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Foreword

In the last forty years, much research and implementation effort has been devoted to Abstract Interpretation and Logic Programming. Professor Giorgio Levi from the University of Pisa, Italy, has contributed in fundamental ways to both fields. We decided to devote a special issue of Theoretical Computer Science to these research areas to honor his work.

We invited some of the most well known scientists in the fields of Abstract Interpretation and Logic Programming to contribute to this special issue. Each paper has undergone the scrutiny of at least two reviewers. The following nine papers were finally accepted.

- *Termination of Narrowing Revisited.*
Maria Alpuente, Santiago Escobar and Jose Iborra.
This paper describes several classes of term rewriting systems where narrowing has a finite search space and it is still complete as a mechanism for solving reachability goals. The results contained in the paper improve and/or generalize previous criteria in the literature concerning narrowing termination.
- *On the Algebraic Structure of Declarative Programming Languages.*
Gianluca Amato, Jim Lipton and Robert McGrail.
This paper develops an algebraic framework based on indexed monoidal categories, called Logic Programming Doctrines, which provide a uniform, declarative view of the syntax and semantics of logic programming and its various extensions, including constraints, abstract data types, state transformations.
- *Applications of Polyhedral Computations to the Analysis and Verification of Hardware and Software Systems.*
Roberto Bagnara, Patricia M. Hill and Enea Zaffanella.
Convex polyhedra are the basis for several abstractions used in static analysis and computer-aided verification of complex and sometimes mission-critical systems. This paper makes a survey of the range of applications of polyhedral computations in this area and look at some possible combinations of polyhedra with other numerical abstractions for improving the precision of the analysis.
- *S-Semantics for Logic Programming: A retrospective look.*
Annalisa Bossi.
This paper provides an overview of the s-semantics and its applications. The s-semantics was one of the lines of research which had been originated and promoted by Giorgio Levi and his group.
- *Abstract Interpretation of Resolution-Based Semantics.*
Patrick Cousot, Radhia Cousot and Roberto Giacobazzi.
This paper extends the abstract interpretation point of on context-free grammars to resolution-based logic programs and proof systems. The abstraction starts from the c and s semantics introduced by Giorgio Levi and his group.
- *Detecting Non-Strict Independence Using Sharing and Freeness Information for Automatic Parallelization of Logic Programs.*
Daniel Cabeza and Manuel Hermenegildo.
This paper presents (some extension on) classic techniques for compile-time detection of non-strict independence based on extracting information from (abstract interpretation-based) analyses using the now well understood and popular *Sharing + Freeness* domain.
- *Focusing and polarization in linear, intuitionistic and classical logics.*
Chuck Liang and Dale Miller.
A focused proof system provides a normal form to cut-free proofs in which the application of invertible and non-invertible inference rules are structured. This paper presents a new, focused proof system for intuitionistic logic, and show how other intuitionistic proof systems can be mapped into the new system by inserting logical connectives that prematurely stop focusing. A focused proof system for classical logic is also designed.

- *Local Consistency for Extended CSPs.*

Michael Maher.

This paper extends the framework of Constraint Satisfaction Problems to make it more suitable for modern constraint programming languages where both constraint satisfaction and constraint solving have a role. Some principles for local consistency conditions in the extended framework are developed and some relationships between the various consistency conditions are established.

- *LMNtal as a Hierarchical Logic Programming Language.*

Kazunori Ueda.

This paper focuses on LMNtal, which is a unifying computational model featuring concurrency, mobility and multiset rewriting. The main contribution is a logical interpretation of LMNtal based on intuitionistic linear logic and a flattening technique.

We would like to thank all the people who have made the publication of this issue possible, starting with the authors who have provided high-quality work and have followed with precision the reviewers' suggestions; the reviewers who have improved the quality of the original manuscripts and have promptly satisfied our requests; Roberto Barbuti for having provided an overview of the scientific contributions of Giorgio; Alessio Guglielmi for having added a human touch to this issue; the Editor in Chief, Professor Sannella, for his support from the very beginning to the idea of this special issue.

As a personal note, we would like to express our gratitude to Giorgio for having been our advisor. He has had a fundamental influence on us, both at the scientific and, even more prominently, at the ethical level. In particular, he has taught us to always take into account the human aspects of academia and research. In retrospect, this has been an extremely important lesson for our professional development.

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