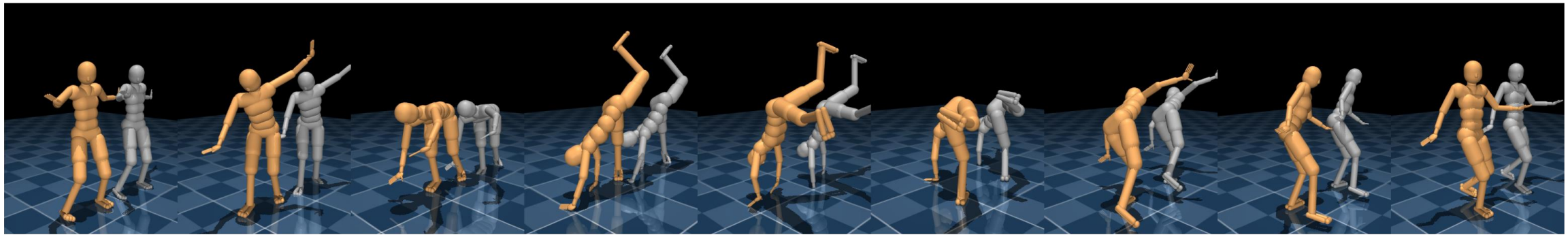

MoCapAct: A Multi-Task Dataset for Simulated Humanoid Control

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Georgia Tech Robotics & Intelligent Machines

Microsoft Research

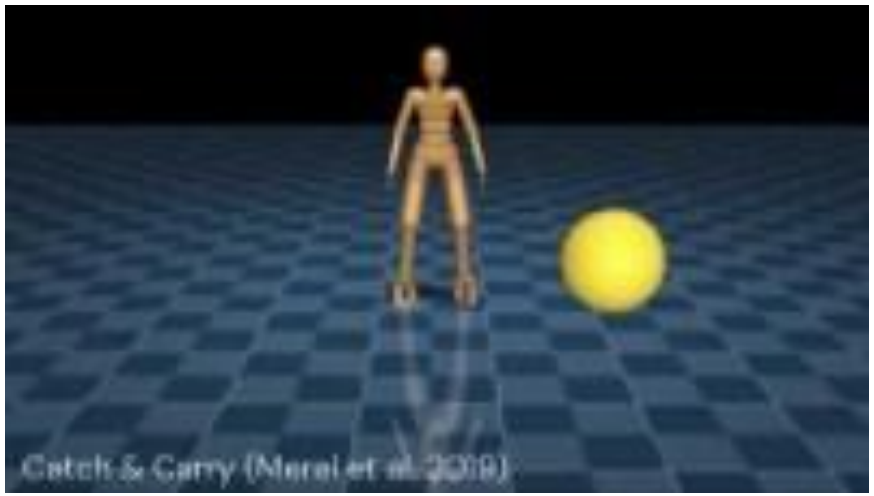
Simulated humanoid control

- Simulated humanoid control allows for studying artificial intelligence via motor control
- Very difficult control problem
  - High dimensional
  - Discontinuous dynamics
  - Easy to lose balance

Obstacle navigation

Emergence of Locomotion Behaviours (Heess et al., 2017)

Catching objects



Catch & Carry (Merel et al., 2019)

