

Tree Automata for Reachability in Rewriting

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1 Topic

Computing or approximating *reachable terms* has many applications in rewriting (termination proof, complexity analysis, confluence proof) and outside rewriting (model-checking of infinite-state systems, abstract interpretation of programs). *Tree automata* are a formalism well adapted to tackle this goal because they make it possible to finitely represent the set of reachable terms which is generally infinite.

- finite automata on trees, their properties and their operations.
- sets of normal forms
- term rewriting systems preserving regularity (automata that are locally closed w.r.t. rewriting)
 - known left-linear term rewriting system classes preserving regularity: from ground to path overlapping.
 - the tree automata completion algorithm which computes reachable terms for those classes.
 - how to relax the left-linearity restriction?
- over and under-approximations of reachable terms and their applications to program verification.

Applications to termination proof and complexity analysis will be presented by Johannes Waldmann in his “Weighted Automata and Rewriting” course for ISR2017.

2 About the course format

I will present definitions and theorems on slides. Most of the practical exercises will be done, interactively, using the `Timbuk`¹ tree automata library. I will provide either the source or an online version of the library.

3 About the speaker

Thomas Genet is working on reachability for term rewriting since 1998. He is a member of the program verification group of the IRISA lab at Université de Rennes 1. He applied reachability to verification problems ranging from the security of industrial cryptographic protocols to the static analysis of Java bytecode programs.

¹ <http://people.irisa.fr/Thomas.Genet/timbuk>