

Advancing Automated Theorem Proving: Towards Research-Level Mathematics

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Automated theorem proving (ATP) stands at the intersection of computer science and mathematics, and has become an increasingly important domain for demonstrating the capabilities of large language models (LLMs). While current systems show strong performance on Olympiad-style problems, they often struggle to generalize to research-level mathematics, where deep structural and contextual understanding and long-range reasoning are essential.

In this talk, I will review the current landscape of ATP systems and highlight key challenges in scaling them to advanced mathematical domains. I will then present our recent work, which integrates a research-level autoformalization pipeline, an interactive proving environment, and dedicated premise retrieval system to substantially improve LLM generalization in formal mathematics, especially in algebra and other structurally rich areas. Finally, I will discuss how such systems can support the formalization community and contribute to the long-term goal of machine-assisted research-level theorem proving.