

I am an applied researcher with 6+ years of research experience in the areas of robotics and machine learning. My research interests include imitation learning, inverse reinforcement learning, model learning, probabilistic deep learning, computer vision, trajectory optimization and control theory. I develop safe machine learning algorithms for motion planning, control, and behavior prediction of autonomous robots.

EXPERIENCE

Amazon Robotics AI Applied Scientist II at Canvas Mobility team – Research and development on motion control	Louisville, CO, USA May 2022–Present
Honda Research Institute, USA (HRI-US) Research Intern at ML planning and control team – Machine Learning-based autonomous driving	San Jose, CA, USA May 2021–Dec 2021
Georgia Institute of Technology Graduate Research Assistant at Autonomous Control and Decision Systems Lab. – AutoRally: Offroad autonomous driving – AlphaPilot: Lockheed Martin AI Drone Racing Innovation Challenge	Atlanta, GA, USA Aug. 2016–May 2022

EDUCATION

Georgia Institute of Technology Ph.D. in Electrical and Computer Engineering, PI: Evangelos A. Theodorou – Thesis: “Robust Deep Vision-based Planning and Control Algorithms with Probabilistic Learning”	Atlanta, GA, USA May 2022
Georgia Institute of Technology M.S. in Electrical and Computer Engineering, PI: Evangelos A. Theodorou	Atlanta, GA, USA Aug. 2018
Hanyang University B.S. in Electrical Engineering (Summa Cum Laude)	Seoul, S. Korea Feb. 2016

SKILLS

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|----------------------------------------------------------|---------------------------------------------------|
| • Languages: Python, C++, MATLAB, Shell scripting | • Deep Learning Tools: PyTorch, TensorFlow |
| • Robotics: ROS, CARLA, MuJoCo, OpenAI Gym | • Virtualization/Cloud: Docker, AWS |
| • Version Control: GitHub, GitLab, Bitbucket | • Operating Systems: Linux, Windows |

HONORS AND AWARDS

• Lockheed Martin AlphaPilot Qualifier	2019
• Amazon.com Amazon Web Services Machine Learning Research Awards & Scholarship (75,000 USD)	2018–2019
• RSS 2018 Finalist to Best Systems Paper Award	2018
• South Korea Government Scholarship to Study Abroad (80,000 USD)	2016–2018
• Hanyang Univ. 2nd Prize in Capstone Design Contest	2015
• Hanyang Univ. Dean’s List & Scholarship	2013–2015

PROJECTS

Fully Autonomous Mobile Robot in Amazon Sort Centers

Amazon Robotics AI

May 31. 2022–Present

- Developed automatic A/B comparison tools for motion controller performance analysis.
- Implemented a trajectory tracking controller.
10% improvement in tracking error compared to an existing motion controller.
- Keywords: Trajectory tracking, Feedback controller, Input constraints.

Machine Learning-based autonomous driving

HRI-US.

May 10. 2021–Dec 17. 2021

- Developed ML-based motion planning and behavior prediction algorithms for safe autonomous driving.
12% improvement in collision rate compared to SOTA RL methods.
- Keywords: Inverse RL, Planning under uncertainty, Risk-sensitive MPC, LSTM, CNN, VAE, GAN.
- Publications: 1 Journal, 2 Conferences, 2 Patent applications.

AutoRally: Safe ML-based off-road high-speed autonomous driving

Georgia Tech.

Aug. 15. 2016–May 7. 2022

- Developed ML-based motion planning, control, and failure detection algorithms for safe autonomous driving
62% improvement in obstacle avoidance compared to SOTA imitation learning methods.
- Keywords: RL, MPC, CNN, LSTM, Imitation learning, Bayesian neural networks, System identification, Vision-based control, Explainable AI, Uncertainty quantification.
- Publications: 1 Journal, 5 Conferences, 3 Workshops.

AlphaPilot: Lockheed Martin AI Drone Racing Innovation Challenge

Georgia Tech.

Feb. 1. 2019–Dec. 6. 2019

- AlphaPilot Qualifier; Top 9 out of 430 teams worldwide.
- Developed ML-based motion planning algorithms for drone racing.
8% improvement in collision rate compared to motion planning algorithms without ML.
- Keywords: Visual servoing, MPC, System identification, Object detection, Optical flow prediction.
- Publications: 1 Journal, 1 Conference.

