Special issue on Concurrency Theory (CONCUR 2018)

This special issue contains the revised and extended versions of selected contributions that were presented at the 29th International Conference on Concurrency Theory (CONCUR 2018), held in Beijing, China, September 4–7, 2018.

CONCUR is a forum for the development and dissemination of leading research in concurrency theory and its applications. Its aim is to bring together researchers, developers, and students to exchange and discuss latest theoretical developments and learn about challenging practical problems. CONCUR is the reference annual event for researchers in the field.

The principal topics include basic models of concurrency such as abstract machines, domain-theoretic models, game-theoretic models, process algebras, graph transformation systems, Petri nets, hybrid systems, mobile and collaborative systems, probabilistic systems, real-time systems, biology-inspired systems, and synchronous systems; logics for concurrency such as modal logics, probabilistic and stochastic logics, temporal logics, and resource logics; verification and analysis techniques for concurrent systems such as abstract interpretation, atomicity checking, model checking, race detection, pre-order and equivalence checking, run-time verification, state-space exploration, static analysis, synthesis, testing, theorem proving, type systems, and security analysis; distributed algorithms and data structures: design, analysis, complexity, correctness, fault tolerance, reliability, availability, consistency, self-organisation, self-stabilisation, protocols. The theoretical foundations of more applied topics like architectures, execution environments, and software development for concurrent systems such as geo-replicated systems, communication networks, multiprocessor and multicore architectures, shared and transactional memory, resource management and awareness, compilers and tools for concurrent programming, programming models such as component based, object- and service-oriented can also be found at CONCUR.

The proceedings of the conference have been published as volume 118 of LIPIcs. They include 37 papers (from over 100 submissions), among which 6 excellent publications were invited for submitting substantially revised and extended versions to this special issue.

After a rigorous reviewing process, the following 5 publications were accepted to this special issue of the Journal of Computer and Systems Sciences (JCSS).

The paper "Communicating finite-state machines, first-order logic, and star-free propositional dynamic logic" by Benedikt Bollig, Marie Fortin, and Paul Gastin studies the first-order logic of message sequence charts (MSCs), which naturally arise as executions of communicating finite-state machines (CFMs). The authors introduce a star-free version of propositional dynamic logic (PDL). The main contributions are the exact relation between CFMs and fragments of monadic second-order logic: every first-order sentence can be transformed into an equivalent star-free PDL sentence (and conversely), which can further be translated into an equivalent CFM.

In the paper "Deciding probabilistic bisimilarity distance one for probabilistic automata", Qiyi Tang and Franck van Breugel propose a faster algorithm for computing the probabilistic bisimilarity distance for probabilistic automata. Existing algorithms for this problem, which is relevant in verification, have high complexity and cannot be used in practice. The paper provides the first tractable algorithm that decides distance one and characterises probabilistic bisimilarity distances as a policy iteration algorithm. Combining it with faster algorithm for deciding distance zero, the findings allow for efficient reasoning about simulation distance.

The paper "Selective monitoring" by Radu Grigore, and Stefan Kiefer investigates selective monitors for labelled Markov chains. A selective monitor may observe the outputs generated by a Markov chain during its run to decided whether the run is correct or faulty. It may skip reading some outputs for efficiency with the goal to observe as few as possible for its decision. For general Markov chains, the authors show an undecidability result for selectively monitoring, but if any output identifies the state the Markov chain is in, then simple optimal monitors can be computed efficiently.

The paper "Non-deterministic weighted automata evaluated over Markov chains" by Jakub Michaliszyn and Jan Otop presents the first study of non-deterministic weighted automata under probabilistic semantics. Words are viewed as random events generated by a Markov chain, and functions computed by weighted automata are random variables. The expected value and the cumulative distribution for such random variables are shown to be

uncomputable in general and can have irrational values. The paper provides approximation algorithms that work in time exponential time in the size of the automaton and polynomial in the size of the Markov chain and the given precision. In an interesting twist, this result is applied to show that non-deterministic automata can be effectively determinised with respect to the standard deviation metric.

In the paper "The complexity of synthesizing elementary net systems relative to natural parameters", Christian Rosenke and Ronny Tredup study the feasibility problem 'can a labeled transition system be synthesised into an elementary net system', parametrised by the state degree and event manifoldness as parameters for feasibility and the related event state separation property and state separation property. The paper shows that the problem is NP-complete even for small parameters (greater than (1,2) for (state degree, event manifoldness), while separation and even state separation is tractable for (1,2), and state separation is tractable for (1,1), leaving only the complexity of state separation for (1,2) open.

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