SHIYU FENG

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RESEARCH INTERESTS & SUMMARY

- A Ph.D. candidate in Mechanical Engineering and Robotics at Georgia Tech.
- Research topics: Vision-based Navigation, Perception, Planning, Controls, Collision Avoidance and Robot Safety.
- Using C++, Python, MATLAB, and ROS/Gazebo through research and prototyping.

EDUCATION

Ph.D. Candidate in Mechanical Engineering August 2016 – Expected May 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

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 (Equal Contribution), 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 (Equal Contribution), 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, Aug. 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.

[5] R. Xu, S. Feng (Equal Contribution), 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, Oct. 2021.

[6] H. Chen, S. Feng, Y. Zhao, C. Liu, and P. A. Vela, "Safe Hierarchical Navigation in Crowded Dynamic Uncertain Environments," 2022 IEEE 61st Conference on Decision and Control (CDC), Cancun, Mexico, 2022, pp. 1174-1181.

[7] J. S. Smith, S. Feng, F. Lyu, and P. A. Vela, Real-Time Egocentric Navigation Using 3D Sensing. Cham: Springer International Publishing, 2020, pp. 431–484.

[8] A. H. Chang, S. Feng, Y. Zhao, J. S. Smith, and P. A. Vela. Autonomous, monocular, vision-based snake robot navigation and traversal of cluttered environments using rectilinear gait motion. arXiv preprint arXiv:1908.07101 (2019).

RESEARCH & WORK EXPERIENCE

Graduate Research Assistant May 2017 – Present

Intelligent Vision and Automation Lab (Georgia Tech)

Project: Hierarchical Stereo Navigation with Sparse Representation; **Advisor**: Dr. Patricio A. Vela

- Created an egocentric perception space by combining stixel and sparse features estimated from the stereo camera. The perception propagates to maintain temporal information for perception space collision checking (PiPS). It has better computational efficiency and scalability among different workstations and embedded devices.
- Designed a Potential Gap local planning that formulates potential fields from sparse gaps to generate safe trajectories. The gaps are detected within any laser scan-like egocentric perception to represent collision free region.
- Proposed a trajectory servoing method to track Cartesian trajectories within image space composed of sparse feature points from V-SLAM. It reduces the reliance on the accuracy of pose estimation.
- Implemented a hierarchical vision-based planning framework (GPF-BG) integrating our previous Global Path Follower (GPF) navigation system and a gap-based local planner using Bézier curves (BG) for safe quadrupedal navigation.
- Extended the Potential Gap navigation technique by guaranteeing safety for nonholonomic robots in all tiers of hierarchy. Nonlinear MPC with a keyhole-shaped zeroing barrier function is applied to track local trajectories and ensure safety.
- Trained a deep learning model to synthesize ego-centric collision free trajectories from stereo image inputs. Learning model is utilized as an explainable method for choosing the best trajectory.
- Developed multiple hierarchical navigation systems, e.g., GPF-X, for different robotic platforms: mobile robots, mobile manipulation robots, snake-like robots, and quadrupedal robots.
- Benchmarked different navigation performance in ROS/Gazebo simulation and real robots with stereo cameras, depth cameras, and laser scanner.

ORS Undergraduate Research Mentor August 2019 – Present

School of Electrical and Computer Engineering (Georgia Tech)

- Lead undergraduate research on vision-based navigation including image processing, obstacle avoidance, path planning, control, deep learning and so on.

Perception Engineer Intern May 2018 – August 2018

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

- Implemented C++ OpenCV algorithm to achieve stop-line and traffic light detection using image processing approaches.
- Deployed the algorithm on a real testing car in ROS environment, and accomplished field test.
- Contributed to deep learning detection model training and image annotation.
- Assisted in completing camera installation, calibration, and image acquisition.

Teaching Practicum August 2021 – December 2021

ME 3017: System Dynamics (Georgia Tech); **Supervisor**: Dr. Jun Ueda

- Assisted in developing course materials, homework, and exams.
- Provided weekly office hours and taught three lectures.

Graduate Teaching Assistant August 2016 – August 2019

ME 2110: Creative Decisions and Design (Georgia Tech); **Supervisor**: Dr. Thomas Kurfess, Dr. Christopher Saldana

- Instructor for mechatronics and machining training.
- Responsible for tutoring and assessing students.

- Conduct open lab and troubleshoot student questions.

Graduate Research Intern September 2015 – May 2016

MPC Lab (University of California, Berkeley)

Project: Fault Tolerant Control in Autonomous Driving, Perception; **Advisor**: Dr. Francesco Borrelli

- Built the main sensor data association algorithm in Python and connected ECOS solver with the algorithm.
- Tested the sensor association algorithm in simulation and on a real car.

TECHNICAL SKILLS

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

SDKs: OpenCV, ROS, Gazebo, CasADi, PCL, Linux, GIT, Jira, PyTorch, TensorFlow

Tools: Weka, Solidwords, ProE, AutoDesk, ANSYS