Hyung-Jin Yoon

Mechanical Engineering, Tennessee Technological University
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Research Interests

Integration of Machine Learning and Control, Aerial Robotics, Autonomous Vehicle, Cyber Physical System, Mechatronics, Sampling Based Optimal Control.

Academic Background

Ph.D. Mechanical Engineering 2019
University of Illinois at Urbana-Champaign, IL, USA
- Ph.D. research under direction of Prof. Naira Hovakimyan.
  Dissertation title: Path Planning and Control of Flying Robots with Account of Humans' Safety Perception.

M.S. Applied Mathematics 2019
University of Illinois at Urbana-Champaign, IL, USA

M.S. Electric and Electronic Engineering 2013
Sungkyunkwan University, Seoul, South Korea

B.S. Mechanical Engineering 2006
Hanyang University, Seoul, South Korea

Research Experience

Assistant Professor 2023 - Present
Tennessee Technological University, Cookeville, TN, USA

Postdoctoral Researcher 2020 - 2023
University of Nevada, Reno, NV, USA
- Develop control, planning and learning algorithms with applications to autonomous vehicles.
- Support proposal writing.

Postdoctoral Researcher 2019 - 2020
Media Lab, Massachusetts Institute of Technology, MA, USA
- Application of reinforcement learning for healthcare industry.
- Support proposal writing.

Graduate Research/Teaching Assistant 1/2014 - 5/2019
University of Illinois at Urbana-Champaign, IL, USA
- Developed virtual reality (VR) testing environment to text human's safety perception of a UAV
- Developed optimal trajectory generation of the UAV using an identified the safety perception model.

Industry Experience

Data Analytics Intern 5/2018 - 8/2018
Caterpillar, Campaign, IL, USA
- Implementation of reinforcement learning to heavy equipment operations.

Research Engineer 8/2006 - 8/2013
Hyundai Motor Company, Seoul, South Korea
- Developed electric car energy consumption simulation and tuning gain scheduling map of the prototype cars.

Teaching Experience

Mechanical Engineering in Tennessee Tech University
Main instructor of the following courses:
- VE 3400 Introduction to Automotive Systems (Fall 2023)
- VE 4050 Autonomous Vehicles (Spring 2024)

Mechanical Engineering in University of Nevada, Reno
Main instructor of the following courses:
- ME 410.1001 Introduction to System Control (Spring 2021)
- ME 310.4001 System Analysis and Design (Summer 2022/2021/2020)

Grant Activity

Subcontract from the NASA ULI through University of Neveda, Reno, "Virtual Reality and Testbed Development for Advanced Air Mobility." H. Yoon (PI). Total Award Amount: $15,000, 2024

NASA, UNIVERSITY LEADERSHIP INITIATIVE (ULI), "Robust and Resilient Autonomy for Advanced Air Mobility." N. Hovakimyan (PI), awarded in 2022
- Wrote the content related to integration and testing utilizing photo realistic simulation environments.

NSF, Civil, Mechanical and Manufacturing Innovation (CMMI), "Towards Attack-Resilient Vision-Guided Unmanned Aerial Vehicles: An Observability Analysis Approach." P. Voulgaris (PI). Total Award Amount: $274,354, awarded in 2022
- Wrote the content related to adversarial machine learning and reinforcement learning.

Journal Publications

1. **Hyung-Jin Yoon**, Ryan Holmes, Hamidreza Jafarnejadsani, and Petros Voulgaris, "**Real-time Adversarial Image Perturbations for Autonomous Vehicles using Reinforcement Learning**," *ACM Transactions on Cyber-Physical Systems (Accepted).*
2. Tristan Hill, **Hyung-Jin Yoon**, and Stephen Canfield, "**Automated Weld Path Generation in Cluttered Environments Using Segmentation and Iterative Closest Point Workpiece Localization**," *Journal of Mechanisms and Robotics (2025).*
3. Ran Tao, Hunmin Kim, **Hyung-Jin Yoon**, Wenbin Wan, Naira Hovakimyan, Lui Sha, and Petros Voulgaris, "**Backup Plan Constrained Model Predictive Control with Guaranteed Stability**," *AIAA Journal of Guidance, Control, and Dynamics (2023).*
4. **Hyung-Jin Yoon**, Hamidreza Jafarnejadsani, and Petros Voulgaris, "**Learning When to Use Adaptive Adversarial Image Perturbations against Autonomous Vehicles**," *IEEE Robotics and Automation Letters (2023).*
5. Christopher Widdowson, **Hyung-Jin Yoon**, Thiago Marinho, Naira Hovakimyan and Ranxiao Frances Wang, "**A Novel Measure of Human Safety Perception in Response to Flight Characteristics of Collocated UAVs in Virtual Reality**," *IEEE Transactions on Human-Machine Systems (2023).*

