Introduction to the 39th International Conference on Logic Programming Special Issue

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This issue of TPLP contains selected papers of the *39th International Conference on Logic Programming (ICLP 2023)*, held at Imperial College London, UK, from July 9 to July 15, 2023.

The International Conference on Logic Programming (ICLP) is the premiere international scientific venue for presenting, discussing, and disseminating fundamental and applied research in the field of logic programming and in related interdisciplinary fields. The conference was launched in 1982, with its first edition in Marseille, France, and continues to serve the broad international logic programming community.

ICLP 2023 was a special edition of the conference as it celebrated also the closing event of the *Year of Prolog* – a year-long celebration of the 50th anniversary of the introduction of the Prolog programming language. The conference included a dedicated session to discuss the achievements accomplished throughout the year, the assignment of the 2023 Alan Colmerauer Prize, and an event on "Teaching Prolog: the Next 50 Years."

1 Conference topics

Contributions to ICLP 2023 were sought in all areas of logic programming, including but not restricted to:

- Theoretical Foundations;
- Language Design and Programming Methodologies;
- Program Analysis and Optimization;
- Implementation Methodologies;
- Related Paradigms, Integration, and Synergies;
- Applications of Logic Programming.

Besides the main conference track, the conference specifically sought contributions in two thematic tracks:

- Logic Programming and Machine Learning;
- Logic Programming and Explainability, Ethics, and Trustworthiness.

2 Conference components

Along with the main track, composed of selected papers presented in this special issue of TPLP, the conference included a number of additional components:

1. Technical Communications Track: Technical communications are shorter presentations focused on work in progress and novel research directions; they often include preliminary results to be shared with the logic programming community but not mature enough for a regular publication.
2. Recently Published Research Track: This track provides a forum to discuss important results related to logic programming that appeared recently (from January 2021 onwards) in select journals and conferences, but have not been previously presented at ICLP.
3. Short Papers Track: This track allows short papers to be presented as posters, providing the opportunity to highlight upcoming research directions and novel challenges.
4. Systems and Demos Track: This track provides a venue to showcase logic programming systems and implementations in a live setting. Demonstrations in this track are intended to show the relevance, potential, and innovation of the tool and allow time for discussions with their creators.
5. Doctoral Consortium: The Doctoral Consortium (DC) on Logic Programming provides students and early career researchers with the opportunity to present and discuss their research programs, obtain feedback from both peers and experts in the field, and participate in mentoring sessions on how to prepare for and succeed in a research career.
6. Summer School in Logic Programming: The Summer School is an opportunity for beginning students and practitioners to learn about foundational and advanced topics in logic programming, directly from the experts in the field. The 2023 Summer School featured four lectures, delivered by Vladimir Lifschitz (*"Fine Points of Answer Set Programming"*), Theresa Swift (*"New Directions in Prolog Programming"*), Konstantin Schekotihin & Alice Tarzariol (*"Industrial Applications of Logic Programming"*), and Marina De Vos (*"Answer Set Programming in Normative Systems"*).
7. Logic Programming Contest: The Logic Programming contest, a live event where teams compete in the use of logic programming to solve challenging problems, has been a staple of the conference for many years.
8. Birds of a Feather (BoF) session: The BoF session provided an inclusive environment for colleagues with similar interests to meet for informal discussion; differently from workshops, the BoF is focused on informal conversations, brainstorming, and hands-on activities. ICLP 2023 featured one BoF session titled *"AI Safety and Ethics – Contemporary and Future Considerations,"* organized by Francis Rhys Ward, Henrik Aslund, Dylan Cope, Mackenzie Jorgensen, Nandi Schoots, and Luke Thorburn.

9. Teaching Prolog: The Next 50 Years: This event, co-located with ICLP and organized by the Prolog Education Committee, provided a forum for exploring how to promote learning of Prolog internationally and across the broad educational pipeline.
10. Women@ICLP: This event, organized by Daniele Nantes Sobrinho (chair of the Women in Logic group) featured a panel of women speakers from the ICLP community (including Claudia Schulz from Thomson Reuters, Stefania Costantini from University of L'Aquila, two PhD students from the Doctoral Consortium, namely Andrea Rafanelli from University of Pisa and Ramsha Ali from University of Klagenfurt), exploring challenges and experiences relevant to promote gender equity in the field of logic programming.
11. Co-Located Workshops: ICLP 2023 featured six co-located workshops: Answer Set Programming and Other Computing Paradigms, Epistemic Extensions of Logic Programming, Goal-directed Execution of Answer Set Programs, Logic Programming and Legal Reasoning, Probabilistic Logic Programming, and Safe & Trustworthy AI.

ICLP 2023 also included an Industry Event, with the participation of representatives of the industrial sponsors. The event consisted of a panel discussion on "The role of symbolic AI in today's AI industrial landscape."

