20. Jahrestagung der GI-Fachgruppe „Logik in der Informatik“

8.–9. November 2013, Bremen

Tagungsort:

Cartesium, Rotunde
Universität Bremen
Enrique-Schmidt-Straße 5
28359 Bremen

siehe auch Lageplan auf der vorletzten Seite

Homepage:

`http://tinyurl.com/loginf2013`

Mit freundlicher Unterstützung von:

Gesellschaft für Informatik

Universität Bremen

Deutsches Forschungszentrum für Künstliche Intelligenz GmbH

SFB/TR 8 SPATIAL COGNITION

Programm

Freitag, 8. 11. 2013

14:00–15:00	Christel Baier, TU Dresden *Quantitative Analysis of Randomized Systems and Probabilistic Automata*
15:00–15:25	Karin Quaas, Universität Leipzig *Ehrenfeucht-Fraïssé Games for* TPTL *and* MTL *over Non-Monotonic Data Words*
15:25–15:50	Helmut Seidl, TU München *Parametric Strategy Iteration*
15:50–16:10	Kaffeepause
16:10–17:10	Manuel Bodirsky, LIX Palaiseau *The Logic* MMSNP_2 *and Constraint Satisfaction with Infinite Templates*
17:10–17:35	Irina Schindler, Universität Hannover *Parameterized Complexity Results for Propositional Circumscription*
17:35–18:00	Johannes Ebbing, Universität Hannover *Extended Modal Dependence Logic EMDL*
18:00–18:30	Mitgliedertreffen der Fachgruppe und Wahl der Fachgruppenleitung
20:00–	Abendessen im Restaurant „Bandonion“ *Wegbeschreibung siehe Ende des Dokuments*

Samstag, 9. 11. 2013

9:00–10:00	Wim Martens, Universität Bayreuth *The Logic and Illogic of SPARQL Property Paths*
10:00–10:25	Thomas Zeume, Universität Dortmund *Dynamic Conjunctive Queries*
10:25–10:45	Kaffeepause
10:45–11:10	Lew Gordeew, Universität Tübingen/Universiteit Gent/PUC-Rio *Toward Optimal Encoding of Terms and Proofs*
11:10–11:35	Christoph Lüth, Universität Bremen/DFKI Bremen *Foundations and Applications of Hierarchical Proofs*
11:35–12:00	Stefan Milius, Universität Erlangen-Nürnberg *Coalgebras and Generalized Regular Expressions*
12:00–12:20	Kaffeepause
12:20–12:45	Roy Mennicke, TU Ilmenau *Model Checking Concurrent Recursive Programs*
12:45–13:10	Mathias Soeken, Universität Bremen *Bounds for the Number of Toffoli Gates in Reversible Logic Circuits*

Internetzugang: Die Universität Bremen ist an *eduroam* beteiligt. Für Teilnehmende ohne *eduroam*-Zugang halten wir Gastzugänge zum lokalen WLAN bereit – bitte sprechen Sie uns an.

Christel Baier, TU Dresden

Quantitative Analysis of Randomized Systems and Probabilistic Automata

The automata-based model checking approach for randomized distributed systems relies on an operational interleaving semantics of the system by means of a Markov decision process and a formalization of the desired event E by an ω-regular linear-time property, e.g., an LTL formula. The task is then to compute the greatest lower bound for the probability for E that can be guaranteed even in worst-case scenarios. Such bounds can be computed by a combination of polynomially time-bounded graph algorithm with methods for solving linear programs. In the classical approach, the "worst-case" is determined when ranging over all schedulers that decide which action to perform next. In particular, all possible interleavings and resolutions of other nondeterministic choices in the system model are taken into account.
As in the nonprobabilistic case, the commutativity of independent concurrent actions can be used to avoid redundancies in the system model and to increase the efficiency of the quantitative analysis. However, there are certain phenomena that are specific for the probabilistic case and require additional conditions for the reduced model to ensure that the worst-case probabilities are preserved. Related to this observation is also the fact that the worst-case analysis that ranges over all schedulers is often too pessimistic and leads to extreme probability values that can be achieved only by schedulers that are unrealistic for parallel systems. This motivates the switch to more realistic classes of schedulers that respect the fact that the individual processes only have partial information about the global system states. Such classes of partial-information schedulers yield more realistic worst-case probabilities, but computationally they are much harder. A wide range of verification problems turns out to be undecidable when the goal is to check that certain probability bounds hold under all partial-information schedulers.

