FIRST-ORDER THEOREM PROVING AND VAMPIRE

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First-order theorem proving is one of the earliest research areas within artificial intelligence and formal methods. It is undergoing a rapid development thanks to its successful use in program analysis and verification, security analysis, symbolic computation, theorem proving in mathematics, and other related areas. Breakthrough results in all areas of theorem proving have been obtained, including improvements in theory, implementation, and the development of powerful theorem proving tools. However, recent developments are not always easily accessible to non-specialists. This mini-lecture series aims to address this by introducing the audience to first-order theorem proving. The workhorse used for a demonstration of concepts discussed at the tutorial will be our award-winning theorem prover Vampire [1].

This lecture series will be split in two parts. The first part immediately helps the audience place the work in context by introducing them to an application of theorem proving in Vampire for validating mathematical theorems. The second part introduces the core concepts of automating first-order theorem proving in first-order logic with equality. We will discuss the resolution and superposition calculus [3, 2], introduce the saturation principle, present various algorithms implementing redundancy elimination, and demonstrate how these concepts are implemented in Vampire.

The tutorial is meant for graduate students, as well as for more experienced researchers in the field of formal methods. Participants are expected to have basic knowledge in first-order logic and formal methods. By the end of the tutorial, participants will have a better understanding in choosing the appropriate proving methodology for their specific application.

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References

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