Impact of Intermediate-Task Training on Cross-Lingual Zero-Shot Performance of Multilingual LLMs

Assignee Research

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Abstract

The use of Large Language Models (LLMs) for program code generation has gained substantial attention, but their biases and limitations with non-English prompts challenge global inclusivity. This paper investigates the complexities of multilingual prompt-based code generation. Our evaluations of LLMs, including CODELLAMA and CODEGEMMA, reveal significant disparities in code quality for non-English prompts; we also demonstrate the inadequacy of simple approaches like prompt translation, bootstrapped data augmentation, and fine-tuning. To address this, we propose a zero-shot cross-lingual approac

1 Introduction

This paper examines: Bridging the Language Gap: Enhancing Multilingual Prompt-Based Code Generation in LLMs via Zero-Shot Cross-Lingual Transfer. Research question: What is the impact of intermediate-task training using code-related tasks (e.g., code generation, code summarization) on the cross-lingual zero-shot performance of multilingual LLMs, evaluated on benchmarks like MBXP or CodeXGLUE?.

2 Methodology

Systematic literature search across multiple databases yielded 12 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.1/10.

3 Results

12 papers retrieved. 12 claims extracted; 9 independently verified. Quality review score: 7.1/10.

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
GPT-4 reliably generates code across all language prompts with slightly varying error profiles, except for Hindi and Chi	✓	0.23
CodeLLaMa shows more pronounced disparities between languages, with higher error rates and lower all-tests-passed rates	✓	0.21
CodeLLaMa-Instruct-7B performs better in Spanish than in English.	✓	0.17
LLaMa 7B, when instruction-tuned for multilingual tasks, performs better in Spanish than in English.	✓	0.23
The proposed method uses a multilingual encoder like LASER to map multilingual embeddings into the LLM's token space.	✓	0.24
The proposed method requires training only on English data.	✓	0.17
Results on a translated and quality-checked MBPP dataset show substantial improvements in code quality using the propose	✓	0.26
For GPT-4 on English prompts, the Total Error Rate is 58.37, Lexical Error Rate is 10.9, Syntax Error Rate is 47.47, and	×	0.13
For GPT-4 on Hindi prompts, the Total Error Rate is 67.7 and the All-Tests-Passed Rate is 32.3.	×	0.11
For CodeLLaMa-7B on English prompts, the Total Error Rate is 87.16 for the Original baseline and 75 for the LP approach.	×	0.12
The quality of generated code diminishes as prompts shift from English to other languages.	✓	0.21
LLMs often exhibit biases against non-English prompts in code generation tasks.	✓	0.18

References

- http://arxiv.org/abs/2005.13013v2
- http://arxiv.org/abs/2408.09701v2
- http://arxiv.org/abs/2310.09917v3