

Robot Perception and Control

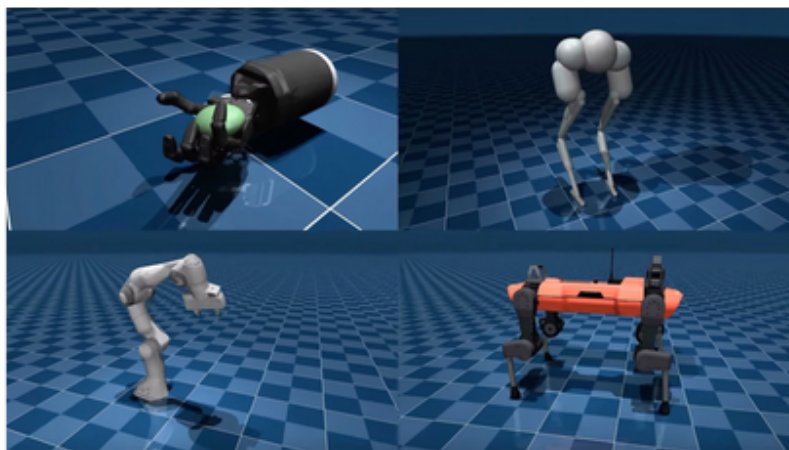
Simulators

Last updated: Jul / 25 /2024

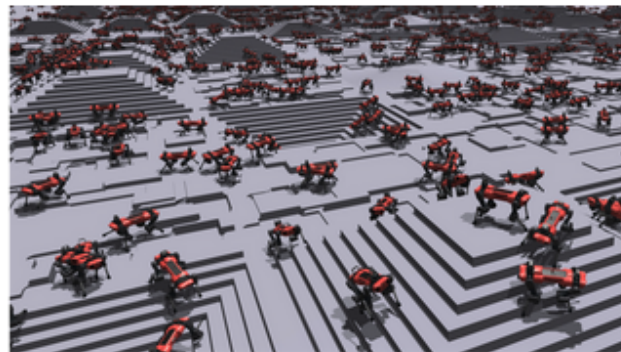
Kashu Yamazaki

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Simulators



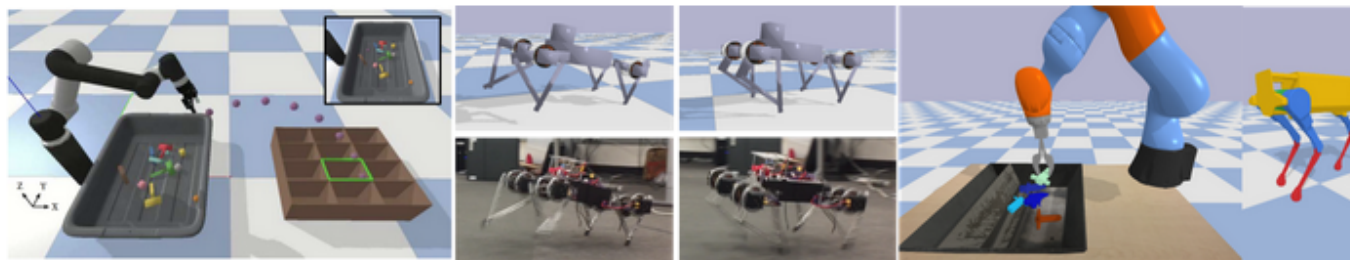
Mujoco



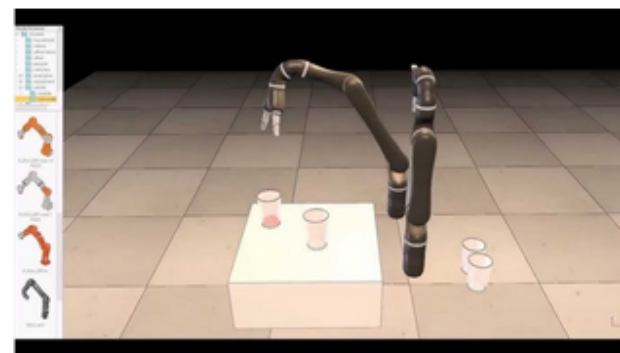
Isaac Gym



Omniverse



PyBullet

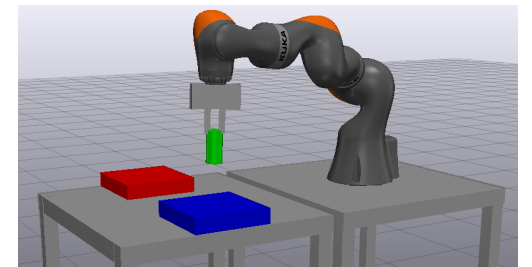
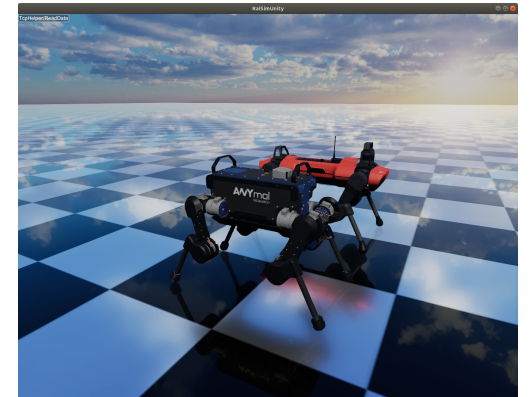
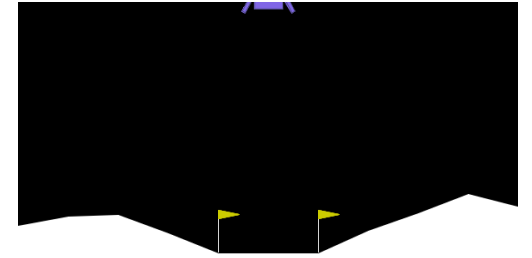


V-REP

Research oriented simulators

Popularized in robotics as sim2real research

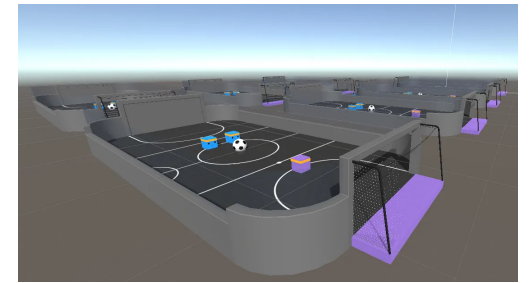
- **Gymnasium** (OpenAI Gym)†: An API standard for single-agent reinforcement learning environments.
- **MuJoCo**†:
- **NVIDIA Isaac**†: GPU accelerated simulation: Gym (depricated), Sim, and Orbit.
- **RaiSim**†: physics engine for robotics and artificial intelligence research with easy to use C++ library.
- **PyBullet**†:
- **Drake** (MIT)†: C++ toolbox started by the Robot Locomotion Group at the MIT and Toyota.
- **Gazebo**†: part of ROS.



Game engines as simulators

General purpose (physics simulation, rendering, etc.) game engines:

- **Unity3D** (Unity Technologies)↑: cross-platform game engine developed by Unity Technologies
 - **Barracuda**: neural network interface for Unity
- **Unreal Engine** (Epic Games)↑: 3D computer graphics and game engines developed by Epic Games
- **CryEngine** (Crytek)↑:
- **Lumberyard** (Amazon)↑:
- **Stingray** (Autodesk)↑:
- **PhysX** (Nvidia)↑:



Describing a Robot

URDF

URDF (Unified Robot Description Format) is a standard format based on XML used to describe a robot model in simulators. A URDF models a robot as a tree structure composed of **links** and **joints**. Links represent the robot's physical parts, while joints define how these parts move relative to each other, specifying their spatial relationships.

Language in Simulator

Sim2Real

Domain Randomization