

Agile Trajectory Generation for Tensile Perching with Aerial Robots

Current Issues

- Approaching/Wrapping
 - Tether hitting itself
 - Novel Trajectories - Figure of 8
- Wrapping
 - 100g Weight leads to a 12% reuction in flight time
- Taking-off phase from the upside-down stage of the drone

Progress Update

Deep Q Learning

Human-Level Control through Deep Reinforcement Learning

- Trained a NN to estimate the Q Function.
- Frame rates comparable to human reaction.
- Experience Replay - potentially link of experience replay with different envs:

An Application of Reinforcement Learning to Aerobatic Helicopter Flight

Deep Q-Learning from Demonstrations

- Small sets of training data to massively accelerate the learning.
- Motivated by the lack of real-world simulators for many tasks.
- Replay buffer - demonstration-data is never overwritten.
- Loss functions - 1-Step double Q-Learning Loss, N-Step Q-Learning Loss, Supervised Large Margin Classification Loss, L2 Regularization Loss.
- Future Direction - Apply these concepts to domains with continuous actions where the classification loss becomes a regression loss.

SAC

Soft Actor–Critic with Inhibitory Networks for Retraining UAV Controllers Faster

- Traditional SAC for retraining a policy can lead to catastrophic forgetting of the policy's known skills.
- Proposes SAC with Inhibitory Networks
- Transfer Learning - combining multiple skills/training within different environments

General

Autonomous Unmanned Aerial Vehicle Navigation using Reinforcement Learning: A Systematic Review (2022)

- Survey consisting of 159 papers in UAV + Reinforcement Learning
 - ~30 were directly related to Path Planning
 - Energy-Aware UAV Navigation
- Further Papers
 - Path Planning Frameworks
 - Transfer Learning Frameworks
- Simulation Software - Gazebo & ROS, AirSim & Unreal Engine

Table 3 (continued).

Unlimited	Continuous	Policy based	REINFORCE (Williams, 1992)	On	No	No	No	No	–
			TPRO (Schulman et al., 2015)	On	No	No	No	No	Koch et al. (2019)
			PPO (Schulman et al., 2017)	On	No	No	No	No	Morad et al. (2021), Yan et al. (2020), Zhang et al. (2020b), Hasanzade and Koyuncu (2021), Wang et al. (2021), Hodge et al. (2021), Deshpande et al. (2020), Maxey and Shamwell (2019), Koch et al. (2019)
			PPG (Cobbe et al., 2020)	Off	No	No	No	No	–
			SVPG (Liu et al., 2017)	Off	No	No	No	No	–
		Actor–Critic	SLAC (Lee et al., 2019)	Off	Yes	No	No	No	–
			ACE (Zhang and Yao, 2019)	Off	Yes	Yes	No	No	–
			DAC (Zhang and Whiteson, 2019)	Off	Yes	No	No	No	–
			DPG (Silver et al., 2014)	Off	Yes	No	No	No	Li et al. (2019a)
			RDPG (Heess et al., 2015)	Off	Yes	No	No	No	–
			DDPG (Lillicrap et al., 2015)	Off	Yes	No	No	No	Bouhamed et al. (2020d), Wang et al. (2018, 2020a), Bouhamed et al. (2020b,c), Li et al. (2019b), Grando et al. (2020), Wang et al. (2020b), Liu et al. (2019), He et al. (2020), Zhou et al. (2019), Doukhi and Lee (2021), Koch et al. (2019), Lee et al. (2018)
			TD3 (Fujimoto et al., 2018)	Off	Yes	No	No	No	Omi et al. (2021)
			SAC (Haarnoja et al., 2018)	Off	Yes	No	No	No	Grando et al. (2020)
Multi-agent and distributed actor–critic			Ape-X DPG (Horgan et al., 2018)	Off	Yes	No	Yes	No	–
			D4PG (Barth-Maroon et al., 2018)	Off	Yes	No	Yes	Yes	–
			A2C (Mnih et al., 2016)	On	Yes	Yes	Yes	No	Lee and Kim (2020) and Peake et al. (2020)
			DPPO (Heess et al., 2017)	On	No	No	Yes	Yes	–
			A3C (Mnih et al., 2016)	On	Yes	Yes	No	Yes	Wang et al. (2020b)
			PAAC (Alfredo et al., 2017)	On	Yes	Yes	No	No	–
			ACER (Wang et al., 2016a)	Off	Yes	Yes	No	No	–
			Reactor (Gruslys et al., 2017)	Off	Yes	Yes	No	No	–
			ACKTR (Wu et al., 2017)	On	Yes	Yes	No	No	–
			MADDPG (Lowe et al., 2017)	Off	Yes	No	No	Yes	–
			MATD3 (Ackermann et al., 2019)	Off	Yes	No	No	Yes	–
			MAAC (Iqbal and Sha, 2019)	Off	Yes	No	No	Yes	Fan et al. (2020)
			IMPALA (Espeholt et al., 2018)	Off	Yes	Yes	Yes	Yes	–
			SEED (Espeholt et al., 2019)	Off	Yes	Yes	Yes	Yes	–

