HUANG, HEJUN

(+1) 616-274-8147 | hejun@umich.edu | hejunhuang | huanghejun.com

SUMMARY

Passionate dual master's degree holder with interests in the intersection of **control theories**, **learning**, **optimization**, **statistical inference**, **robot locomotion**, and **path planning**. Designed several algorithms for diverse models, with the vision to advance their safety, stability, surveillance, and privacy.

- **Control and Learning**: Region-of-Attraction guided controller meets Reinforcement learning: [1,2,3].
- **Optimization and Statistical inference**: Sum-of-Squares programming under Gaussian Processes: [1,5].
- **Robot locomotion and Path planning**: Remote Identification systems with drone's surveillance and privacy maintenance: [4,6].

EDUCATION

M.Sc. Aerospace Eng. Dec. 2023
GPA: 3.4 | University of Michigan, Ann Arbor, MI

M.Sc. Mechanical and Automation Eng. Nov. 2020
GPA: 3.7 | Chinese University of Hong Kong, HKSAR, China

B.Sc. Mechatronics Eng. Jun. 2019
GPA: 3.2 | North China Electric Power University, Hebei, China

EMPLOYMENT

Graduate Research Assistant Aug. 2022 - Dec. 2023
LATTICE Lab, University of Michigan

- Led and mentored a subteam of 2 graduates and 1 undergraduate to design drone path planning: check reachability tube and formulate minimum jerk/snap trajectory.
- Developed formal coverage estimations for drone trajectories under urban Remote Identification systems.
- Created a framework to rank regional privacy scores for drone delivery tasks in Remote Identification systems.
- Developed `MATLAB`-based drone Remote Identification system illustration demo with *MyGepData* dataset. Created visualizations showing a drone's trajectory and its potential reach, either within or beyond the Remote Identification System's scope, in cities like NYC, LA, and SF.

Research Assistant Sept. 2020 - Jul. 2022
Dept. of Mechanical and Automation Eng., Chinese University of Hong Kong

- Developed an approximation process for partially unknown systems via polynomials using Gaussian Processes (GP).
- Integrated Sum-of-Squares programming with GP for control Lyapunov-barrier function (CLBF) computation.
- Created an augmented algorithm to expand the CLBF-certified region under partially unknown dynamics.
- Designed a Reinforcement Learning (RL) framework with the augmented CLBF computation algorithm for certifying safety and convergence in stabilization tasks.
- Collaborated in developing *RiPO*, a novel risk-manageable portfolio optimization framework for maximizing profits in uptrends and minimizing risks in downtrends.
- Developed teaching and vocational skills while sharpening technical abilities in related fields.

Intellectual Property Department Intern Mar. 2019 - Jul. 2019
Daimler Greater China Investment Co., Inc. Beijing

- Maintained and updated internal intellectual property database for Daimler's business units
- Updated patent-search formula for business units with related analysis reports
- Assisted in completing Freedom to Operate reports on CN market fuel cells and batteries.

SKILLSET

Programming language: `MATLAB, Python, C++, CSS.`
Technologies: `Linux, GIT, Docker, Conda, Pytorch, Tensorflow, JAX || SOSTOOLS, SOSPT, YALMIP, CVXOPT, SciPy, NumPy, Matplotlib, Pandas, Mosek, Gurobi || RaiSim, CARLA, ROS2, WordPress.`
Language: Mandarin, Cantonese, full professional proficiency in English.

PUBLICATION

[6] **Huang, H.**, Fang, Y., Mazotti, B., Kim, J., Li, M.Z. (2023). Privacy-Aware Coverage Design and Analysis in Drone Remote Identification Systems. Under review.

[5] Li, Z., **Huang, H.**, & Vincent, Tam (2023). Combining Reinforcement Learning and Barrier Functions for Adaptive Risk Management in Portfolio Optimization. Under review.

[4] **Huang, H.**, Mazotti, B., Kim, J., & Li, M.Z. (2023). Remote Identification Trajectory Coverage in Urban Air Mobility Applications. *Air Traffic Management R&D Seminar*.

[3] **Huang, H.**, Li, Z., & Han, D. (2022). Barrier Certified Safety Learning Control: When Sum-of-Squares Programming Meets Reinforcement Learning. *Conference on Control Technology and Applications*.

[2] Han, D. & **Huang, H.** (2022). Sum-of-Squares Program and Safe Learning On Maximizing the Region of Attraction of Partially Unknown Systems. *Asian Control Conference*.

[1] **Huang, H.** & Han, D. (2022). On Estimating the Probabilistic Region of Attraction for Partially Unknown Nonlinear Systems: A Sum-of-Squares Approach. *Chinese Control and Decision Conference*.

SELECTED COURSES AND PROJECTS

Multidisciplinary Design Optimization 2023

- Tested Newton and Quasi-Newton solvers and identified different types of numerical errors.
- Solved an unconstrained problem by using a line-search-based method.
- Solved a constrained problem via Sequential Quadratic Programming.
- Performed Algorithmic Differentiation and Implicit Analytic Methods to compute gradients.

AI Foundations and Information System 2023

- Learned topics: Automata Theory, Turing Machine, Search, Constraint Satisfaction Problems, Bayesian\Decision Net, Logic Agent, Markov Decision Processes, Reinforcement Learning, Multi-Agent Systems, Machine Learning.

Inference, Estimation, and Learning 2022

- Formulated multilevel Monte Carlo and Control Variables for stochastic ODEs.
- Employed Bayesian inference for target location identification with minimal samplings.
- Performed Delayed Rejection Adaptive Metropolis algorithm to infer nonlinear dynamical models.
- Deployed various Gaussian filtering algorithms, e.g., EKF, UKF, GHKF, and particle filtering.

Mechanical Product Digital Design 2018

- Rehabilitation Exercise Assistant Robot for Cerebral Palsy Patients. [**Video**]
- ReadyGo Maker: a self-service Hot Dog Assembly Machine. [**Video**]

TEACHING EXPERIENCE

AEROSP 590: Direct Study 2023 Summer
Teaching assistant Ann Arbor, MI

Summer Research Project 2020, 2021
Teaching assistant Hong Kong

ENGG 1910: Demystifying AI 2022
Teaching assistant Hong Kong

HONORS AND AWARDS

Pedagogical Innovation SILVER, and People's Poster Prize [expo] 2021
For top 3% projects in 2021 HK Teaching and Learning Innovation EXPO

First Class Scholarship 2016, 2017, 2018
For top 5% students

Hao Peng Mechatronic Scholarship 2016, 2018
For top 10% students

Third, Second Prize 2017, 2018
For top 8%, 15% participants in the National Mechanical Product Digital Design Competition