Yu Zheng

Portfolio, Github, Google Scholar
Electrical and Computer Engineering, Florida State University
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SUMMARY

Highly motivated control system researcher with over 6 years of experience in the intersection of control and estimation, optimization, and deep learning, especially with applications on cyber-physical autonomous systems. Skilled in motion dynamics, kinematics, path planning, and control and estimation algorithms. Proven track record of successful project delivery and cross-functional collaboration.

EXPERIENCES

Research Intern 2022.5 - 2022.8
Ford Motor Company, Dearborn, USA

- Advanced Driving Assistant System (ADAS) Research

1. Built the launch system, and sensor interface systems (ROS2, C++) for the Localization, Odometry, and Mapping, contributed to the delivery of the new ADAS software framework on ROS2
2. Developed and Demonstrated a deterministic simulation framework, enabling deterministic testing, evaluation, and production
3. Experienced with the data capture, fusion, and visualization of perception sensors, including Lidar, Radar, GNSS

Research Assistant 2019 - Present
Florida State University, RASLab, Tallahassee, USA

- Autonomous Driving:

1. Built a vision-based lane following control system on a 1/10 scale autonomous vehicle, including model characterization, vision-based lane detection, sensor odometry and fusion, throttle-based cruise control, and lateral model predictive control;
2. Contributed to a lightweight learning-based Georeferened tracking with an uncalibrated monocular camera, Won 2nd place in Navy AI-Track-at-sea competition (68% accuracy), Achieved 98% accuracy for indoor environment with continuous efforts after the competition;
3. Developed a reinforcement learning (RL)-based highway lane change controller;
4. Built a remote racing system based on Jetson TX2 and ROS, including real-time video streaming, dynamic steering force feedback, and auto-centering.
5. Developed robust and resilient consensus control for the formation control of connected vehicles.

- Safe Autonomy:

1. Proposed a smooth sensor proofing attack to mislead the vehicle on the wrong tracking path, performed experiments on a differential-driven vehicle with non-holonomic constraint;

2. Proposed Gaussian process regression (GPR)-based and MLP-based anomaly detection and localization, one relevant book chapter was published;
3. Proposed attack-resilient estimation algorithm to maintain correct vehicle path tracking in adversarial environments, proposed techniques supported the winning of a 300 million research funding.

Research Assistant 2017 - 2019
Huazhong University of Science and Technology, Wuhan, China

- Diagnostic Control of Autonomous Underwater Vehicles

1. Developed a real-time diagnostics and prognostics system using an Expert system and fault tree analysis
2. Developed Reference system design with finite state machine
3. Managed software development, hardware-in-the-loop testing, and experiments of real-time embedded control system

EDUCATION

Ph.D. Candidate Electrical and Computer Engineering Present
Florida State University, Tallahassee, USA

M.eng. Naval Architecture and Ocean Engineering 2019
Huazhong University of Science and Technology, Wuhan, China

B.Sc. Marine Engineering 2017
Wuhan University of Technology, Wuhan, China

SKILLS

- Autonomous Driving: Vehicle dynamics, Vehicle kinematics, Path planning and tracking, Dead-reckoning, Adaptive cruise control, Sensor odometry and fusion, Vision-based detection.
- Control and estimation: Linear control, Optimal Control, Model-predictive control, Lyapunov analysis, Robust control (LMI based), ℓ_2 decoders (LSE, KF, EKF, UKF, Luenberger-like observers, particle filter), ℓ_1 decoders, Adaptive filters.
- Deep/machine learning: Kernel regression (GPR, SVM, linear, polynomial...), Classification, Neural networks (FCN, CNN, RNN), Generative model (GANs), Reinforcement learning.
- Optimization: Convex/nonconvex problems, Geometric projection, Gradient-based solvers, Interior-point method
- Software: Matlab/Simulink, ROS/ROS2, Python, C++; Git, Opencv, Rviz, Docker, Stateflow, Tensorflow, Keras, Jupyter; Agile, Trello; Linux, Jetson tx2/nano, raspberry pi

ACHIEVEMENTS

- 2022 Student Employee of the Year Nominee
- 2nd Place in Navy AI-Track-at-Sea Competition (Team ASG Auto)

CONTRIBUTIONS

- **Y. Zheng**, OM Anubi. "Attack-resilient observer pruning for path-tracking control of Wheeled Mobile Robot." Dynamic Systems and Control Conference. Vol. 84287. American Society of Mechanical Engineers. (2020)
- **Y. Zheng**, and Olugbenga Moses Anubi. "Resilient Observer Design for Cyber-Physical Systems with Data-Driven Measurement Pruning." Security and Resilience in Cyber-Physical Systems. Springer, Cham. (2022)

- **Y. Zheng**, OM Anubi, "Attack-Resilient Weighted L1 Observer with Prior Pruning", American Control Conference. (2021)
- **Y. Zheng**, SB Mudhangulla, OM Anubi, "Moving-horizon False Data Injection Attack Design against Cyber-Physical Systems", Control Engineering Practice. [Conditional Accepted], (2023).
- **Y. Zheng**, G. X. Wang, et al. "A Finite State Machine Based Diagnostic Expert System of Large-Scale Autonomous Unmanned Submarine", in IEEE Conference on Underwater System Technology, (2018)
- **Y. Zheng**, OM Anubi, Lalit Mestha, Hema Achanta, Robust Resilient Signal Reconstruction under Adversarial Attacks, 2023 American Control Conference. (Accepted)
- Wang, W., **Y. Zheng**, Xu, G., Li, W., and Ma, X. . Research and Experiments on Submergence for Self-propelled Model with Positive Buoyancy. In The 28th International Ocean and Polar Engineering Conference. OnePetro. (2018)