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Research Interests

Curriculum Vitae

Autonomous Mission Planning and Intelligent Decision-making

- Learning-based route planning and scheduling of multiple agents under dynamic environments

Deep Reinforcement Learning for Optimization Problems

- Efficient learning of heuristics to combinatorial optimization with physical constraints

Mathematical Programming Formulation and Techniques

 Application of optimization priciples and algorithms for intelligent transportation systems, safe planning of multi-agent systems, and autonomomous systems

EDUCATION

Korea Advanced Institute of Science & Technology (KAIST)

Daejeon, Korea

Master of Science (MS) in Aerospace Engineering (Advisor: Prof. Jae-myung Ahn)

Sep. 2020 - Aug. 2022

- Thesis: Multiple UAV Routing for Re-planning under Dynamic Environment using Deep Reinforcement Learning
- GPA: 4.11/4.30

Bachelor of Science (BS) in Aerospace Engineering

Sep. 2012 - Feb. 2017

- GPA: 3.92/4.30, Magna Cum Laude
- Class Rank: 56/573, Top 9.8%

Research Experiences

Strategic Aerospace Initiative, KAIST &

Daejeon, Korea

Research Assistant (Advisor: Prof. Jae-myung Ahn)

Sep. 2020 - Present

1. Routing Problems Considering Value System for Exploration Missions

- Proposed a data-efficient online methodology to train a Transformer-based policy network for solving routing problems via deep reinforcement learning [JR1], [C1-2]

2. Data-driven Flow Modeling and Analysis

 Developed a deep-learning model for efficient prediction of aerodynamic coefficients under extreme flow conditions [JR2], [C3]

Aerospace Technology Research Institute, ADD &

Daejeon, Korea

First Lieutenant (Research Officer for National Defense[†]) (Mentor: Dr. Woohyuk Chang) Jun. 2017 – May. 2020

1. Autonomous Navigation and Mission Management Technology

- Developed mission planning algorithm for UAVs operating in dynamic environment [J1], [C4-5]
- Formulated UAV planning problem as MILP and solved via Gurobi optimizer
- Developed a parallel genetic algorithm for fast online planning on GPU

2. Autonomous Mission Planning System Simulator

- Developed an autonomous mission planning program for UAV simulator on Linux [P1]

Unmanned Systems Research Group, KAIST &

Daejeon, Korea

Undergraduate Research Intern (Advisor: Prof. David Hyun-chul Shim)

Dec. 2015 - Sep. 2016

1. Development of Modular Drone with Self-Configuration

- Designed and constructed a 3D-printable modular drone that can configure itself before flight
- Received Excellent Award among 53 projects in Undergraduate Research Participation (URP) program

JOURNAL PUBLICATIONS

[J1] Lee, D. H., Jang, H., Kim, S. H., & Chang, W. (2020). Multi-UAV Mission Allocation and Optimization Technique Based on Discrete-Event Modeling and Simulation. *Journal of the Korean Society for Aeronautical & Space Sciences*, 48(2), 159-166.

[†] ROND: Korean research program modeled after Israel's Talpiot program, selecting 20 undergraduates across the country to serve their military duties as research officers at Agency for Defense Development (ADD)

[JR1] Lee, D. H. & Ahn, J. (2022). Multi-Start Team Orienteering Problem for UAS Mission Re-Planning with Data-Efficient Deep Reinforcement Learning. Journal of Intelligent & Robotic Systems.

Conference Proceedings

- [C1] Lee, D. H., & Ahn, J. A Deep Reinforcement Learning Approach to solve the Vehicle Routing Problem with Resource Constraints. In AIAA Scitech Forum 2023, Maryland, USA. (Session: Autonomy IV, to appear)
- [C2] Moon, C. H., Lee, D. H., & Ahn, J. Truck-Drone Delivery Using Heterogeneous Vehicle Routing Problem Based on Deep Reinforcement Learning. In AIAA Scitech Forum 2023, Maryland, USA. (Session: Autonomous Mission Management Concepts and Technologies II, to appear)
- [C3] Lee, D. H., Lee, D. U., Lee, J., Lee, B. J., & Ahn, J. Prediction of Multiple Aerodynamic Coefficients of Missiles using CNN. In AIAA Scitech Forum 2022, San Diego, USA. (Session: Learning, Reasoning, and Data Driven Systems III)
- [C4] Lee, D. H., Chang, W., & Byun, J. An Optimization Technique for Discrete Event Model-based UAV Real-Time Heterogeneous Mission Allocation. In 2018 Proceedings of the Korean Society for Aeronautical and Space Sciences, Fall Conference, Jeju, Korea.
- [C5] Lee, D. H., Chang, W., & Byun, J. Discrete-event Modeling and Simulation of Autonomous Multi-UAV Mission Management. In 2018 Avionics Systems Symposium Korea (ASSK), Yeosu, Korea.

Patents (Registered)

[P1] Chang, W., Lee, D. H., Jang, H., Method and apparatus for optimization of unmanned vehicle mission allocation, KR102063851 (Jan. 2020)

AWARDS & HONORS

- Excellent Paper Award, ASSK 2018	July. 2018
- Excellence in Leadership & Volunteer Activity, KAIST	Mar. 2016
· Granted to top 5% students with active participation in the leadership programs.	
- Excellent Award in URP, KAIST	Aug. 2016
- Dean's List , College of Engineering, KAIST	Feb. 2016
· Awarded to top 3% (GPA: $4.22/4.3$)	

SCHOLARSHIPS

 National Scholarship for Graduate Study, KAIST Full support for graduate school tuition and monthly stipends 	2020 - 2022
 Department Honors Scholarship, KAIST Dean's list for 2015 Fall 	Feb. 2016
 The Boeing Company-KAIST Undergraduate Scholarship, KAIST Merit-based scholarship which offered \$1,500 per semester for academic excellence 	2014 - 2016
 National Scholarship for Science & Engineering, Korea Student Aid Foundation (KOSAF) Full support for university tuition and \$8,700 scholarship as a ROND cadet 	2015 - 2016
- National Scholarship for Undergraduate Study, KAIST	2012 - 2014

TEACHING

Teaching Assistant @KAIST

- AE201 Introductory Flight Project
- HSS024 Advanced English Writing
- HSS025 Advanced English Reading

Spring 2021

Spring 2015–Spring 2016

Spring 2015–Spring 2016

Summer 2015 Winter 2014; Winter 2015

- Academic English Camp

LEADERSHIP EXPERIENCES

Graduate	Student	Association,	Department	of AE

Vice President Feb. 2021 - Feb. 2022

ROND Cadet Association &

President Aug. 2015 - Mar. 2017

Undergraduate Student Council, KAIST &

Student Representative, Bureau of International Relations

Aug. 2014 - Dec. 2014

KISA(KAIST International Students Association), KAIST

Head, Bureau of Public Relations 2015

Extracurricular Activities

KAIST-Saudi Aramco Mentoring Program

Mentor Feb. 2015 - Dec. 2015

- Mentor for prospective freshmen from Saudi Arabia and UAE during their preparatory first year

LANGUAGES

Fluent in English and native in Korean

- GRE: 326 (Verbal: 159, Quantitative: 167, Writing: 4.5)

- TOEFL: 115 (Reading: 29, Listening: 29, Speaking: 27, Writing: 30)

Programming Skills

Python {PyTorch, NumPy, Matplotlib}, MATLAB, C/C++, NVIDIA CUDA, IATEX