



Extreme Parkour with Legged Robots

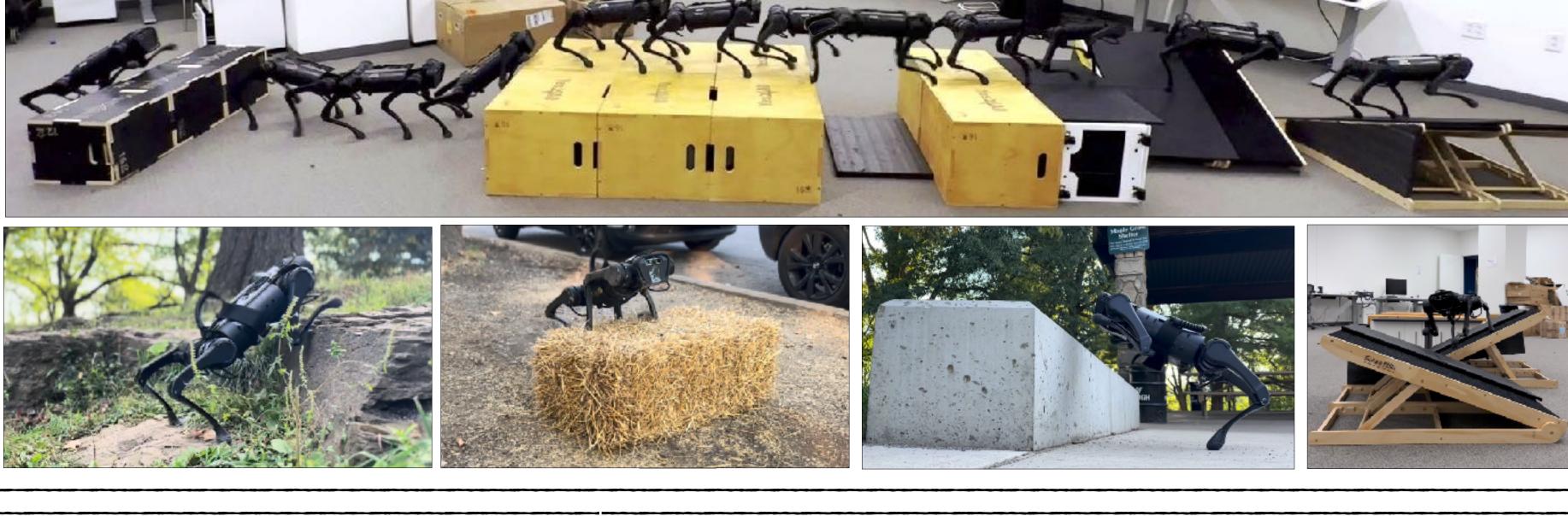




extreme-parkour.github.io

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Motivation Could we learn a single vision-based policy for agile parkour? 0.5m 0.8m (2x robot) (2x robot)





Vision Locomotion:

- The action is noisy and laggy.
- The camera has artifacts, latency and jitter.

Agile Parkour:

- Extreme motion needs precise control.
- The heading should be adjusted by robot itself.
- Walking in different styles is still under exploration.

12 Joints Max torque: 33.5NM 0.4m Intel RealSense 0.26m **Onboard** Less than 10k **Computation: Jetson NX**

Unified Rewards

• Velocity Tracking Reward: Encourage to track heading

$$r_{tracking} = \min(\langle \mathbf{v}, \mathbf{\hat{d}}_w \rangle, v_{cmd})$$
 $\mathbf{\hat{d}}_w = \frac{\mathbf{p} - \mathbf{x}}{\|\mathbf{p} - \mathbf{x}\|}$ is target direction.

• Clearance Reward: Penalize dangerous footprints

$$r_{clearance} = -\sum_{i=0}^{4} c_i \cdot M[p_i]$$

• Stylized Reward: Encourage handstand walk $r_{stylized} = W \cdot \left[0.5 \cdot \langle \mathbf{\hat{v}}_{fwd}, \mathbf{\hat{c}} \rangle + 0.5\right]^2$

is sampled randomly in {0, 1} in training and controlled via joystick in deployments.

where M is a boolean function which is 1 iff the lies within 5cm of an edge.

