CALM Public

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Code

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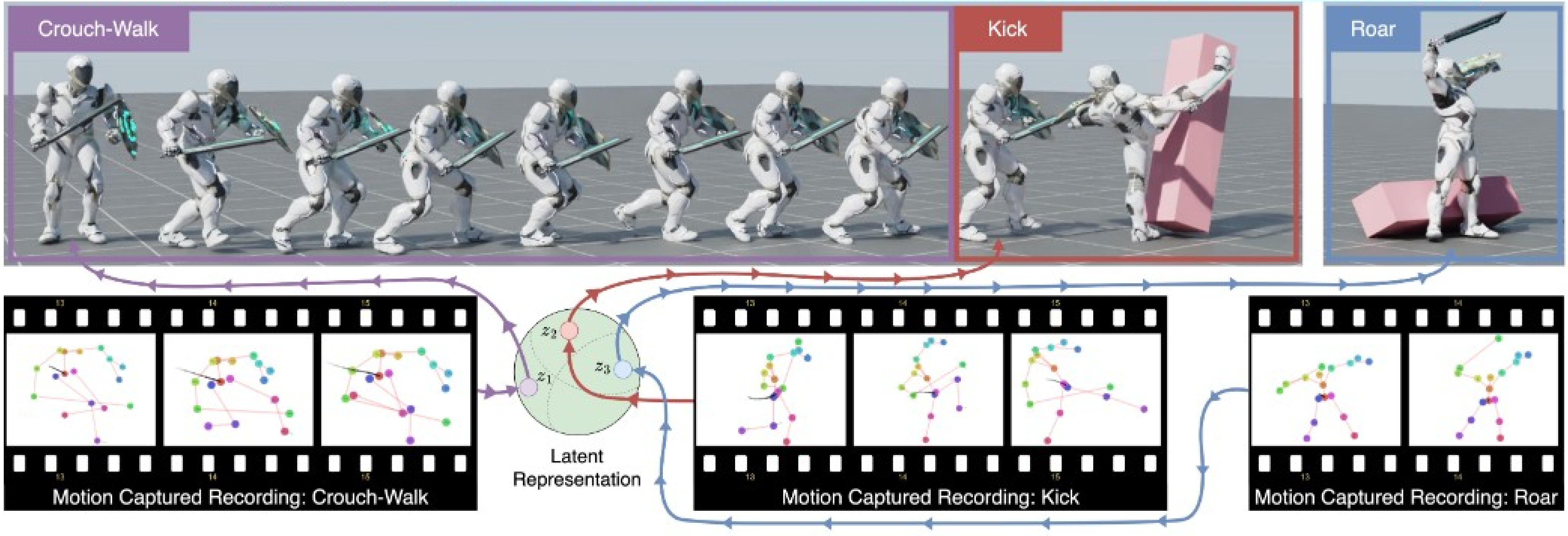
README License

Conditional Adversarial Latent Models

Code accompanying the paper: "CALM: Conditional Adversarial Latent Models for Directable Virtual Characters"


Crouch-Walk
Kick
Roar
z_2
z_1
z_3
Latent Representation
Motion Captured Recording: Crouch-Walk
Motion Captured Recording: Kick
Motion Captured Recording: Roar

CALM builds upon, and borrows code from, Adversarial Skill Embeddings (Peng et. al., 2022, ASE).

Installation

Download Isaac Gym from the website, then follow the installation instructions.

Once Isaac Gym is installed, install the external dependencies for this repo:

```
pip install -r requirements.txt
```

CALM

Pre-Training

First, a CALM model can be trained to **imitate** a dataset of motions clips using the following command:

```
python calm/run.py --task HumanoidAMPGetup --cfg_env calm/data/cfg/humanoid_calm_sword_shield_getup.yam
```

`--motion_file` can be used to specify a dataset of motion clips that the model should **imitate**. The task `HumanoidAMPGetup` will train a model to **imitate** a dataset of motion clips and get up after falling. Over the course of training, the latest checkpoint `Humanoid.pth` will be regularly saved to `output/`, along with a Tensorboard log. `--headless` is used to disable **visualizations** and `--track` is used for tracking using weights and biases. If you want to view the simulation, simply remove this flag. To test a trained model, use the following command:

```
python calm/run.py --test --task HumanoidAMPGetup --num_envs 16 --cfg_env calm/data/cfg/humanoid_calm_s
```

You can also test the **robustness** of the model with `--task HumanoidPerturb`, which will throw projectiles at the character.

