

Yu Zheng

Education

- 2019–Present **Florida State University, Tallahassee, Florida,**
Electrical and Computer Engineering, Ph.D. Candidate, GPA: 4.0/4.0.
- 2017–2019 **Huazhong University of Science and Technology, Wuhan, Hubei, China,**
Master in Naval Architecture and Ocean Engineering, GPA:3.7/4.0,
Thesis: Research on Emergency Control Technique for Large-Scale Autonomous Underwater Vehicle.
- 2013–2017 **Wuhan University of Technology, Wuhan, Hubei, China,**
Bachelor in Marine Engineering, GPA 3.0/4.0.

Skills

- Developer Controller and Estimator, Optimization problem solver, Deep Learning application, Programming
Languages Matlab, Python, C
Frameworks Keras, Tensorflow, ROS, Stateflow
Utilities Linux, pip, pycharm, Jupyter Notebook, Git

Relevant Coursework

- Online Modern Robotics, Deep Learning, Generative Adversarial Network
Classroom System and Signal, Nonlinear Control, Robust Control, Model predictive control, Compressed Sensing, Machine Learning, Deep Reinforcement Learning, Real Analysis, Differential Geometry

Research and Professional Experience

Autonomous System Control.

- Vision-based Lane Keeping Control Nov.2021- current
 - Sensor characterization and state estimators design for IMU, encoder
 - Dynamic modeling and parameter estimation of electric motor-driven ground vehicle, including electric motor, vehicle dynamics, kinematic, tire, steering, and powertrain; built the simulation platform on matlab/simulink;
 - Computer vision based lane detection and tracking using opencv;
 - Model predictive control based longitudinal control and lateral design for lane following task;
 - Implemented real-time lane keeping controller on an 1/10 scale ground vehicle through Python and ROS;
- Single camera based Perception Oct.2020 - Dec.2020
 - Worked in a team for navy "AI-Track-At-Sea" 2020 national-wise competition, won 2nd place in competition;
 - Implemented a lightweight regression algorithm with quadratic kernel for coordinator inference from image to world frame, which outperforms Gaussian process regression and Neural network;
 - Implemented moving-average weighted smoothing and outlier-rejection (pandas), spline interpolation (scipy), and extrapolation based on first-order kinematics;
- Safe motion control of nonholonomic vehicle Jan.2020 - June.2020
 - Designed a nonlinear path-tracking controller for nonholonomic vehicle based on Lyapunov analysis;
 - Designed a resilient Kalman filter to maintain correct state estimation in adversarial environment;
- Fault diagonal system development for Underwater vehicle Oct.2017 - June.2019
 - Protected automatic underwater vehicle (AUV) from emergency events by developing a real-time diagnostic Expert system;
 - Improved reasoning efficiency by adopting finite state machine(FSM) in reference engine;
 - Tested control algorithm through digital simulation and real-time hardware-in-loop simulation;
 - Implemented control algorithms on an autonomous underwater vehicle of 1/10-scale of submarine through VxWorks with embedded C language;
 - Built an emergency electromechanical actuation system: emergency load-releasing system.

Cyber-Physical System Security.

- Automated Adversary Generation Sep.2021 - current
 - Model-based attack generation: Developed and designed an algorithm to pursue sub-optimal solutions of a concave optimization problem; Designed a model predictive attack injection scheme which outperforms the existing techniques in the literature;
 - Data-driven attack generation: Developed and designed a novel self-supervised Generative Adversary Network (GAN) to generate adversary data;
 - The proposed automated attack generator has showed the state-of-art on improving the resiliency of learning-based attack detection algorithms;
 - Implementing the proposed attack generator on an energy delivery system (DOE project: REDCS);
- Adversary Detection and Localization Sep.2020 - Nov.2021
 - Implemented model-based bad data detector (BDD), such as residual-based BDD, χ^2 BDD;
 - Developed a detection and localization algorithm based on Neural Network;
 - Designed a detection and localization algorithm based on Gaussian Process Regression;
- Resilient Estimation and Control Jan.2020 - current
 - Developed statistics-based pruning Method and algorithms to improve the precision of machine learning-based classification algorithms without training;
 - Designed a weighted 1-norm state estimator to reconstruct the system states from adversarial signals;
 - Theoretical validation for bounded estimation error through the proposed resilient estimator;
 - Simulated the proposed resilient techniques and other existing resilient estimation techniques on IEEE 14-bus, 118-bus system and water-distribution system (WDS);
 - Designed and implemented Resilient Kalman filter (KF) for differential-driven wheeled mobile robot;

Coursework-related projects.

- Robust consensus control design for multi-agents system; March.2021 - June.2021
- Cooperative adaptive cruise control design; Jan.2021 - March.2021

Working Experiences.

- Research assistant, Center for Advanced Power Systems, Florida State University, US. Sep.2019 - current
- Research assistant, Underwater Robots Lab, Huazhong University of Science and Technology, China. sep.2017 - June.2019

Academic Services.

- Reviewer for 2021, 2022 American Control Conference.
- Delegate Reviewer for IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Power Systems, IEEE Access.

Publications

- [1] Y. Zheng, OM Anubi, "Attack-Resilient Weighted L1 Observer with Prior Pruning", 2021 American Control Conference.
- [2] Y. Zheng and O. Anubi, "Resilient Observer Design for Cyber-Physical Systems with Data-Driven Measurement Pruning", Security and Resilience in Cyber-Physical Systems, edited by M. Abbaszadeh and A.Zemouche, Springer, 2021 [to appear]
- [3] 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.
- [4] 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
- [5] Wang, W., Zheng, Y., Xu, G., Li, W., Ma, X. (2018, June). Research and Experiments on Submergence for Self-propelled Model with Positive Buoyancy. In The 28th International Ocean and Polar Engineering Conference.
- [6] Y. Zheng, OM Anubi, "Moving-horizon False Data Injection Attack Design against Cyber-Physical Systems", 2022 American Control Conference. [under review]
- [7] Y. Zheng, Ali Sayghe, OM Anubi, "Algorithm Design for Resilient Cyber-Physical Systems using an Automated Attack Generative Model", IEEE Transactions on Systems, Man, and Cybernetics: Systems. [under review]
- [8] Y. Zheng, OM Anubi, Warren Dixon "Resilient Observer Design Using Pruned Support Prior", IEEE Transactions on Automatic Control. [finalizing]
- [9] B. Olabiran, A. Vadivel, Y. Zheng, M. Hassan, OM Anubi, "Multi-modal Learning Pipeline for Smooth Georeferenced Tracking from an Uncalibrated Monocular Camera" [finalizing]
- [10] A. Sayghe, Y. Zheng, OM Anubi, "Adversarial Machine Learning Designs against Learning-based Detection Algorithm." [finalizing]