Efficient and Scalable Applications of Logic (DE/EN)

Within the broad topic of efficient and scalable applications for (propositional) logic reasoning, changing topics are available on request in the following areas:

High Performance SAT Solving

Our massively parallel SAT solving engine named **mallob** scored the 1st place in the Cloud Track of the International SAT Competition 2020, but still has room for numerous improvements, such as finding a way to automatically select a solver portfolio on a per-instance basis, and exploring more promising approaches to diversify individual solvers.

Malleable Scheduling of Logic Applications

The platform mallob not only solves one propositional formula at a time, but offers a generic interface to solve several problems at once on a set of computing nodes and distributes them automatically using randomized distributed algorithms. Thereby a key technology is the ability of the application to support a fluctuating number of compute nodes during the calculation (→ Malleability). In addition to SAT Solving, malleable interfaces for further applications can be explored, such as automated planning, SMT solving or other logic applications.

Hierarchical Automated Planning

Our planning system **Lilotane** solves hierarchical planning problems by reducing them to propositional logic without performing an expensive preprocessing previous approaches rely on. As such Lilotane scored the 2nd place in the Total Order Track of the International Planning Competition 2020. Several aspects of this approach can be improved and extended, such as finding optimal plans, extending the underlying planning model, researching alternative SAT encodings, and improving the pruning inside the planning problem's instantiation.

Requirements and Organization

For most of the topics solid programming skills in C++ are required (depending on the project, these skills can be acquired over the course of the project). For topics with parallel / distributed programming, basic knowledge with MPI is recommended.

A thesis can be supervised in German or English and should be written in English. If interested, please contact Dominik Schreiber ⟨dominik.schreiber@kit.edu⟩.

References

mallob : https://github.com/domschrei/mallob
Lilotane : https://github.com/domschrei/lilotane