Lingjun Zhao

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Education

- **University of Michigan** — Ann Arbor, USA
  M.S. in Robotics; ***GPA: 4.00/4.00*** — *Aug 2022 - April 2024*
  Courses: *Math for Robotics, Robotics System Lab, Computer Vision, Mobile Robotics, Robot Learning for Planning and Control, Introduction to Robotic Manipulation, Autonomous Vehicles, etc.*
- **Tianjin University** — Tianjin, China
  B.S. in Mechanical Design, Manufacturing and Automation; ***GPA: 3.81/4.00*** — *Sep 2018 - June 2022*
  Courses: *Mechanical Design and Manufacturing, Mechanics, Control of Mechatronic Systems, Introduction to Robotics, Introduction to Artificial Intelligence, Introduction to Electrical Engineering, etc.*

Research Interests

- **Robot Perception**: Object Detection / Tracking, Instance Segmentation, Semantic Scene Completion
- **Sensor Fusion**: LiDAR-Camera-Radar Fusion for Autonomous Vehicles, Vision-Tactile Fusion for Robotic Manipulation
- **Robot Learning**: Machine Learning and Reinforcement Learning for Robot Planning and Control
- **Robot Localization and Mapping**: Semantic Mapping, NeRF-based Robot Localization

Skill

- **Programming Languages**: Python, C/C++, MATLAB
- **Frameworks and Tools**: PyTorch, MMDetection3D, ROS, GTSAM, Linux, Docker, GIT
- **Engineering Softwares**: SolidWorks, Creo, AutoCAD, ABAQUS, Adams
- **Languages**: English (TOEFL: 107; GRE: 322+4.0), Mandarin

Publication

- **Enhanced Camera-Radar Object Detection with Cross-modality Knowledge Distillation** — Submitted
  Lingjun Zhao*, Jingyu Song, Katherine A. Skinner*
  - **CRKD Framework**: Propose a novel cross-modality KD framework to enable LC-to-CR distillation in the BEV feature space and the CR student can outperform existing baselines without additional cost during inference.
  - **Novel KD Modules and Adaptive Fusion**: Design four KD modules to address the notable discrepancies between different sensors to realize effective cross-modality distillation and apply a gated network to CRKD for adaptive fusion.
  - **3D Object Detection**: Conduct extensive evaluation on nuScenes dataset to demonstrate the effectiveness of our model which can improve the mAP and NDS of student detectors by 3.5% and 3.2% respectively.
- **LiRaFusion: Deep Adaptive LiDAR-Radar Fusion for 3D Object Detection** — Submitted
  Jingyu Song, ***Lingjun Zhao****, Katherine A. Skinner* — *ICRA 2024*
  - **Early Voxel Fusion**: Design an early fusion module for joint voxel feature encoding.
  - **Middle Feature Fusion**: Design a middle fusion module to adaptively fuse feature maps via a gated network.
  - **3D Object Detection**: Perform 3D object detection on NuScenes to demonstrate LiRaFusion leverages the complementary information of LiDAR and radar effectively and achieves notable improvement over existing methods.
- **A Tactile Sensor with Slippage Prediction by Unequal Height Dome Array** — Accepted
  Yong Yang, Meirong Zhao, Yifan Jia, ***Lingjun Zhao****, Dongji Piao, Yelong Zheng, Le Song* — *IEEE SENSORS*
  - **Tactile Sensor Design**: Engage in the design of a high-resolution vision-based tactile and slip sensor integrated on a manipulator aimed at helping robots ensure safe contact and move objects safely in case of a possible collision.
  - **Contact Mechanics Model**: Utilize finite element analysis method to construct the contact mechanics model and optimize the arrangement law of unequal height dome array.
  - **Slippage Prediction**: Improve the adaptability of the touch and slip sensor to the shape characteristics of the object, and prolong the pre-sliding window period and realized the sliding prediction function of smooth plate.

Project

- **Loc-NeRF++: An Enhanced Robot Localization using Neural Radience Fields** — University of Michigan
  Course Project, supervised by Prof. Maani Ghaffari — *Jan 2023 - Apr 2023*
  - **Outdoor Scenes Extension of Loc-NeRF**: Scale up Monte Carlo Localization to large outdoor environments using NeRF models and complete its evaluation on the OMMO dataset.
  - **Adaptive Particle Filter**: Improve the existing particle filter used in Loc-NeRF by applying KLD-Sampling which adjusts the number of particles to perform more precise and real-time localization.
- **Ordinary Differential Equation Based Learning Dynamics for Robotic Systems** — University of Michigan
  Course Project, supervised by Prof. Nima Fazeli and Prof. Dmitry Berenson — *Jan 2023 - Apr 2023*
  - **Learning-based Dynamics Model**: Train and compare discrete numerical differential equation based networks with continuous neural ordinary differential equation based networks.

- **Robot Planar Pushing Simulation**: Complete the Panda robot planar pushing simulation using different ODE-based dynamics models and a MPPI controller, leading to the smoothness comparison of the pushing trajectories.
- **Open-source Dynamics Dataset Evaluation**: Evaluate the ODE-based dynamics models on the open-source Forward Dynamics Dataset using KUKA LWR and Baxter.

- **Depth-aware and Laplacian-steered Instance Style Transfer** — University of Michigan
  Course Project, supervised by Prof. Andrew Owens — *Sep 2022 - Dec 2022*
  - **Semantic Segmentation**: Perform semantic segmentation using Fully Convolutional Network and SegNet, compare and evaluate their segmentation performance on the PASCAL VOC 2012 Dataset.
  - **Depth-aware and Laplacian-steered loss**: Introduce depth-aware loss and Laplacian-steered loss into neural style transfer to keep the content image with more depth and detailed information.
  - **Instance Style Transfer**: Combine semantic segmentation with neural style transfer to perform instance style transfer to stylize specific objects within one natural image using different artistic styles.
- **Ophthalmic Surgical Robot Micro-manipulator Design** — Tianjin University
  Individual Final Year Research, supervised by Prof. Fujun Wang — *Dec 2021 - June 2022*
  - **Origami Mechanism Design**: Design a novel origami-based parallelogram RCM mechanism composed of flexure hinges and rigid body as the main structure of the invasive ophthalmic surgical robot.
  - **Kinematics Modelling and Simulation**: Complete the forward and inverse kinematics modelling and the robot motion simulation using the rigid-flexible coupling method.
  - **Dynamics Modelling and Simulation**: Establish the input stiffness model and the output flexibility model of the surgical robot, and evaluate its dynamics performance via finite element analysis.
  - **Parameter Optimization**: Optimize the robot's dimension parameters to improve its input and output stiffness.

Experience

- **UM Ford Center for Autonomous Vehicles (FCAV)** — University of Michigan
  Graduate Research Assistant, supervised by Prof. Katherine A. Skinner — *Jan 2023 - Present*
- **Laboratory of Micro/Nano Manufacturing Technology** — Tianjin University
  Summer Intern, supervised by Prof. Le Song — *May 2021 - Sep 2021*
- **Key Laboratory of Mechanism Theory and Equipment Design** — Tianjin University
  Undergraduate Research Assistant, supervised by Prof. Fujun Wang — *Apr 2020 - June 2022*

Honor and Award

- National Scholarship of China **(Top 0.2%)** - September, 2021
- Weichai Power Scholarship **(Top 5%)** - November, 2020
- Merit Student of Tianjin University - 2019, 2020, 2021