

QIANXIN QU

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EDUCATION

China University of Mining & Technology, Beijing

Sep 2019 - Jun 2023

B.Eng in Computer Science and Technology

Overall GPA: 3.5/4.0, Average Score: 85/100(ranking ~25%)

Selected Courses: C/C++ Programming, Data Structures & Algorithms, Artificial Intelligence, Computer Vision

School of Vehicle and Mobility, Tsinghua University

Sep 2022 - Jun 2023

Joint Training with the State Key Laboratory of Automotive Safety and Energy

WORK EXPERIENCE

School of Vehicle and Mobility, Tsinghua University

Aug 2023 - Apr 2026

Research Assistant | [Prof. Xinyu Zhang](#) and [Prof. Jun Li](#)

RESEARCH INTERESTS

- **3D computer vision:** Registration/Calibration, Perception, SLAM.
- **Autonomous Driving:** Multi-end Multi-modal Sensors Fusion, V2X, End-to-End Driving.
- **Application of VLM & VLA:** Scene Understanding, Robot Manipulation, Agentic AI.

PUBLICATIONS

* indicates equal contribution, † indicates corresponding author

- [1] (T-ITS 2025) Zhang, X.†*, **Qu, Q.***, Xiong, Y., Xia, C., Song, Z., & Li, J. . V2X-Reg++: A Real-time Global Registration Method for Multi-end Sensing System in Urban Intersections. *IEEE Transactions on Intelligent Transportation Systems*, 2025. (JCR Q1, CAS Q1 top, CCF-B, IF:8.4)
DOI: [10.1109/tits.2025.3609859](https://doi.org/10.1109/tits.2025.3609859)
- [2] (IROS 2024) **Qu Q.***, Xiong Y*, Zhang G., Wu X., Gao X., Gao X., Li H., Guo S., Zhang G.†. (2024) V2I-Calib: A Novel Calibration Approach for Collaborative Vehicle and Infrastructure LiDAR Systems. *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2024. (Oral, Top Robotics Conference)
DOI: [10.1109/iro58592.2024.10802098](https://doi.org/10.1109/iro58592.2024.10802098)
- [3] (T-IM 2023) Zhang, X.†, Xiong, Y., **Qu, Q.**, ... & Li, J. Automated Extrinsic Calibration of Multi-cameras and LiDAR. *IEEE Transactions on Instrumentation and Measurement*, 2023. (JCR Q1, IF:5.9, Student First Author)
DOI: [10.1109/TIM.2023.3341122](https://doi.org/10.1109/TIM.2023.3341122)
- [4] (IoT-J 2025) Xiong, Y., Zhang, X., Gao, X., **Qu, Q.**, ... & Li, J.† . Cooperative Camera-LiDAR Extrinsic Calibration for Vehicle-Infrastructure Systems in Urban Intersections. *IEEE Internet of Things Journal*, 2025. (CAS Q1 top, IF:8.9)
DOI: [10.1109/JIOT.2025.3567973](https://doi.org/10.1109/JIOT.2025.3567973)
- [5] (T-ASE 2024) Xiong, Y., Zhang, X., Gao, W., Wang, Y., Liu, J., **Qu, Q.**, ... & Li, J.† . GF-SLAM: A novel hybrid localization method incorporating global and circular arc features. *IEEE Transactions on Automation Science and Engineering*, 2024. (JCR Q1, CAS Q2 top, CCF-B, IF:6.4)
DOI: [10.1109/TASE.2024.3451297](https://doi.org/10.1109/TASE.2024.3451297)
- [6] (VTC2026-Spring) Xia C., Song, Z., **Qu, Q.**, Zhang, G., Zhou, S.†, Niu Z. SparseCoM: Fully Sparse Collaborative Perception via Mixture of BEV Experts. *IEEE 103rd Vehicular Technology Conference*, 2026.
- [7] (IJCNN 2026) Xia C., **Qu, Q.**, Song, Z., Zhang, G., Zhou, S.†, Niu Z. . CoSTr: a Fully Sparse Transformer with Mutual Information for Pragmatic Collaborative Perception. *International Joint Conference on Neural Networks*, 2026.

Under Review:

- [8] Zhang, X.†, Ying, J., ..., **Qu, Q.**, Li, L. & Li, J. . WAMoE3D: Weather-aware Mixture-of-Experts for MLLM-based 3D Scene Understanding in Autonomous Driving. (Under Review for T-CSVT, JCR Q1, CAS Q1 top, CCF-B, IF: 8.3)

PATENTS

- [9] Li, J., **Qu, Q.**, Lin, R., ...& Zeng, W. (Date of Grant: 2025-03-04) "Method and System for Employment Relation Extraction from Business Cards" Chinese Patent CN114220112B.
- [10] Zhang, X., Xiong, Y., **Qu, Q.**, Wu, X., & Guo, S. (Date of Publication: 2024-12-06). "Method and Apparatus for Extrinsic Calibration between Vehicle-Mounted and Roadside LiDARs" Chinese Patent Application CN119087408A.

