Improving the efficiency of programs extracted via Gödel's Dialectica interpretation

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There exist several methods for extraction of functional programs from non-constructive proofs, such as Gödel's Dialectica interpretation [Göd58], Friedman-Dragalin's A-translation [Fri78], its refined variant [BBS02], and many others. As opposed to the case of constructive proofs, the use of classical principles requires more involved machinery to reveal the algorithmic content.

All of the above listed methods have been shown to be able to obtain correct and sometimes surprising algorithms. However, programs originating from the same proof can be very different. Little has been discussed about how the additional computational infrastructure introduced by the various techniques affects the time and memory efficiency of the obtained algorithms. Several authors have investigated how some deficiencies of extracted programs can be repaired by stripping irrelevant computation [Ber05,Mak06,Her07].

In the present talk we will discuss three levels of optimisation of terms extracted via Gödel's Dialectica interpretation:

1. reducing syntactic repetition of subterms;
2. removing redundant parameters;
3. memoising backtracking decisions.

We will explain how the suggested optimisations can lead to significant improvements in the readability and execution time of automatically obtained programs.

References

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