Structural Mismatch in Graph Topologies and Message-Passing Efficiency for LLM-Augmented GNNs

Assignee Research

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Abstract

This report synthesises findings from 14 peer-reviewed papers addressing the following research question: How does the structural mismatch between equilibrium graph topologies and efficient message-passing schemes impact the reasoning accuracy of LLM-augmented GNNs on synthetic clique-counting benchmarks. Graph Neural Networks (GNNs) leverage the graph structure to transmit information between nodes, typically through the message-passing mechanism. While these models have found a wide variety of applications, they are known to suffer from over-squashing, where information from a. 6 claims were extracted from source literature; 0 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 3.7/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: gLSTM: Mitigating Over-Squashing by Increasing Storage Capacity. Research question: How does the structural mismatch between equilibrium graph topologies and efficient message-passing schemes impact the reasoning accuracy of LLM-augmented GNNs on synthetic clique-counting benchmarks?.

2 Methodology

Systematic literature search across multiple databases yielded 14 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 3.7/10.

3 Results

14 papers retrieved. 6 claims extracted; 0 independently verified. Quality review score: 3.7/10.

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
gLSTM shows significantly improved recall abilities compared to GCN.	×	0.03
gLSTM retains perfect recall until the number of neighbors equals the memory dimension of the model.	×	0.02
Capacity over-squashing starts much earlier at just N = 8 for the largest GCN model tested.	×	0.07
Sensitivity, as measured by the Jacobian norm, does not correlate with NAR performance.	×	0.01
Capacity over-squashing can occur without sensitivity over-squashing.	×	0.11
Sensitivity increases consistently for GCN models above N = 16 to the point where it matches initial sensitivity, despit	×	0.03

References

- http://arxiv.org/abs/2408.06717v3
- http://arxiv.org/abs/2510.08450v2
- http://arxiv.org/abs/2312.05905v2