Yuan Gao

Ph.D. Candidate & Research Associate — Autonomous Vehicle Systems
Technical University of Munich

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Actively seeking a Ph.D. research internship in foundation models for autonomous driving — foundation-model-based scenario generation & analysis, and vision-language-action (VLA) models.
Available from early 2027 for 3–6 months.

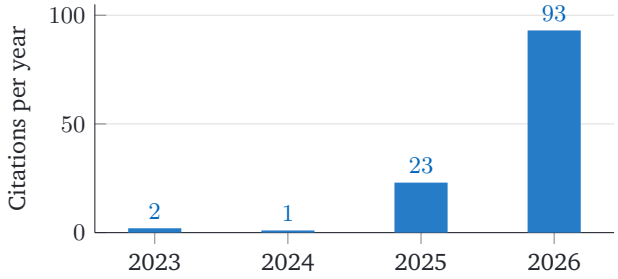
Research Interests

Foundation models (LLMs, VLMs, VLAs, world models) for autonomous driving — scenario generation and scenario analysis, safety-critical scenario evaluation, visual question answering and benchmark construction, semantic anomaly detection, agent-level risk assessment; motion planning and optimal control of multi-agent systems.

Research Impact

- **121 citations** total | h-index 4 | i10-index 2
- **93 citations in 2026 alone** — already ∼4× the 2025 total
- **228 GitHub stars** on the FM-AD-Survey repository
- **15 research outputs** (11 peer-reviewed) — 9 first-authored

Source: Google Scholar, August 2026.



2026 is year-to-date; Scholar per-year counts may not sum to the total.

Education

Ph.D. in Mechanical Engineering (Autonomous Vehicle Systems) — Oct 2024 – present
Technical University of Munich (TUM), School of Engineering and Design
Professorship of Autonomous Vehicle Systems; advisor: Prof. Dr.-Ing. Johannes Betz.
Research: scenario generation and analysis for autonomous driving based on foundation models.

M.Sc. Development, Production, and Management in Mechanical Engineering — Oct 2021 – Aug 2023
Technical University of Munich (TUM)
Grade 1.5 — passed with distinction (double Master's program).

M.Sc. Mechatronics and Robotics — Oct 2019 – Feb 2023
Technical University of Munich (TUM)
Grade 1.2 — passed with high distinction.
Master's thesis at the Chair of Information-oriented Control (Prof. Dr.-Ing. Sandra Hirche, Dr. Junjie Jiao).

M.Sc. studies, Mechatronics and Information Technology — Oct 2018 – Sep 2019
Karlsruhe Institute of Technology (KIT)
Continued Master's studies at TUM from Oct 2019.

B.Eng. Mechanical Design, Manufacture, and Automation — Sep 2013 – Jun 2017
Hefei University of Technology, China
GPA 3.74/4.3, rank 3/384 — Excellent Graduate honors.
Exchange semester at I-Shou University, Taiwan (Feb – Jun 2015), GPA 4.0/4.0.

Awards & Honors

- Double M.Sc. passed with **high distinction** (Grade 1.2, Mechatronics & Robotics) and **distinction** (Grade 1.5), TUM.
- **Excellent Graduate** honors, Hefei University of Technology — undergraduate rank **3 / 384**.
- Perfect GPA (4.0 / 4.0) on exchange semester, I-Shou University, Taiwan.

Research & Professional Experience

Research Associate / Ph.D. Candidate Oct 2024 – present
Professorship of Autonomous Vehicle Systems, TUM

- Lead research on foundation-model-based scenario generation and analysis for autonomous driving in a project funded by the German Central Innovation Programme for SMEs (ZIM).
- First-authored publications at ICRA, IROS, ITSC, and IEEE OJ-ITS; co-authored papers at ECCV (2×) and ITSC; built open-source frameworks, benchmarks, and datasets (NuRisk, FM-AD-Survey, From Words to Collisions).
- Supervised 11 student theses/projects; teaching assistant for the F1TENTH practical course and the Future Mobility Camp seminar.

Research Assistant Jul 2023 – Nov 2023
Chair of Information-oriented Control, TUM
Distributed optimal control of multi-agent systems. Afterwards (Dec 2023 – Sep 2024), prepared Ph.D. applications and extended the Master's thesis results into a journal submission (IEEE TCNS, under review).

Intern — Healthcare / Medical Robotics Feb 2023 – Jun 2023
ITK Engineering GmbH (Bosch Group)
Internship in the healthcare and medical robotics product area.

Student Research Assistant Mar 2022 – Aug 2022
Chair of Automotive Technology, TUM (Prof. Dr.-Ing. Markus Lienkamp)
Driving-simulator research for automated driving; previously completed a semester thesis at the same chair (May – Dec 2021).

