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Logic Programming and Nonmonotonic Reasoning

15th International Conference, LPNMR 2019
Philadelphia, PA, USA, June 3–7, 2019
Proceedings

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Preface

This volume contains the papers presented at the 15th International Conference on Logic Programming and Nonmonotonic Reasoning (LPNMR 2019) held June 3–7, 2019, at Saint Joseph's University in Philadelphia, USA. The conference was co-located with the Datalog 2.0 Workshop, the Workshop on Bidirectional Transformations, and the Workshop on Theory and Practice of Provenance at the Philadelphia Logic Week 2019.

LPNMR 2019 was the 15th in the series of international meetings on logic programming and non-monotonic reasoning. LPNMR is a forum for exchanging ideas on declarative logic programming, non-monotonic reasoning, and knowledge representation. The aim of the conference is to facilitate interactions between researchers and practitioners interested in the design and implementation of logic-based programming languages and database systems, and those working in knowledge representation and nonmonotonic reasoning. LPNMR strives to encompass theoretical and experimental studies that have led or will lead to advances in declarative programming and knowledge representation, as well as their use in practical applications. This year's edition of the conference attempted to raise submissions discussing the use of LPNMR techniques in emerging applications stemming from such areas as deep learning, robotics, cybersecurity, modeling cyberphysical systems, and human-aware AI. LPNMR 2019 thus brought together researchers from LPNMR core areas and application areas of the aforementioned kind in order to share research experiences, promote collaboration, and identify directions for joint future research.

LPNMR received 45 submissions in three categories: technical papers, system descriptions, and application descriptions. Of these, 22 submissions were accepted as regular papers and three as short papers, yielding an acceptance rate of 55%. Each reviewed paper was examined by at least three experts and discussed amongst them, the Program Committee (PC) members, and the program chairs. This volume contains versions of these articles that have been revised by their authors according to the comments provided in the reviews. Two of the papers were selected for Springer Best Paper Awards: "Pruning External Minimality Checking for ASP Using Semantic Dependencies" by Thomas Eiter and Tobias Kaminski (Best Student Paper Award), and "Splitting Epistemic Logic Programs" by Pedro Cabalar, Jorge Fandinno and Luis Fariñas del Cerro (Best Paper Award).

In addition to the oral presentations of the technical papers, the scientific program featured invited talks by:

- Esra Erdem, Sabanci University, Turkey
- Michael Gelfond, Texas Tech University, USA
- V. S. Subrahmanian, Dartmouth College, USA

The program also included sessions dedicated to the Answer Set Programming Challenge and the Doctoral Consortium of the conference. The conference proceedings

contain abstracts for the invited talks and the Answer Set Programming Challenge. The main conference was preceded by several workshops offering an inspiring start to the event.

The LPNMR 2019 conference received generous support from several organizations. We gratefully acknowledge our sponsors, *Artificial Intelligence* journal, Association for Logic Programming (ALP), Haub School of Business at Saint Joseph's University, European Association for Artificial Intelligence (EurAI), National Science Foundation (NSF), and Potassco Solutions. We also would like to thank Springer for the longstanding, successful cooperation with the LPNMR series. The possibilities for fast-track journal publications in *Artificial Intelligence* and *Theory and Practice of Logic Programming*, as well as the best paper prize offered by Springer, brought additional value and motivation. The conference was managed with the help of EasyChair.

Many people played an important role in the success of LPNMR 2019 and deserve our acknowledgment: the PC members and additional reviewers for their timely expertise in carefully reviewing the submissions. The organizers of the Answer Set Programming Challenge, Carmine Dodaro, Christoph Redl, and Peter Schüller dedicated themselves to designing a sequel to the ASP Competition series in order to let LPNMR systems face novel and challenging real-world benchmarks. Fangkai Yang and Jörg Pührer organized an excellent Doctoral Consortium program, guiding young researchers to plan their research and careers. Mario Alviano's contribution was invaluable in coordinating the workshop program and Gregory Gelfond advertised the conference through a number of channels. We also wish to thank all authors who submitted papers and all the conference participants for fruitful discussions. Last but not least, special thanks go to the local organization team and, in particular, to Virginia Miori, Joseph DiAngelo, Lara Guerrini, Jeannine Shantz, Ruixin "Reese" Guo, Andrew Westveer, Elizabeth Angelucci, and Kelsey Neri, for their support and for being our hosts during the wonderful days at Saint Joseph's University.

