Tianrui Guan

rayguan@umd.edu tianruiguan.phd Google Scholar

Education

- **University of Maryland, College Park** — College Park, MD
  *Ph.D., **Computer Science**, advisor: Dinesh Manocha* — *Jan 2022 - Current*
  *Masters of Science with Thesis, **Computer Science**, GPA: 4.0* — *Aug 2019 - Dec 2021*
- **University of Maryland, College Park** — College Park, MD
  *Bachelor of Science, **Computer Science and Statistics**, GPA: 3.97* — *Aug 2016 - May 2019*
  Graduated with Magna Cum Laude Latin Honor, Computer Science Department Honors

Research Projects

- **Language and Visual Hallucination for LVLMs** — *in progress*
  Dataset for Large VLMs Benchmark and Analysis, and Automatic Hallucination Generation.
- **Visual-Language Model and Retrieval for Navigation** — *in progress*
  Visual-language Model for Object Navigation, Visual Illusion and Language Hallucination of LVLMs
- **Global and Local Point Matching**
  Cross-source Point Registration, Robotic Navigation and Localization
- **Autonomous Driving**
  3D Object Detection, Trajectory Prediction, Tracking
- **Terrain Classifications and Segmentation in Unstructured Environment**
  Semantic Segmentation, Terrain Classification, Traversability Estimation, Robotic Navigation and Control
- **UAV Activity Recognition**
  Aerial Activity Recognition, Edge Computing

Working Experience

- **Amazon Lab126** — Sunnyvale, CA
  Research Intern — *Summer 2023, Summer 2024*
  - **Language-driven Zero-Shot Object Retrieval and Navigation. (*Accepted to ICRA 2024*)**: We present a novel language-driven object-centric image representation for visual-language model (VLM) fine-tuning to handle complex object-level queries. We design a novel LLM-based augmentation and prompt templates for stable training and zero-shot inference. We implement our method on Astro robot and deploy it in both simulated and real-world environments.
  - **Visual Language Navigation**: Following up the previous idea, we extend our method into Visual-Language Navigation (VLN), which takes both object-referral instructions and fine-grained step-by-step instructions. We want to utilize the generalization capabilities of VLMs (with generation) in the task, instead of only an visual alignment model for retrieval. Combining retrieval with language reasoning and navigation and providing some factual ground in output generation can be really useful for halluciantion mitigation.
- **Baidu USA** — Sunnyvale, CA
  Research Intern — *Summer 2021, 2022*
  - **Terrain Traversability Mapping and Navigation System (*Accepted to RSS 2022 and Autonomous Robots*)**: We built a traversability estimation system for unstructured environment and excavator applications, including perception, navigation and control. We built the infrastructure and first prototype of our navigation system in unstructured worksite.
  - **Terrain Classification with Adpative Scheduling Control (*Accepted to ICRA 2023*)**: We proposed a terrain classification network using both visual and inertial information of the terrain. Our method can make accurate prediction known terrain and generalize to unknown terrain based on its navigation properties. We implemented a adaptive control framework that can lead to better navigation result.
- **University of Maryland, College Park** — College Park, MD
  Research Assistant - Department of Computer Science — *August 2021 - Current*
  Teaching Assistant - Department of Computer Science — *2018 - 2021*

List of Publications and Contributed Works

1. ***Tianrui Guan****, Xiyang Wu**, Dianqi Li, Shuaiyi Huang, Xiaoyu Liu, Xijun Wang, Ruiqi Xian, Abhinav Shrivastava, Furong Huang, Jordan Lee Boyd-Graber, Tianyi Zhou, Dinesh Manocha.* AutoHallusion: Automatic Generation of Hallucination Benchmarks for Vision-Language Models. *Empirical Methods in Natural Language Processing (EMNLP 2024).* Link Code Project Page

2. ***Tianrui Guan****, Fuxiao Liu**, Xiyang Wu, Ruiqi Xian, Zongxia Li, Xiaoyu Liu, Xijun Wang, Lichang Chen, Furong Huang, Yaser Yacoob, Dinesh Manocha, Tianyi Zhou.* HallusionBench: An Advanced Diagnostic Suite for Entangled Language Hallucination & Visual Illusion in Large Vision-Language Models. *Conference on Computer Vision and Pattern Recognition (CVPR 2024).* Link Code

