SHIYU FENG

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RESEARCH INTERESTS & SUMMARY

- Engages in research involving Vision-based Navigation, Perception, Motion Planning, Optimal Control, Collision Avoidance, Robot Safety, and Vehicle Autonomy. Additionally, interested in exploring the combination of control, planning, and reinforcement learning as a prospective avenue for future research beyond the existing scope.
- Created real-time hierarchical navigation systems through C++ and Python in ROS/Gazebo simulation and real robots.
- Extensively worked with real-time stereo and depth cameras, multiple robotic platforms, and autonomous vehicles.

TECHNICAL SKILLS

Robotics Skills: perception, sampling and optimization based motion planning, collision avoidance, linear and nonlinear controller design, robot localization, dynamics modeling, optimization, teleguidance, robot safety, real-time system

Programming Languages: C/C++, Python, MATLAB, LabVIEW

SDKs: ROS, Gazebo, Eigen, PyTorch, TensorFlow, OpenCV, PCL, CasADi, ACADOS

Hardware: Turtlebot, PyRobot/LoCoBot, Stretch, Unitree A1, Kinect Depth Camera, RealSense D435i

Tools: Linux, GitHub, Jira, Weka, SolidWorks

Languages: Chinese, English

EDUCATION

Ph.D. Candidate in Mechanical Engineering, focused on Robotics   August 2016 – Expected Summer 2024

Georgia Institute of Technology, Atlanta, GA, USA

- The George W. Woodruff School of Mechanical Engineering   GPA: 4.00/4.00
- Advisor: Dr. Patricio A. Vela (ECE Department); Co-advisor: Dr. Jun Ueda (ME Department)

Master of Engineering in Mechanical Engineering   August 2015 – May 2016

University of California at Berkeley, Berkeley, CA, USA

- Department of Mechanical Engineering, Controls   GPA: 3.43/4.00

Bachelor of Science in Mechanical Engineering   September 2011 – July 2015

Chongqing University (CQU), Chongqing, China

- Department of Mechanical Engineering   GPA: 3.73/4.00 (Ranked in the top 1%)
- Graduated as an Outstanding College Graduate

SELECTED PUBLICATIONS

[1] S. Feng, Z. Zhou, J. S. Smith, M. Asselmeier, Y. Zhao, and P. A. Vela. GPF-BG: A Hierarchical Vision-Based Planning Framework for Safe Quadrupedal Navigation. IEEE International Conference on Robotics and Automation (ICRA). 2023.

[2] S. Feng, A. Abuaish, and P. A. Vela. "Safer Gap: A Gap-based Local Planner for Safe Navigation with Nonholonomic Mobile Robots." arXiv preprint arXiv:2303.08243 (2023).

[3] S. Feng, Z. Wu, Y. Zhao, and P. A. Vela, "Image-Based Trajectory Tracking Through Unknown Environments Without Absolute Positioning," in IEEE/ASME TMECH, vol. 27, no. 4, pp. 2098-2106, 2022.

[4] S. Feng, F. Lyu, J. Ha Hwang, and P. A. Vela, "Ego-centric Stereo Navigation Using Stixel World," 2021 IEEE International Conference on Robotics and Automation (ICRA), Xi'an, China, 2021, pp. 13201-13207, 2021.

[5] R. Xu, S. Feng, and P. A. Vela, "Potential Gap: A Gap-Informed Reactive Policy for Safe Hierarchical Navigation," in IEEE Robotics and Automation Letters, vol. 6, no. 4, pp. 8325-8332, 2021.

RESEARCH & WORK EXPERIENCE

Graduate Research Assistant   May 2017 – Present

Intelligent Vision and Automation Lab, Georgia Tech | **Advisor**: Dr. Patricio A. Vela

Project: Hierarchical Stereo Navigation with Sparse Representation

- Created a sparse ego-centric perception space from stereo cameras to describe local environments and track temporal sensing information for real-time motion planning and collision checking that has five times faster computational efficiency and scalability among workstations and lightweight embedded devices.
- Designed safety-guaranteed motion planning methods to achieve 0% collision rates for holonomic and nonholonomic dynamics involving model predictive control, potential fields, and control barrier functions, which improves safety performance of classical planning techniques in configuration space.
- Established an image-based trajectory tracking method with VSLAM to improve trajectory tracking accuracy by 28%.
- Implemented a vision-based navigation framework (GPF-BG) for quadrupedal robots to obtain 10% more success rates.
- Developed real-time navigation system architectures containing perception, planning, SLAM localization, and control modules for different platforms: mobile robots, mobile manipulation robots, snake-like robots, and quadrupedal robots.
- Conducted quantitative research on navigation performance in ROS/Gazebo simulation and real robots (Turtlebot, LoCoBot, Stretch, Unitree A1) with stereo cameras, depth cameras, laser scanners, and LiDAR.
- Trained deep learning neural networks to intelligibly select ego-centric collision-free trajectories from stereo images, which involves machine learning and computer vision.
- Research to deploy reinforcement learning models for navigation and object searching in a mobile manipulation task.

Perception Engineer Intern   May 2018 – August 2018

ADAS Team, Seres (SF Motors), Santa Clara, CA | **Supervisors**: Chongyu Wang, Fan Wang

- Implemented C++ OpenCV algorithm to achieve stop-line and traffic light detection through classical computer vision.
- Contributed to deep learning traffic detection and data preparation.
- Deployed classical and learning-based algorithms in autonomous driving field tests.
- Assisted in completing camera installation, sensor calibration, and real-time image acquisition.

Graduate Researcher   September 2015 – May 2016

MPC Lab, University of California at Berkeley | **Advisor**: Dr. Francesco Borrelli

Project: Fault Tolerant Control in Autonomous Driving, Perception

- Developed the main sensor data association algorithm in Python with an external optimization solver.
- Tested the sensor association algorithm in simulation and on a real autonomous driving car.

LEADERSHIP & TEACHING EXPERIENCE

ORS and VIP Undergraduate Research Mentor   August 2019 – Present

School of Electrical and Computer Engineering, Georgia Tech

- Supervised and organized 8+ undergraduate research projects on vision-based navigation with SLAM, perception, planning, teleoperation, control, deep learning, software, hardware design, etc. Offering help and support to undergraduate researchers.

Teaching Practicum   August 2021 – December 2021

School of Mechanical Engineering, Georgia Tech | **Supervisor**: Dr. Jun Ueda

Course ME 3017: System Dynamics

- Participated in the creation of course materials, assignments, and exams while also offering guidance through office hours. Delivered portions of lectures and supported undergraduate students in addressing their academic inquiries.

Graduate Teaching Assistant   August 2016 – August 2018

School of Mechanical Engineering, Georgia Tech | **Supervisors**: Dr. Thomas Kurfess, Dr. Christopher Saldana

Course ME 2110: Creative Decisions and Design

- Worked in collaboration to create course materials, assignments, and exams while offering office hours.
- Instructed on mechatronics and machining training while overseeing machining open labs.
- Acted as the lead TA for a semester, organizing TA training and open labs, and coordinating the final competition.