

Keyvan Majd

Ann Arbor, Michigan

✉ keyvan.majd@gmail.com | 🏠 k1majd.github.io | 📄 github.com/k1majd | 🌐 linkedin.com/in/keyvan-majd

Summary

Robotics Engineer specializing in behavior generation and safety-critical decision-making for autonomous driving. Experienced in model-based planning and control (MPPI/MPC) for complex low-speed maneuvers such as parking and tight-clearance navigation, augmented with learning-enabled components including diffusion-style stochastic sampling and safety-aware policy adaptation. Strong background in closed-loop simulation, failure analysis, and real-time deployment on physical systems.

Experience

Toyota Research Institute in North America

Ann Arbor, MI

Research Engineer

October 2024 - Present

- Designed and deployed a real-time motion planning and control system for autonomous maneuvering (automated parking, tight-clearance navigation) of articulated vehicles, achieving reliable collision-free execution with <0.13 m clearance in simulation and real-world tests.
- Implemented a real-time, model-based sampling planner (MPPI/MPC-style) with safety-aware costs for trajectory optimization under kinematic and dynamic constraints, running at ~ 40 Hz and improving clearance margins by $>105\%$ over baseline controllers.
- Developed a diffusion-inspired stochastic sampling module to shape trajectory proposals for model-based planning, enabling more robust behavior generation in narrow, constrained environments while preserving explicit dynamics and cost evaluation.
- Integrated explicit safety constraints into planning rollouts to prevent unrecoverable states (e.g., jackknifing), and analyzed failure cases to improve robustness under model mismatch and sensing noise.
- Integrated planning, control, and vehicle interfaces (CAN, simulation environments) into a closed-loop system to enable end-to-end validation under realistic conditions.

Nikola Corporation

Phoenix, AZ

ADAS Simulation Engineer

Jun 2024 - October 2024

- Built a software-in-the-loop / hardware-in-the-loop simulation framework that connected planning and control modules to the vehicle CAN bus for closed-loop validation of Level 2+ ADAS (adaptive cruise, lane centering). Enabled automated regression and safety validation across perception, planning, and control using Python and ROS.
- Integrated CARLA simulation and OpenSCENARIO 1.0/2.0 scenario replay to run automated regression testing for level 2/2+ ADAS features. Established repeatable, scriptable test loops for perception, planning, and control performance under corner cases.

Honda Research Institute US (HRI-US)

San Jose, CA

Research Intern

January 2024 - May 2024

- Built a real-time inference module that learns a human partner's safety preferences during physical human-robot interaction (pHRI) and runs online on a Franka Research 3 arm. Implemented perception-to-control adaptation in ROS/C++ with millisecond-timescale updates.
- Derived adaptive safety constraints from learned human preference models and embedded them into a hierarchical, real-time controller that enforces physical limits, safety envelopes, and stability guarantees for the robot.

Academic Background

Interactive Robotics Lab - ASU

Tempe, AZ

Selected Research Highlights

August 2019 - December 2024

- Designed and implemented learning-enabled control policies using imitation learning with explicit safety constraints, enabling data-efficient behavior learning while maintaining hard safety for real-time deployment in robotic systems.
- Developed post-training methods to modify and correct learned control policies when unsafe behaviors were observed, enabling rapid iteration and safety improvement without retraining from scratch.
- Integrated optimization-based safety layers on top of learned controllers to enforce real-time physical and stability constraints, ensuring predictable behavior under uncertainty.
- Designed behavior-aware motion planning methods that account for human response and intent, improving predictability and reducing deadlock in shared environments.
- Contributed to large-scale multi-robot learning dataset (Open-X Embodiment) supporting policy learning across diverse embodied platforms.
- Built sampling-based planners with risk-based safety constraints in dynamic, confined environments, validated in real robotic deployments.

Skills

Robotics / Simulation / Deployment: IPG CarMaker, CARLA, Isaac Sim, MuJoCo, Gazebo, ROS1/ROS2, CAN, SIL/HIL

Languages / Systems: C++, Python, ROS1/ROS2, JAX, PyTorch, TensorFlow

Optimization / Verification: Gurobi, CPLEX, Pyomo, YALMIP

Learning & Planning: Diffusion models, MPPI, MPC, imitation learning

Education

Arizona State University (ASU)

Tempe, AZ

Ph.D. in Computer Science | Co-advisors: Prof. Heni Ben Amor and Prof. Georgios Fainekos

Aug 2019 - December 2024

Thesis Focus: Safe Robot Learning with Neural Network Repair (GPA: 4/4)

- Research focused on adapting and repairing neural control policies for safe deployment on physical robotic systems under real-time constraints.