Karin Quaas, Universität Leipzig

Ehrenfeucht-Fraïssé Games for TPTL and MTL over Non-Monotonic Data Words

joint work with Claudia Carapelle, Shiguang Feng, and Oliver Fernandez Gil

Metric Temporal Logic (MTL) and Timed Propositional Temporal Logic (TPTL) are prominent extensions of Linear Temporal Logic to specify properties about data languages. In this paper, we consider the class of data languages of non-monotonic data words over the natural numbers. We prove that, in this setting, TPTL is strictly more expressive than MTL. To this end, we introduce Ehrenfeucht-Fraïssé (EF) games for MTL. Using the EF game for MTL, we also prove that the MTL membership decision problem ("Given a TPTL-formula, can the language defined by this formula be expressed in MTL?") is undecidable. We also define EF games for TPTL and show the effect of various syntactical restrictions on the expressiveness of MTL and TPTL.

Helmut Seidl, TU München

Parametric Strategy Iteration

Sensitivity analysis of programs asks how the behavior of the program is affected by the parameters of the program. Likewise, *mode analysis* asks for regions of the parameter space where the program behaves qualitatively differently. In order to perform such analyses, we introduce *parametric strategy iteration* for parametric systems of integer equations. This generalization of strategy iteration for non-parametric systems of integer equations deals with parametric systems by means of *region trees*. Each required operation on these trees is polynomial-time if only constantly many parameters are involved. Parametric strategy iteration allows to construct *parametric integer interval analysis* as well as parametric analysis of differences of integer variables. It thus provides a general technique to realize sensitivity analysis and mode analysis if numerical properties of integer variables are of concern.

Manuel Bodirsky, LIX Palaiseau

The Logic MMSNP$_2$ and Constraint Satisfaction with Infinite Templates

Monotone Monadic Strict NP (MMSNP) is the fragment of monadic existential second-order logic where the first-order part is universal and monotone. This logic has been introduced in the context of Constraint Satisfaction Problems (CSPs) by Feder and Vardi, who showed that MMSNP has a complexity dichotomy if and only if finite-domain CSPs have a complexity dichotomy.

This talk is about the logic MMSNP$_2$, the variant of MMSNP where we additionally allow edge-quantification (à la Courcelle). It has been observed by Madelaine that every problem in MMSNP$_2$ can be described as a finite union of CSPs with a countably infinite omega-categorical template. For those templates, the so-called universal-algebraic approach to constraint satisfaction applies. We conjecture that MMSNP$_2$ has a complexity dichotomy, and sketch a strategy to prove that every problem in MMSNP$_2$ is polynomial-time equivalent to a finite-domain CSP. The strategy leads to research questions that are of independent interest in universal algebra and in Ramsey theory.

Irina Schindler, Universität Hannover

Parameterized Complexity Results for Propositional Circumscription

In this paper we investigate an application of Courcelle's theorem and the logspace version of Elberfeld et al. to the non-monotonic logic Circumscription. Here we will show how two obtain fixed-parameter time and space efficient results for parameterized versions of two circum-scriptive inference problems. Furthermore we prove that for a wide range of parameterizations several restricted fragments of these problems do not admit efficient fixed-parameter algorithms even for large classes like $\mathrm{XP}_{\mathrm{nu}}$ or $\mathrm{XL}_{\mathrm{nu}}$ under reasonable complexity assumptions.

