ZHENHUA XU

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Position

The University of Hong Kong	**Apr. 2023 – Current**
Postdoc, work with Prof. Hengshuang Zhao	*HKSAR, China*

Hong Kong University of Science and Technology	**Sep. 2018 – Mar. 2023**
Research assistant	*HKSAR, China*

Education

Hong Kong University of Science and Technology	**Sep. 2018 – Mar. 2023**
*Ph.D. of CS. **HKPFS awardee.** Supervised by Prof. Ming Liu and Prof. Huamin Qu*	*HKSAR, China*

University of California, Los Angeles	**Jul. 2017 – Sep. 2017**
CSST (Cross-disciplinary Scholars in Science and Technology) program (GPA 4.0/4.0)	*LA, USA*

Harbin Institute of Technology	**Sep. 2014 – Jun. 2018**
*Bachelor in Electronics and Information Engineering (Score 91.19/100, **ranking 1/88**)*	*Harbin, China*

Zhengzhou Foreign Language School	**Sep. 2011 – Jun. 2014**
	Zhengzhou, China

Research Keywords

Autonomous Driving, Large Language Model, High-definition Map, Robotics, Computer Vision

Research Experience

Large Language Model for Autonomous Driving | *Robotics, Computer vision*   **2023-Current**

- Autonomous vehicles promise reduced traffic, fewer accidents, and increased sustainability. However, a key challenge is achieving explainable autonomous driving, where AI systems transparently justify decisions—essential for commercialization and addressing safety, ethical, and legal concerns.
- The emergence of large language models (LLMs, e.g., ChatGPT, GPT4) enhances explainable autonomous driving by translating technical data into everyday language, providing context-aware AI explanations, and augmenting training. They also address ethical and legal concerns, fostering trust and seamless human-AI interactions.
- We propose leveraging large language models (LLMs) to demystify autonomous driving. LLMs are trained to control vehicles like humans and offer conceptual explanations for each specific action, enhancing transparency and understanding.
- Several research academic research projects are ongoing.

Vector Map Creation | *Robotics, Computer vision*   **2019-Current**

- Vector maps, including standard and high-definition maps, are crucial for autonomous vehicles as they supply navigation and planning algorithms with vital information about static line-shaped objects like road boundaries and networks. However, manual creation is inefficient and labor-intensive. Thus, there is a need for efficient and effective methods to automatically generate vector maps of target objects.
- Our team proposed to handle this problem from multiple aspects, such as offline global map construction by imitation learning, online map detection by transformers, and graph manipulation. All projects achieved promising results.
- Multiple papers including 7 first-author papers are accepted by top journals and conferences in the robotics communities (e.g., RA-L, ICRA, IROS, TGRS).

Preprints

[1] **Z. Xu**., Y. Zhang, E. Xie, Z. Zhao, Y. Guo, K.K. Wong, Z. Li and H. Zhao, 2023. DriveGPT4: Interpretable End-to-end Autonomous Driving via Large Language Model. Under review, 2023. **Preprint**. ⚯ Web Page

[2] **Z. Xu**., K.K. Wong and H. Zhao. InsMapper: Exploring Inner-instance Information for Vectorized HD Mapping. Under review, 2023. **Preprint**. ⚯ Web Page

Full List of Publications

[1] H. Liu, L. Zheng, X. Yan, B. Xue, **Z. Xu**, and M. Liu, "PGO-IPM: Enhance IPM Accuracy with Pose-guided Optimization for Low-cost High-definition Angular Marking Map Generation," in IEEE Intelligent Vehicles Symposium (IV), 2024.

[2] **Z. Xu**, Y. Liu, Y. Sun, L. Wang, and M. Liu, "RNGDet++: Road Network Graph Detection by Transformer with Instance Segmentation and Multi-scale Features Enhancement," in IEEE Robotics and Automation Letters (RAL), 2023. 🔗 Web Page

[3] **Z. Xu**, Y. Liu, Y. Sun, L. Wang, and M. Liu, "CenterLineDet: CenterLine Graph Detection for Road Lanes with Vehicle-mounted Sensors by Transformer for HD Map Generation," in 2023 IEEE/RSJ International Conference on Robotics and Automation (ICRA), 2023. 🔗 Web Page

[4] Y. Liu, **Z. Xu**, H. Huang, L. Wang, and M. Liu, "FSNet: Redesign Self-Supervised MonoDepth for Full-Scale Depth Prediction for Autonomous Driving," IEEE Transactions on Automation Science and Engineering (TASE), 2023.

