

Idea2Paper: Research Agents can Self-Improve by Discovering and Refining Research Techniques

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Large language models (LLMs) have shown remarkable capabilities in automating parts of the research process, yet most existing research agents rely on fixed, manually designed research strategies and lack the ability to improve themselves over time. In this work, we present Idea2Paper, a research agent framework that enables agents to self-improve by autonomously discovering and refining research techniques through iterative interaction with existing technical tools and resources. Instead of following predefined workflows, Idea2Paper allows agents to retrieve, query, and experiment with available tools, inducing reusable research techniques that progressively enhance research performance. We instantiate Idea2Paper across multiple research stages, including problem formulation, method exploration, and experimental design, and show that agents equipped with self-discovered techniques consistently outperform strong baselines with static strategies. Our results demonstrate that self-improvement emerges naturally from technique discovery and refinement, leading to more effective and scalable autonomous research. Overall, Idea2Paper highlights a promising direction toward adaptive research agents that continuously evolve their research capabilities rather than relying on fixed heuristics.

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1 Introduction

References

Appendix