

Teacher-Student Actor

CMD Obs:

Base_vel_cmd;
Foot_id_cmd;
Foot_pos_cmd;

Base Obs:

Base_quat;
Gravity vec;
Joint_pos;
Joint_vel;
Last_action;

Terrain Obs:

Height Scans;

Privileged Obs:

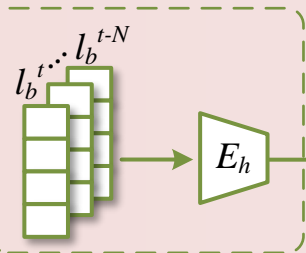
Base_mass;
Friction;
Addition_force;
Addition_torque;
Target_joint_cmd;

Commands

Base State

Terrain Height

Privileged State



l_b

E_e

E_t

E_p

+

l_p

Regress

obs_c

obs_b

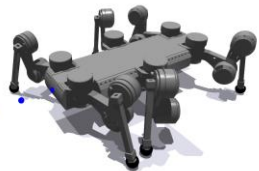
obs_e



obs_p

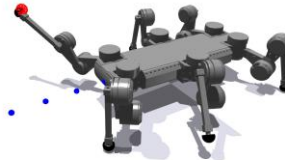
Task1

Base Locomotion



Task2

Mobile Manipulation



Task3

Stationary Manipulation



Multi-Head Critic

Rewards

Root Velocity Tracking

Safety Penalties

Root Velocity Tracking

Feet Position Tracking

Safety Penalties

Feet Position Tracking

Safety Penalties

Task Heads

h_θ



n_1

W_1, b_1

h_θ



n_2

W_2, b_2

h_θ



n_3

W_3, b_3

Policy Optimization

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Update with **PopArt**