



Large-scale

Open-source

Human Motions

CLONE: Closed-Loop Whole-Body Humanoid Teleoperation for Long-Horizon Tasks

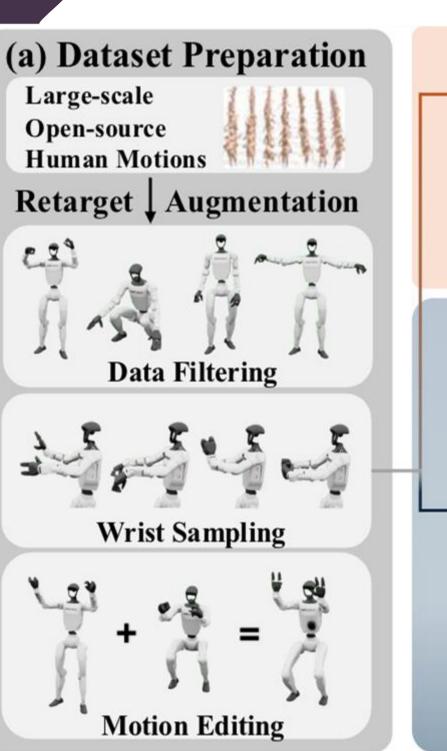
Challenges

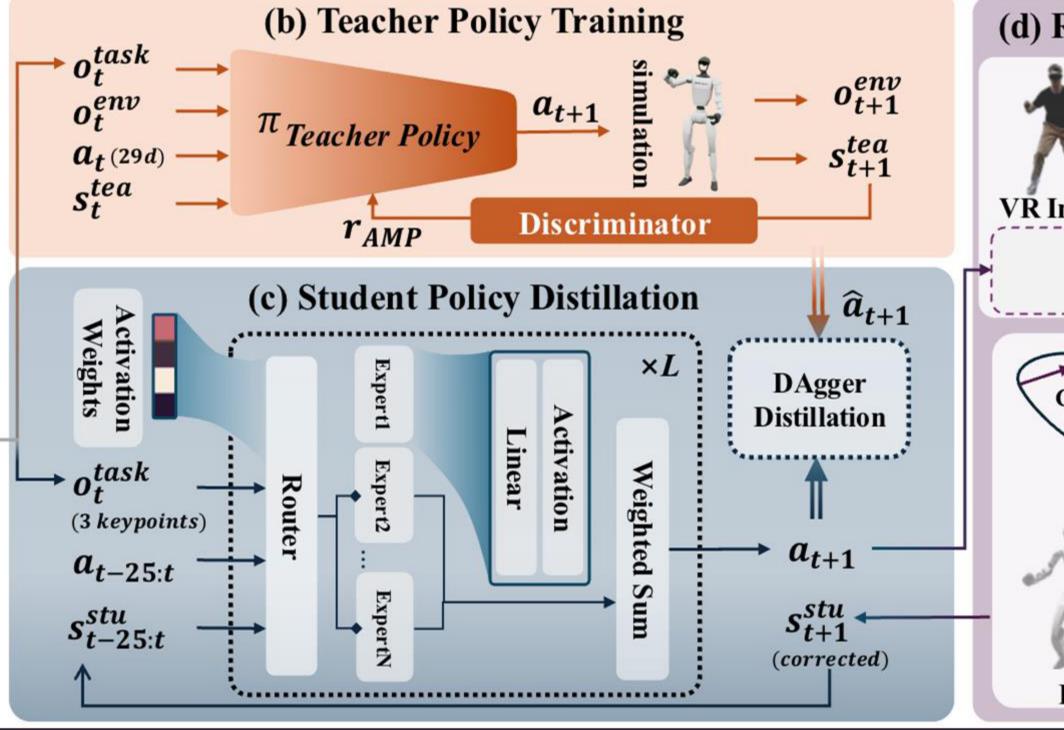
> Accumulated positional error due to the absence of robot state feedback

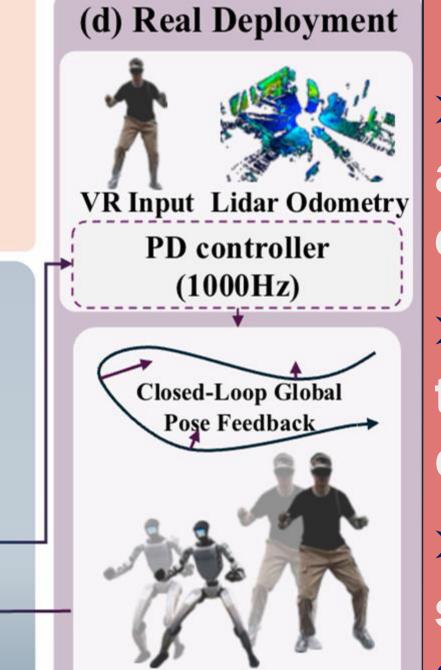
- ➤ Coordinated whole-body coordination
- > Uncomprehensive dataset