3. ***Tianrui Guan****, Yurou Yang, Harry Cheng, Muyuan Lin, Richard Kim, Rajasimman Madhivanan, Arnie Sen, Dinesh Manocha.* LOC-ZSON: Language-driven Object-Centric Zero-Shot Object Retrieval and Navigation. *IEEE International Conference on Robotics and Automation (ICRA 2024).* Link

4. ***Tianrui Guan****, Ruiqi Xian*, Xijun Wang, Xiyang Wu, Mohamed Elnoor, Daeun Song, Dinesh Manocha.* AGL-NET: Aerial-Ground Cross-Modal Global Localization with Varying Scales. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024).* Link Code

5. ***Tianrui Guan****, Aswath Muthuselvam, Montana Hoover, Xijun Wang, Jing Liang, Adarsh Jagan Sathyamoorthy, Damon Conover, Dinesh Manocha.* CrossLoc3D: Aerial-Ground Cross-Source 3D Place Recognition. *International Conference on Computer Vision (ICCV 2023).* Link Code

6. ***Tianrui Guan****, Ruitao Song, Zhixian Ye, Liangjun Zhang.* VINet: Visual and Inertial-based Terrain Classification and Adaptive Navigation over Unknown Terrain. *IEEE International Conference on Robotics and Automation (ICRA 2023).* Link

7. ***Tianrui Guan****, Divya Kothandaraman, Rohan Chandra, Adarsh Jagan Sathyamoorthy, Kasun Weerakoon, Dinesh Manocha.* GA-Nav: Efficient Terrain Segmentation for Robot Navigation in Unstructured Outdoor Environments. *IEEE Robotics and Automation Letters (RAL), 2022.* Link Code

8. ***Tianrui Guan****, Zhenpeng He, Ruitao Song, Liangjun Zhang.* TNES: Terrain Traversability Mapping, Navigation and Excavation System for Autonomous Excavators on Worksite. *Autonomous Robots.* Link

9. ***Tianrui Guan****, Zhenpeng He, Ruitao Song, Dinesh Manocha, Liangjun Zhang.* TNS: Terrain traversability mapping and navigation system for autonomous excavators. *Proceedings of Robotics: Science and Systems (RSS 2022).* Link

10. ***Tianrui Guan****, Jun Wang*, Shiyi Lan, Rohan Chandra, Zuxuan Wu, Larry Davis, Dinesh Manocha.* M3DETR: Multi-Representation, Multi-Scale, Mutual-Relation 3D Object Detection With Transformers. *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV 2022).* Link Code

11. *Xiyang Wu, Ruiqi Xian,* ***Tianrui Guan****, Jing Liang, Souradip Chakraborty, Fuxiao Liu, Brian Sadler, Dinesh Manocha, Amrit Singh Bedi.* On the Safety Concerns of Deploying LLMs/VLMs in Robotics: Highlighting the Risks and Vulnerabilities. *under submission.* Link Project Page

12. *Xiyang Wu, Rohan Chandra,* ***Tianrui Guan****, Amrit Singh Bedi, Dinesh Manocha.* iPLAN: Intent-Aware Planning in Heterogeneous Traffic via Distributed Multi-Agent Reinforcement Learning. *7th Annual Conference on Robot Learning (CoRL), 2023.* ***Oral presentation.*** Link Code

13. *Divya Kothandaraman,* ***Tianrui Guan****, Xijun Wang, Sean Hu, Ming Lin, Dinesh Manocha.* FAR: Fourier Aerial Video Recognition. *European Conference on Computer Vision (ECCV 2022).* Link Code

14. *Rohan Chandra,* ***Tianrui Guan****, Srujan Panuganti, Trisha Mittal, Uttaran Bhattacharya, Aniket Bera, Dinesh Manocha.* Forecasting Trajectory and Behavior of Road-Agents Using Spectral Clustering in Graph-LSTMs. *IEEE Robotics and Automation Letters (RAL), 2020.* Link

