HUANG, HEJUN

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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: 3.642 | University of Michigan, Ann Arbor, MI

M.Sc. Mechanical and Automation Eng. Nov. 2020
GPA: 3.463 | Chinese University of Hong Kong, HKSAR, China

B.Sc. Mechatronics Eng. Jun. 2019
GPA: 81.62 | North China Electric Power University, Hebei, China

EMPLOYMENT

Research Intern Jan. 2024 - Jun. 2024
Robotics and Autonomous Driving Lab, Baidu USA Sunnyvale, CA

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

- 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 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 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

Rackham Conference Travel Grant 2023
Grant for conference attendance at UMich

Engineering Graduate Fellowship 2022,2023
Full funding for graduate study at UMich

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