Johannes Ebbing, Universität Hannover

Extended Modal Dependence Logic EMDL

In this paper we extend modal dependence logic MDL by allowing dependence atoms of the form $\mathrm{dep}(\varphi_1, \ldots, \varphi_n)$ where φ_i, $1 \leqslant i \leqslant n$, are modal formulas (in MDL, only propositional variables are allowed in dependence atoms). The reasoning behind this extension is that it introduces a temporal component into modal dependence logic. E.g., it allows us to express that truth of propositions in some world of a Kripke structure depends only on a certain part of its past. We show that EMDL strictly extends MDL, i.e., there exist EMDL-formulas which are not expressible in MDL. However, from an algorithmic point of view we do not have to pay for this since we prove that the complexity of satisfiability and model checking of EMDL and MDL coincide. In addition we show that EMDL is equivalent to ML extended by a certain propositional connective.

Wim Martens, Universität Bayreuth

The Logic and Illogic of SPARQL Property Paths

RDF and SPARQL are becoming increasingly popular and are bringing many new and interesting research challenges. During the development of these standards, the World Wide Web Consortium (W3C) does not necessarily always have all the cards on the table in order to make perfectly informed design decisions and therefore it partly relies on input from the research community. This is a very interesting situation for researchers since it can give the opportunity to immediately have research results incorporated into practice. In this talk I will discuss some experiences from our interaction with the W3C concerning the semantics of property paths in SPARQL. Property paths are a relatively new feature in SPARQL 1.1 and essentially correspond to regular expressions that should be evaluated over RDF graphs.

Thomas Zeume, Universität Dortmund

Dynamic Conjunctive Queries

joint work with Thomas Schwentick

In this talk we investigate classes of queries maintainable by conjunctive queries (CQs) and their extensions and restrictions in the dynamic complexity framework of Patnaik and Immerman. We study the impact of union, atomic negation and quantification on the dynamic expressiveness of CQs, for the standard semantics as well as for Delta-semantics. Furthermore the dynamic expressiveness of CQs is compared to the expressiveness of (static) FO.

Lew Gordeew, Universität Tübingen/Universiteit Gent/PUC-Rio

Toward Optimal Encoding of Terms and Proofs

Traditional tree-like description of basic objects in algebra, logic and proof theory is very often unnecessarily voluminous, as compared to dag-like representations thereof. It is shown how to formalize a natural idea of general tree-to-dag compressing functions and corresponding minimal-size dag-like representations (abbr.: *mdr*). In the case of term algebra the mdr's are uniquely determined; in the proof theoretic case the uniqueness fails in general. It turns out that mdr's can exponentially reduce the size of tree-like inputs. Generally the size of mdr is bounded by the number of pairwise distinct objects occurring as labels in the underlying tree. In the proof theoretic case (where labels are sequents) in order to overcome exponential speed-up of propositional cut elimination, it seems reasonable to upgrade dags to more sophisticated semidags, which leads to even more economical methods of proof encoding.

Christoph Lüth, Universität Bremen/DFKI Bremen

Foundations and Applications of Hierarchical Proofs

Hierarchical proofs (or hi-proofs) as introduced by Denney, Power and Tourlas are an attempt to abstract large proofs (as e.g. produced by theorem provers) with respect to their hierarchical structure. Hi-proofs take the hierarchical structure of the proofs as primary; the idea is that this structure explicates the organisation and construction of the proof, thus making information explicit which is implicit in the unstructured proof-tree. We give an introduction to this work, along with latest developments on querying and transforming hi-proofs.

Stefan Milius, Universität Erlangen-Nürnberg

Coalgebras and Generalized Regular Expressions

Coalgebras provide a uniform framework for studying dynamical systems, including several types of automata. In this talk, I will present a setting in which one can make use of the coalgebraic view on systems extend a regular expression calculus for bisimilarity to one for a new and coarser coalgebraic language equivalence; the latter equivalence arises from a generalized powerset construction that determinizes coalgebras. We show that soundness and completeness are established by proving that expressions modulo axioms of a regular expression calculus form the rational fixpoint of the functor F describing the "determinized" part of the type FT of the systems one wants to reason about, where T is a monad describing the branching of the systems (e.g. non-determinism, weights, probability etc.). As an application, I consider weighted automata, and I present a new sound and complete expression calculus for weighted language equivalence. As a special case, we obtain non-deterministic automata, where we recover Rabinovich's sound and complete calculus for language equivalence.