Precision-Training

After the CALM low-level controller has been trained, it can be used to train style-**constrained**-**locomotion** controllers. The following command will use a pre-trained CALM model to perform a target heading task:

```
python calm/run.py --task HumanoidHeadingConditioned --cfg_env calm/data/cfg/humanoid_sword_shield_head
```

`--llc_checkpoint` specifies the checkpoint to use for the low-level controller. A pre-trained CALM low-level controller is available in `calm/data/models/calm_llc_reallusion_sword_shield.pth`.

To test a trained model, use the following command:

```
python calm/run.py --test --task HumanoidHeadingConditioned --num_envs 16 --cfg_env calm/data/cfg/human
```

Task-Solving (**Inference** -- no training!)

The CALM low-level controller and the high-level **locomotion** controller can be combined to solve tasks without further trianing. This phase is **inference** only.

```
python calm/run.py --test --task HumanoidStrikeFSM --num_envs 16 --cfg_env calm/data/cfg/humanoid_sword
```

`--llc_checkpoint` specifies the checkpoint to use for the low-level controller. A pre-trained CALM low-level controller is available in `calm/data/models/calm_llc_reallusion_sword_shield.pth`. `--checkpoint` specified the checkpoint to use for the precision-trained high-level controller. A pre-trained high-level precision-trained controller is available in `calm/data/models/calm_hlc_precision_trained_reallusion_sword_shield.pth`.

The built-in tasks and their respective config files are:

```
HumanoidStrikeFSM: calm/data/cfg/humanoid_sword_shield_strike_fsm.yaml
HumanoidLocationFSM: calm/data/cfg/humanoid_sword_shield_location_fsm.yaml
```

Task-Training

In addition to precision training, a high-level controller can also be trained to directly solve tasks. The following command will use a pre-trained CALM model to perform a target heading task:

```
python calm/run.py --task HumanoidHeading --cfg_env calm/data/cfg/humanoid_sword_shield_heading.yaml --
```

`--llc_checkpoint` specifies the checkpoint to use for the low-level controller. A pre-trained CALM low-level controller is available in `calm/data/models/calm_llc_reallusion_sword_shield.ckpt`. `--task` specifies the task that the character should perform, and `--cfg_env` specifies the environment configurations for that task. The built-in tasks and their respective config files are:

```
HumanoidReach: calm/data/cfg/humanoid_sword_shield_reach.yaml
HumanoidHeading: calm/data/cfg/humanoid_sword_shield_heading.yaml
HumanoidLocation: calm/data/cfg/humanoid_sword_shield_location.yaml
HumanoidStrike: calm/data/cfg/humanoid_sword_shield_strike.yaml
```

To test a trained model, use the following command:

```
python calm/run.py --test --task HumanoidHeading --num_envs 16 --cfg_env calm/data/cfg/humanoid_sword_s
```

AMP

We also provide an implementation of **Adversarial** Motion Priors (https://xbpeng.github.io/projects/AMP/index.html). A model can be trained to **imitate** a given reference motion using the following command:

```
python calm/run.py --task HumanoidAMP --cfg_env calm/data/cfg/humanoid_sword_shield.yaml --cfg_train ca
```

The trained model can then be tested with:

```
python calm/run.py --test --task HumanoidAMP --num_envs 16 --cfg_env calm/data/cfg/humanoid_sword_shiel
```

Motion Data

Motion clips are located in `calm/data/motions/`. Individual motion clips are stored as `.npy` files. Motion datasets are specified by `.yaml` files, which contains a list of motion clips to be included in the dataset. Motion clips can be **visualized** with the following command:

```
python calm/run.py --test --task HumanoidViewMotion --num_envs 2 --cfg_env calm/data/cfg/humanoid_sword
```

`--motion_file` can be used to **visualize** a single motion clip `.npy` or a motion dataset `.yaml`.

If you want to retarget new motion clips to the character, you can **take a look** at an example retargeting script in `calm/poselib/retarget_motion.py`.