6. **Hyung-Jin Yoon**, Christopher Widdowson, Thiago Marinho, Ranxiao Frances Wang, and Naira Hovakimyan, "**Socially-Aware Path Planning for a Flying Robot in Close Proximity of Humans**," *ACM Transactions on Cyber-Physical Systems (2019).*

Conference Publications

1. Ashik Rasul, Humaira Tasnim, **Hyung-Jin Yoon**, Ayoosh Bansal, Duo Wang, Naira Hovakimyan, Lui Sha, Petros Voulgaris. "**Bayesian Data Augmentation and Training for Perception DNN in Autonomous Aerial Vehicles**," *AIAA SciTech 2025 Forum*
2. Mikael Yeghiazaryan, Ayoosh Bansal, Yangge Li, Chuyuan Tao, **Hyung-Jin Yoon**, Prateek Arora, Duo Wang, Sayan Mitra, Christos Papachristos, Petros Voulgaris, Lui Sha, Naira Hovakimyan. "**Verification and Validation of a Vision-Based Landing System for Autonomous VTOL Air Taxis**," *AIAA SciTech 2025 Forum*
3. **Hyung-Jin Yoon**, Matthew Sellers, and Bruce Jo. "**Sample-Based Model Predictive Control for Stewart Platform Using Data-Driven Model**," *AIAA Aviation 2024 Forum*
4. Antonio Fernández Castaño, Caleb Patton, **Hyung-Jin Yoon**, and Petros Voulgaris. "**Uncertainty Quantification-Based Switching Control Method for Vision-Based Object Tracking in Unmanned Aerial Vehicles**," *AIAA SciTech 2024 Forum*
5. Bansal, Ayoosh, Yang Zhao, James Zhu, Sheng Cheng, Yuliang Gu, **Hyung-Jin Yoon**, Hunmin Kim, Naira Hovakimyan, and Lui R. Sha. "**Synergistic Perception and Control Simplex for Verifiable Safe Vertical Landing**," *AIAA SciTech 2024 Forum*
6. **Hyung-Jin Yoon**, Antonio Fernández Castaño, and Petros Voulgaris. "**Adaptive Control to Suppress Torque Ripple in Electric Vehicles**," *3rd Modeling, Estimation and Control Conference (MECC) 2023*
7. **Hyung-Jin Yoon**, Chuyuan Tao, Hunmin Kim, Naira Hovakimyan, and Petros Voulgaris. "**Adaptive Risk Sensitive Path Integral for Model Predictive Control via Reinforcement Learning**," *In 2023 31st Mediterranean Conference on Control and Automation (MED), IEEE, 2023*
8. **Hyung-Jin Yoon**, Chuyuan Tao, Hunmin Kim, Naira Hovakimyan, Petros Voulgaris, "**Sampling Complexity of Path Integral Methods for Trajectory Optimization** ," *IEEE American Control Conference (2022 ACC)*
9. Chuyuan Tao, Hunmin Kim, **Hyung-Jin Yoon**, Naira Hovakimyan, Petros Voulgaris, "**Control Barrier Function Augmentation in Sampling-based Control Algorithm for Sample Efficiency** ," *IEEE American Control Conference (2022 ACC)*
10. Chuyuan Tao, **Hyung-Jin Yoon**, Hunmin Kim, Naira Hovakimyan, Petros Voulgaris. "**Path integral methods with stochastic control barrier functions**," *IEEE Conference on Decision and Control (2022 CDC)*
11. **Hyung-Jin Yoon**, Petros Voulgaris. "**Multi-time Predictions of Wildfire Grid Map using Remote Sensing Local Data**," *IEEE International Conference on Knowledge Graph (2022 ICKG)*
12. **Hyung-Jin Yoon**, Hunmin Kim, Kripash Shrestha, Naira Hovakimyan, Petros Voulgaris, "**Estimation and Planning of Exploration Over Grid Map Using A Spatiotemporal Model with Incomplete State Observations** ," *IEEE Conference on Control Technology and Applications (IEEE CCTA 2021)*

