Physical Plausibility-aware Trajectory Prediction via Locomotion Embodiment
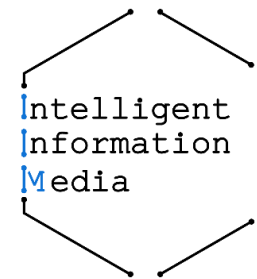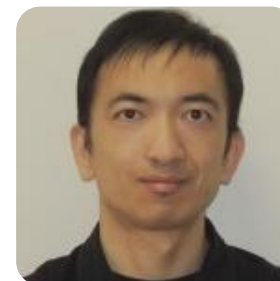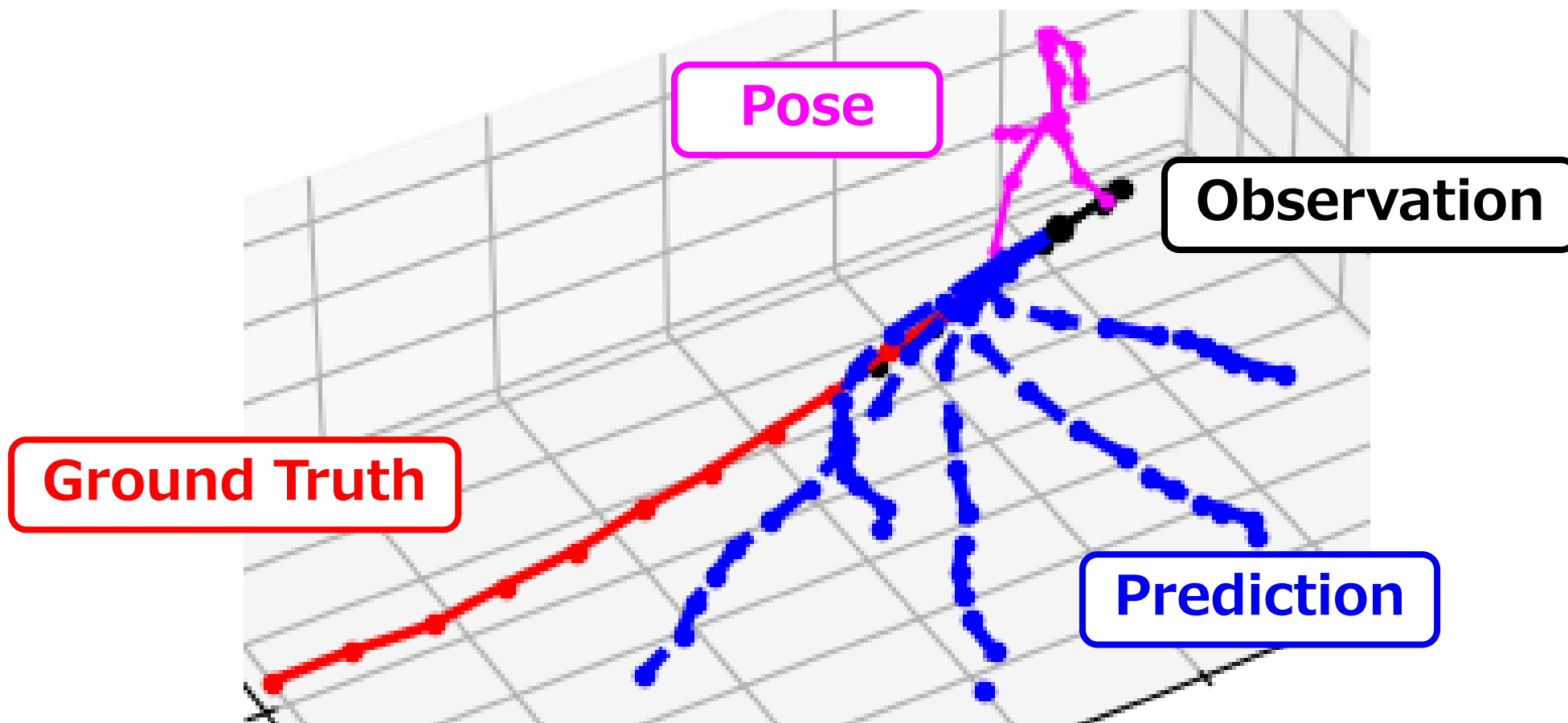
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T. Oba, T. Maeda,
S. Nobuhara, N. Ukita**