Team soccer

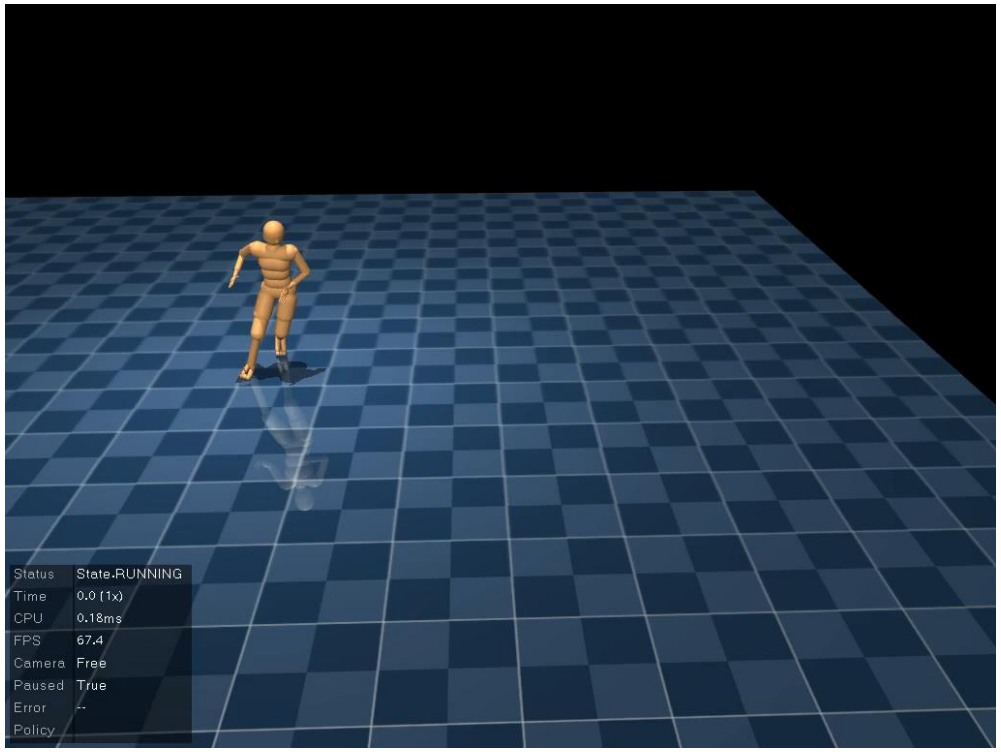
From Motor Control to Team Play (Liu et al., 2022)

Grounding skills with motion capture data

- Motion capture (MoCap) data demonstrates what good humanoid motion looks like
- DeepMind's MuJoCo-based repo `dm_control` contains 3.5 hours of MoCap data
- Still difficult: Must find joint torques that realize the MoCap data in the MuJoCo simulator