15. *Mohamed Elnoor, Kasun Weerakoon, Gershom Seneviratne, Ruiqi Xian,* ***Tianrui Guan****, Mohamed Khalid M Jaffar, Vignesh Rajagopal, Dinesh Manocha.* Robot Navigation Using Physically Grounded Vision-Language Models in Outdoor Environments. *Under Review.* Link

16. *Ruiqi Xian, Xiyang Wu,* ***Tianrui Guan****, Xijun Wang, Boqing Gong, Dinesh Manocha.* SOAR: Self-supervision Optimized UAV Action Recognition with Efficient Object-Aware Pretraining. *Under Review.* Link

17. *Mohamed Elnoor, Kasun Weerakoon, Adarsh Jagan Sathyamoorthy,* ***Tianrui Guan****, Vignesh Rajagopal, Dinesh Manocha.* AMCO: Adaptive Multimodal Coupling of Vision and Proprioception for Quadruped Robot Navigation in Outdoor Environments. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024).* Link

18. *Xiaoyu Liu, Paiheng Xu, Junda Wu, Jiaxin Yuan, Yifan Yang, Yuhang Zhou, Fuxiao Liu,* ***Tianrui Guan****, Haoliang Wang, Tong Yu, Julian McAuley, Wei Ai, Furong Huang.* Large Language Models and Causal Inference in Collaboration: A Comprehensive Survey. *Under Review.* Link

19. *Xijun Wang, Ruiqi Xian,* ***Tianrui Guan****, Fuxiao Liu, Dinesh Manocha.* SCP: Soft Conditional Prompt Learning for Aerial Video Action Recognition. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024).* Link

20. *Adarsh Jagan Sathyamoorthy, Kasun Weerakoon,* ***Tianrui Guan****, Mason Russell, Damon Conover, Jason Pusey, Dinesh Manocha.* VERN: Vegetation-aware Robot Navigation in Dense Unstructured Outdoor Environments. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2023).* Link

21. *Xijun Wang*, Ruiqi Xian*,* ***Tianrui Guan****, Celso M. de Melo, Stephen M. Nogar, Aniket Bera and Dinesh Manocha.* AZTR: Aerial Video Action Recognition with Auto Zoom and Temporal Reasoning. *IEEE International Conference on Robotics and Automation (ICRA 2023).* Link

22. *Kasun Weerakoon, Adarsh Jagan Sathyamoorthy, Jing Liang,* ***Tianrui Guan****, Utsav Patel, Dinesh Manocha.* GrASPE: Graph based Multimodal Fusion for Robot Navigation in Unstructured Outdoor Environments. *IEEE Robotics and Automation Letters (RAL), 2023.* Link

23. *Liangjun Zhang, Xibin Song, Liyang Wang, Lingfeng Qian,* ***Tianrui Guan****, Zhenpeng He, Zhixian Ye, Ruitao Song, Haodong Ding, Dinesh Manocha.* Autonomous Excavator System with Real-World Deployment. *IEEE International Conference on Robotics and Automation, Construction Workshop (ICRA Workshop 2022).* Link

24. *Jing Liang, Kasun Weerakoon,* ***Tianrui Guan****, Nare Karapetyan, Dinesh Manocha.* AdaptiveON: Adaptive Outdoor Navigation Method For Stable and Reliable Motions. *IEEE Robotics and Automation Letters (RAL), 2022.* Link

25. *Adarsh Jagan Sathyamoorthy, Kasun Weerakoon,* ***Tianrui Guan****, Jing Liang, Dinesh Manocha.* TerraPN: Unstructured terrain navigation through Online Self-Supervised Learning. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022).* Link

26. *Jing Liang, Yi-Ling Qiao,* ***Tianrui Guan****, Dinesh Manocha.* OF-VO: Reliable Navigation among Pedestrians Using Commodity Sensors. *IEEE Robotics and Automation Letters (RAL), 2021.* Link

27. *Adarsh Jagan Sathyamoorthy, Utsav Patel,* ***Tianrui Guan****, Dinesh Manocha.* Frozone: Freezing-Free, Pedestrian-Friendly Navigation in Human Crowds. *IEEE Robotics and Automation Letters (RAL), 2020.* Link

