Model-Based Knowledge Representation and Reasoning Via Answer Set Programming

Torsten Schaub*

Universität Potsdam, Institut für Informatik,
August-Bebel-Str. 89, D-14482 Potsdam, Germany
`torsten@cs.uni-potsdam.de`

Abstract. The field of knowledge representation and reasoning has been going through a methodological shift during recent years. While the past was dominated by query-oriented reasoning, model-based techniques become more and more popular nowadays. This development was primarily driven by the availability of highly efficient Boolean constraint solvers, like satisfiability and answer set solvers. The general idea is to translate an application problem into a logical specification. This specification is in turn passed to a solver, which outputs models representing solutions to the initial application problem.

The talk will provide an introduction to answer set programming (ASP), its proof-theoretic foundations, methodology, implementation techniques along with a glimpse of an exemplary application. Besides knowledge representation and reasoning, ASP has its roots in deductive databases, nonmonotonic reasoning, and logic programming. Applications are specified in ASP in terms of sets of logical rules. Modern ASP solvers rely on high-performance Boolean constraint solving techniques, which allow them to tackle application domains consisting of millions of variables. Meanwhile, this approach proved to be an effective tool in a range of applications, like planning, model checking, and bio-informatics.

References

1. Gelfond, M., Lifschitz, V.: The stable model semantics for logic programming. In: Kowalski, R., Bowen, K. (eds.) *Proceedings of the Fifth International Conference and Symposium of Logic Programming (ICLP 1988)*, pp. 1070–1080. MIT Press, Cambridge (1988)
2. Niemelä, I.: Logic programs with stable model semantics as a constraint programming paradigm. *Annals of Mathematics and Artificial Intelligence* 25(3-4), 241–273 (1999)
3. Marek, V., Truszczyński, M.: Stable models and an alternative logic programming paradigm. In: Apt, K., Marek, W., Truszczyński, M., Warren, D. (eds.) *The Logic Programming Paradigm: A 25-Year Perspective*, pp. 375–398. Springer, Heidelberg (1999)

4. Baral, C.: Knowledge Representation, Reasoning and Declarative Problem Solving. Cambridge University Press, Cambridge (2003)
5. Anger, C., Konczak, K., Linke, T., Schaub, T.: A glimpse of answer set programming. *Künstliche Intelligenz* 19(1), 12–17 (2005)
6. Ferraris, P., Lifschitz, V.: Mathematical foundations of answer set programming. In: Artémov, S., Barringer, H., d’Avila Garcez, A., Lamb, L., Woods, J. (eds.) *We Will Show Them! Essays in Honour of Dov Gabbay*, vol. 1, pp. 615–664. College Publications (2005)
7. Gebser, M., Liu, L., Namasivayam, G., Neumann, A., Schaub, T., Truszczyński, M.: The first answer set programming system competition. In: Baral, C., Brewka, G., Schlipf, J. (eds.) *LPNMR 2007. LNCS (LNAI)*, vol. 4483, pp. 3–17. Springer, Heidelberg (2007)
8. Gelfond, M.: Answer sets. In: *Handbook of Knowledge Representation*, Elsevier, Amsterdam (2008)