Roy Mennicke, TU Ilmenau

Model Checking Concurrent Recursive Programs

In the spirit of Gabbay, Hodkinson and Reynolds, a temporal logic is MSO-definable if its modalities can be described using formulas from monadic second-order logic. We consider two bounded versions of the model checking problem of a fixed MSO-definable temporal logic TL specifying properties of multiply nested words, i.e., of runs of pushdown automata with multiple stacks. One of the problems asks, given a multi-stack system A, a temporal formula F from TL, and a bound k, whether all nested words w which are accepted by A and whose split-width is bounded by k satisfy F. The notion of bounded split-width, recently introduced by Cyriac, Gastin, and Narayan Kumar, is a convenient characterization of the sets of multiply nested words whose MSO-theory is decidable. If each modality of TL is $\mathrm{M}\Sigma(n)$-definable, i.e., if each modality can be defined by a formula from the n-th level of the monadic quantifier alternation hierarchy, then we are able to show that this problem can be solved in $(n+1)$-fold exponential time. Conversely, for every $n \geqslant 1$, we prove that there exists an $\mathrm{M}\Sigma(n)$-definable temporal logic whose satisfiability problem is hard for n-fold exponential space. Regarding the other model checking problem considered, we require w to be a k-scope nested word where scope-boundedness is a notion due to La Torre and Napoli. In this case, we can infer the same lower and upper bounds.

