Extending Hyper Tableaux with Rigid E-Unification

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In [BFN96] we introduced a variant of clausal normal form tableaux called "hyper tableaux". Hyper tableaux keep many desirable features of analytic tableaux (structure of proofs, reading off models in special cases) while taking advantage of central ideas from (positive) hyper resolution: for the first, the calculus employs the "hyper-property", which means that in each inference step all negative literals of a clause are to be resolved away simultaneously. For the second, hyper tableaux make extensive use of universally quantified variables, thus enabling "subsumption" as the primary pruning technique. An implementation is available and showed very promising results.

In the talk we well report about ongoing work on two improvements of the basic calculus. The first improvement deals with a shortcoming of the basic calculus, which is the need for "purifying" substitutions in disjunctions of positive literals. In order to guarantee the soundness of the calculus, a disjunction of the form $P(x, y) \vee P(y, z)$ leads to two tableau branches containing literals $P(x, y)\pi$ and $P(y, z)\pi$, where π is a ground substitution for y. Such a technique is prohibitive if the Herbrand base explodes very quickly. In the talk we will sketch a solution to this problem which avoids the need for purifying substitutions while retains the positive features. For instance, the modified calculus still yields a decision procedure for the function-free case (unlike hyper resolution).

The second improvement is the extension with a dedicated inference rule for equality. We will use the completion-based method for mixed universal and rigid E-unification of [Bec94]. This procedure was developed to be used within free variable semantic tableaux, and its application within the modified hyper tableaux calculus is very natural. Its recent version [BP96] is in particular attractive because it improves the interaction between the foreground reasoner (i.e. hyper tableaux) and the equality reasoner by preserving the results of the completion procedure to subsequent calls to it.

References

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