Master Thesis Topic

Probabilistic Abstractions for Model Checking

Motivation and Background

Model checking [1] is a formal technique for verification of temporal properties over a system or system model. The approach is severely impacted by the state explosion problem, where the size of the system to analyse grows exponentially. Techniques have been developed that attack this issues [2,3].

Probabilistic model checking aims at realizing similar verification activities over systems that behave probabilistically and non-deterministically. Previous abstractions techniques may or may not work in this case, which involves optimization problem solving at every step of the way—such data may likely not be abstracted away so easily.

Goals

The goal of the research is to create a technique that can abstract away details of a model that do not regard a property to be checked. This technique shall be implemented and tested against a current probabilistic model checker [4].

Description of the Task

The tasks of the thesis are

- to develop and implement a probabilistic abstraction technique.
- to apply this technique to the problem of probabilistic model checking, and analyse the impact on both completeness and soundness of the approach.

Research Type

Theoretical Aspects:	*****
Industrial Relevance:	**∗∗∗
Implementation	**∗∗∗

Prerequisite The student should be enrolled in the master of software engineering or master of computer science program, and has completed the required course modules to start a master thesis.

Skills required The student should have or be willing to acquire the following skills: graph theory, formal verification, formal modelling and temporal modal logics, probability theory, optimization problem solving. The student should also have, or want to learn, programming in Java and/or C.

References

[1] Christel Baier and Joost-Pieter Katoen. 2008. *Principles of Model Checking*. The MIT Press.

[2] Clarke, E., Grumberg, O. et. al, Counterexample-Guided Abstraction Refinement for Symbolic Model Checking, CAV 2000

[3] E. Emerson and T. Wahl. Dynamic symmetry reduction. In Proc. TACAS'05

[4] A. Hinton, M. Kwiatkowska, G. Norman, and D. Parker. PRISM: A tool for automatic verification of probabilistic systems. In TACAS'06

Contacts

Esteban Pavese, Humboldt-Universität zu Berlin, Institut für Informatik, Lehrstuhl Software Engineering, Unter den Linden 6, 10099 Berlin, Germany

Application Please contact me during my office hours or write an email with the title: "[Thesis]-Probabilistic Slicing" to se-career@informatik.hu-berlin.de