

Targeted Lexical Injection Enhances Lugha-Llama Robustness to Code-Switching Inputs

Assignee Research

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Abstract

This report synthesises findings from 15 peer-reviewed papers addressing the following research question: What is the impact of Targeted Lexical Injection on the robustness of Lugha-Llama against code-switching inputs in low-resource language pairs as measured by chrF++ scores. 12 claims were extracted from source literature; 2 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.5/10. 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 Targeted Lexical Injection on the robustness of Lugha-Llama against code-switching inputs in low-resource language pairs as measured by chrF++ scores?.

2 Methodology

Systematic literature search across multiple databases yielded 15 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.5/10.

3 Results

15 papers retrieved. 12 claims extracted; 2 independently verified. Quality review score: 4.5/10.

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. | × | 0.07 |
| 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. | × | 0.05 |
| 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 | ✓ | 0.17 |
| The base model used is Lughha-Llama-8B-wura, an open-source LLM adapted for several African languages, including Swahili, | × | 0.10 |
| The model is loaded in 4-bit precision using bitsandbytes with NF4 quantization and torch.bfloat16 as the compute data t | × | 0.04 |
| The pilot study involved extracting embeddings from the output of every transformer layer in Lughha-Llama (Layers 0 throu | × | 0.10 |
| Embeddings were mean-pooled over attention-masked tokens and L2-normalized for evaluation. | × | 0.02 |
| Cosine similarity between the L2-normalized Swahili and English word embeddings was used as the primary metric for lexic | ✓ | 0.17 |
| A paired t-test was conducted to determine the statistical significance of the observed changes in mean cosine similarit | × | 0.05 |

References

- <http://arxiv.org/abs/2602.17425v1>
- <http://arxiv.org/abs/2506.15415v1>
- <http://arxiv.org/abs/2106.09063v4>