Human demonstration

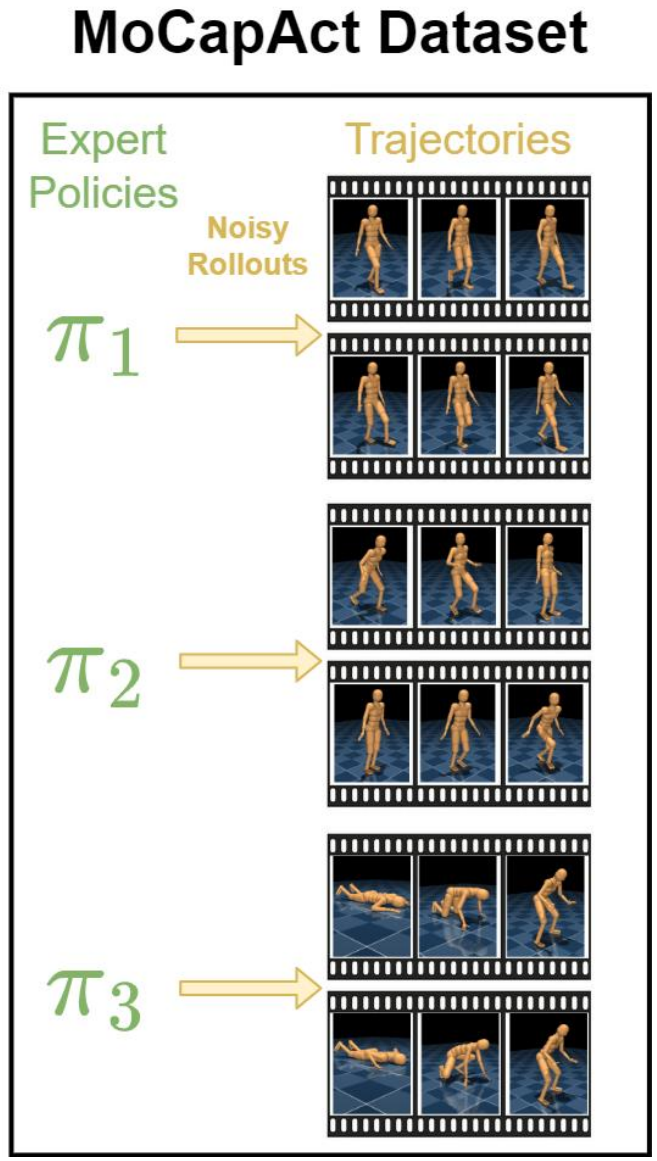
Kinematic playback in MuJoCo



Our dataset

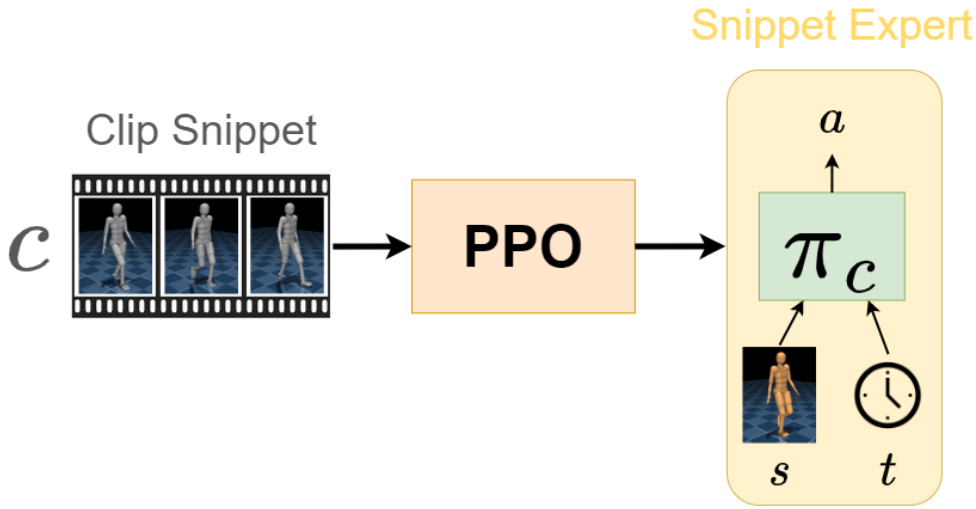
MoCapAct (Motion Capture with Actions)

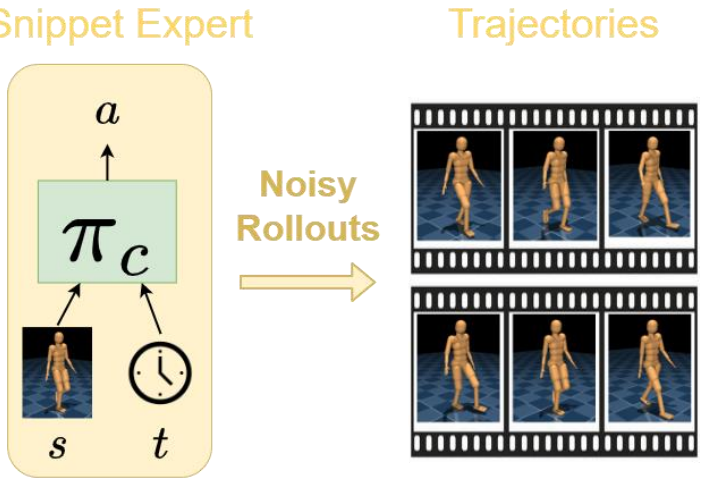
- Clip snippet-tracking experts
- Rollouts from experts
  - Proprioceptive observations, expert actions, value function estimates, etc.



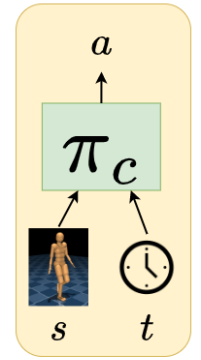
Clip snippet expert and rollouts

- For each snippet, we train a snippet expert $\pi_c(a|s,t)$ using PPO to track the snippet
- 2589 snippets → 2589 policies
- Took **50 years** of wall-clock time to train all policies
- We rollout each snippet expert to collect humanoid observations, actions, value function estimates, etc.