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- Given past observation, predict future trajectory of the target

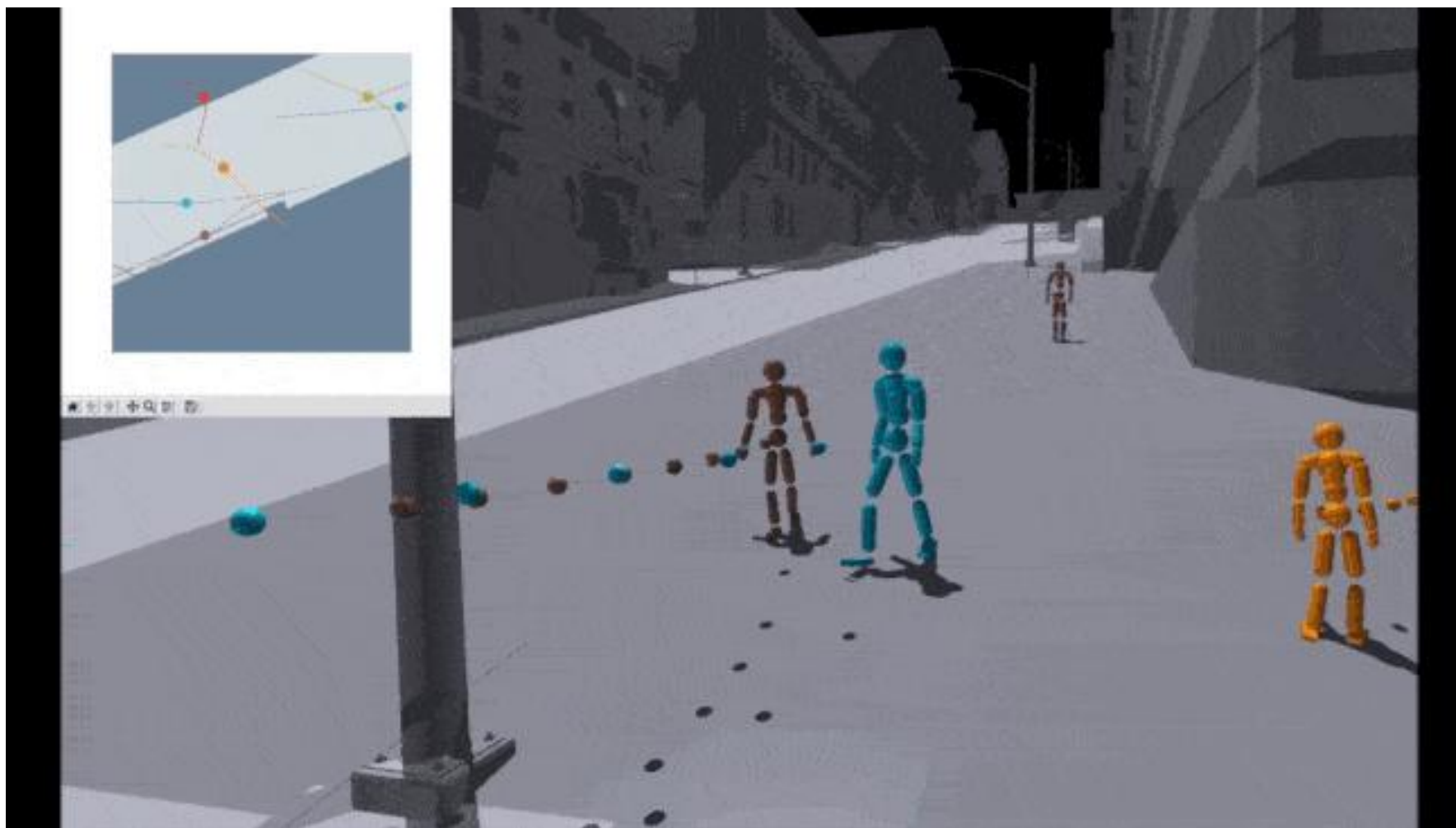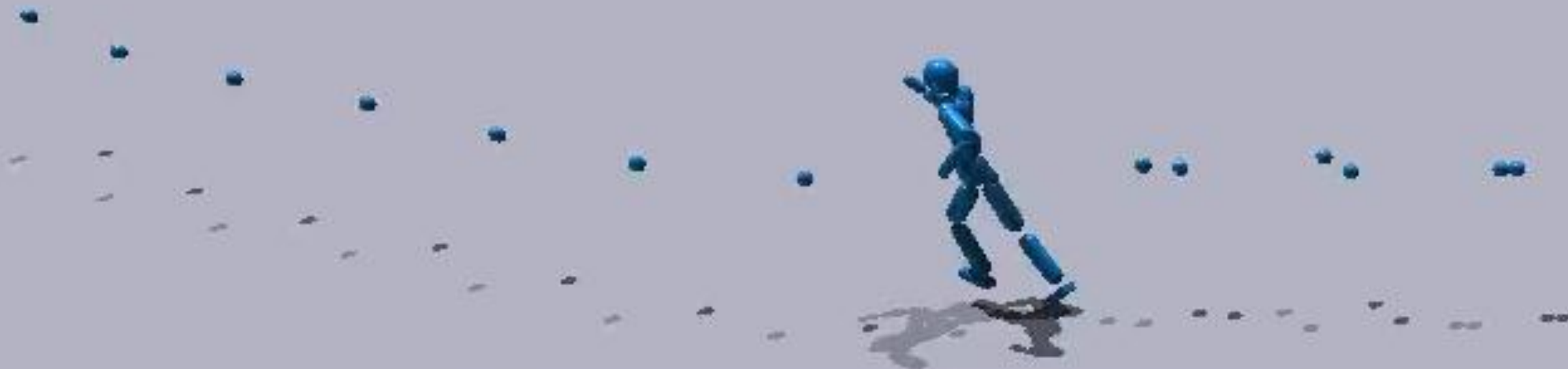**Implausible prediction even with pose input**

