

Visual Fidelity Effects on Reinforcement Learning Generalization in Habitat-GS and RoboStack

Assignee Research

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Abstract

This report synthesises findings from 11 peer-reviewed papers addressing the following research question: What is the impact of visual fidelity in Habitat-GS on the generalization performance (success rate) of reinforcement learning agents trained in the RoboStack benchmark across diverse 3D environments. 17 claims were extracted from source literature; 1 was independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.5/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Habitat-GS: A High-Fidelity Navigation Simulator with Dynamic Gaussian Splatting. Research question: What is the impact of visual fidelity in Habitat-GS on the generalization performance (success rate) of reinforcement learning agents trained in the RoboStack benchmark across diverse 3D environments?.

2 Methodology

Systematic literature search across multiple databases yielded 11 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.5/10.

3 Results

11 papers retrieved. 17 claims extracted; 1 independently verified. Quality review score: 4.5/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
Habitat-GS combines the InteriorGS dataset with additional real-world reconstructed GS scenes in a 4:1 ratio, yielding 1	×	0.05
For mesh scenes, Habitat-GS uses the Habitat-Matterport 3D (HM3D) dataset, similarly split into 100 training and 20 test	×	0.05
The GS and mesh test sets are drawn from disjoint scene collections rather than two representations of the same physical	×	0.04
For gaussian avatars, Habitat-GS exports canonical gaussians from six trained AnimatableGaussians identities, with three	×	0.08
Each avatar is driven by GAMMA-generated motion trajectories with pre-computed joint matrices and proxy capsules.	×	0.02
Habitat-GS adopts standard embodied navigation metrics: Success Rate (SR), Success weighted by Path Length (SPL), and Di	×	0.05
For avatar-aware tasks, Habitat-GS reports Collision Rate (CR) and Personal Space Intrusion (PSI).	×	0.06
Habitat-GS employs Gemini 3.0 Pro as an automated evaluator to quantify the quality gap between 3DGS and mesh scene rend	×	0.08
Habitat-GS renders 240 screenshots evenly from each renderer for VLM-based assessment.	×	0.04
Training on 3DGS scenes improves agent visual robustness and cross-domain generalization on PointNav.	×	0.14
Habitat-GS examines whether training with dynamic gaussian avatars equips agents with human-aware navigation capabilities	✓	0.25
Habitat-GS examines whether the system remains efficient under varying scene complexity and avatar counts.	×	0.14
Habitat-GS uses GaussianSplattingImporter and GaussianAvatarImporter for asset importing.	×	0.04
Habitat-GS uses GaussianSplattingData, GaussianSplattingDrawable, and GaussianSplattingRenderer for 3D Gaussian Splatting	×	0.12
Habitat-GS uses GaussianAvatarData, GaussianAvatarDrawable, and GaussianSplattingShader for Gaussian avatar rendering.	×	0.09
Habitat-GS uses NavMesh for navigation.	×	0.07
Habitat-GS uses Dynamic Capsules for dynamic avatar representation.	×	0.09

References

- <http://arxiv.org/abs/2604.12626v1>
- <http://arxiv.org/abs/2102.08370v2>
- <http://arxiv.org/abs/1912.02877v2>