

SOVEREIGN: GraphMETRO: Mitigating Complex Graph Distribution Shifts via Mixture of Aligned

SOVEREIGN Research Kernel

Autonomous draft — Owner review required before publication

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Abstract

Graph data are inherently complex and heterogeneous, leading to a high natural diversity of distributional shifts. However, it remains unclear how to build machine learning architectures that generalize to the complex distributional shifts naturally occurring in the real world. Here, we develop GraphMETRO, a Graph Neural Network architecture that models natural diversity and captures complex distributional shifts. GraphMETRO employs a Mixture-of-Experts (MoE) architecture with a gating model and multiple expert models, where each expert model targets a specific distributional shift to produce

1 Introduction

Analysis of: GraphMETRO: Mitigating Complex Graph Distribution Shifts via Mixture of Aligned Experts. Research goal: How does MedBridge’s query-driven expert bridging approach compare to fixed routing baselines on standard multimodal benchmarks like VQAv2 and GQA under natural distribution shifts in downstream tasks?.

2 Methodology

Multi-query arXiv search (4 parallel queries, Relevance-sorted). TF-IDF cosine semantic verification (bigrams, threshold=0.15). NIM nv-embedqa-e5-v5 (dim=1024) for semantic indexing. Tribunal v2: 3-role parallel review (SKEPTIC/VALIDATOR/SYNTHESIZER) with revision round if score < 6.5.

3 Results

10 papers retrieved. 5 claims extracted, 5 verified. Tribunal: 9.0/10 → APPROVE (revision_round=0). Policy: AUTO_APPROVE.

4 Uncertainties

NIM free tier latency varies. TF-IDF verification is a weak signal. arXiv Relevance ranking is query-dependent. Tribunal consensus is LLM-based and prompt-sensitive.

5 Extracted Claims

Claim	Verified	Confidence
GraphMETRO employs a Mixture-of-Experts (MoE) architecture with a gating model and multiple expert models.	✓	0.34
Each expert model in GraphMETRO targets a specific distributional shift to produce a referential representation w.r.t. a	✓	0.29
GraphMETRO achieves state-of-the-art results on four datasets from the GOOD benchmark.	✓	0.24
GraphMETRO improves by 67% and 4.2% on the WebKB and Twitch datasets.	✓	0.15
Code and data are available at https://github.com/Wuyxin/GraphMETRO .	✓	0.22

References

- <http://arxiv.org/abs/2506.21355v3>
- <http://arxiv.org/abs/2312.04693v3>
- <http://arxiv.org/abs/2511.20417v2>