# Kihyun Kim

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## Research Interests

Reinforcement learning & Preference learning (RLHF, inverse RL, offline RL), Control (stochastic optimal control, robust control)

## Education

**Massachusetts Institute of Technology** *Cambridge, United States*

Ph.D. Program in Electrical Engineering & Computer Science *Sep. 2021 - Current*

- Advisor: Prof. Asuman Ozdaglar, Prof. Pablo Parrilo

**Seoul National University** *Seoul, Republic of Korea*

B.S. in Electrical and Computer Engineering *Mar. 2014 - Aug. 2020*

- Graduated with *Summa Cum Laude* (GPA: 4.15/4.30 Overall, 4.22/4.30 in Major)
- Paused for two years to fulfill military duty in the Republic of Korea (Dec. 2016 - Sep. 2018)

**Seoul Science High School** *Seoul, Republic of Korea*

High school for gifted students in science and mathematics *Mar. 2011 - Feb. 2014*

## Publications

**[1]** A Unified Linear Programming Framework for Offline Reward Learning from Human Demonstrations and Feedback
Kihyun Kim, Jiawei Zhang, Pablo Parrilo, Asuman Ozdaglar
*International Conference on Machine Learning (ICML)*, 2024

**[2]** Distributional robustness in minimax linear quadratic control with Wasserstein distance
Kihyun Kim, Insoon Yang
*SIAM Journal on Control and Optimization* 61.2 (2023) pp. 458–483. SIAM, 2023

**[3]** Minimax control of ambiguous linear stochastic systems using the Wasserstein metric
Kihyun Kim, Insoon Yang
*2020 59th IEEE Conference on Decision and Control (CDC)*, 2020

**[4]** Optimizing large-scale fleet management on a road network using multi-agent deep reinforcement learning with graph neural network
Juhyeon Kim, Kihyun Kim
*2021 IEEE International Intelligent Transportation Systems Conference (ITSC)*, 2021

**[5]** Generative autoregressive networks for 3d dancing move synthesis from music
Hyemin Ahn, Jaehun Kim, Kihyun Kim, Songhwai Oh
*IEEE Robotics and Automation Letters* 5.2 (2020) pp. 3501–3508. IEEE, 2020

**[In preparation]** Offline Nash Learning from Human Feedback for Distributional Preference Models
Kihyun Kim, Jiawei Zhang, Pablo Parrilo, Asuman Ozdaglar
*Work in Progress*, 2024

## Research Experience

**Laboratory for Information & Decision Systems (LIDS)** *MIT*

Advisor: Prof. Asuman Ozdaglar, Prof. Pablo Parrilo *Sep. 2021 - Current*

- Research Focus: RLHF, Inverse RL, Offline RL
- Proposed a novel linear programming (LP) framework for offline reward learning (Inverse RL & RLHF) that estimates the reward function without Bradley–Terry (BT) model assumption by effectively addressing the data coverage issue in offline settings
- Studied a game-theoretic approach to preference learning for general human preferences in offline settings

**Control and Optimization Research Lab** *Seoul National University*

Advisor: Prof. Insoon Yang *Sep. 2019 - Aug. 2021*

- Research Focus: Stochastic optimal control, Distributionally robust optimization
- Developed a novel minimax linear-quadratic control method using the Wasserstein metric, which is robust to the unknown distribution of system parameters
- Suggested a theoretical connection between the classical H-infinity controller and the modern distributionally robust optimization technique with the Wasserstein ambiguity set

**Robot Learning Lab** *Seoul National University*

Advisor: Prof. Songhwai Oh *Jun. 2019 - Aug. 2019*

- Research Focus: Robot learning, Humanoid robot, Generative model
- Developed an experimental program for a real humanoid robot using ROS to evaluate motion sequences generated from deep neural network models

## Work & Teaching Experience

**Teaching Assistant** *MIT*

6.7920: Reinforcement Learning: Foundations and Methods *Sep. 2024 - Dec. 2024*

- Graduate-level course on reinforcement learning (Instructors: Prof. Cathy Wu, Prof. Munther Dahleh)

**ML Research Internship** *LG AI Research*

Summer Internship, Advanced ML Lab at LG AI Research *Jun. 2024 - Sep. 2024*

- Proposed and analyzed an RLHF model that incorporates confidence levels in human feedback data.

**Digital Signal Processing Enginner** *Republic of Korea*

SEC Signals Laboratory, Republic of Korea Army *Dec. 2016 - Sep. 2018*

- Specialized in digital signal detection and demodulation

**Mathematical Olympiad Instructor** *Republic of Korea*

Privatenote Co. *Aug. 2015 - Feb. 2016*

- Led online courses for students preparing for the national Mathematical Olympiad
- Courses covered: Number Theory, Algebra, Geometry

## Honors & Awards

2021 - 2026 **KFAS Doctoral Study Abroad Scholarship**, *Korea Foundation for Advanced Studies*

2014 - 2020 **Seoam Undergraduate Scholarship**, *Seoam Yoon Se Young Foundation*

2019 **Kwon Oh-hyun Scholarship**, *Former CEO of Samsung Electronics & SNU ECE Alumni Association*

2015 **6th Place (Special Prize)**, ACM International Collegiate Programming Contest Korea Regional

## Skills

**Programming** Python (PyTorch, NumPy, Pandas, etc.), Julia, C/C++, Java, Matlab, ROS, LaTeX

**Languages** English (professional), Korean (native)