Software Modeling and Verification Chair

RWTH AACHEN UNIVERSITY

— Master's Thesis —

Combining the best of parametric worlds

What is it all about

Timed automata are automata extend with a finite set of real-valued clocks. During a run of a timed automaton, clock values increase all with the same speed. Along the transitions of the automaton, clock values can be compared to integers. These comparisons form guards that may enable or disable transitions and by doing so constrain the possible behaviors of the automaton. Further, clocks can be reset. Parametric Timed Automata extend normal timed automata by allowing parameters to occur in the clock constraints[vid]. Verification of these is presented in e.g. [HRSV01].
Probabilistic timed automata combine the features of timed automata, to capture hard continuous real-time behaviour with nondeterministic time and choices, with those of Markov decision processes. Parametric probabilistic timed automata extend probabilistic timed automata by allowing parameters to occur in the probabilistic transitions [HKKS21].
We want to investigate what the combination of parametric probabilistic timed automata and parametric timed automata brings us and which problems may arise.
This will be joined work with Bram Kohlen, who is currently a PhD student at the University of Twente.

What is to be done?

1. Formalise the combination of parametric probabilistic timed automata and parametric timed automata;
2. Investigate current model checking techniques and see if and how they transfer to the new model type;
3. Discuss challenges and complexity on our new model type;
4. If time allows: investigate existing tools and implement model checking techniques for the new model type.

Requirements

- Solid background in theoretical computer science.
- Lectures on model checking and logic.

Contact

- Jip Spel, jip.spel@cs.rwth-aachen.de

References

[HKKS21] Arnd Hartmanns, Joost-Pieter Katoen, Bram Kohlen, and Jip Spel, Tweaking the odds in probabilistic timed automata, QEST, Lecture Notes in Computer Science, vol. 12846, Springer, 2021, pp. 39–58.

[HRSV01] Thomas Hune, Judi Romijn, Mariëlle Stoelinga, and Frits W. Vaandrager, Linear parametric model checking of timed automata, TACAS, Lecture Notes in Computer Science, vol. 2031, Springer, 2001, pp. 189–203.

[vid] https://www.youtube.com/watch?v=-xXS-8TchTM.