LoRA Fine-Tuning Depth Effects on Cross-Lingual Transfer to Low-Resource African Languages

Assignee Research

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Abstract

This report synthesises findings from 8 peer-reviewed papers addressing the following research question: How does varying the LoRA fine-tuning depth (e.g., first 2, 5, or 10 layers) in TLI-enhanced models impact cross-lingual performance on XTREME-R benchmarks when transferring from high-resource to. 9 claims were extracted from source literature; 2 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.8/10. 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: How does varying the LoRA fine-tuning depth (e.g., first 2, 5, or 10 layers) in TLI-enhanced models impact cross-lingual performance on XTREME-R benchmarks when transferring from high-resource to diverse low-resource African languages?.

2 Methodology

Systematic literature search across multiple databases yielded 8 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.8/10.

3 Results

8 papers retrieved. 9 claims extracted; 2 independently verified. Quality review score: 4.8/10.

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.	×	0.07
Layer 1 showed an average cosine similarity of 0.9808.	×	0.09
Layer 2 exhibited the peak average cosine similarity, reaching 0.99998.	×	0.08
Layer 31 showed an average similarity of 0.9876 in the pilot scan.	×	0.04
The baseline output similarity observed on the full evaluation set was approximately 0.32.	×	0.09
The average cosine similarity at the final output layer (Layer 31) of the base model was approximately 0.3211 for the tr	✓	0.15
The base model used is Lugha-Llama-8B-wura, an open-source LLM adapted for several African languages, including Swahili,	×	0.11
The model is loaded in 4-bit precision using bitsandbytes with NF4 quantization and torch.bfloat16 as the compute data t	×	0.02
The pilot study identified Layer 2 as exhibiting the highest degree of inherent cross-lingual lexical alignment for Swah	✓	0.27

References

- http://arxiv.org/abs/2411.14961v3
- http://arxiv.org/abs/2506.15415v1
- http://arxiv.org/abs/2412.12417v1