PROJECT & RESEARCH EXPERIENCE

1. Application of Multi-modal Large Language Models for Autonomous Driving

July. 2025 - Present

- Key Contributor | Tsinghua University | [Voyah Co., Ltd.](#) | [Prof. Xinyu Zhang](#) and [Prof. Jun Li](#)

- Project Description:

- This project explores the potential of MLLM to address the long-tail problem in autonomous driving.

- Main Contributions:

- Establishing an MLLM-based scene understanding benchmark for adversarial weather by defining data annotation specifications, constructing pre-annotation pipelines using LLMs, and evaluating *SOTA models* (e.g., *OmniDrive*) on custom datasets.
- Proposed an adaptive fusion framework for InterVL3.5 architecture, utilizing a *Weather-aware Mixture-of-Experts (WAMoE)* module to dynamically fuse camera, LiDAR, and radar features, coupled with *fine-tuning* to enhance perception and reasoning capabilities in adverse weather. (*Under review at T-CSVT [7]*).
- Introduced 3D foundation model (VGGT) based feature distillation at the VLM encoder stage, bridging the spatial capability gap in autonomous driving VLMs to yield a 12.5% absolute gain in driving VQA accuracy.

2. Multi-Agent Cooperative Perception for V2X Scenarios

Sep. 2024 - Nov. 2025

- Key Contributor | Tsinghua University | [CAIC](#) | [Prof. Xinyu Zhang](#) and [Prof. Jun Li](#)

- Description:

- This research aims to enhance multi-agent perception capacity in connected vehicle (V2X) environments.

- Main Contributions:

- Participated in the creation of a real-world cooperative perception dataset and benchmark, by leveraging the spatio-temporal alignment framework [1][2][9] for the data acquisition platform and assisting with the subsequent data pipeline including *cleaning, annotation, API design, and benchmark construction*.
- Proposed a communication-efficient cooperative perception network utilizing *mutual information* for feature compression and *sparse attention* for BEV features fusion. Achieved SOTA performance across two V2X datasets, improving AP by an average of 1% while reducing communication bandwidth by 10%. (*paper [6][7]*).
- Developed V2X-VGGT, pioneering an end-to-end non-initial-extrinsic cooperative perception paradigm based on 3D reconstruction foundation models. Addressing the field's unquantified reliance on stable localization priors, this framework abandons flawed object-centric alignment to achieve a 7% absolute AP boost over current SOTA.

3. Multi-end Sensor Registration for dynamic V2X Scenarios

Oct. 2023 - Dec. 2024

- Project Leader | Tsinghua University | [CAIC](#) | [Prof. Xinyu Zhang](#) and [Prof. Jun Li](#)

- Description:

- This research focuses on the challenge of spatio-temporal alignment for multi-end sensors in dynamic V2X scenario

- Main Contributions:

- Contributed to an IoT-J survey [4] on sensor calibration in multi-agent V2X systems by pioneered a novel conceptual bridge between extrinsic calibration and downstream cooperative perception, authoring the core chapters that redefine the field's taxonomy.
- Proposed a new initial-value-free V2X spatial registration paradigm by analytically constructs *3D geometric constraints via SVD algorithm* and reformulates the task as a *first-order Optimal Transport problem*, achieving an average 27% increase in RR metrics on DAIR-V2X datasets and dropped registration latency to 30ms on single i5 CPU. [CODE](#) (*First-author papers [1] [2]*)
- Engineered the spatio-temporal alignment pipeline for a multi-sensor data acquisition system (Camera, LiDAR, GPS/IMU) via PPS/PTP time synchronization and multi-end spatial registration framework protected by *patent [9]*.

4. Robust Calibration and Localization for Autonomous Vehicles

Dec. 2022 - Dec. 2023

- Key Contributor | Undergraduate Thesis | Tsinghua University | [Prof. Xinyu Zhang](#) and [Prof. Jun Li](#)

- Project Description:

- This project focused on two key challenges for vehicle autonomy: 1) correcting sensors extrinsic parameter drift and 2) mitigating localization drift during signal outages.

- Main Contributions:

- Developed a cross-modal line feature extractions (LSD algorithm for images and depth discontinuities for point cloud), as well as enhanced the *cross-modal line feature-based extrinsic optimization module using g2o*, achieving niSOTA performance on the KITTI dataset by an average rotation errors of <0.2 degrees. (*T-IM Paper[3]*, [CODE](#))
- Implemented an *adaptive SLAM system with EKF/Particle Filter switching* to correct for drift during signal outages, maintaining positioning error within 3 cm in feature-sparse environments. (*T-ASE Paper [5]*)
- Assisted in the real-world validation and deployment of the calibration algorithm with industry partners like Meituan, MOGOX and SAIC Motor, leading to its successful commercial licensing.

SKILLS

Programming: Python, C/C++, LaTeX, Java, Matlab, Shell

Software: ROS/ROS2, Pytorch, CARLA, Mujoco, IssacSim, Solidworks, Codex, Claude Code

Languages: Native in Mandarin, Proficient in English (IELTS 6.5), Basic in Italian.

HONORS & AWARDS

• School Level Excellent Student Cadre	2020
• School Scholarship (top 10%)	2020,2021
• Third Prize in the National Competition of Group Programming Ladder Tournament	2021
• First prize in the entrepreneurship and innovation competition of Hebei Province	2023