28. *Adarsh Jagan Sathyamoorthy, Jing Liang, Utsav Patel,* ***Tianrui Guan****, Rohan Chandra, Dinesh Manocha.* DenseCAvoid: Real-time Navigation in Dense Crowds using Anticipatory Behaviors. *IEEE International Conference on Robotics and Automation (ICRA 2020).* Link

29. *Rohan Chandra, Uttaran Bhattacharya, Christian Roncal, Aniket Bera, Dinesh Manocha.* RobustTP: End-to-End Trajectory Prediction for Heterogeneous Road-Agents in Dense Traffic with Noisy Sensor Inputs. *ACM Computer Science in Cars Symposium (CSCS 2019). Contribution of the project: Development of the code and software.* Link & Code

Academic Services

- Reviewer for IEEE/CVF Computer Vision and Pattern Recognition Conference (*CVPR*) *2022 - 2024*
- Reviewer for IEEE International Conference on Computer Vision (*ICCV*) *2023*
- Reviewer for European Conference on Computer Vision (*ECCV*) *2022, 2024*
- Reviewer for Conference on Neural Information Processing Systems (*NeurIPS*) *2024*
- Reviewer for Annual AAAI Conference on Artificial Intelligence (*AAAI*) *2025*
- Reviewer for The International Conference on Artificial Intelligence and Statistics (*AISTATS*) *2025*
- Reviewer for Asian Conference on Computer Vision (*ACCV*) *2024*

- Reviewer for International Conference on 3D Vision (*3DV*) *2022*
- Reviewer for IEEE/CVF Winter Conference on Applications of Computer Vision (*WACV*) *2023 - 2024*
- Reviewer for International Conference on Intelligent Robots and Systems (*IROS*) *2020 - 2024*
- Reviewer for International Conference on Robotics and Automation (*ICRA*) *2021 - 2025*
- Reviewer for Annual Meeting of the Association for Computational Linguistics (*ACL*) *Since 2024*
- Reviewer for IEEE Robotics and Automation Letters (*RA-L*) *Since 2021*
- Reviewer for Autonomous Robots (Springer) *Since 2023*
- Reviewer for IEEE Transactions on Intelligent Vehicles *Since 2023*
- Reviewer for IEEE Robotics & Automation Magazine *Since 2024*
- Reviewer for IEEE Transactions on Circuits and Systems for Video Technology *Since 2024*

Talks

- **Global localization for robot navigation** Oct 2024
  Guest Lecture @ NC State University - AI-powered Robotics
- **Large Visual-Language Models and Hallucinations** Oct 2024
  Multimodal Webinar @Twelve Labs
- **Large Visual-Language Models and Hallucinations** Apr 2024
  Computer Vision Seminar @UMD
- **Language Hallucination and Visual Illusion in Large Visual-Language Models** Feb 2024
  AGI Leap Summit
- **Object Retrieval and Navigation using Visual-Language Models** Jan 2024
  Baidu Robotics and Autonomous Driving Lab (RAL)
- **Terrain Traversability Mapping and Navigation System for Autonomous Excavators** Jun 2022
  Robotics: Science and Systems (RSS 2022)
- **Multi-Representation, Multi-Scale, Mutual-Relation 3D Object Detection With Transformers** Jan 2022
  IEEE/CVF Winter Conference on Applications of Computer Vision (WACV 2022)
- **Terrain Segmentation and Traversability Analysis in Unstructured Outdoor Environments** Nov 2021
  University of Maryland, College Park

Honors and Awards

- **RAS Travel Award** | International Conference on Intelligent Robots and System (IROS 2022) *Oct 2022*
- **Goldhaber Travel Award** | University of Maryland, College Park *Aug 2022*
- **ICSSA Travel Award** | University of Maryland, College Park *Aug 2022*
- **SRC Research Scholars Fellowship** | Semiconductor Research Corporation *Aug 2020*
- **MAGNA CUM LAUDE** | University of Maryland, College Park *May 2019*
- **Dean's List** | University of Maryland, College Park *2016 - 2019*
- **Silver Medal** | China National Double Foot Robot Competition *2015*
- The Mathematics Honor Program pre-selected for Shandong University (23 out of 3000+) *2014*