Publications

Author name in bold; citation counts from Google Scholar, August 2026. 9 of 15 publications are first-authored.

Journal Articles

[J1] **Y. Gao**, M. Piccinini, Y. Zhang, D. Wang, K. Moller, R. Brusnicki, B. Zarrouki, A. Gambi, J. F. Totz, K. Storms, S. Peters, A. Stocco, B. Alrifaee, M. Pavone, J. Betz. "Foundation Models in Autonomous Driving: A Survey on Scenario Generation and Scenario Analysis." *IEEE Open Journal of Intelligent Transportation Systems*, 2026. **82 citations** [DOI] [arXiv] [code ★ 228]

[J2] **Y. Gao**, J. Jiao, Z. Li, S. Hirche. "H_2 Suboptimal Containment Control of Homogeneous and Heterogeneous Multi-Agent Systems." *IEEE Transactions on Control of Network Systems* (under review). [arXiv]

Conference & Workshop Papers

[C1] **Y. Gao**, M. Piccinini, R. Brusnicki, Y. Zhang, J. Betz. "NuRisk: A Visual Question Answering Dataset for Agent-Level Risk Assessment in Autonomous Driving." *IEEE International Conference on Robotics and Automation (ICRA)*, 2026. **6 citations** [arXiv] [code ★ 7] [dataset]

[C2] **Y. Gao***, W. Miao*, M. Piccinini, H. Wang, Q. Song, J. Betz (* equal contribution). "Chat2Scenic: An Iterative RAG-Based Framework for Scenario Generation in Autonomous Driving." *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2026 (accepted).

[C3] F. R. Schäfer, **Y. Gao**, D. Wang, T. Stauner, S. Günnemann, M. Piccinini, S. Schmidt, J. Betz. "EgoDyn-Bench: Evaluating Ego-Motion Understanding in Vision-Centric Foundation Models for Autonomous Driving." *European Conference on Computer Vision (ECCV)*, 2026 (accepted). [arXiv]

[C4] D. Wang, Z. Liang, H. Ye, Z. Sun, Z. Lu, Y. Zhang, Y. Zhao, **Y. Gao**, M. Seegert, F. R. Schäfer, H. Qin, W. Li, L. Palmieri, F. Jahncke, M. Piccinini, J. Betz. "Target-Bench: Can Video World Models Achieve Mapless Path Planning with Semantic Targets?" *European Conference on Computer Vision (ECCV)*, 2026 (accepted). **6 citations** [arXiv] [code] [project] [dataset]

[C5] R. Brusnicki, D. Pop, **Y. Gao**, M. Piccinini, J. Betz. "Can VLMs Unlock Semantic Anomaly Detection? A Framework for Structured Reasoning." *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, 2026 (accepted). [arXiv] [code] [project]

[C6] Q. Song, **Y. Gao**, R. Brusnicki, F. Sarro. "Warnless at the DeepTest 2026 Tool Competition." *7th IEEE/ACM International Workshop on Deep Learning for Testing (DeepTest)*, 2026.

[C7] **Y. Gao**, M. Piccinini, J. Betz. "Towards Whole-Body VLA: A Scalable Data Collection Framework for Quadrupedal Mobile Manipulators." *2nd German Robotics Conference*, 2026.

[C8] **Y. Gao**, M. Piccinini, K. Moller, A. Alanwar, J. Betz. "From Words to Collisions: LLM-Guided Evaluation and Adversarial Generation of Safety-Critical Driving Scenarios." *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, 2025. **17 citations** [arXiv] [code ★ 31]

[C9] **Y. Gao**, J. Jiao, S. Hirche. "H_2 Suboptimal Leader-Follower Consensus Control of Multi-Agent Systems." *IFAC World Congress*, 2023. IFAC-PapersOnLine 56(2), 2614–2619. **3 citations** [code]

[C10] **Y. Gao**, J. Jiao, S. Hirche. "H_2 Suboptimal Containment Control of Multi-Agent Systems." *American Control Conference (ACC)*, 2023. [IEEE Xplore] [code]

Preprints

[P1] Q. Song, **Y. Gao**, J. Betz, D. Pfahl, M. R. Mousavi, F. Sarro. "In the Driver's Seat: A Multi-Company Study on the Reality of Autonomous Driving System Testing." arXiv:2607.15820, 2026. [arXiv]

[P2] Z. Li, F. Zhao, M. Piccinini, B. Zarrouki, **Y. Gao**, Z. Shan, J. Betz, C. Lv, L. Xie. "SGTP: Sampling-based Game-Theoretic Planning for Real-Time Multi-Vehicle Autonomous Racing." arXiv:2607.25388, 2026. [arXiv] [code] [project]

