

SOVEREIGN: ExpertFlow: Efficient Mixture-of-Experts Inference via Predictive Expert Caching

SOVEREIGN Research Kernel

Autonomous draft — Owner review required before publication

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Abstract

Sparse Mixture-of-Experts (MoE) models can outperform dense large language models at similar computation by activating only a small set of experts per token. However, stacking many expert modules introduces substantial parameter memory, which makes MoE models difficult to deploy in memory-constrained environments such as single-GPU devices. Offloading alleviates this issue by storing inactive experts in CPU memory and loading them on demand, but existing methods remain limited: static caches disregard input-dependent routing, and methods that train separate models to predict expert usage ahead

1 Introduction

Analysis of: ExpertFlow: Efficient Mixture-of-Experts Inference via Predictive Expert Caching and Token Scheduling. Research goal: Does soft modality-guided specialization in MoE-VLMs reduce hallucination rates on object existence and attribute binding metrics (e.g., POPE, AMBER) relative to dense counterparts of similar FLOPs?.

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

6 papers retrieved. 0 claims extracted, 0 verified. Tribunal: 2.7/10 → 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/2410.17954v2>
- <http://arxiv.org/abs/2402.14800v2>
- <http://arxiv.org/abs/2401.04088v1>