A Structural Framework for Context Engineering in Language Models

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Abstract

This paper proposes a formal methodological framework for context engineering, enabling interpretable and verifiable management of natural language inputs across languages and tasks. The framework introduces a three-layer structure—Interpreter Layer, Schematic Layer, and Conceptual Layer—with an additional proposed Reasoning Layer. This hierarchical structure moves beyond memory stacking, modeling context in abstracted and transferable ways to support consistent downstream reasoning and explainability.

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1 Introduction

Large language models (LLMs) rely heavily on contextual input for performance. However, current techniques often treat context as raw token memory, resulting in opaque and unstructured representations. This work proposes a shift to structured context modeling using a layered framework.

2 Methodology

2.1 Interpreter Layer

Transforms natural language into a finite set of sentence-level logical patterns:

- "Assume A → therefore B"
- "But C → B does not hold"
- "Result = D"

This abstracts language into functional logical units.

2.2 Schematic Layer

Defines logical structure over sentence patterns. Abstracts away semantic content into structural placeholders (e.g., subject/predicate/object) and their relations (causal, adversarial, conditional).

2.3 Conceptual Layer

Maps schema into cross-linguistic conceptual nodes, replacing tokens with language-independent concepts. Ensures explainability and transferability.

2.4 Reasoning Layer (Proposed)

Models inference as "schema × concept pool" expansion. Allows logical propagation by structurally guided conceptual filling. Principle: inference is structure-driven, not token-chained.

3 Core Ideas

(1) **De-contentization:** Structure first, semantics second.
(2) **Cross-linguistic universality:** Pattern and concepts are language-agnostic.
(3) **Explainability:** Transparent linkage from input to structured reasoning.

4 Related Work

Works on prompt engineering, chain-of-thought prompting, and schema-guided dialogue inspired this framework. Unlike prior work, our approach formally decouples linguistic content from structural context representation.

5 Conclusion

This paper introduces a structural and conceptual approach to context engineering. The proposed framework reduces reliance on memory length, increases explainability, and provides a reusable and cross-linguistic model of context for large language models.

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