13. Hunmin Kim, **Hyung-Jin Yoon**, Wenbin Wan, Naira Hovakimyan, Lui Sha, and Petros Voulgaris, "**Backup plan constrained model predictive control** ," *IEEE Conference on Decision and Control (2021 CDC)*
14. Hyungsoo Kang, **Hyung-Jin Yoon**, Venanzio Cichella, Naira Hovakimyan, Petros Voulgaris, "**Time Coordination of Multiple UAVs over Switching Communication Networks with Digraph Topologies** ," *IEEE Conference on Decision and Control (2021 CDC)*
15. **Hyung-Jin Yoon**, Wenbin Wan, Hunmin Kim, Naira Hovakimyan, Lui Sha, Petros Voulgaris, "**Towards Resilient UAV: Escape Time in GPS Denied Environment with Sensor Drift**," *IFAC Symposium on Automatic Control in Aerospace (IFAC ACA2019).*
16. **Hyung-Jin Yoon**, Donghwan Lee, and Naira Hovakimyan, "**Hidden Markov Model Estimation-based Q-learning for Partially Observable Markov Decision Process**," *IEEE American Control Conference (IEEE ACC2019).*
17. **Hyung-Jin Yoon**, Christopher Widdowson, Thiago Marinho, Ranxiao Frances Wang, and Naira Hovakimyan, "**A Path Planning Framework for a Flying Robot in Close Proximity of Humans**," *IEEE American Control Conference (IEEE ACC2019).*
18. **Hyung-Jin Yoon**, Huaiyu Chen, Kehan Long, Heling Zhang, Donghwan Lee, Aditya Gahlawat, and Naira Hovakimyan, "**Learning to Communicate: A Machine Learning Framework for Heterogeneous Multi-Agent Robotic Systems**," *AIAA Intelligent Systems Conference*, January 7-11, San Diego, CA, USA. 2019.
19. Donghwan Lee, **Hyung-Jin Yoon**, and Naira Hovakimyan, "**Primal-Dual Algorithm for Distributed Reinforcement Learning: Distributed GTD2**," *IEEE Conference on Decision and Control (2018 CDC)*, December 17-19, Miami Beach, FL, USA.
20. Christopher Widdowson, **Hyung-Jin Yoon**, Venanzio Cichella, Ranxiao Frances Wang, and Naira Hovakimyan, "**VR environment for the study of collocated interaction between small UAVs and humans**," *AHFE 2017 International Conference on Human Factors in Robots and Unmanned Systems, 2017.*
21. **Hyung-Jin Yoon**, Venanzio Cichella, and Naira Hovakimyan, "**Robust Adaptive Control Allocation for an Octocopter under Actuator Faults**," *AIAA Guidance, Navigation, and Control Conference. 2016.*

Talks

1. **Stochastic Methods and Adversarial Machine Learning for Autonomous Systems**, University of New Mexico, Mechanical Engineering Seminar, 2024, USA.
2. **Learning Human's Physiological Arousal Induced by a Flying Robot**, NSF-FAST Workshop 2017: Machine Learning for Discovery Sciences, Yerevan Armenia.
3. **Regression of Human Physiological Arousal Induced by Flying Robots Using Deep Recurrent Neural Networks**, Coordinated Science Lab Student Conference 2017, University of Illinois at Urbana-Champaign.
4. **Prediction of Distance To Empty for Electric Vehicle**, Korean Society of Automotive Engineers, Annual Congress 2012, Seoul Korea.
5. **Driving Range Development of Small EV**, Society of Automotive Engineers of Japan, Annual Congress 2012, Yokohama Japan.

Poster Sessions

1. **Socially-Aware Path Planning for a Flying Robot in Close Proximity of Humans**, 2018 National Robotics Initiative (NRI) Principal Investigators' Meeting.
2. **Learning Human's Physiological Arousal Induced by a Flying Robot**, Data Science Day 2017, Illinois Data Science Initiative at the University of Illinois at Urbana-Champaign.

Patents

1. US 8896247 B2, **Current sensor reconfiguration method of a vehicle having a motor**.
2. US 8504219 B2, **Telematics device for electric vehicle and remote air-conditioning control method thereof**.

Mentoring Experience

Research Mentor for Undergraduate at Tennessee Tech University 2023 - Present

- Undergraduate: Matthew Sellers (Building a parallel robot platform); Trevon Collins (NVIDIA ISAAC Robot simulation); Scoot Schmitz (Autonomous RC plane).

Research Mentor for Undergraduate and Graduate Students at UNR 2020 - Present

- Undergraduate: Alissa Chavalithumrong (pursuing Ph.D degree at MIT)
- Graduate: Caleb Patton (ongoing), Antonio Fernández Castaño (Future employee at Tesla starting summer 2024), Kripash Shrestha (SW engineer at Amazon)

Research Mentor for Undergraduate and Graduate Students at UIUC 2018 - 2020

- Undergraduate: Huaiyu Chen (M.S degree at UPenn)
- Graduate: Chuyuan Tao (Ph.D. Candidate), Hyungsoo Kang (Ph.D. Candidate)

Professional Service

Conference Session Chair

- AIAA Scitech 2024 Session Chair - GNC-24, Enabling Technologies for AAM Autonomy

Reviewer for Conferences and Journals

- IEEE Transactions on Automatic Control
- AIAA Journal of Guidance, Control, and Dynamics
- IEEE International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Robotics and Automation (ICRA)
- American Control Conference
- IEEE Conference on Decision and Control

Computer Skills

1. Machine Learning Tools: Pytorch, Tensorflow.
2. Python: COURSERA certificate (Python for Everybody).
3. MATLAB: Simulink, Stateflow.
4. C and C++: Autonomous vehicle firmware.
5. Unreal and Unity: Game/VR Environment Development