Note on Tree of Thoughts: Deliberate Problem Solving with Large Language Models

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1 Motivation

Shortcoming of current paradigm-original autoregressive mechanisms: Current LLMs fall short in tasks that require exploration, strategic lookahead, or where initial decisions play a pivotal role.

Analogous to the two modes of human thought, the simple associative token-level choices of LMs are reminiscent of "System 1"- a fast, automatic, unconscious mode. Thus might benefit from augmentation by a more delibrate "System 2" which can

- maintains and explores diverse alternatives for current choices instead of just picking one
- evaluates its current status and actively looks ahead or backtracks to make more global decisions

This paper the **Tree of Thoughts** (TOT) framework for general problem solving with LMs.

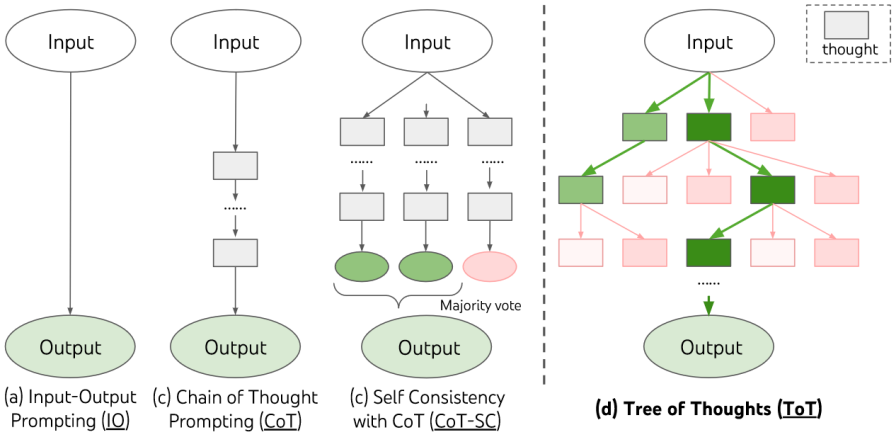

Figure 1: Schematic illustrating various approaches to problem solving with LLMs. Each rectangle box represents a thought, which is a coherent language sequence that serves as an intermediate step toward problem solving.

As Figure 1 illustrates, while existing methods (detailed below) sample continuous language sequences for problem solving, ToT actively maintains a tree of thoughts, where each thought is a coherent language sequence that serves as an intermediate step toward problem solving (Table 1)

Finally, This paper combine this language-based capability to generate and evaluate diverse thoughts with search algorithms, such as breadth-first search (BFS) or depth-first search (DFS), which allow systematic exploration of the tree of thoughts with lookahead and backtracking.

2 Background

	Game of 24	**Creative Writing**	**5 × 5 Crosswords**
Input	4 numbers (4 9 10 13)	4 random sentences	10 clues (h1. presented;..)
Output	An equation to reach 24(13-9)*(10-4)=24	A passage of 4 paragraphs ending in the 4 sentences	5x5 letters: SHOWN; WIRRA; AVAIL; ...
Thoughts	3 intermediate equations (13-9=4 (left 4,4,10); 10-4=6 (left 4,6); 4*6=24)	A short writing plan (1. Introduce a book that connects...)	Words to fill in for clues: (h1. shown; v5. naled; ...)
#ToT steps	3	1	5-10 (variable)

Table 1: Task overview. Input, output, thought examples are in blue