💡 Idea: Locomotion Embodiment

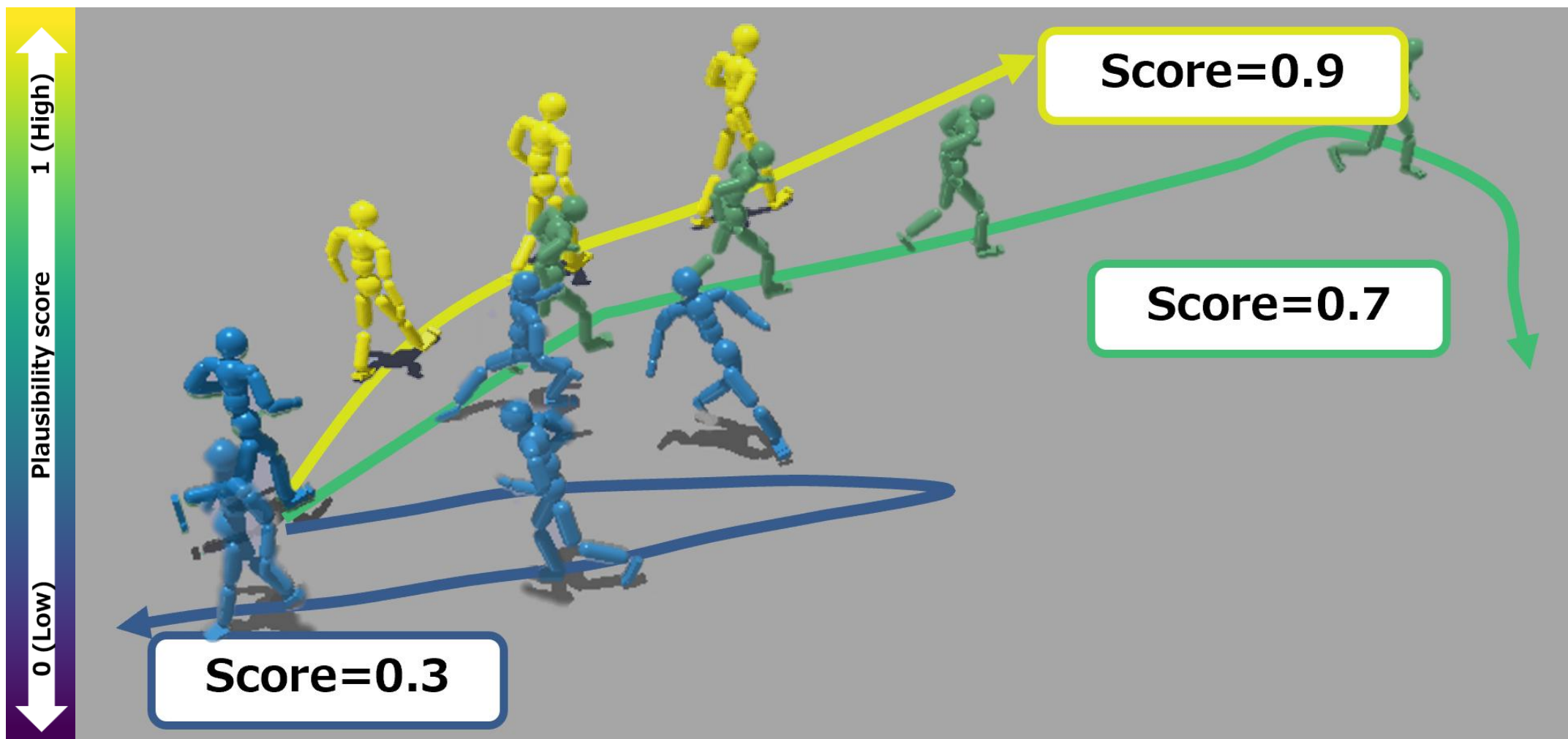- Employ locomotion generation method in a physics simulator