June 2019

Marcello Balduccini
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Theory and Practice of Logic Programming, Cambridge University Press

Abstracts of Invited Contributions

Logic Programming and Non-monotonic Reasoning from 1991 to 2019: A Personal Perspective

Michael Gelfond

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Abstract. The field of logic programming and nonmonotic reasoning was born in 1991, when a number of researchers working in "the theoretical ends" of logic programming and artificial intelligence gathered in Washington D.C. for the first LPNMR workshop, which was organized by Anil Nerode, Wiktor Marek, and V. S. Subrahmanian. I was privileged to attend this meeting; to closely observe the development of the field over the past 28 years; and to witness many remarkable achievements, which in 1991 I would not have believed to be possible. In this talk I plan to discuss some of these achievements and share a number of personal observations on the field's history, current state, and possible future directions. Among other things, I will comment on the development of powerful knowledge representation languages, the design and implementation of non-monotonic reasoning systems, and use of these languages and systems in formalizing various types of knowledge and reasoning tasks. The talk is not meant to be a survey of the field, rather it is my personal perspective limited to a small, but important, collection of topics I am most familiar with.

Integrating AI and Robotics Using Answer Set Programming

Esra Erdem

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Abstract. Successful deployment of robotic assistants in social environments necessitates these systems to be furnished with high-level cognitive abilities, such as planning and diagnostic reasoning, to be able to deal with high complexity and wide variability of their surroundings, and perform typical everyday tasks robustly and without sacrificing safety. In the presence of humans, robotic agents need further abilities, such as commonsense reasoning, explanation generation, and epistemic reasoning, to be able to collaborate, communicate and live with humans. We have been investigating the use of Answer Set Programming to endow robotic agents with such cognitive capabilities, considering various robotic domains, such as service robotics, medical robotics, and cognitive factories. In this talk, we will share our experiences of using Answer Set Programming in robotics applications, and discuss its strengths and weaknesses as a knowledge representation and reasoning paradigm to integrate Artificial Intelligence and Robotics.

Logic for Machine Learning Based Security

V. S. Subrahmanian

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Abstract. The talk will cover 2 broad areas: (i) the role of logic in providing human-understandable explanations of forecasts produced by complex machine learning models, (ii) the use of logic based methods for reasoning about deception in cybersecurity. In the first part, I will describe BEEF, a framework that generates logic-based "balanced" explanations (which explain both why a forecast might be correct and why it might be incorrect). BEEF is capable of operating "on top" of any binary classifier. In the second part, I will describe logic-based methods to lead an attacker astray when he successfully penetrates a system by providing him fake results in response to scan requests. I will conclude with suggestions on how the LPNMR community may build upon these ideas.

The ASP Challenge 2019

Carmine Dodaro[1], Christoph Redl[2], and Peter Schüller[2]

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The Answer Set Programming Challenge 2019 is run jointly among the Technische Universität Wien (Austria) and the University of Genoa (Italy), in Spring 2019. The event is the sequel to the ASP Competition series, which was held biannually since 2007. Unlike the previous ASP Competitions, the ASP Challenge 2019 focuses on challenging persons and teams rather than systems. To this end, five real problems from research and industry have been collected and are to be solved by researchers and students using arbitrary available systems, which do not necessarily have to be developed by the participants. Indeed, participants are encouraged to use any available system(s) and to combine ASP with other formalisms, as long as ASP or an extension thereof plays a crucial role. Submissions are expected to comprise the used systems and an encoding.

The challenge benefits the ASP community as challenging real-world research and industrial benchmarks become available, and it also benefits the problem providers as they get solutions to their problems.

Differently from previous editions, we host the challenge on the StarExec platform at https://www.starexec.org/ with two aims: (i) attracting expert and non-expert participants, and (ii) providing timely feedback to solutions and permitting participants to adjust solutions instead of collecting encodings and solvers, running the competition offline, and publishing the results afterwards.

We use the following problem domains:

- The *House Reconfiguration Problem* is an abstract version of (re-)configuration problems occurring in practice. The task is, given a legacy configuration, to find an (optimal) reconfiguration satisfying various constraints.
- The industrial *Insurance Referees Assignment Problem* is a scheduling problem from the insurance domain, where referees are to be assigned to insurance cases according to various hard and soft constraints.
- The *Automated Warehouse Scenario* is a planning problem where robots have to deliver products to picking stations to fulfill orders.
- In the *Fastfood Problem*, given a set of restaurants, the task is to select a number of them as depots such that the sum of distances from each restaurant to the closest depot is minimized.

– The problem of *Checking Policies for Reactive Agents* comes from the planning domain. An agent in a grid environment has to find a goal, where the environment and obstacles are only partially observable.

For details we refer to https://sites.google.com/view/aspcomp2019/.

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