Practical

Reproducing Code Results

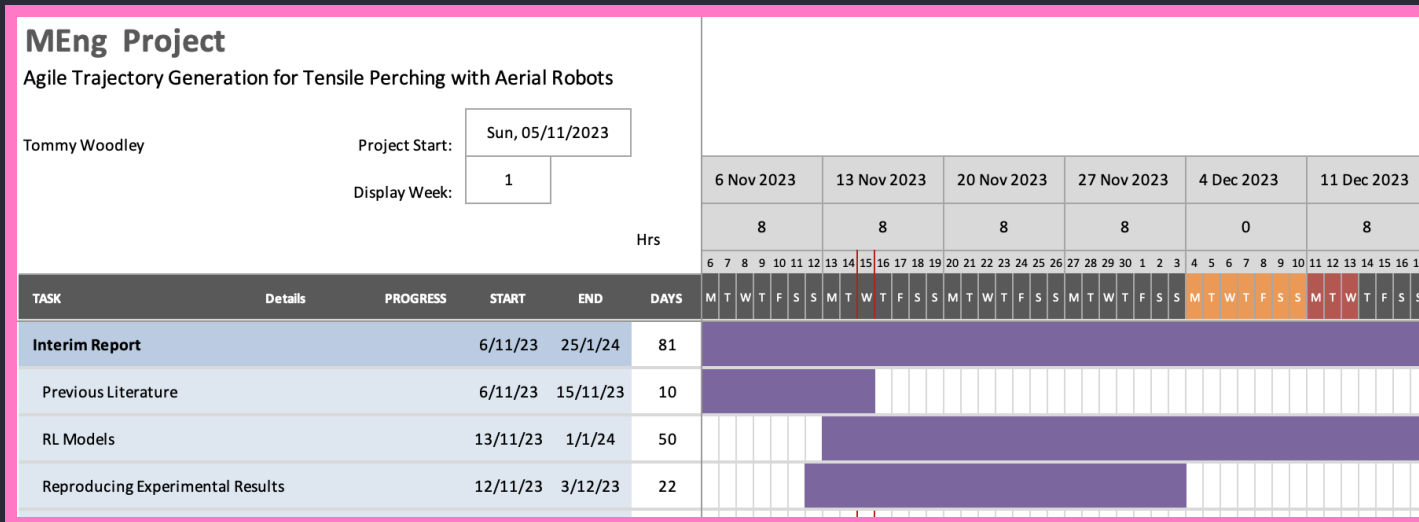
- Began to look through previous work.
 - Taking longer than anticipated to fully understand.

Gazebo

- Gazebo Setup
 - Currently struggling with setting up the environment.

General Plans

- Literature
 - Many different areas to explore.
- Practical
 - Behind where I had initially anticipated.
 - Want to dedicate more time over the next week towards this.



Plans Until Next

Literature

- Explore different models presented in the Systematic Review.

Practical

- Dedicate more time over the next week.
- Aim to have the environment set to be able run previous work.

Feedback