tigers   **Shanghai, China**
Working with **Intel and World Wildlife Fund(WWF)**   *Sept 2019 - Jul 2020*

- Collect video data in order to ReID amur tigers with deep learning methods to help to track them in natural reserve.
- Established an amur tiger ReID dataset with object detection and Multiple Object Tracking methods.
- Created a video ReID method which is 7% more accurate than the previous image ReID method for amur tigers.

AWARD

- Scholarship for academic excellence 2018, 2019, 2020, Shanghai Jiao Tong University.

- First class scholarship for graduate student, 2022 Shanghai Jiao Tong University.

- Huawei Scholarship 2022, (5 in 220).