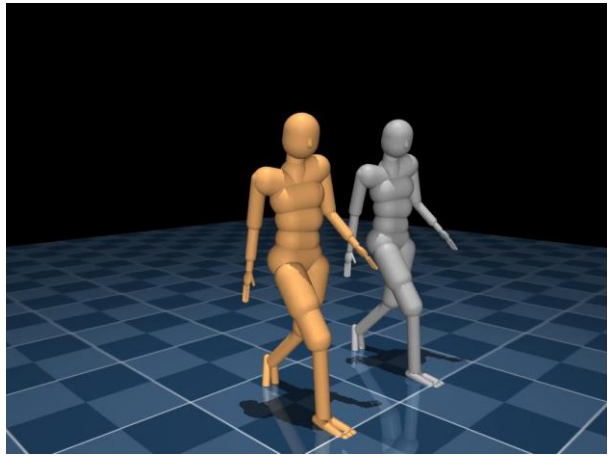




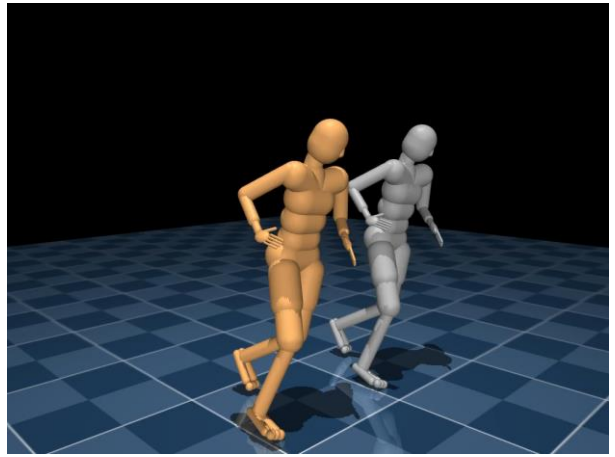
Some behaviors in MoCapAct



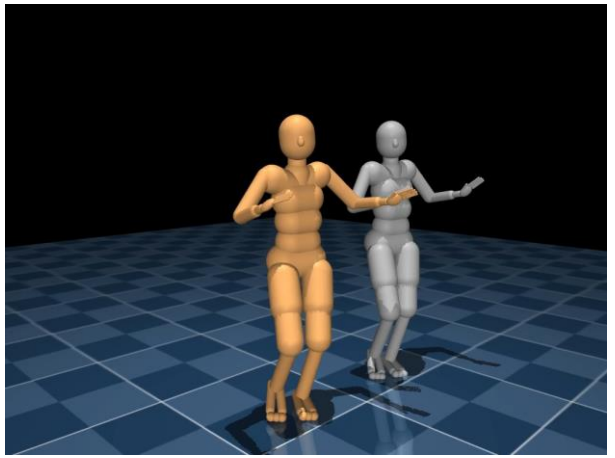
Walking



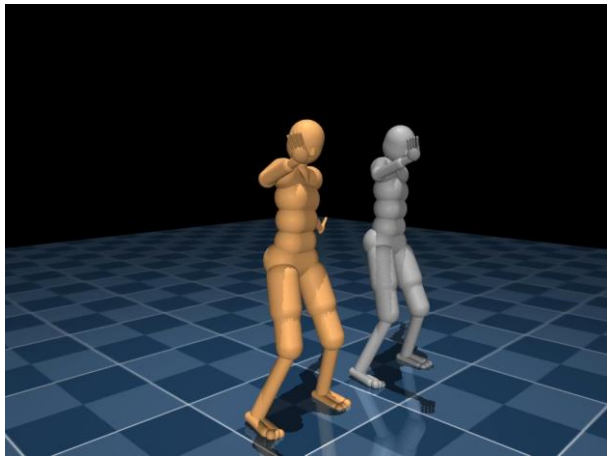