Rempe *et al.*, Trace and Pace (CVPR2023)

Cannot follow implausible trajectories!
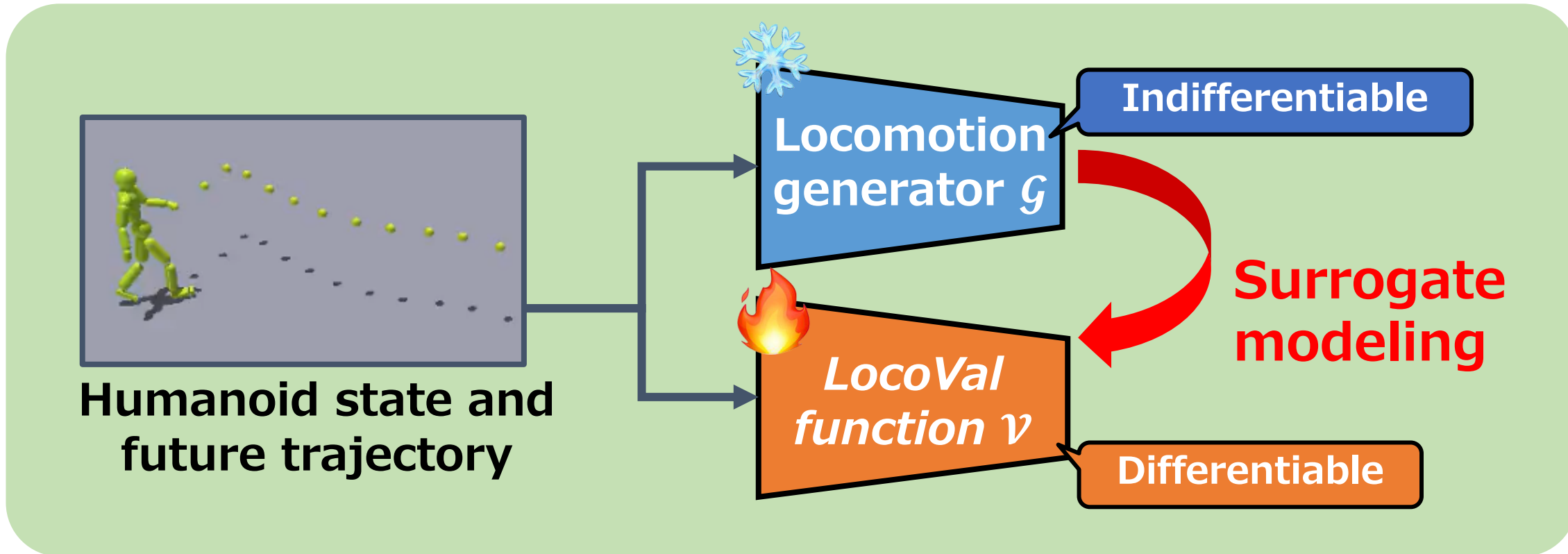
💡 Idea: Locomotion Embodiment

