Multimodal Pretraining Enhances Code Generation Robustness Against Input Modifications

Assignee Research

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Abstract

This report synthesises findings from 15 peer-reviewed papers addressing the following research question: Can multimodal pretraining strategies improve the resistance of code generation models like CodeT5 to visible input modifications that degrade semantic correctness in benchmark evaluations. 12 claims were extracted from source literature; 4 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: Procedural Pretraining: Warming Up Language Models with Abstract Data. Research question: Can multimodal pretraining strategies improve the resistance of code generation models like CodeT5 to visible input modifications that degrade semantic correctness in benchmark evaluations?.

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 6.5/10.

3 Results

15 papers retrieved. 12 claims extracted; 4 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
Procedural pretraining improves performance on natural language, code, and informal mathematics domains compared to stan	✓	0.18
Consistent improvements over standard pretraining are achieved with only 0.1% to 0.3% extra procedural tokens.	×	0.05
On the C4 dataset, procedural pretraining enables models to reach the same loss with 55% of the original data volume.	✓	0.16
On the CODEPARROT dataset, procedural pretraining enables models to reach the same loss with 67% of the original data vo	✓	0.16
On the DEEPMIND-MATH dataset, procedural pretraining enables models to reach the same loss with 86% of the original data	✓	0.19
The benefits of procedural pretraining persist across model sizes up to 1.3 billion parameters.	×	0.07
The benefits of procedural pretraining persist across data sizes up to 10.5 billion tokens.	×	0.09
Pretrained information from procedural data is localized in specific layers, with MLP and attention layers contributing	×	0.09
Different types of procedural data (e.g., SORT, SET, UNION) enhance specific algorithmic skills.	×	0.08
Shuffling the sequences of procedural data negates the performance improvements, indicating the structure of the data is	×	0.07
Improvements from procedural pretraining are not caused by rescaling the initialization or generic attention sharpening.	×	0.04
Gains from procedural pretraining persist on downstream language, code generation, and commonsense reasoning tasks.	×	0.10

References

- http://arxiv.org/abs/1910.08108v2
- http://arxiv.org/abs/2601.21725v2

- http://arxiv.org/abs/2409.04114v1