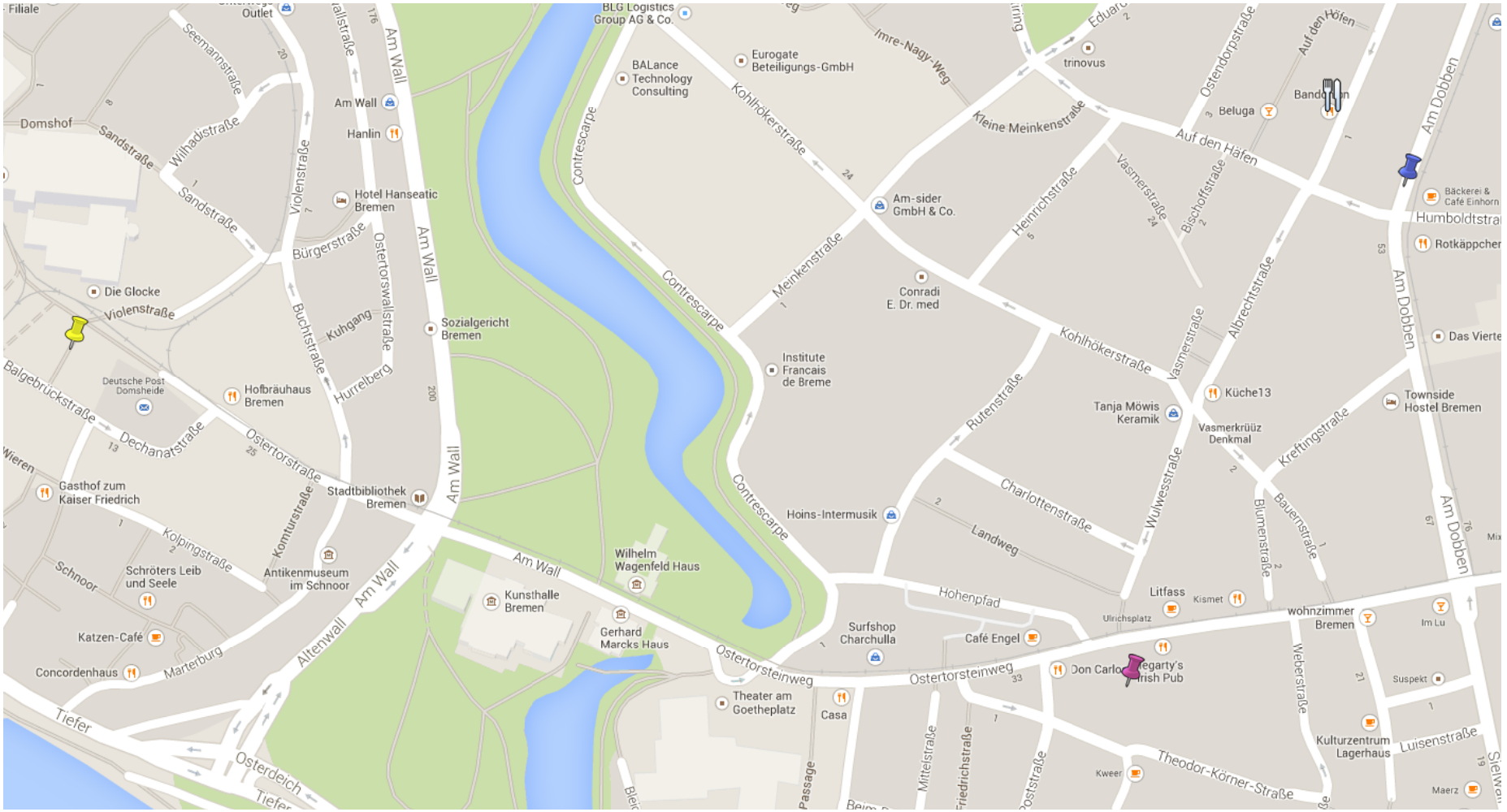
Mathias Soeken, Universität Bremen

Bounds for the Number of Toffoli Gates in Reversible Logic Circuits

Joint work with Nabila Abdessaied, Rolf Drechsler, and Michael K. Thomsen

We refer to functions in the set $\mathcal{R}_n = \{f : \{0,1\}^n \to \{0,1\}^n \mid f \text{ bijective}\}$ as *reversible functions* on n variables. *Synthesis* is the problem of finding a sequence of reversible functions $g_1, g_2, \ldots, g_k$ such that $f = g_1 \circ g_2 \circ \cdots \circ g_k$ where '$\circ$' denotes decomposition and each g_i is from a *gate set* $G \subseteq \mathcal{R}_n$. G is called *universal* if such a sequence exists for all functions. The length of the smallest sequence for a given function f and a given gate set G is denoted $\|f\|_G$.
Toffoli gates $\mathcal{T}_n$ are a universal gate set and have the form $g(x_1, \ldots, x_n) = (x_1, \ldots, x_{i-1}, x_i \oplus x_{c_1} x_{c_2} \cdots x_{c_\ell}, x_{i+1}, \ldots, x_n)$ for some $i \in \{1, \ldots, n\}$ and $x_i \notin \{x_{c_1}, \ldots, x_{c_\ell}\}$. We are interested in determining $\|\mathcal{R}_n\|_{\mathcal{T}_n} = \max\{\|f\|_{\mathcal{T}_n} \mid f \in \mathcal{R}_n\}$. A lower bound is given by $\log_{|\mathcal{T}_n|} |\mathcal{R}_n| \leq \|\mathcal{R}_n\|_{\mathcal{T}_n}$. In the talk, we are presenting upper bounds for $\|\mathcal{R}_n\|_{\mathcal{T}_n}$ based on synthesis algorithms and illustrate research directions in order to determine an exact value for $\|\mathcal{R}_n\|_{\mathcal{T}_n}$.

Lageplan. Tagungsgebäude *Cartesium*: C2. Straßenbahn: *Universität Zentralbereich* C2 neben Mensasee.



Restaurant Bandonion
Gertrudenstraße 37, 28203 Bremen, Tel. 0421 71832, bandonion-bremen.de

Straßenbahnhaltestelle Humboldtstr.
Linie 10

Straßenbahnhaltestelle Wulwesstraße/Ulrichsplatz

Straßenbahn- und Bushaltestellen Domsheide
Linien 2, 3, 4, 6, 8, 10, 24, 25

Stadtplanausschnitt mit Restaurant *Bandonion*.

Ab Universität: Straßenbahn 6 bis Hauptbahnhof, dann Straßenbahn 10 (Richtung Sebaldsbrück) bis Humboldtstraße

Ab Stadtzentrum (Domsheide): Straßenbahn 2 (Ri. Sebaldsbrück) oder 3 (Ri. Weserwehr) bis Wulwesstraße/Ulrichsplatz.