Evaluate trajectories by plausibility scores
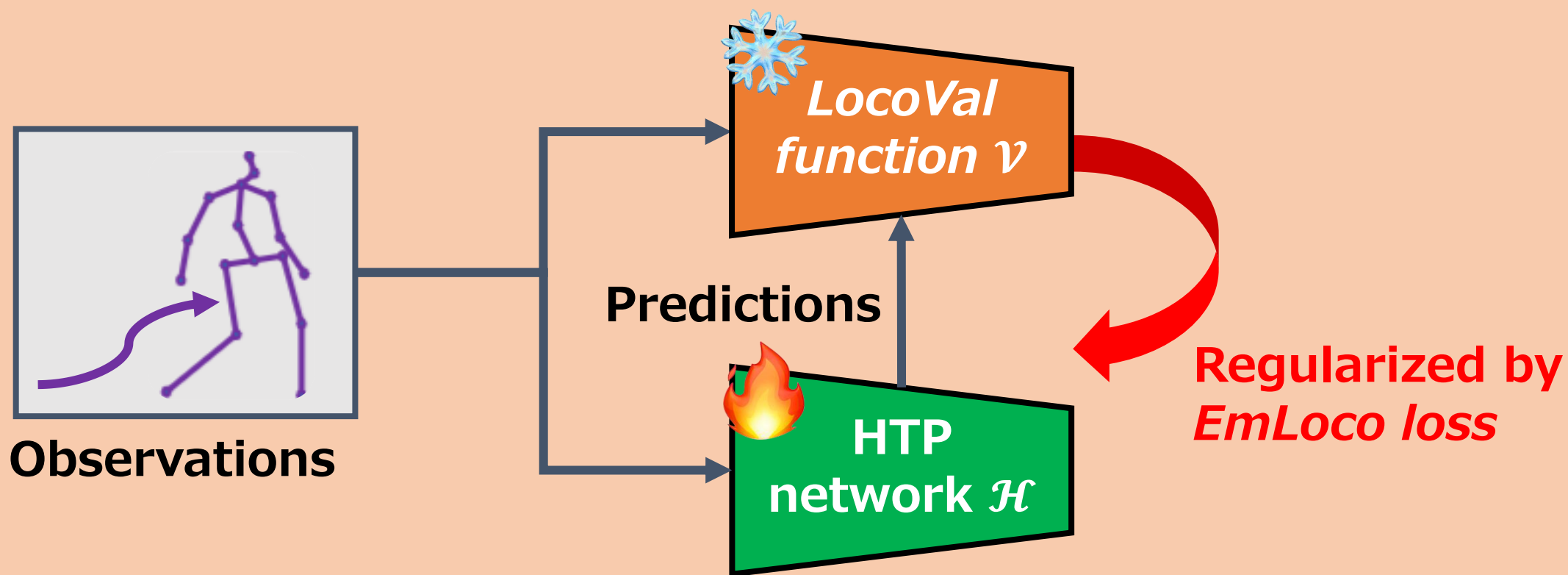
Estimate scores of locomotion generation

