Keuntaek Lee

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Research Interests

My research interests are in the areas of robotics and machine learning. More specifically, imitation learning, inverse reinforcement learning, model learning, probabilistic deep learning, computer vision, and control theory. I develop safe machine learning algorithms for planning, control, and behavior prediction of autonomous vehicles.

Experience

Amazon Robotics AI — Louisville, CO, USA
Applied Scientist II at Mobility team — May 2022–Present
- Research and development on planning and control

Honda Research Institute, USA (HRI-US) — San Jose, CA, USA
Research Intern at ML planning and control team — May 2021–Dec 2021
- Machine Learning/AI-based autonomous driving

Georgia Institute of Technology — Atlanta, GA, USA
Graduate Research Assistant at Autonomous Control and Decision Systems Lab. — Aug. 2016–May 2022
- AutoRally: Offroad autonomous driving
- AlphaPilot: Lockheed Martin AI Drone Racing Innovation Challenge
- Virtual Sully: Autopilot for handling uncertainties

Education

Georgia Institute of Technology — Atlanta, GA, USA
Ph.D. in Electrical and Computer Engineering, PI: Evangelos A. Theodorou — May 2022
- Thesis: "Robust Deep Vision-based Planning and Control Algorithms with Probabilistic Learning"

Georgia Institute of Technology — Atlanta, GA, USA
M.S. in Electrical and Computer Engineering, PI: Evangelos A. Theodorou — Aug. 2018

Hanyang University — Seoul, S. Korea
B.S. in Electrical Engineering — Feb. 2016
- Summa Cum Laude

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

Machine Learning/AI-based autonomous driving HRI-US.
May 10. 2021–Dec 17. 2021

- Developed ML-based motion 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–May 7. 2022

- Developed ML-based motion planning, control, and failure detection algorithms for safe autonomous driving
- 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
- Keywords: Inverse RL, MPC, CNN
- Publications: 1 Conference

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
- Keywords: Visual servoing, MPC, System identification, Object detection, Optical flow
- 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", *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] 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.

Skills

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

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