MAP-i Doctoral Program in Computer Science
Thesis Proposal

Title:

On Applying Tabling to Answer Set Programming

Brief Description:

Logic Programming (LP) languages, such as Prolog, provide a high-level, declarative approach to programming. Despite the power, flexibility and good performance that Prolog has achieved, the past years have seen wide efforts at increasing its declarativeness, expressiveness and efficiency. One proposal that has gained popularity is the use of tabling. In a nutshell, tabling consists of storing intermediate answers for subgoals so that they can be reused when a repeated subgoal appears. It can be shown that tabling based models are able to avoid looping, have better termination properties, and often significantly reduce the search space for logic programs. Currently, tabling is widely available in systems like XSB Prolog, Yap Prolog, B-Prolog, ALS-Prolog, and Mercury.

Another subarea of LP that is becoming one of the fastest growing fields in knowledge representation is Answer Set Programming (ASP). The basic idea of ASP is to represent a given problem by a logic program whose answer sets correspond to solutions, and then use an ASP solver for finding answer sets for the program. ASP solvers rely on a two phase implementation consisting of: elimination of variables for obtaining propositional programs (the grounding phase); and computation of answer sets for propositional programs. The computation phase can be decomposed into alternating deterministic and non-deterministic parts. For the non-deterministic parts we must branch on possible truth values for the undefined atoms. Since the number of choices determines an exponential search tree, ASP solvers utilize some heuristics to guide their choices. Tabling technology seems thus an excellent candidate to significantly reduce the search space for these kind of problems. Combining tabling with ASP is a challenging problem that will require novel and original contributions to the state-of-the-art.

The main goal of this work is to study how tabling technology can be used to improve the overall performance of ASP solvers. In particular, an important result of this research should be the design and implementation of an ASP system incorporating

tabling technology as a means to significantly reduce the search space for these kind of problems. With such a system combining the power of tabling with that of ASP, we expect to be able to improve the efficiency of particular complex combinatorial search problems, such as Product Configuration, Model Checking, Planning and Diagnosis problems.

Grants:

The proposed research work can be supported by a BI(Msc) research fellowship during 30 months in the context of the research project *`STAMPA - Sophisticated TAbling Mechanisms for Prolog and their Applications'* (more details about STAMPA in http://www.dcc.fc.up.pt/stampa).

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