- Surrogate model of indifferentiable physics simulation

Evaluate plausibility scores of prediction

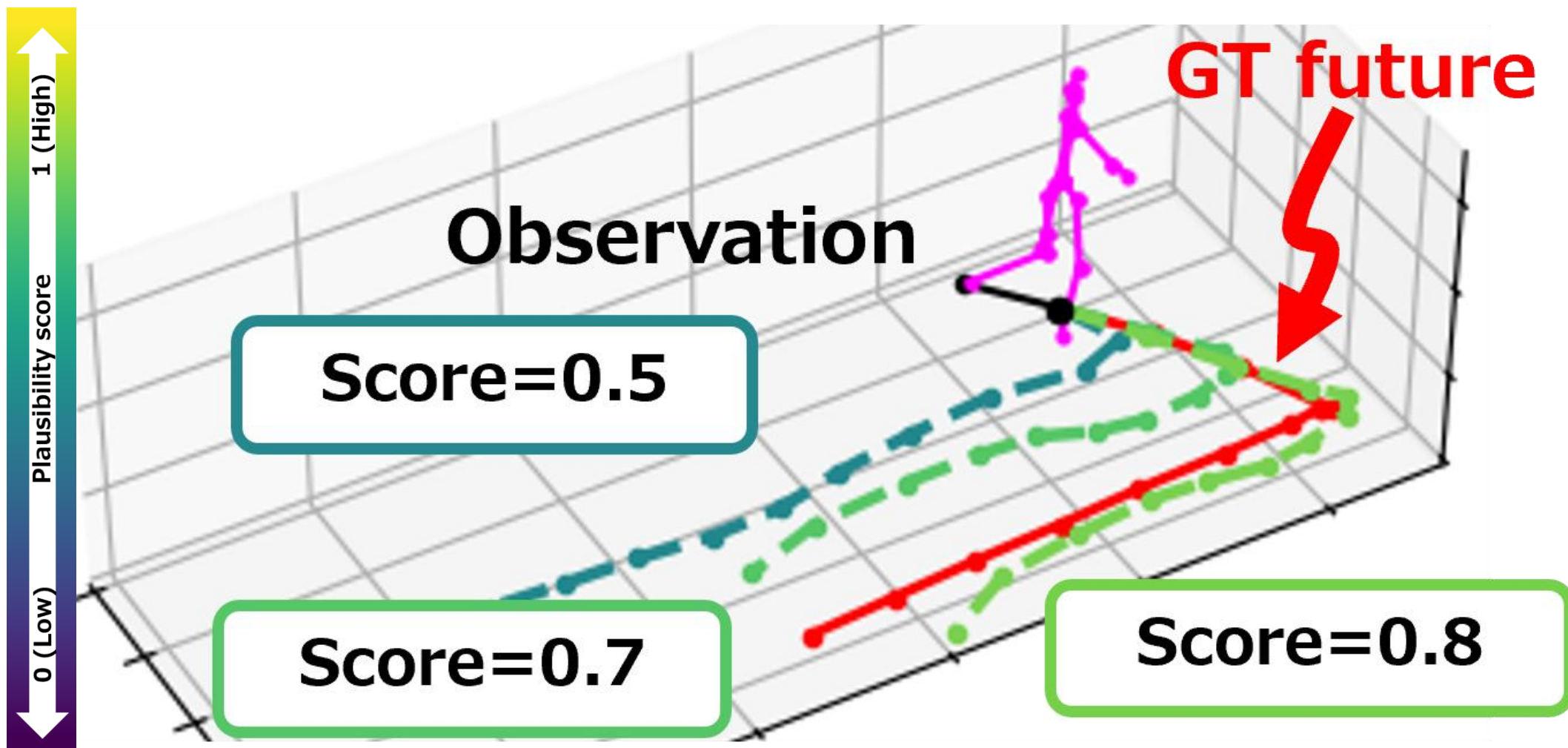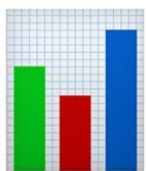- **Embodied Locomotion (EmLoco) loss** for HTP training

Filter out implausible predictions at inference

Experimental results
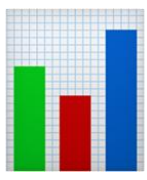
Results

Methods	Prediction error (ADE)
Baseline* (w/o EmLoco loss)	1.86
Ours (w/ EmLoco loss)	**1.68**
Ours (w/ EmLoco loss and LocoVal filtering)	**1.65**

EmLoco loss and LocoVal filtering effectively improve HTP performance!