PUBLICATIONS

- [1] **K. Lee**, D. Isele, E. A. Theodorou, and S. Bae, “Risk-sensitive mpcs with deep distributional inverse rl for autonomous driving”, in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2022.
- [2] **K. Lee**, D. Isele, E. A. Theodorou, and S. Bae, “Spatiotemporal costmap inference for model predictive control via deep inverse reinforcement learning”, in *IEEE Robotics and Automation Letters (RA-L)*, Jan. 2022.
- [3] R. Singh, **K. Lee**, and Y. Chen, “Sample-based distributional policy gradient”, in *4th Annual Learning for Dynamics and Control Conference (L4DC)*, Jun. 2022.
- [4] **K. Lee**, B. Vlahov, J. Gibson, J. M. Rehg, and E. A. Theodorou, “Approximate inverse reinforcement learning from vision-based imitation learning”, in *2021 International Conference on Robotics and Automation (ICRA)*, Jun. 2021.
- [5] Z. Wang, O. So, **K. Lee**, and E. A. Theodorou, “Adaptive risk sensitive model predictive control with stochastic search”, in *3rd Annual Learning for Dynamics and Control Conference (L4DC)*, Jun. 2021.

- [6] **K. Lee**, J. Gibson, and E. A. Theodorou, “Aggressive Perception-Aware Navigation using Deep Optical Flow Dynamics and PixelMPC”, *IEEE Robotics and Automation Letters (RA-L)*, 2020.
- [7] **K. Lee**, G. N. An, V. Zakharov, and E. A. Theodorou, “Perceptual attention-based predictive control”, *3rd Conference on Robot Learning (CoRL)*, 2019.
- [8] **K. Lee**, K. Saigol, and E. A. Theodorou, “Early failure detection of deep end-to-end control policy by reinforcement learning”, in *2019 International Conference on Robotics and Automation (ICRA)*, May 2019, pp. 8543–8549.
- [9] **K. Lee**, Z. Wang, B. I. Vlahov, H. K. Brar, and E. A. Theodorou, “Ensemble bayesian decision making with redundant deep perceptual control policies”, *18th IEEE International Conference on Machine Learning and Applications (ICMLA)*, 2019.
- [10] Y. Pan, C.-A. Cheng, K. Saigol, **K. Lee**, X. Yan, E. A. Theodorou, and B. Boots, “Imitation learning for agile autonomous driving”, in *International Journal of Robotics Research (IJRR)*, 2019.
- [11] Z. Wang, **K. Lee**, M. A. Pereira, I. Exarchos, and E. A. Theodorou, “Deep forward-backward sdes for min-max control”, *The 58th IEEE Conference on Decision and Control (CDC)*, 2019.
- [12] G. Williams, B. Goldfain, **K. Lee**, J. Gibson, J. M. Rehg, and E. A. Theodorou, “Locally weighted regression pseudo-rehearsal for adaptive model predictive control”, *3rd Conference on Robot Learning (CoRL)*, 2019.
- [13] **K. Lee**, K. Saigol, and E. A. Theodorou, “Safe imitation learning for end-to-end control”, in *Robotics: Science and Systems (RSS) Workshop: Adversarial Robotics*, 2018.
- [14] Y. Pan, C.-A. Cheng, K. Saigol, **K. Lee**, X. Yan, E. A. Theodorou, and B. Boots, “Agile autonomous driving using end-to-end deep imitation learning”, in *Robotics: Science and Systems (RSS)*, 2018.
- [15] Y. Pan, C.-A. Cheng, K. Saigol, **K. Lee**, X. Yan, E. A. Theodorou, and B. Boots, “Deep autorally: Agile autonomous driving via end-to-end imitation learning”, in *Robotics: Science and Systems (RSS) Workshop on Learning from Demonstrations in High-Dimensional Feature Spaces*, 2017.
- [16] Y. Pan, C.-A. Cheng, K. Saigol, **K. Lee**, X. Yan, E. A. Theodorou, and B. Boots, “Learning deep neural network control policies for agile off-road autonomous driving”, in *2017 Conference on Neural Information Processing Systems (NeurIPS) Deep Reinforcement Learning Symposium*, 2017.

TEACHING

Georgia Institute of Technology

- **Guest Lecturer** in Robotics and Autonomy (AE4803) Spring 2020, Fall 2020
Lectures on Differential Dynamic Programming and Model Predictive Control
- **Teaching Assistant** in Feedback Control Systems (ECE3550) Spring 2019

ACADEMIC SERVICES

Reviewer

- IEEE International Conference on Robotics and Automation (ICRA) 2019, 2022
- IEEE Robotics and Automation Letters (RA-L) 2020, 2021
- IEEE Conference on Decision and Control (CDC) 2019, 2020
- Autonomous Robots (AURO) 2022
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2021
- Robotics: Science and Systems (RSS) 2019