14. Meeting of the

IFIP WG 1.6 on Term Rewriting

May 28, 2012, Nagoya, Japan

09:00 − 09:30 Ashish Tiwari:
Rewriting, Flux-Balance Analysis, and Growing Microbial Organisms

09:30 − 10:00 Hélène Kirchner:
Rewriting and Visualization for Huge Dynamic Graphs

10:00 − 10:30 Coffee Break

10:30 − 11:00 Nao Hirokawa:
A Rewriting Solution to the Parsing Problem

11:00 − 11:30 Bernhard Gramlich:
On Modularity of Termination Properties of Rewriting under Strategies

11:30 − 12:00 Aart Middeldorp (chair):
Discussion on Rewriting-Related Conferences

12:00 − 13:30 Lunch

13:30 − 14:00 Frédéric Blanqui:
Computability Closure: the Swiss knife of Higher-Order Termination

14:00 − 14:30 Kristoffer Rose:
Practical Rewriting with Higher Order Abstract Syntax

14:30 − 15:00 Hans Zantema (chair):
Discussion on Open Problems in Rewriting

15:00 − 15:30 Vincent van Oostrom (chair):
Discussion on Funding for Rewriting-Related Projects

15:30 − 16:00 Coffee Break

16:00 − 16:30 Aart Middeldorp / Vincent van Oostrom (chairs):
Discussion on ISR

- Salvador Lucas: *Report on ISR 2012 in Valencia*
- Claude Kirchner: *Proposal for ISR 2014 in Valparaiso*
- Aart Middeldorp: *Proposal for ISR 2014 in Leipzig*

16:30 − 17:00 Hans Zantema (chair):
Business Meeting (for members of the WG only)

Ashish Tiwari: *Rewriting, Flux-Balance Analysis, and Growing Microbial Organisms*

Given a term rewriting system R and two terms s and t, the reachability problem is concerned with deciding if t is reachable from s using the rewrite rules in R.

While it is undecidable in general, reachability is decidable in some special cases. A particularly interesting case is reachability in Petrinets, which are ground rewriting systems over a signature containing AC symbols. In this special case, reachability is decidable, but its complexity is prohibitive. The metabolic network of a microbe can be almost automatically derived from its genetic data, which in turn can be obtained by sequencing its genome. The obtained metabolic network is a Petrinet, and questions related to the organisms growth in a particular nutrient media can be cast as a reachability problem.

Flux-balance analysis is a popular technique for answering questions about the metabolic network of an organism. It is a constraint-based approach for solving the reachability problem approximately. In this talk, we describe a modified flux-balance approach for predicting minimal nutrient sets for an organism based on its metabolic network. We describe the results obtained by applying the algorithm to E. Coli. The results include the surprising prediction of growth by E. Coli on cynate as a sole carbon and nitrogen source, which was also experimentally confirmed.

Hélène Kirchner: *Rewriting and Visualization for Huge Dynamic Graphs*

The talk will present a visual graph rewriting environment that combines rewriting and graph visualization techniques with the objective to handle the huge size challenge of some applications modeled by dynamically evolving graphs.

Domain experts can design graphical models, use simulation to compute or check postulated properties and make testable predictions about possible outcomes. We present the features of our visual environment that allow users to simulate, visualize and manipulate the system on both a global and local scale.

We describe the current state of the project, its outputs and the next research problems to solve.

Nao Hirokawa: *A Rewriting Solution to the Parsing Problem*

The fundamental problem of parsing is resolving the nondeterminism of when to apply grammar rules. In this presentation, based on a joint work with Aaron Stump, we show how powerful methods from term rewriting can be applied to provide new solutions to this problem. The heart of our approach is Knuth-Bendix completion. We derive rewrite systems from context-free grammars in such a way that the system will rewrite input strings to their parse trees. Then we use completion to compute an equivalent complete system, thus resolving the grammar's nondeterminism.

Bernhard Gramlich: *On Modularity of Termination Properties of Rewriting under Strategies*

The modularity of termination and confluence properties of term rewriting systems has been extensively studied, for disjoint unions and other more general types of combinations. However, for rewriting under strategies the theory is less well explored. Here we extend the modularity analysis of termination properties systematically to (variants of) innermost and outermost rewriting. It turns out that - as expected - in essence innermost rewriting behaves nicely w.r.t. modularity of termination properties, whereas this is not at all the case for outermost rewriting, at least not without

further assumptions. (Joint work with Klaus Györgyfalvay)

Frédéric Blanqui: *Computability Closure: the Swiss knife of Higher-Order Termination*

I will recall the notion of computability introduced by Tait (1967) and Girard (1971) for proving the termination of beta-reduction in typed lambda-calculi, and show how it can be extended to deal with various forms of higher-order rewrite relations, and how it can be related with other notions or techniques too.

Kristoffer Rose: *Practical Rewriting with Higher Order Abstract Syntax*

I show how higher order rewriting is used for manipulating a higher order abstract syntax representation of a low level data flow code generation notation used in a production compiler. What coding patterns should we make easy in rewriting to support it? How do we interface rewriting, in practice as well as formally, to helper components such as SAT/SMT solvers and Hash indexers?