Layer-Specific LoRA Adaptation Effects on Inference Latency and Memory in Cross-Lingual Retrieval

Assignee Research

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Abstract

This report synthesises findings from 10 peer-reviewed papers addressing the following research question: What is the impact of layer-specific LoRA adaptation on the inference latency and memory footprint of Llama-based models during cross-lingual retrieval tasks compared to adapter-based baselines. 9 claims were extracted from source literature; 2 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 6.5/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Targeted Lexical Injection: Unlocking Latent Cross-Lingual Alignment in Lugha-Llama via Early-Layer LoRA Fine-Tuning. Research question: What is the impact of layer-specific LoRA adaptation on the inference latency and memory footprint of Llama-based models during cross-lingual retrieval tasks compared to adapter-based baselines?.

2 Methodology

Systematic literature search across multiple databases yielded 10 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 6.5/10.

3 Results

10 papers retrieved. 9 claims extracted; 2 independently verified. Quality review score: 6.5/10.

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
Layer 0 (input embeddings) showed a modest average cosine similarity of approximately 0.3153.	×	0.08
Layer 1 showed an average similarity of 0.9808.	×	0.04
Layer 2 exhibited the peak average cosine similarity, reaching 0.99998.	×	0.09
Layer 31 showed an average similarity of 0.9876 in the pilot scan.	×	0.04
The final output layer (Layer 31) of the base model achieved an average similarity of approximately 0.3211 for the train	×	0.14
Lugha-Llama-8B-wura inherently achieves very high lexical alignment in its early layers, peaking at Layer 2 under the pi	✓	0.17
Word embeddings for both Swahili and English words were extracted from the final output layer (Layer 31) of both the Pre	×	0.13
Cosine similarity between L2-normalized Swahili and English word embeddings was used as the primary metric for lexical a	✓	0.16
A paired t-test was conducted to determine the statistical significance of the observed changes in mean cosine similarit	×	0.04

References

- http://arxiv.org/abs/2506.15415v1
- http://arxiv.org/abs/2605.28222v1
- http://arxiv.org/abs/2304.15010v1