Agile Trajectory Generation for Tensile Perching with Aerial Robots

Progress Update

Focussed around the learning from previous demos of the approaching stage.

- Adapted the environment to be part of a gym wrapper & standard baselines wrapper.
  - Gym: Framework of RL environments.
  - Standard Baselines: Set of reliable RL algorithms in PyTorch.
- Approaching Stage
  - R = $-distance\_to\_goal$ where goal is just above the branch.
  - Soft Actor Critic (from Demonstrations).

- Current Issues
  - Simulator Staying Alive
  - Need to decide what is an appropriate max action for the drone: 0.001m at 240Hz = 0.24m/s
  - Also considering position based instead of action based.
  - Speed
    - Numpy: Inefficient list operations in pybullet simulation (36%)
    - Headless: Currently only implemented a "human" env, want a way in the wrapper to not show the GUI. (52%)
    - Imperial DoC - GPUs: Currently just running on my own laptop.
    - Parallelisation: Stable Baselines provides relatviely straightforward methods to use multiple enviornments at the same time - in parallel.

Overall Progess

- Exams for 2 weeks:
  - Unavailable for 2 weeks: Friday 15th March & Friday 22nd March.
  - Next meeting that I will be here are: 1pm Friday 29th March, 9:30am Friday 5th April.

Demonstrations

- Approaching Stage 5 demonstrations seems to perform quite well.

Expert Demos	Mixed Demos	Poor Quality	Very Poor Quality
5x Fast Demos	2x Fast Demos	0x Fast Demos	0x Fast Demos
0x Slow Manuever	2x Slow Manuever	4x Slow Manuever	0x Slow Manuever
0x Random Flight	1x Random Flight	1x Random Flight	5x Random Flight

- Total: 5x Fast Demos, 5x Slow Mauever, 5x Random Flight.

Reward System

- Sparse Reward: Easy to define but harder to train from, Some evidence that can still perform well with demonstrations.
  - R = hanging underneath the branch structure - defining a zone.
- Dense Reward: Harder to define but makes training faster.
  - Approaching
  - Wrapping
  - Hanging
  - Safe Tether
  - Faster Agile (1-shot) motion