[P3] **Y. Gao**, D. Hua, M. Piccinini, F. R. Schäfer, K. Moller, L. Li, J. Betz. "StyleVLA: Driving Style-Aware Vision Language Action Model for Autonomous Driving." arXiv:2603.09482, 2026. **3 citations** [arXiv]

Talks & Presentations

IEEE ICRA 2026 (Vienna, Austria) — presented *NuRisk* [C1]. Jun 2026

IEEE ITSC 2025 (Gold Coast, Australia) — presented *From Words to Collisions* [C8]; workshop talks at the *LLVM-AD* and *Interaction-driven Behavior Prediction & Planning* workshops. Nov 2025

Research visit, Australian Centre for Robotics, University of Sydney. Nov 2025

Academic Service

Conference reviewer: NeurIPS 2026 • ICLR 2026 • CVPR 2026 • ICRA 2026, 2025 • IROS 2026 • ITSC 2026, 2025 • IEEE IV 2026, 2025 • IFAC World Congress 2023.

Journal reviewer: IEEE Open Journal of Intelligent Transportation Systems • IEEE Robotics and Automation Letters.

Teaching (Technical University of Munich)

Teaching Assistant, "F1TENTH: Autonomous Driving Hands-on" (practical course, English). WS 2024, WS 2025

Teaching Assistant, "Future Mobility Camp" (project-week seminar, practical sessions). WS 2024, WS 2025

Tutor, "F1TENTH: Autonomous Driving Hands-on" (practical course, English). WS 2024

Tutor, "The Driving Simulator in the Development Process" (practical course, German). SS 2022

Certification: TUM Onboarding Program, elective module "Designing Courses." Dec 2024

Student Supervision (11 theses & projects)

- Chen Li, *Multimodal Retrieval-Augmented Closed-Loop Autonomous Driving Scenario Generation*, Master's thesis, Jun 2026
- Joshua Pusch, *A VLM-Based Scenario Analysis of Autonomous Driving*, interdisciplinary project, Mar 2026
- Haoyu Wang, *Closing the Loop: Integrating Vision-Language Models for Feedback-Driven ADAS Scenario Generation*, Master's thesis, Mar 2026
- Mengchen Cai, *From State Machines to Traffic Safety: Benchmarking Driver Assistance Systems Using Structured Scenario Models*, research internship, Feb 2026
- Karmishth Annauth, *Literature Study: Lightweight and Fast-Inference Vision-Language Models for Autonomous Driving*, semester thesis, Feb 2026
- Wenting Miao, *Retrieval-Augmented Generation of Simulator-Compatible ADAS Scenarios*, Master's thesis, Jan 2026
- Dengyuan Hua, *VLM-based Trajectory Generation: Driving Behavior Diversity*, Master's thesis, Jan 2026
- Yung Loon Lim, *Bridging ADAS/ADS Functionality, Regulations, and Scenario-Based Testing: A Comprehensive Literature Review*, semester thesis, Dec 2025
- Leonardo Zambrano, *Fine-Tuning Vision-Language Models for Risk Assessment in Autonomous Driving*, Bachelor's thesis, Oct 2025
- Sebastian Müller, *Generation of Safety-Critical Scenarios Based on LLMs*, Bachelor's thesis, Sep 2025
- Marek Lorenz, *Risk-Aware Scenario Analysis Based on LLMs in Autonomous Driving*, Bachelor's thesis, Apr 2025

Open-Source Software

- **FM-AD-Survey** (★ 228) — curated paper collection on foundation models for scenario generation & analysis in autonomous driving.
- **From-Words-to-Collisions** (★ 31) — LLM-guided evaluation and adversarial generation of safety-critical scenarios (ITSC 2025).
- **IFAC2023** (★ 24) & **ACC2023** — MATLAB implementations of H_2 suboptimal multi-agent control papers.
- **Riskaware-Scenario-analyse** (★ 21) — risk-aware scenario analysis based on LLMs.

Skills

Programming	Python, C, C++, C#
ML / Foundation Models	PyTorch, Hugging Face, LLMs & VLMs, agentic AI (LangChain, LangGraph, RAG)
Robotics & Systems	ROS/ROS 2, Linux, Git, CARLA simulation
Modeling & CAD	MATLAB/Simulink, Modelica, SILAB, PLC (CODESYS); AutoCAD, CATIA, Creo, SolidWorks
Languages	Chinese (native) • German (fluent, C1/DSH-2) • English (fluent, C1/IELTS 7.0)