

## RESEARCH INTERESTS

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My research interests are in the areas of robotics and machine learning. More specifically, my research centers around control theory, reinforcement learning, computer vision, and explainable artificial intelligence. I develop safe learning-based algorithms for path planning, decision making, control, and behavior prediction of autonomous vehicles and robots.

## EXPERIENCE

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### **Honda Research Institute, USA (HRI-US)**

Research Intern

San Jose, CA, USA

May 2021–Dec 2021

- Machine Learning/AI-based autonomous driving

### **Georgia Institute of Technology**

Graduate Research Assistant at Autonomous Control and Decision Systems Lab.

Atlanta, GA, USA

Aug. 2016–Present

- AutoRally: Offroad autonomous driving
- AlphaPilot: Lockheed Martin AI Drone Racing Innovation Challenge
- Virtual Sully: Autopilot for handling uncertainties

## EDUCATION

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### **Georgia Institute of Technology**

Ph.D. in Electrical and Computer Engineering, PI: Evangelos A. Theodorou

Atlanta, GA, USA

Aug. 2016–Present

- Expected Graduation Date: May 2022
- Thesis: “Robust Deep Vision-based Planning and Control Algorithms with Probabilistic Learning”

### **Georgia Institute of Technology**

M.S. in Electrical and Computer Engineering, PI: Evangelos A. Theodorou

Atlanta, GA, USA

Aug. 2016–Aug. 2018

### **Hanyang University**

B.S. in Electrical Engineering

Seoul, S. Korea

Feb. 2009–Feb. 2016

- Summa Cum Laude

## HONORS AND AWARDS

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- 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

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### Machine Learning/AI-based autonomous driving

HRI-US.

May 10. 2021–Dec 17. 2021

- Developed ML-based path planning and behavior prediction algorithms for safe autonomous driving
- Keywords: Inverse RL, Planning under uncertainty, Risk-sensitive MPC, LSTM, CNN, VAE, GAN
- Publications: 1 Journal published and 1 Journal under review. 2 Patents under review

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

Georgia Tech.

Aug. 15. 2016–Present

- Developed ML-based path planning, control, and failure detection algorithms for safe autonomous driving
- Funding sources: Amazon Web Services Machine Learning Research Awards, Komatsu Ltd.
- 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

### Virtual Sully: Autopilot for Handling Large Uncertainties

Georgia Tech.

Oct. 1. 2019–May 9. 2021

- Developed ML-based autopilot systems for safe landing under uncertain situations
- Funding sources: NSF Award 1932288
- Keywords: Inverse RL, MPC, CNN
- Publications: 1 Conference

### Deep Perceptual Adaptive Control for Safe Autonomy

Georgia Tech.

#### AlphaPilot: Lockheed Martin AI Drone Racing Innovation Challenge

Feb. 1. 2019–Dec. 6. 2019

- AlphaPilot Qualifier; Top 9 out of 430 teams worldwide
- Funding sources: NASA Langley Research Center Grant 80NSSC19M0211
- Keywords: Visual servoing, MPC, System identification, Object detection, Optical flow
- Publications: 1 Journal, 1 Conference

## PUBLICATIONS

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- [1] **K. Lee**, D. Isele, E. A. Theodorou, and S. Bae, “Risk-sensitive mpcs with deep distributional inverse rl for autonomous driving”, *Preprint*, under review.
- [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] **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.
- [4] 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.
- [5] **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.
- [6] **K. Lee**, G. N. An, V. Zakharov, and E. A. Theodorou, “Perceptual attention-based predictive control”, *3rd Conference on Robot Learning (CoRL)*, 2019.

- [7] **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.
- [8] **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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] **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.
- [13] 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.
- [14] 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.
- [15] 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.

## SKILLS

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

## TEACHING

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### 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

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### Reviewer

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