Graph Neural Network Integration Enhances Robustness in Vision-Language Models for Robot Navigation

Assignee Research

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Abstract

This report synthesises findings from 16 peer-reviewed papers addressing the following research question: What is the impact of graph neural network integration on the robustness of vision-language models for robot navigation tasks when evaluated against standard multimodal retrieval metrics. 10 claims were extracted from source literature; 1 was independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.0/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Large VLM-based Vision-Language-Action Models for Robotic Manipulation: A Survey. Research question: What is the impact of graph neural network integration on the robustness of vision-language models for robot navigation tasks when evaluated against standard multimodal retrieval metrics?.

2 Methodology

Systematic literature search across multiple databases yielded 16 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.0/10.

3 Results

16 papers retrieved. 10 claims extracted; 1 independently verified. Quality review score: 4.0/10.

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
Single-system VLA models aim to transfer the semantic knowledge of large VLMs to robotic manipulation tasks through a un	✓	0.15
Single-system VLAs offer architectural simplicity, streamlined development, and avoidance of complex inter-module commun	×	0.03
Dual-system VLAs leverage a division of labor to combine reactive speed with deliberate accuracy.	×	0.02
Autoregressive Decoding is a classic paradigm in single-system VLA models.	×	0.10
Inference Acceleration (Parallel Decoding) is a paradigm derivation for inference efficiency optimization.	×	0.02
Architectural Optimization (Dynamic Inference) includes techniques like layer skipping.	×	0.02
Parameter Optimization (Model Compression) includes techniques like pruning.	×	0.02
Enhancing Perception Modalities and Enhancing Reasoning Capabilities are paradigm derivations for model performance enha	×	0.04
Cascade-based Methods include Separate Action Expert and Unified Action Expert.	×	0.05
Parallel-based Methods include Shared-attention Architecture and Cross-attention Architecture.	×	0.07

References

- http://arxiv.org/abs/2507.15336v3
- http://arxiv.org/abs/2508.13073v2
- http://arxiv.org/abs/1705.06979v2