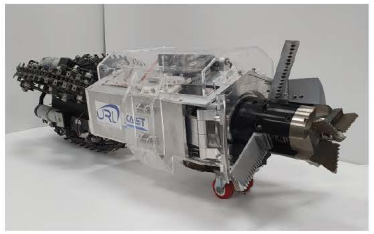
Future Robot Platforms



Mole-bot
(두더지로봇)

CAROS
(벽면등반드론)

FAROS
(방염드론)

Exploration drone
(탐사 드론)

Principal Investigator

Hyun MYUNG
명 현

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- School of Electrical Engineering
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KAIST

자세한 내용은 아래 링크를 이용해주세요!
https://urobot.kaist.ac.kr

Urban Robotics Lab.

Robotics for Smart Cities: Our lab focuses on the research and development of Robotics Technologies for Smart Cities.

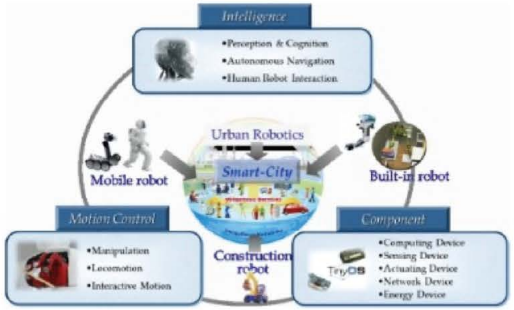
DreamWaQ by

URL @ KAIST
URBAN ROBOTICS LAB

DreamWaQ (보행제어기)	DreamRiser (자세 재회복)	DreamSTEP (자율보행)	연구실 홈페이지

Introduction

Our lab focuses on the research and development of Robotics Technologies for Smart Cities. The research fields include autonomous robot navigation. AI, machine learning, monitoring. Inspection, control, and rehabilitation for smart cities and civil infrastructures. We also deal with big data informatics supporting sensing, analysis and design activities needed to construct and operate smart and sustainable built environments.



Research Interests

Autonomous Robot Navigation

- Vision, LiDAR, magnetic field, beacon-based SLAM (Simultaneous Localization And Mapping)
- Autonomous navigation of mobile robots, drones, legged robots, swarm robots, self-driving cars
- Optimal path planning and autonomous exploration
- Locomotion control of legged robots
- Indoor positioning in disaster situations
- Localization in GNSS-denied environments
- Underground localization

Spatial Artificial Intelligence & Machine Learning

- Deep learning and machine learning for spatial AI: DNN (Deep neural networks), Bio-inspired NN, Spiking NN, etc.
- Computational intelligence: Evolutionary computation, Neural networks, Fuzzy logic
- Applications: Gesture recognition for HRI (Robot-Human Interaction), Object recognition

Intelligent Robots

- 3D environment sensing & perception: Autonomous 3D map-building
- 3D robot navigation: 3D localization, obstacle avoidance, and path planning
- Fault detection based on 3D map-matching

Monitoring and Inspection for Smart Cities

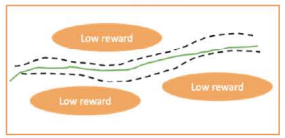
- Structural health monitoring (SHM) using robotics techniques (Vision, LRF)
- Localization and navigation of smart vehicles for structural inspection

연구배경

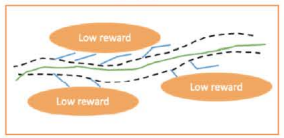
기존 제어기들은 급작스러운 지형의 변화에 재빨리 적응하지 못함

로봇의 상태 추정기 성능이 보장되지 않음

모방학습



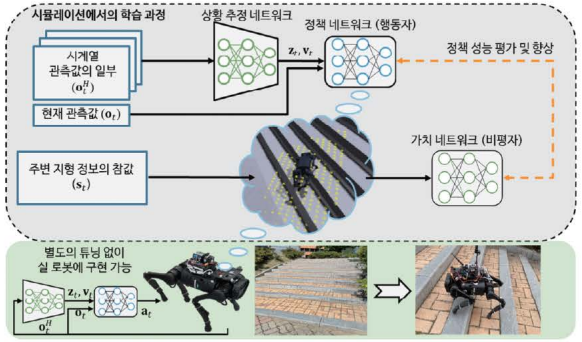
강화학습



강화학습을 활용하면 더 진취적인 학습이 가능하다고 판단함

Near-expert policy
Learned policy
Explorative action

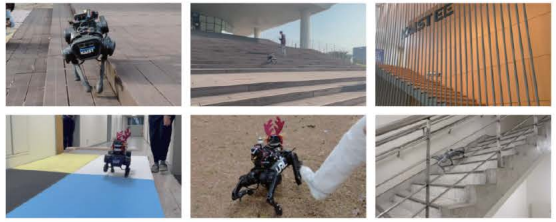
드림워크



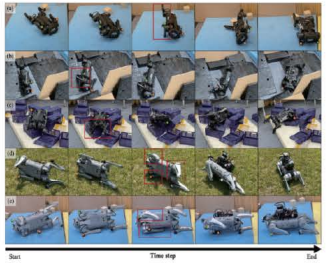
1. 암시적으로 지형 정보를 추론할 수 있는 추정기와 강인한 제어기를 동시에 학습시킴
2. Nvidia의 Isaac Gym 시뮬레이터를 활용하여 학습이 가능하며, RTX 3060Ti를 탑재한 데스크탑으로 약 1시간 정도 소요됨

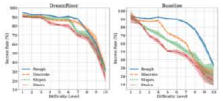
적용분야 및 사례

다양한 지형 극복

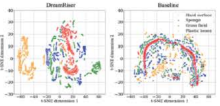


강인한 자세 재회복



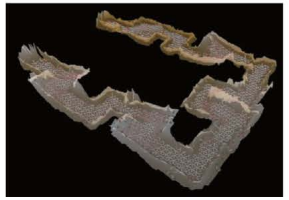


자세 재회복 성공률 테스트



t-SNE 분석을 통해보 시각화된 지형 정보

로보틱스 분야 세계 최대 규모 학회인 IEEE ICRA 2023에서 주최한 사족로봇 자율보행 경진대회(QRC)에서 우승
Team DreamSTEP



QRC 지형 설명도