

MetaGPT Introduces Atom of Thoughts (AoT) for Efficient LLM Reasoning

Novel Markov framework breaks complex problems into history-independent "atoms," boosting performance and enabling smaller models to excel in reasoning tasks.

FRANCISCO, CA, UNITED STATES, April 21, 2025 /EINPresswire.com/ --Researchers from the MetaGPT opensource community, encompassing members from Hong Kong University of Science and Technology (GZ) and DeepWisdom, have today introduced the Atom of Thoughts (AoT), an innovative framework aimed at substantially improving the efficiency and robustness of large language



82.2

86.0

87.4

69.7

70.9

71.2

67.6

80.6

81.0

58.4

68.5

68.8

75.8

<u>80.8</u>

81.4

94.2

<u>95.0</u>

95.1

82.6

<u>83.6</u>

84.9

model (LLM) reasoning. This initiative seeks to address the computational inefficiencies and interference that arise from the excessive dependence of current methodologies on historical context.

AOT (*d*=1) + FoT (*n*=2)

AOT (Ours)

AOT * (Ours)

Contemporary reasoning methodologies, including Chain-of-Thought (CoT) and Tree-of-Thoughts (ToT), along with specialized reasoning models, frequently engage with extensive historical data at each stage of processing. The Approach of Atomic Thinking (AoT) presents a transformative shift, drawing inspiration from human "atomic thinking." It conceptualizes reasoning as a Markov process, wherein intricate challenges are iteratively distilled into manageable, self-sufficient "atomic problems" that are contingent solely upon the present state, thereby alleviating the necessity for historical context.

This is achieved through a two-stage state transition: Decomposition, where the current problem is broken into a dependency graph, and Contraction, where this graph is simplified into a new, equivalent atomic problem state. This iterative process focuses computational resources squarely on the essential reasoning task at hand. A key advantage of AoT is its plug-and-play nature. Its atomic problem states can seamlessly integrate with any existing reasoning framework, prompt strategy, or agent system, acting as a powerful pre-processor to simplify inputs while preserving answer equivalence. Experiments show that AoT enables models with shorter reasoning capabilities, such as gpt-4o-mini, to outperform specialized long-chain models on multi-hop question-answering tasks. When combined with stronger base models, AoT yields even more significant performance gains.

The AoT framework and its code are open-sourced, continuing the MetaGPT community's commitment to collaborative advancement in AI.

Read the paper on <u>arXiv</u> Access the code on <u>GitHub</u>

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