Zhirui Dai

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EDUCATION

University of California San Diego — **San Diego, CA, USA**
Ph.D. in Electrical and Computer Engineering — *01/2022 - Current*

University of California San Diego — **San Diego, CA, USA**
M.S. in Electrical and Computer Engineering — *09/2019 - 06/2021*

Fudan University — **Shanghai, China**
B.S. in Physics — *09/2015 - 06/2019*

PUBLICATIONS

- Dai, Zhirui, et al. "Optimal Scene Graph Planning with Large Language Model Guidance." IEEE International Conference on Robotics and Automation (ICRA), 2024. Link
- Dai, Zhirui, et al. "BEV-net: assessing social distancing compliance by joint people localization and geometric reasoning." Proceedings of the IEEE/CVF international conference on computer Vision. 2021 Link
- Long, Kehan, Yinzhuang Yi, Zhirui Dai, Sylvia Herbert, Jorge Cortés, and Nikolay Atanasov. "Sensor-Based Distributionally Robust Control for Safe Robot Navigation in Dynamic Environments." arXiv preprint arXiv:2405.18251 (2024).
- Lee, Ki Myung Brian, Zhirui Dai, Cedric Le Gentil, Lan Wu, Nikolay Atanasov, and Teresa Vidal-Calleja. "Safe Bubble Cover for Motion Planning on Distance Fields." arXiv preprint arXiv:2408.13377 (2024).

RESEARCH

- Signed Directional Distance Field
  - Proposed signed directional distance field (SDDF), which is defined as the smallest distance between position and obstacle surface along specific direction.
  - Developing different methods, e.g. Gaussian Process Regression, Neural Feature Grids, etc. to learn SDDF.
  - Exploring applications of SDDF, e.g. active mapping, depth rendering, collision checking, etc.
- Real-time Signed Distance Field Learning
  - Developed a highly optimized Gaussian Process-based SDF learning framework, which reaches training speed at around 300 fps on 2D and 40fps on 3D. The framework provides occupancy mapping and SDF estimation simultaneously.
  - Applied the framework in safety control, path planning, etc.
- Optimal Scene Graph Planning with Large Language Model Guidance
  - Developed an optimal scene graph planning method, which uses LLM to convert natural language instructions to linear temporal logic (LTL), and generates optimal planning results with LLM-based guidance.
- Object Retrieval and Registration
  - Exploring methods to improve the speed and accuracy of object CAD retrieval and point-cloud registration, given partial object observation.

WORK EXPERIENCE

Research Internship
XCOM Labs Inc., CA, USA — *08/2021 - 12/2021*

- Developed a better pose estimation algorithm for multi-user VR/AR remote rendering system, which improves user experience by providing lower motion-to-photon latency.
- Created a dataset for xR application head & hand pose estimation.
- Developed a neural network that predicts the pose by 90% lower error than the default OpenVR algorithm.
- Integrated the network as a module into the system and finished the system test.

Software Development Internship
Camel Microelectronics Inc., CA, USA — *01/2018 - 06/2019*

- Developed an IDE called CamelStudioX for education purposes and commercial software development of low-power SoCs. The IDE enables the users to build SoC software on a robust and efficient platform.
- Designed the software architecture, the GUI and finished its programming.
- Developed essential SoC software: soft-float library, HAL library, cross-compiler toolchains, simple make-system, an ELF analyzer-converter, serial-port software, etc..
- Deployed the IDE on servers for software distribution and update release.
- Worked with teammates to test SoC and developed software patches for hardware hotfix.

SERVICES

Teaching Assistant, ECE276B: Planning & Learning in Robotics 04/2024 - 06/2024
Teaching Assistant, ECE276B: Planning & Learning in Robotics 04/2023 - 06/2023
Mentor, ENLACE Summer Research Program 07/2022 - 08/2022
Mentor, ECE Summer Research Internship Program (SRIP) 07/2022 - 08/2022
Mentor, Summer Training Academy for Research Success (STARS) 07/2022 - 08/2022
Mentor, Guided Engineering Apprenticeship in Research (GEAR) 09/2021 - 07/2022

AWARDS & HORNORS

Electrical and Computer Engineering Department Fellowship 2022
Outstanding Graduate of Fudan University 2019

TECHNICAL SKILLS

Programming Languages: C++, CUDA, C, Python, MATLAB, Swift, Java
Libraries and Tools: PyTorch, Sklearn, Pandas, Numpy, OpenCV, Open3D, Git, Docker, Kubenetes