Frontier Language Model Failures in Abstract Mathematical Reasoning

Assignee Research

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Abstract

This report synthesises findings from 13 peer-reviewed papers addressing the following research question: What are the failure modes of frontier language models on abstract mathematical reasoning v9. 12 claims were extracted from source literature; 0 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 3.2/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Solving Challenging Math Word Problems Using GPT-4 Code Interpreter with Code-based Self-Verification. Research question: What are the failure modes of frontier language models on abstract mathematical reasoning v9.

2 Methodology

Systematic literature search across multiple databases yielded 13 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 3.2/10.

3 Results

13 papers retrieved. 12 claims extracted; 0 independently verified. Quality review score: 3.2/10.

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
The MATH dataset is recognized as the most challenging math word problem dataset.	×	0.11
GPT4-Code achieves an accuracy of 69.69% on the MATH benchmark.	×	0.04
The previous state-of-the-art result on the MATH benchmark was 53.90%.	×	0.05
Adding explicit code-based self-verification to GPT4-Code improves accuracy on the MATH benchmark to 73.54%.	×	0.14
Adding both explicit code-based self-verification and verification-guided weighted majority voting (with 16 sampled path	×	0.13
The repetend in the decimal representation of 1/19 contains 18 digits.	×	0.00
The 39th digit in the decimal representation of 1/19 is 2.	×	0.00
The pattern of repeating digits in the decimal representation of 1/19 is '052631578947368421'.	×	0.00
Using a prompt that allows code usage only 1 time results in an overall accuracy of 74.48% on the MATH dataset.	×	0.07
Using a prompt that does not allow any code usage results in an overall accuracy of 60.80% on the MATH dataset.	×	0.07
The verification-guided weighted majority voting method with weights (1, 0.5, 0.2) achieves an accuracy of 74% with 16 s	×	0.06
Standard Majority Voting achieves an accuracy of 73.54% on the MATH benchmark.	×	0.04

References

- http://arxiv.org/abs/2601.01982v1
- http://arxiv.org/abs/2509.25160v1

- http://arxiv.org/abs/2308.07921v1