

# Landscape of Thoughts: Visualizing the Reasoning Process of Large Language Models

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**TLDR:** We introduce the first visualization tool to inspect the language models' reasoning paths

Arxiv: <https://arxiv.org/abs/2503.22165>

Huggingface: <https://huggingface.co/papers/2503.22165>

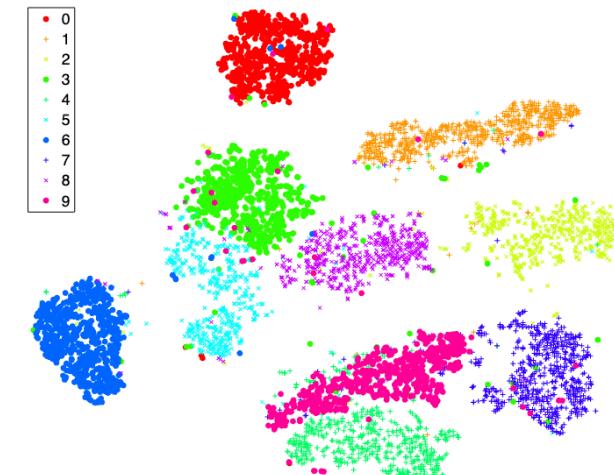
# Motivation: Why visualize?



The problem states that a car is being driven towards the base of a

Here are the step-by-step thoughts for each question: Question 1:

To solve the problem systematically, let's proceed step by step. The scenario involves a car being driven towards a tower, with the initial angle of elevation from the car to the top of the tower being  $45^\circ$ . As the car continues to move and the angle of elevation changes to  $60^\circ$ , the distance to the tower increases. Applying trigonometry, we know that the tangent of the angle of elevation is equal to the ratio of the tower's height ( $h$ ) to its base distance from the car. Initially, with an angle of  $45^\circ$ , we have  $\tan(45^\circ) = h / bT$ , which simplifies to  $1 = h / bT$ . Using the same approach for a new angle of  $50^\circ$ , we get  $\tan(50^\circ) = h / b$ , or equivalently,  $b = h / \tan(50^\circ)$ . The car stops when the angle of elevation changes due to the relative motion with respect to the tower's top, but since we're told the full process takes 10 minutes, we need to define intermediate times. Let  $x$  represent the time the car takes to travel from the initial position ( $t_1$ ) to the point where it's directly aligned with the tower's base. Using right triangles, and applying similar trigonometric relationships for the  $45^\circ$  and  $60^\circ$  ...



(a) Visualization by t-SNE.



(b) Visualization by Sammon mapping.

Figure 2: Visualizations of 6,000 handwritten digits from the MNIST data set.