* Saadatnejad *et al.*, Social-Transmotion (ICLR2024)

Plausible, diverse, and accurate prediction

Pose

Observation

Ground Truth

Baseline*
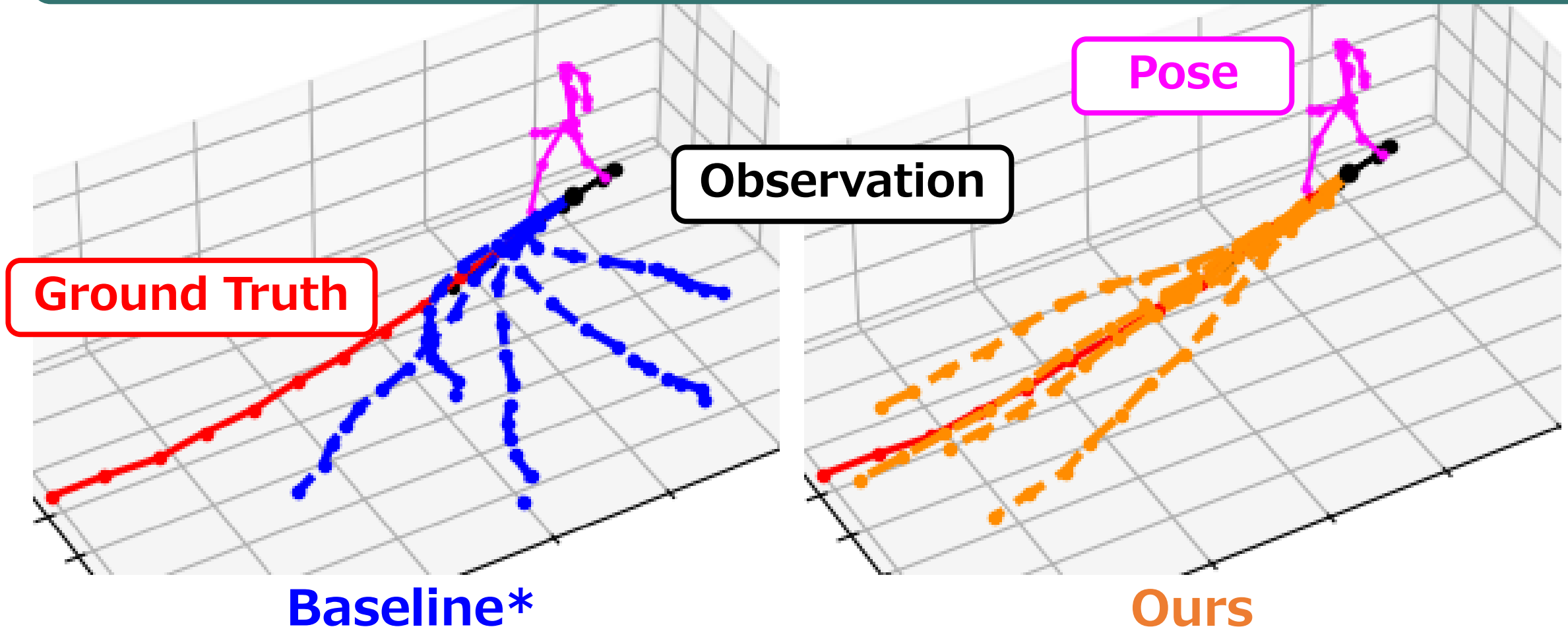
Ours

* Saadatnejad *et al.*, Social-Transmotion (ICLR2024) 11
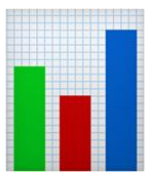
Ours can reasonably evaluate the plausibility

