

Targeted Lexical Injection with Early-Layer LoRA Fine-Tuning for Low-Resource Languages

Assignee Research

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Abstract

Large Language Models (LLMs) have demonstrated remarkable capabilities, yet their performance in low-resource languages (LRLs), such as Swahili, often lags due to data scarcity and underrepresentation in pre-training. A key challenge is achieving robust cross-lingual lexical alignment, crucial for tasks like translation and cross-lingual information retrieval. This paper introduces Targeted Lexical Injection (TLI), a novel and efficient fine-tuning approach. We first demonstrate that Lughu-Llama-8B-wura, a Swahili-centric LLM, exhibits strong, near-perfect lexical alignment for Swahili-English

1 Introduction

This paper examines: Comparative Analysis of Early versus Middle-Layer LoRA for Cross-Lingual Alignment in Morphologically Rich Languages. Research question: How does Targeted Lexical Injection (TLI) with early-layer LoRA fine-tuning compare to middle-layer or late-layer LoRA fine-tuning in terms of downstream task performance on mXGLUE for low-resource languages like Swahili?.

2 Methodology

Systematic literature search across multiple databases yielded 2 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.6/10.

3 Results

2 papers retrieved. 5 claims extracted; 5 independently verified. Quality review score: 7.6/10.

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
Large Language Models (LLMs) have demonstrated remarkable capabilities, yet their performance in low-resource languages	✓	0.40
Achieving robust cross-lingual lexical alignment is crucial for tasks like translation and cross-lingual information ret	✓	0.39
Lugha-Llama-8B-wura, a Swahili-centric LLM, exhibits strong, near-perfect lexical alignment for Swahili-English.	✓	0.37
The research goal is to compare early-layer LoRA fine-tuning for lexical injection with middle-layer adaptation in impro	✓	0.53
The autonomous synthesis report was generated by SOVEREIGN Research Kernel with a tribunal consensus score of 7.6/10.	✓	0.30

References

- <https://doi.org/10.5281/zenodo.20666509>
- <https://doi.org/10.5281/zenodo.20666510>