Methods

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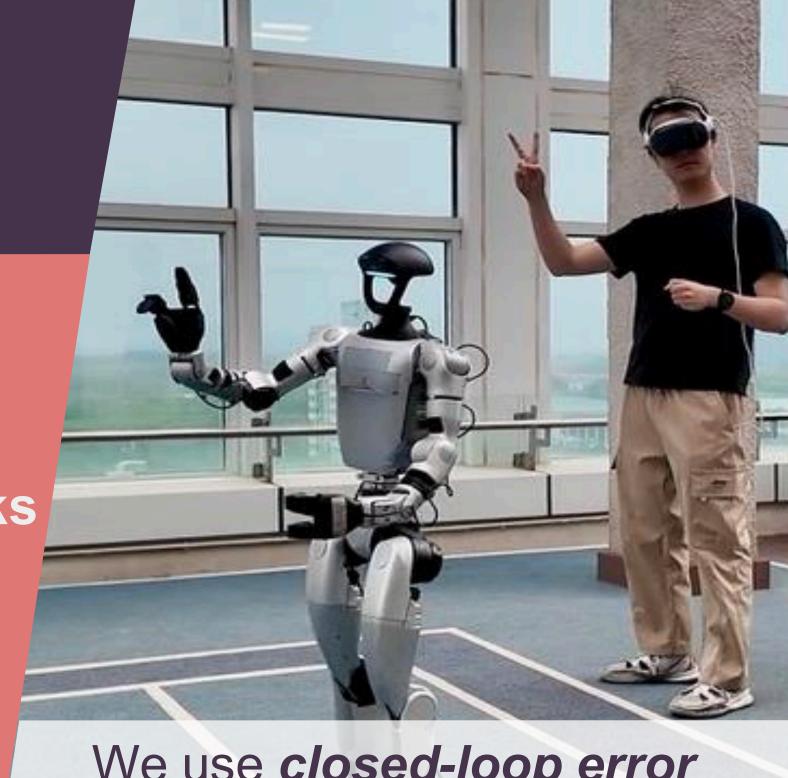


Contributions

Closed-Loop prevents accumulated tracking error in long-horizon tasks

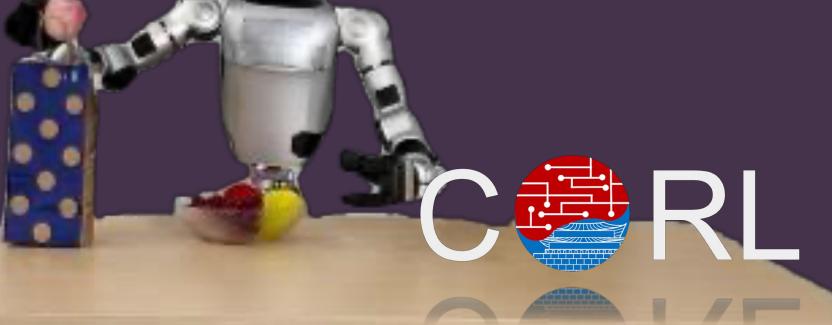
➤ MoE enables a unified tracking policy for diverse motion tracking

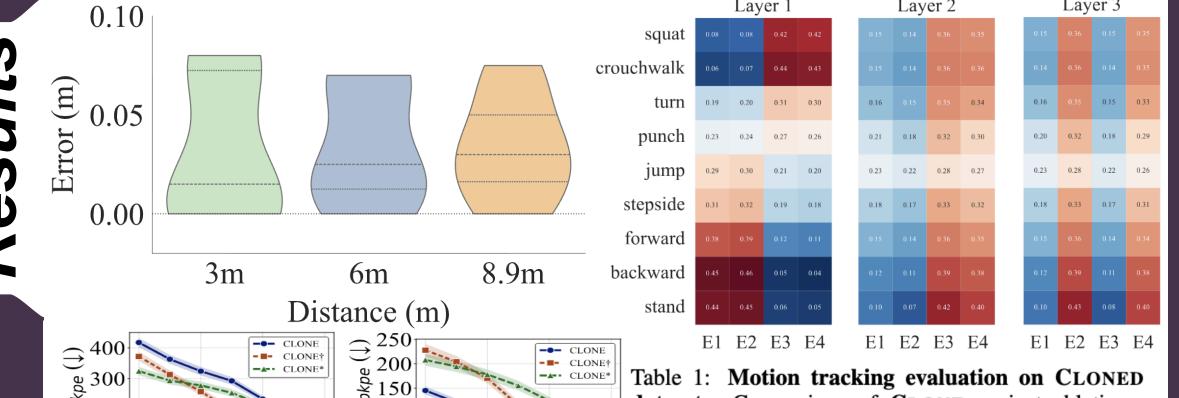
Data augmentation supports dexterous and comprehensive control



We use closed-loop error correction to achieve high-fidelity whole-body teleoperation with minimal long-term drift







Height (m)

dataset. Comparison of CLONE against ablations: CLONE † uses an MLP instead of MoE architecture, while CLONE * trains on OmniH2O data instead of

Method	$\mathbf{SR} \uparrow$	$E_{ ext{mpkpe}}\downarrow$	$E_{ ext{r-mpkpe}}\downarrow$	$E_{\mathrm{vel}}\downarrow$	$E_{ ext{hand-rot}}\downarrow$
CLONE †	100%	113.97	35.55	245.11	4.73
CLONE *	100%	102.20	41.07	309.65	4.61
CLONE	100%	87.84	33.30	227.17	3.61

- > With LiDAR odometry, closed-loop control improves long-horizon tracking precision
- > MoE unlocks more capabilities and improves whole-body control stability