[5] **Z. Xu**, Y. Liu, L. Gan, Y. Sun, L. Wang, and M. Liu, "RNGDet: Road Network Graph Detection by Transformer," in IEEE Transactions on Geoscience and Remote Sensing (TGRS), 2022. 🔗 Web Page

[6] **Z. Xu**, Y. Liu, L. Gan, X. Hu, Y. Sun, L. Wang, and M. Liu, "csBoundary: City-scale Road-boundary Detection in Aerial Images for High-definition Maps," in IEEE Robotics and Automation Letters (RAL), 2022. 🔗 Web Page

[7] Y. Liu, **Z. Xu**, and M. Liu, "Star-Convolution for Image-Based 3D Object Detection," in 2022 IEEE/RSJ International Conference on Robotics and Automation (ICRA), 2022.

[8] **Z. Xu**, Y. Sun, L. Wang, and M. Liu, "CP-loss: Connectivity-preserving Loss for Road Curb Detection in Autonomous Driving with Aerial Images," in 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021. 🔗 Web Page

[9] **Z. Xu**, Y. Sun, and M. Liu, "Topo-Boundary: A Benchmark Dataset on Topological Road-Boundary Detection Using Aerial Images for Autonomous Driving," in IEEE Robotics and Automation Letters (RAL), 2021. 🔗 Web Page

[10] **Z. Xu**, Y. Sun, and M. Liu, "iCurb: Imitation Learning-Based Detection of Road Curbs Using Aerial Images for Autonomous Driving," in IEEE Robotics and Automation Letters (RAL), 2021. 🔗 Web Page

[11] T. Liu*, Q. Liao*, L. Gan, F. Ma, J. Cheng, X. Xie, Z. Wang, Y. Chen, Y. Zhu, S. Zhang, Z. Chen, Y. Liu, M. Xie, Y. Yu, Z. Guo, G. Li, P. Yuan, D. Han, Y. Chen, H. Ye, J. Jiao, P. Yun, **Z. Xu**, H. Wang, H. Huang, S. Wang, P. Cai, Y. Sun, Y. Liu, L. Wang, and M. Liu, "The Role of the Hercules Autonomous Vehicle During the COVID-19 Pandemic: An Autonomous Logistic Vehicle for Contactless Goods Transportation," in IEEE Robotics and Automation Magazine (RAM), 2021.

[12] Q. Wang, **Z. Xu**, Z. Chen, Y. Wang, S. Liu and H. Qu, "Visual Analysis of Discrimination in Machine Learning," in IEEE Transactions on Visualization and Computer Graphics (TVCG), 2021.

[13] Y. Zhang, S. Yang, H. Li, **Z. Xu**. "Shadow tracking of moving target based on CNN for video SAR system." in IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium. IEEE, 2018.

[14] **Z. Xu**, Y. Zhang, H. Li, H. Mu, Y. Zhuang. "A new shadow tracking method to locate the moving target in SAR imagery based on KCF." in International Conference in Communications, Signal Processing, and Systems. Springer, Singapore, 2017.

Awards and Honors

- **2018-2022** HKPF (Hong Kong PhD Fellowship)
- **2018** Outstanding Graduate of Harbin Institute of Technology
- **2018** Guanghua Scholarship

- **2017** UCLA CSST (Cross-disciplinary Scholars in Science and Technology)
- **2017** National Scholarship
- **2016** Meritorious Winner in MCM/ICM
- **2014-2018** Renmin Scholarship
- **2014-2018** University Merit Student
- **2013** Provincial 1st prize in National High School Mathematics League (NO.49)

Academic services

- **Reviewer**:
    IEEE Robotics and Automation Letters (RA-L),
    IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS),
    IEEE/RSJ International Conference on Robotics and Automation (ICRA),
    IEEE Transactions on Geoscience and Remote Sensing (TGRS) ,
    The British Machine Vision Conference (BMVC),
    Autonomous Vehicle Vision (AAV)

- **Teaching assistant:**
    COMP3711 (Design and Analysis of Algorithms),
    COMP3311 (Database Management Systems)