

Master's thesis proposal

Cut elimination in focusing with selection

Context

One of the elements that explain the huge improvement of automated theorem provers in the recent years relies on the use of proof search methods in which the proof search space is very restricted. However, such restrictions should not compromise completeness of the proof search method: given a valid formula, the method should eventually find a proof. Among techniques used for restricting the proof search space, one can cite ordering and selection in methods based on Robinson's resolution; and focusing in sequent calculi, which lead to tableaux and inverse methods. A recent work [1] has shown how to link these two apparently unrelated techniques by slightly generalizing them both. This gives a framework called focusing with selection.

Focusing with selection is not complete in general. Indeed, it depends on how literals are selected in formulas. Completeness is actually equivalent to the admissibility of the cut rule in the focused sequent calculus with selection.

Subject

The goal of this internship is to develop criteria implying completeness of focusing with selection. In particular, it will be studied how completeness in focusing with selection can be reduced to completeness in deduction modulo theory [2], another framework which corresponds to particular instances of focusing with selection, and for which a great variety of techniques have been developed to show completeness. A way to show this reduction will be to study Pfenning's structural cut elimination [3] in focusing with selection, to see how cut admissibility (and hence completeness) can be related in focusing with selection and deduction modulo theory.

Practical informations

The internship will take place in the Laboratoire Spécification et Vérification of the ENS Paris-Saclay in Cachan. It will be supervised by Guillaume Burel, assistant professor at the Ensiie, temporarily assigned in Inria project-team Deducteam, guillaume.burel@ensiie.fr

References

- [1] Guillaume Burel. Linking focusing and resolution with selection. In Igor Potapov, Paul Spirakis, and James Worrell, editors, *MFCS 2018*, volume 117 of *LIPICs*, pages 9:1–9:14, Dagstuhl, Germany, 2018. Schloss Dagstuhl–Leibniz-Zentrum für Informatik.
- [2] Gilles Dowek, Thérèse Hardin, and Claude Kirchner. Theorem proving modulo. *Journal of Automated Reasoning*, 31(1):33–72, 2003.
- [3] Frank Pfenning. Structural cut elimination I. Intuitionistic and classical logic. *Information and Computation*, 157:84–141, 2000.