Pose

Ground Truth

Observation

0 (Low)   Plausibility score   1 (High)
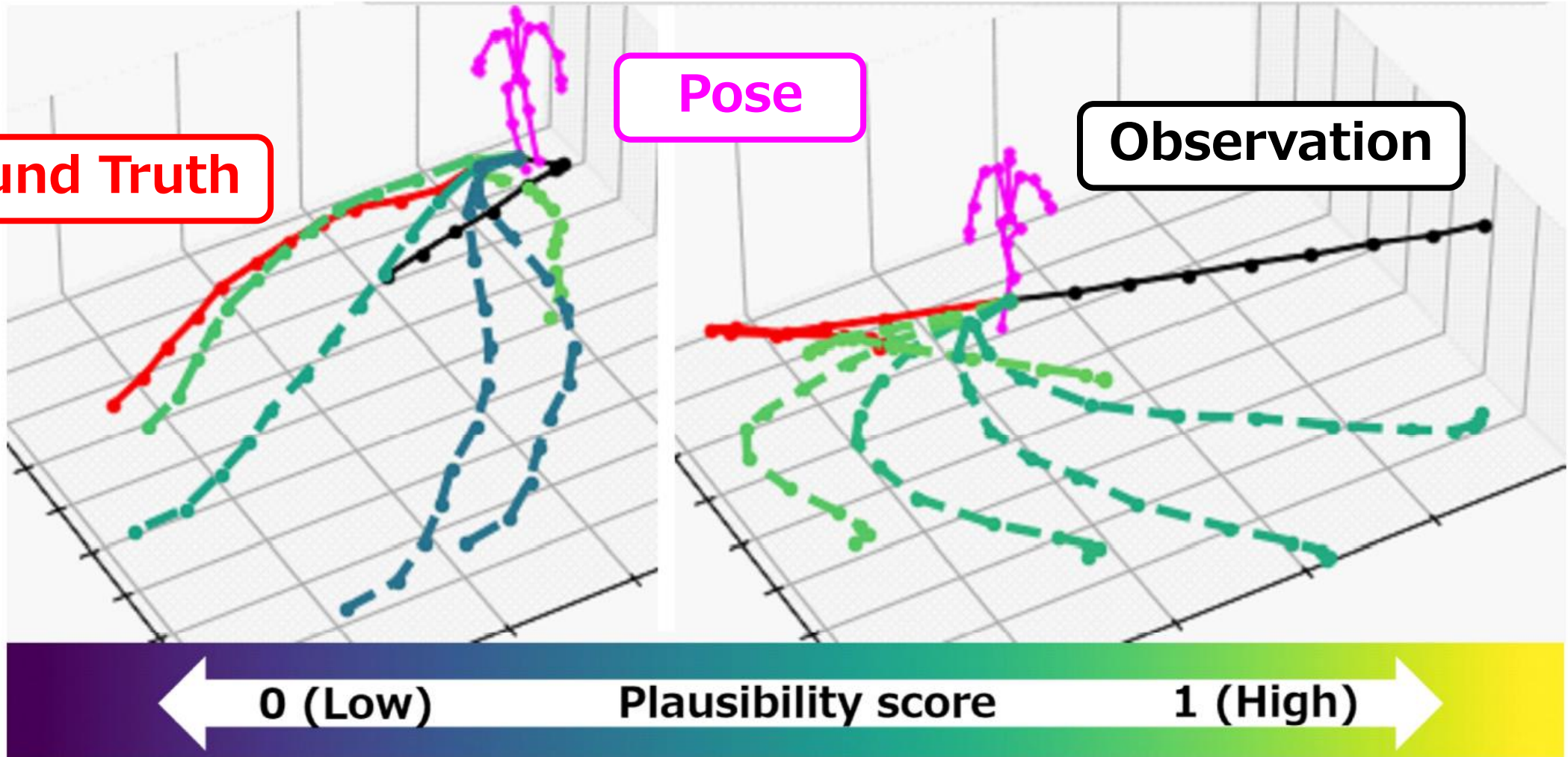
🔑 Key Take-aways

- **Locomotion Embodiment** to promote **plausible HTP**

- **EmLoco loss** and **LocoVal filter** enhance HTP performance

**Project page:
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