

Parallel and Distributed Hierarchical Planning

Projektgruppe „Praxis der Forschung“ – Wintersemester 2020/21

1 Projektbeschreibung

The research area of automated planning, sometimes called AI planning, deals with domain-independent problem resolution algorithms which identify a sequence of actions to execute in order to reach a goal from some particular initial world state [1]. Many combinatorial search problems can be expressed as planning problems.

Hierarchical planning models [2] enhance the expressive power of planning with domain-dependent expert knowledge provided by the domain modeler. Two important merits of such an extension are that (i) search space becomes much more restricted and hence manageable and (ii) a well-structured and easily explainable plan arises from a solved problem. The most common realization of hierarchical planning is called Hierarchical Task Network (HTN) planning. In the last few years numerous efficient HTN planners with differing expressive power and various solving paradigms – forward search through state space, flaw-driven search through the space of possible plans, or incremental reduction to propositional logic – have emerged. Yet, to our knowledge there has been few research regarding the efficient parallelization of these approaches.

As parallel processing power has become ubiquitous and distributed computing in the cloud gains popularity, we believe that a carefully designed parallel and distributed approach for HTN planning can greatly strengthen its practical usability.

In a preliminary analysis and literature research we will identify previous related approaches and find possible entry points, e.g. using established sequential HTN planners as an inspiration or as building blocks for our algorithm. Some planners already feature stages with good potential for parallelization such as the SAT solving backend of Lilotane [3].

We intend to achieve scalable performance in a distributed setting through the message passing interface (MPI). Depending on the progression of the project, we will possibly adapt our approach to support malleability, i.e., to gracefully handle a fluctuating number of computing nodes while solving a particular problem.

2 Literatur

- [1] Ghallab, M., Nau, D., & Traverso, P. (2016). Automated planning and acting. Cambridge University Press.
- [2] Bercher, P., Alford, R., & Höller, D. (2019). A Survey on Hierarchical Planning-One Abstract Idea, Many Concrete Realizations. In IJCAI (pp. 6267-6275).
- [3] Schreiber, D. (2020). Lifted Logic for Task Networks: TOHTN Planner Lilotane Entering IPC 2020. In International Planning Competition (IPC) 2020.

3 Kontakt / Betreuung

Dominik Schreiber

dominik.schreiber@kit.edu, Raum 209 (Geb. 50.34)