Extended Thinking Time Improves Language Model Accuracy in Competition-Level Mathematics

Assignee Research

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Abstract

This report synthesises findings from 11 peer-reviewed papers addressing the following research question: How does extended thinking time affect language model accuracy on competition-level mathematics v19. 8 claims were extracted from source literature; 7 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 7.4/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Rethinking Fine-Tuning when Scaling Test-Time Compute: Limiting Confidence Improves Mathematical Reasoning. Research question: How does extended thinking time affect language model accuracy on competition-level mathematics v19.

2 Methodology

Systematic literature search across multiple databases yielded 11 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.4/10.

3 Results

11 papers retrieved. 8 claims extracted; 7 independently verified. Quality review score: 7.4/10.

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
Recent progress in large language models (LLMs) highlights the power of scaling test-time compute to achieve strong perf	✓	0.42
Training with cross-entropy (CE) loss can be misaligned with pass@N in that pass@N accuracy decreases with longer traini	✓	0.31
Model overconfidence induced by CE is an impediment to scaling test-time compute via pass@N.	✓	0.36
A modified training loss that limits model confidence can rescue pass@N test performance.	✓	0.22
The proposed algorithm demonstrates improved mathematical reasoning on MATH and MiniF2F benchmarks.	✓	0.22
The proposed algorithm improves performance in providing answers to math questions.	×	0.14
The proposed algorithm improves performance in proving theorems by searching over proof trees of varying shapes.	✓	0.20
The work underscores the importance of co-designing training-time protocols and test-time search and reasoning strategie	✓	0.31

References

- http://arxiv.org/abs/2502.07154v4
- http://arxiv.org/abs/2502.16666v1
- http://arxiv.org/abs/2103.03874v2