A DeepRL Framework for Robot Locomotion in Complex environments

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Problem Statement

- **Learning Environments** are a key part of RL research (e.g. ALE[1]).
- **Performance over wide range of environments** is a good measure for intelligence[2].

$$\Upsilon(\pi) = \Sigma_{\mu \in E} 2^{-K(\mu)} V_{\mu}^{\pi}$$

- **Current locomotion benchmarks** provide low to middle level complex tasks, like in [3], [4].

Related Works

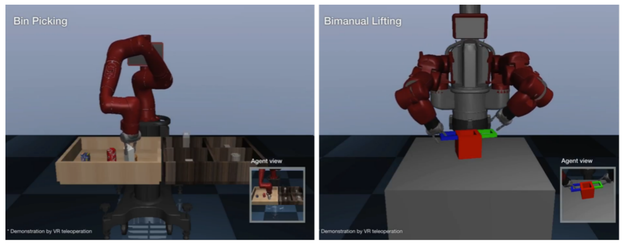

Figure 1: SURREAL[5]

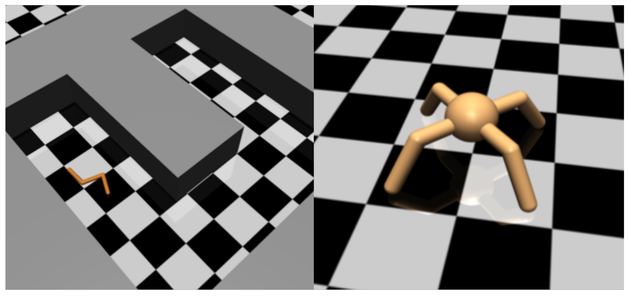

Figure 2: RLlab [6]

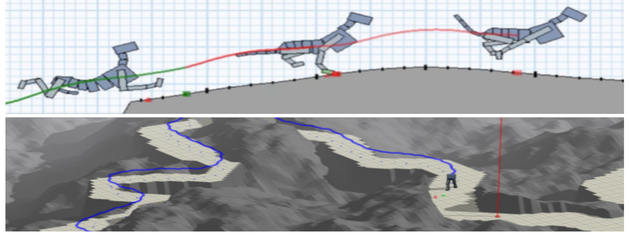

Figure 3: TerrainRLSim [4]

Approach

- **Close to the backend**: the framework is written in C++ close to the physics and graphics backends.
- **But not that close**: the core framework in designed to be agnostic of the physics and graphics backends to allow easy integration into your backends of choice.
- **Any-environment**: the framework is designed to allow the creation of lots of environments easily by means of utilities on top.
- **Python API**: the underlying framework is written in C++, with a Python API on top that exposes to the user the necessary functionality to create environments, define tasks, create agents and sensors, etc.

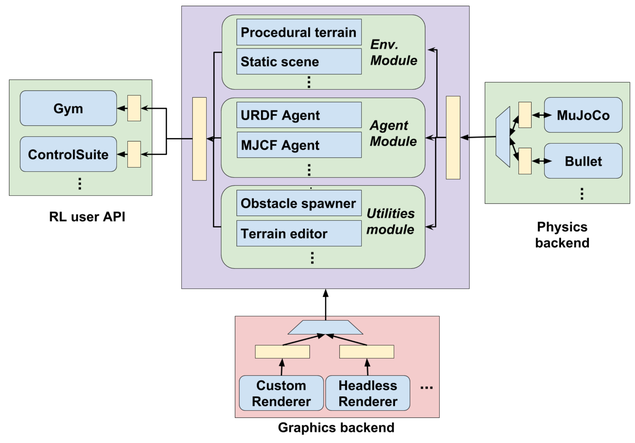

Figure 4: Framework Overview

Current Progress

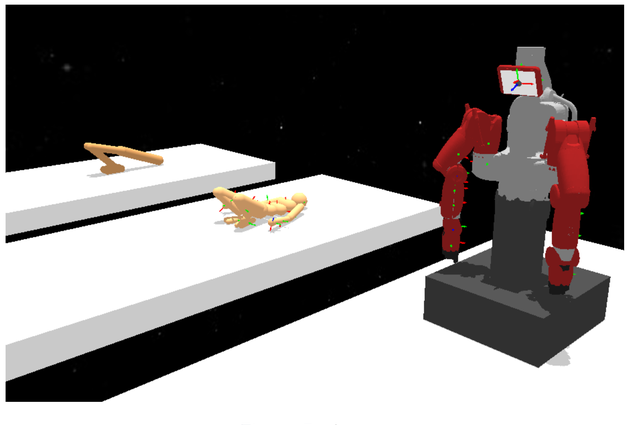

Figure 5: Agents

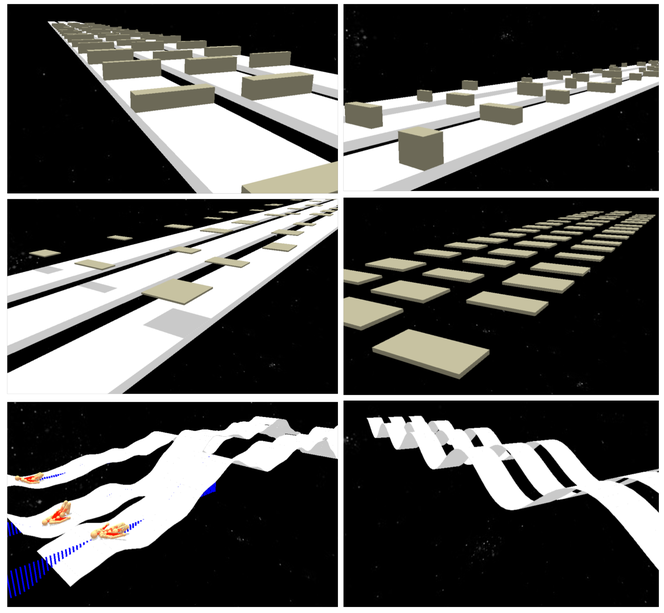

Figure 6: Procedural Terrain Generators

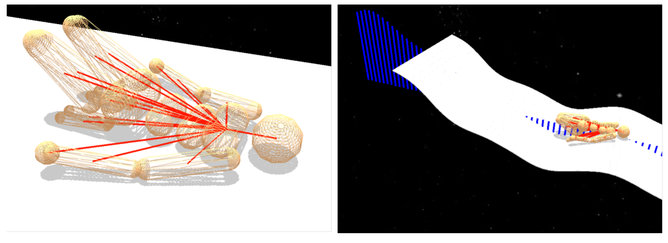

Figure 7: Sensor types: intrinsic(left), extrinsic(right)

Roadmap

- **More environments, utilities and creation tools**
- **Full Bullet and DART support**
- **Python API and documentation**

References

- (1) Bellemare, et al. *The Arcade Learning Environment*. JAIR 2013.
- (2) Shane Legg, Marcus Hutter. *Universal Intelligence*. ArXiv 2017.
- (3) Yuval Tassa, et al. *DeepMind Control Suite*. ArXiv 2018.
- (4) Glen Berseth, et al. *Terrain RL Simulator*. ArXiv 2018.
- (5) Linxi Fan, Yuke Zhu, et al. *SURREAL*. CoRL 2018.
- (6) Yan Duan, Xi Chen, et al. *Bencmarking DeepRL for Continuous Control*. ICML 2016.