SOVEREIGN: Does SMoES's soft modality-guided routing improve MMMU cross-domain robustness (e.g., STEM vs. humanities) and

SOVEREIGN Research Kernel
Autonomous draft — Owner review required before publication

May 28, 2026

Abstract

Mixture-of-Experts (MoE) has become a prevalent backbone for large vision-language models (VLMs), yet how modality-specific signals should guide expert routing remains under-explored. Existing routing strategies are either hand-crafted or modality-agnostic, relying on idealized priors that ignore the layer-dependent modality fusion patterns in MoE-VLMs and provide little guidance for expert specialization. We propose Soft Modality-guided Expert Specialization (SMoES), which consists of dynamic soft modality scores that capture layer-dependent fusion patterns, an expert binning mechanism aligne

1 Introduction

Analysis of: SMoES: Soft Modality-Guided Expert Specialization in MoE-VLMs. Research goal: Does SMoES's soft modality-guided routing improve MMMU cross-domain robustness (e.g., STEM vs. humanities) and reduce expert collapse in MoE-VLMs with 8 vs. 16 experts relative to Top-2 routing baselines?.

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

12 papers retrieved. 0 claims extracted, 0 verified. Tribunal: 2.2/10 → REJECT (revision_round=0). Policy: ESCALATE_TO_OWNER.

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.

References

- http://arxiv.org/abs/2311.16502v4
- http://arxiv.org/abs/2604.23996v1
- http://arxiv.org/abs/2603.11114v1