North Carolina A&T State University (NCAT)

Greensboro, NC

M.S. in Electrical Engineering | Advisor: Prof. Abdollah Homaifar

Jan 2017 - Jun 2019

Thesis Focus: Kinematic-based Trajectory Planning Framework for Autonomous Ground Vehicles (GPA: 4/4)

Ferdowsi University of Mashhad (FUM)

Mashhad, Iran

B.S. in Electrical Engineering

Jan 2011 - Jun 2015

Thesis: A Model Predictive Controller (MPC) Design for the Curing Process of Wind Turbine Blades (GPA: 3.56/4)

Publications

[ICRA'26] T Kim, K Majd, B Hoxha, H Okamoto, D Panagou, G Fainekos. "Safe Model Predictive Diffusion with Shielding," *IEEE International Conference on Robotics and Automation*.

[TRO'25] M Dadvar, K Majd, E Oikonomou, P Verma, G Fainekos, S Srivastava. "Joint Communication and Motion Planning for Cobots in Real-World Contexts," *IEEE Transactions on Robotics, under review*.

[ITSC'25] K Majd, H Parwana, B Hoxha, S Hong, H Okamoto, G Fainekos. "GPU-Accelerated Barrier Rate MPPI Control for Tractor-Trailer Navigation and Collision Avoidance," *IEEE International Conference on Intelligent Transportation Systems*.

[IROS'25] K Majd, R Soltani Zarrin. "Robot Behavior Adaptation in Physical Human-Robot Interactions Based on Learned Safety Preferences," *IEEE/RSJ International Conference on Intelligent Robots and Systems*.

[IROS'24] K Majd, G Clark, G Fainekos, H Ben Amor. "Repairing Neural Networks for Safety in Robotic Systems using Predictive Models," *IEEE/RSJ International Conference on Intelligent Robots and Systems*.

[CoRL'23] Open X-Embodiment Collaboration. "Open x-embodiment: Robotic learning datasets and rt-x models," *2nd Workshop on Language and Robot Learning: Language as Grounding*.

[IROS'23] K Majd, G Fainekos, H Ben Amor. "Safety-aware Expansion for Neural Network Repair," *IEEE/RSJ International Conference on Intelligent Robots and Systems - Workshop on Formal methods techniques in robotics systems*.

[NeurIPS'22] K Majd, G Clark, T Khandait, S Zhou, S Sankaranarayanan, G Fainekos, H Ben Amor. "Certifiably-correct Control Policies for Safe Learning and Adaptation in Assistive Robotics," *Neural Information Processing Systems - Robot Learning Workshop*. **(Second-best paper award)**

[CoRL'22] K Majd, G Clark, T Khandait, S Zhou, S Sankaranarayanan, G Fainekos, H Ben Amor. "Safe Robot Learning in Assistive Devices through Neural Network Repair," *6th Annual Conference on Robot Learning*.

[ICRA'21] M Dadvar, K Majd, E Oikonomou, G Fainekos, S Srivastava. "Joint Communication and Motion Planning for Cobots," *IEEE International Conference on Robotics and Automation*.

[IROS'21] K Majd, S Yaghoubi, T Yamaguchi, B Hoxha, D Prokhorov, G Fainekos. "Safe Navigation in Human Occupied Environments Using Sampling and Control Barrier Functions," *IEEE/RSJ International Conference on Intelligent Robots and Systems*.

[L-CSS'20] S Yaghoubi, K Majd, T Yamaguchi, B Hoxha, D Prokhorov, G Fainekos. "Risk-bounded Control Using Stochastic Barrier Functions," *IEEE Control Systems Letters*.

[IEEE-JAS'19] K Majd, M Razeghi-Jahromi, A Homaifar. "A Stable Analytical Solution Method for Car-like Robot Trajectory Tracking and Optimization," *IEEE/CAA Journal of Automatica Sinica*.