

Chain-of-Thought Prompting Enhances Transformer Multi-Step Logical Reasoning

Assignee Research

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Abstract

This report synthesises findings from 11 peer-reviewed papers addressing the following research question: What architectural innovations improve transformer performance on multi-step logical reasoning v14. 11 claims were extracted from source literature; 1 was 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: Attention as Binding: A Vector-Symbolic Perspective on Transformer Reasoning. Research question: What architectural innovations improve transformer performance on multi-step logical reasoning v14.

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 4.5/10.

3 Results

11 papers retrieved. 11 claims extracted; 1 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
LLMs frequently fail under simple problem variations, struggle with systematic generalization, and exhibit logical incon	×	0.03
Chain-of-thought (CoT) prompting improves performance on many benchmarks.	✓	0.28
Models still display characteristic brittleness, overfitting to surface cues, and sensitivity to minor perturbations.	×	0.04
Transformer representations only partially align with the requirements of systematic symbolic manipulation.	×	0.07
Attention can be understood as a soft binding/unbinding operator.	×	0.11
Queries and keys define role-like subspaces; values supply fillers; and attention weights implement a differentiable unb	×	0.14
Residual connections superpose many such bindings.	×	0.07
When attention operations behave coherently, transformers can approximate structured symbolic manipulation; when they do	×	0.06
Vector Symbolic Architectures (VSAs) provide an algebraic framework for representing symbols and structures in high-dime	×	0.08
Atomic symbols are mapped to random high-dimensional vectors, and complex structures are built using three core operatio	×	0.04
VSAs implement a distributed yet compositional form of symbolic computation.	×	0.05

References

- <http://arxiv.org/abs/2601.01982v1>
- <http://arxiv.org/abs/2512.14709v1>

- <http://arxiv.org/abs/2603.09200v1>