Jogging



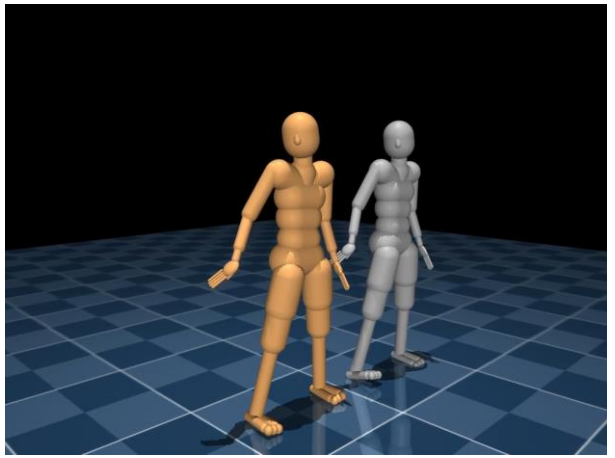
Salsa dance



Cartwheel



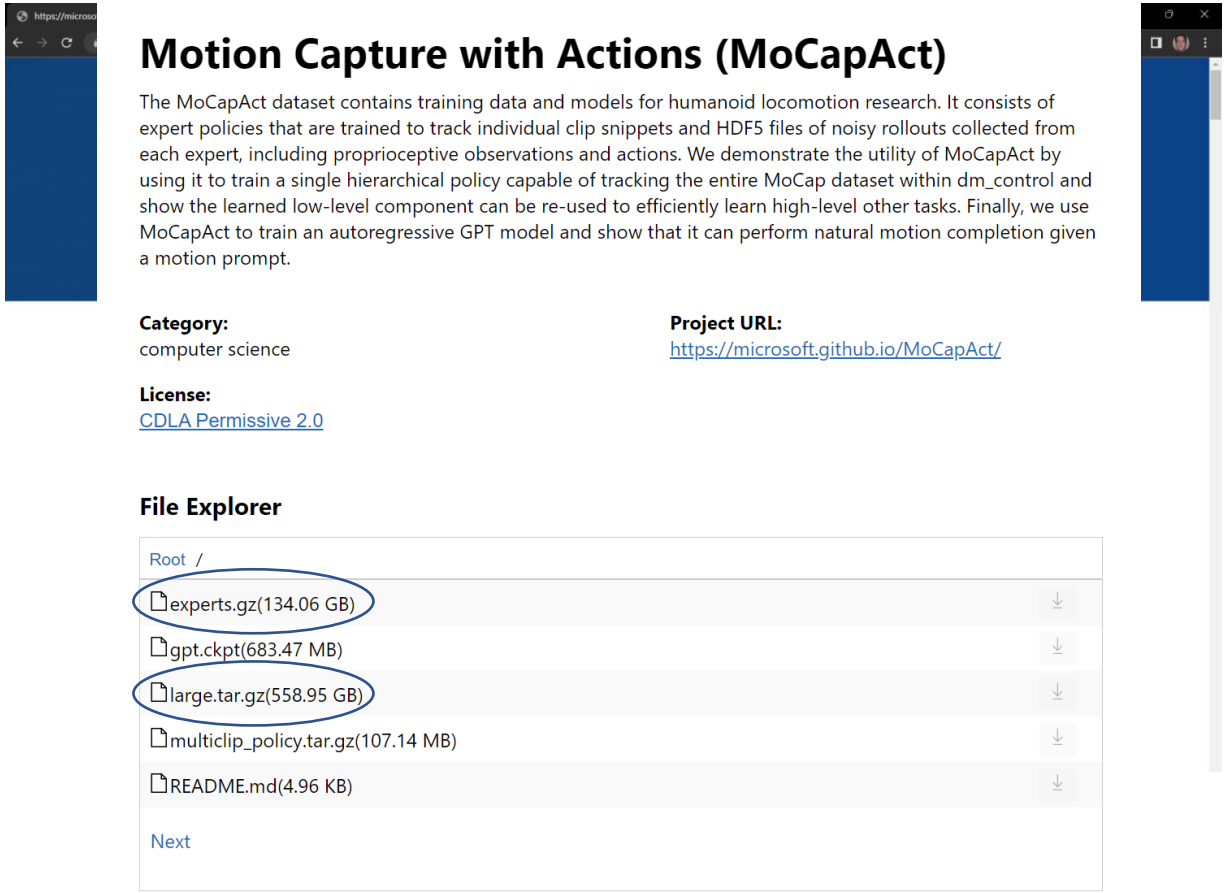
Jumping kick



Gray = MoCap clip
Bronze = our humanoid

Where do I get MoCapAct?