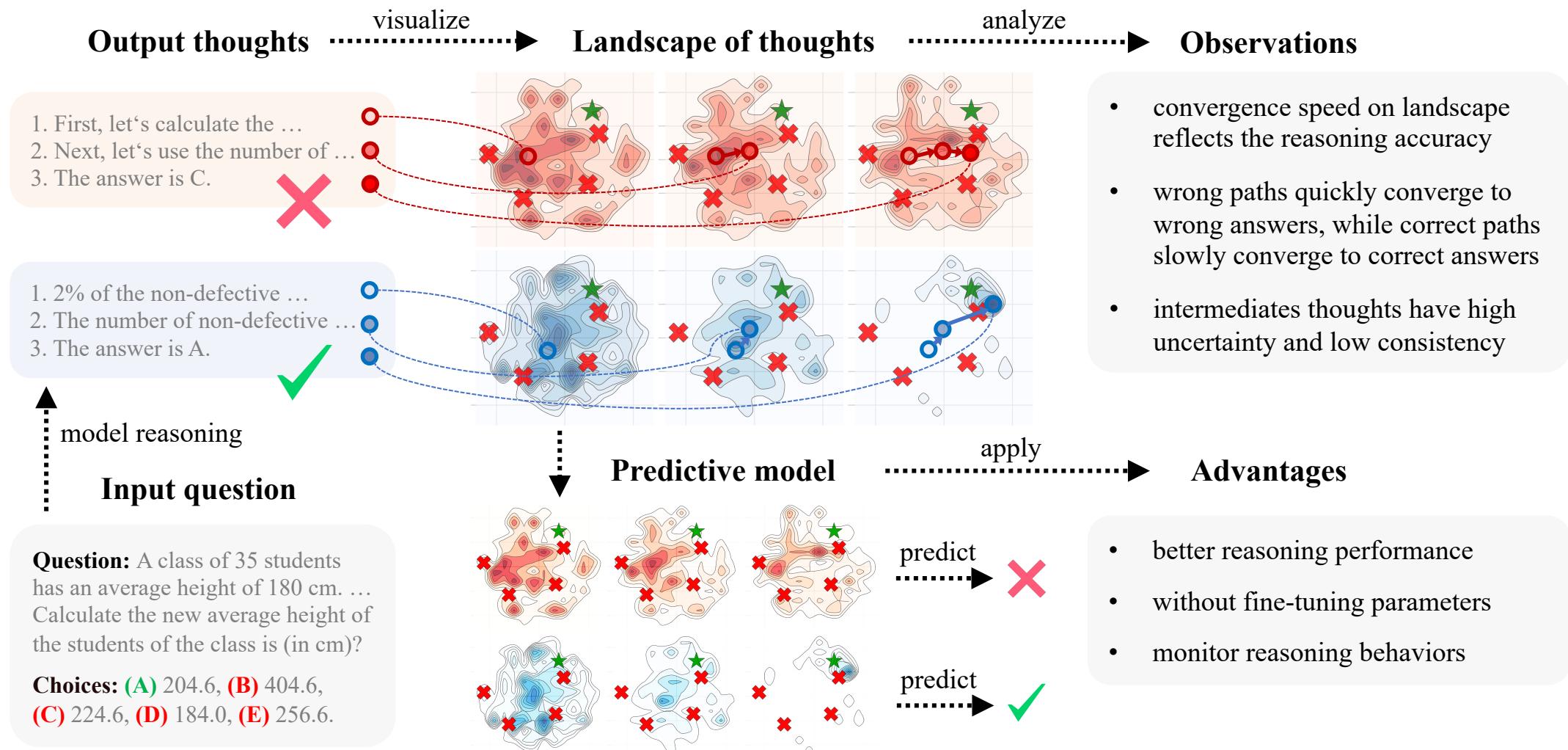
## Text-based analysis

*Tedious and time-consuming*

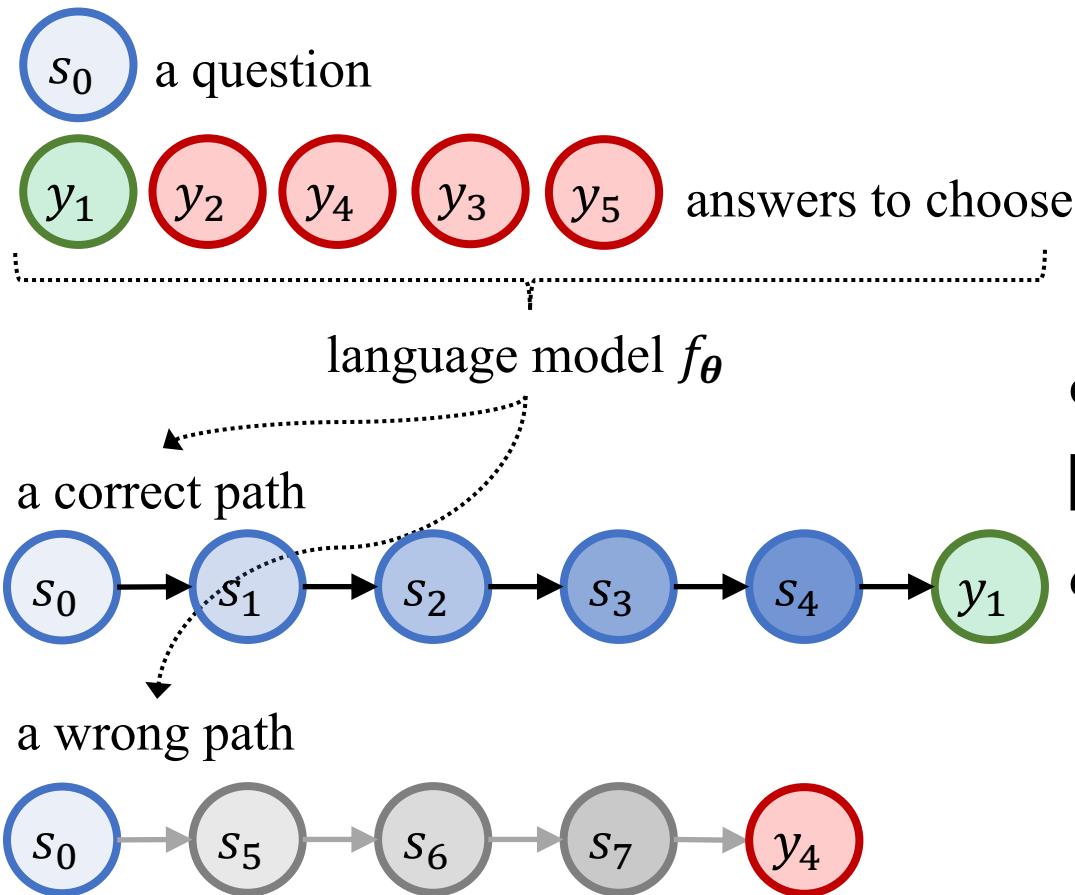
## Visualization analysis

*More easy and intuitive*

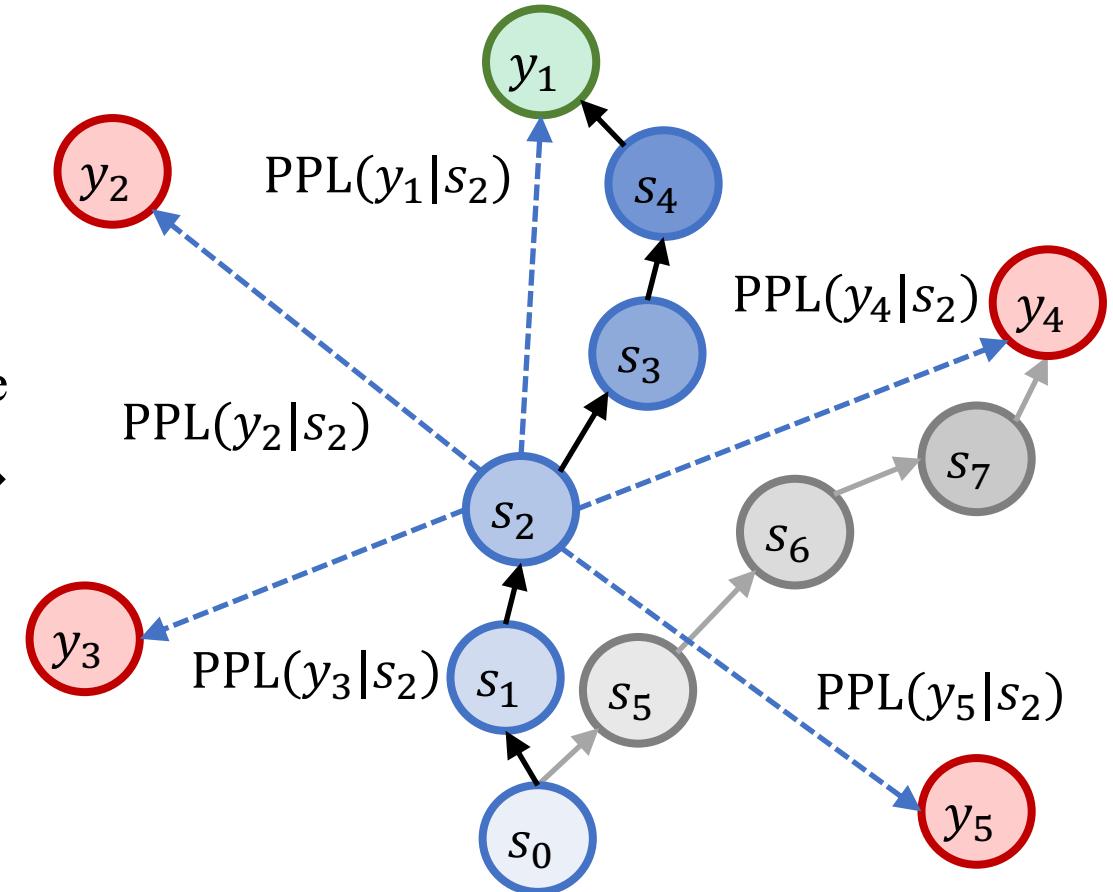
# Method: How visualize?



# Method: How visualize?



compute  
distance



Original thoughts (texts) → Feature of distance (values) → Low-dimensional representation (values)

# Observation: What visualize?

- Comparison across Reasoning Algorithms (CoT, ToT, L2M, MCTS)
- Comparison across Reasoning Tasks (AQuA, MMLU, StrategyQA, CommonSenseQA)
- Comparison across Language Models (Llama 1B, 3B, 8B, 70B)

