Project proposal

Mudathir Mahgoub

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1   Solver for propositional dynamic logic formulas

The idea of the project is to implement a solver for formulas in propositional dynamic logic (PDL). The input would be a formula in PDL and optionally a kripke frame for that formula. The output result is either *unsat*, *sat* or *unknown*. To check the validity of a formula, the input would be its negation, and it is valid if the result is *unsat*. If a kripke frame is given, the result scope would be restricted to this kripke frame. Otherwise, the result scope would be all kripke frames.

2   Implementation

The project is primarily code and would use the SMT solver CVC4 as a back end and apply the relation theory to implement the semantics of PDL. The project would import CVC4 abstract syntax tree (AST) for relations from another project that I am working on (Alloy2SMT translator[1]) which supports type checking and SMT models parsing, albeit it needs some refactoring to be more generic. For this project I would write a translator from PDL AST to CVC4 AST and display back the SMT models returned from CVC4 as Kripke frames and dot files for visualization using software like graphvis.

3   Progress so far

Since CVC4 AST is written in Java, I am using Java for this project along with gradle[2]. I have written an ANTLR4 grammar for PDL following the syntax in chapter 5 in [1]. The grammar also handles a kripke frame written using the set notation in chapter 5 with one difference ($m_{\mathfrak{K}}(a)$ would be written as $m(a)$). Lastly I prepared classes for PDL AST for formulas and programs. Next tasks are parsing PDL formulas into PDL AST and translating this AST into CVC4 AST.

4   Preferences for presentation day

I prefer April 30 for my presentation day.

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[1] https://github.com/CVC4/org.alloytools.alloy/tree/cvc4/alloy2smt
[2] https://github.com/mudathirmahgoub/pdl

References

[1] David Harel, Jerzy Tiuryn, and Dexter Kozen. *Dynamic Logic.* MIT Press, Cambridge, MA, USA, 2000.