- Link to dataset provided on the project website: https://microsoft.github.io/MoCapAct
- Dataset stored on Microsoft Research Open Data
- Experts are Stable-Baselines3 PyTorch policies
- Rollouts are stored in HDF5 files



Motion Capture with Actions (MoCapAct)

The MoCapAct dataset contains training data and models for humanoid locomotion research. It consists of expert policies that are trained to track individual clip snippets and HDF5 files of noisy rollouts collected from each expert, including proprioceptive observations and actions. We demonstrate the utility of MoCapAct by using it to train a single hierarchical policy capable of tracking the entire MoCap dataset within dm_control and show the learned low-level component can be re-used to efficiently learn high-level other tasks. Finally, we use MoCapAct to train an autoregressive GPT model and show that it can perform natural motion completion given a motion prompt.

Category:
computer science

Project URL:
https://microsoft.github.io/MoCapAct/

License:
CDLA Permissive 2.0

File Explorer

Root /

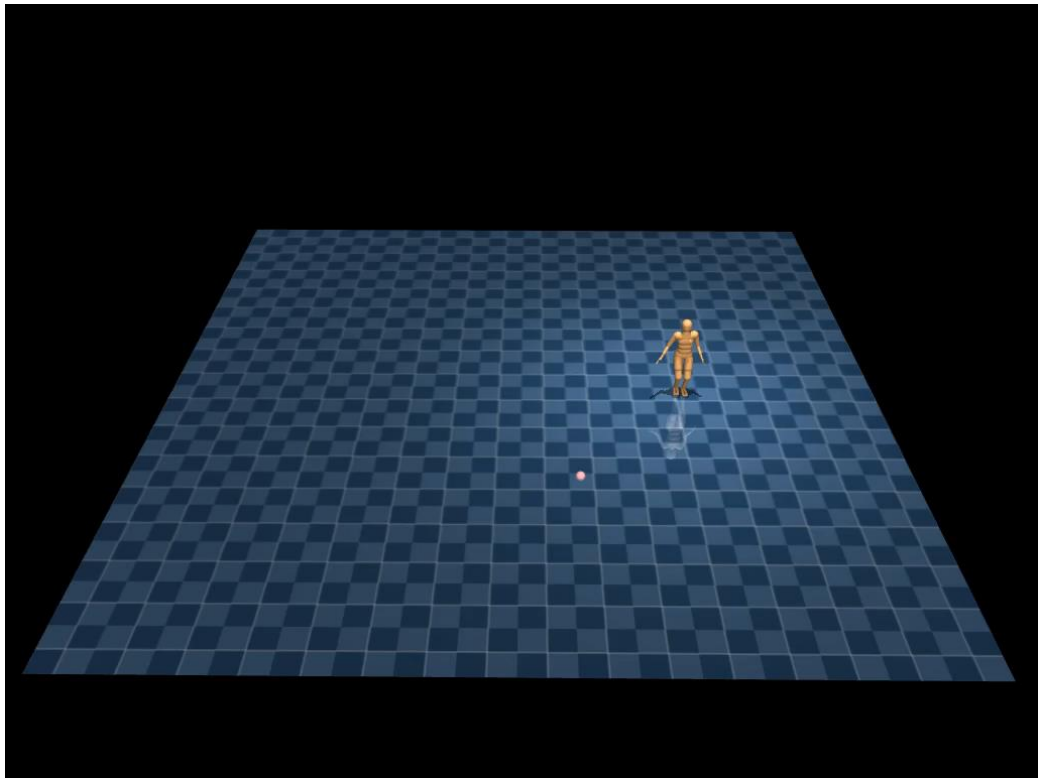
- experts.gz(134.06 GB)
- gpt.ckpt(683.47 MB)
- large.tar.gz(558.95 GB)
- multiclip_policy.tar.gz(107.14 MB)
- README.md(4.96 KB)

Next

Example applications

Red = motion prompt
Bronze = our humanoid
Gray = MoCap clip

Re-using learned skills for RL



Motion completion