3 Conference featured speakers

The following speakers were featured in the conference:

- Sarah Gaggl (TU Dresden, Germany): Invited Speaker, presenting on logic programming and argumentation;
- Marco Maratea (University of Calabria, Italy): Invited Speaker, presenting on applications of answer set programming;
- Jan Wielemaker (Centrum Wiskunde & Informatica, The Netherlands): Invited Speaker, presenting on the rise, fall, and future of Prolog;
- Keith Stenning (The University of Edinburgh, Scotland): Invited Speaker of the special track on Logic Programming and Machine Learning;
- Gopal Gupta (University of Texas at Dallas, USA): Invited Speaker of the special track on Logic Programming and Explainability, Ethics and Trustworthiness;
- Mehul Bhatt (Örebro University, Sweden): Tutorialist, speaking on Cognitive Vision;
- Joseph Townsend (Fujitsu Research of Europe, UK): Tutorialist, speaking on medical applications of neurosymbolic AI.

4 Conference awards

The conference presented the following awards:

- Best Paper Award: Masood Feyzbakhsh Rankooh and Tomi Janhunen: *Capturing (Optimal) Relaxed Plans with Stable and Supported Models of Logic Programs*;
- Best Student Paper Award: Yuheng Wang, Paul Fodor, and Michael Kifer: *Knowledge Authoring for Rules and Actions*.

Furthermore, after an in-depth analysis of citation indices (e.g., SCOPUS, Web of Science, and Google Scholar), two Test-of-Time awards were identified:

- The John Alan Robinson 20 year test-of-time award: Thomas Eiter, Michael Fink: *Uniform Equivalence of Logic Programs under the Stable Model Semantic*;
- The 10 year test-of-time award: Mutsunori Banbara, Takehide Soh, Naoyuki Tamura, Katsumi Inoue, and Torsten Schaub: *Answer set programming as a modeling language for course timetabling.*

5 Conference program

Following the model used in the past editions of ICLP, ICLP 2023 adopted a hybrid publication model, with separate journal papers and Technical Communications (TCs). The papers which appear in this issue of TPLP represent the more mature and highest quality submissions to ICLP 2023. The TCs comprise high-quality papers but presenting results which are more preliminary and not yet ready for the standards of TPLP, as well as accepted short papers, summary of system presentations, and extended abstracts from the Recently Published Research Track.

ICLP 2023 received 93 submissions, resulting in

- 20 papers being accepted for the TPLP rapid publication;
- 26 papers being accepted for regular TC publication;
- 5 papers being accepted as short papers in the TC category;
- 8 papers being accepted as system demonstrations.

In addition, we received and accepted 11 abstracts for the Recently Published Research track. The TCs, system demonstrations, short papers, and the recently published research abstracts appear in a dedicated volume of the Electronic Proceedings in Theoretical Computer Science (EPTCS). All of them receive an allocation of time in the conference program for presentation.

The 20 papers accepted for publication in TPLP appear in this special issue. They are:

- *Nondeterministic Approximation Operators: Ultimate Operators, Semi-equilibrium Semantics, and Aggregates,* by Jesse Heyninck and Bart Bogaerts;
- *Interactive Model Expansion in an Observable Environment,* by Pierre Carbonnelle, by Bart Bogaerts, Joost Vennekens, and Marc Denecker;
- *On Program Completion, with an Application to the Sum and Product Puzzle,* by Vladimir Lifschitz;
- *Integrating Logic Rules with Everything Else, Seamlessly,* by Yanhong A. Liu, Scott D. Stoller, Yi Tong, and Bo Lin;
- *Knowledge-based Reasoning and Learning under Partial Observability for Ad Hoc Teamwork,* by Hasra Dodampegama and Mohan Sridharan;
- *Embracing Background Knowledge in the Analysis of Actual Causality: An Answer Set Programming Approach,* by Michael Gelfond, Jorge Fandinno, and Evgenii Balai;
- *Learnability with PAC Semantics for Multiagent Beliefs,* by Ionela Mocanu, Vaishak Belle, and Brendan Juba;

- *Neuro-Symbolic AI for Compliance Checking of Electrical Control Panels,* by Vito Barbara, Massimo Guarascio, Nicola Leone, Giuseppe Manco, Alessandro Quarta, Francesco Ricca, and Ettore Ritacco;
- *ASPER: Answer Set Programming Enhanced Neural Network Models for Joint Entity-Relation Extraction,* by Trung Le, Tran Cao Son, and Huiping Cao;
- *Capturing (Optimal) Relaxed Plans with Stable and Supported Models of Logic Programs,* by Masood Feyzbakhsh Rankooh and Tomi Janhunen;
- *Knowledge Authoring for Rules and Actions,* by Yuheng Wang, Paul Fodor, and Michael Kifer;
- *Locksynth: A Tool to Derive Synchronization Code for Concurrent Data Structures Using Answer Set Programming,* by Sarat Chandra Varanasi, Neeraj Mittal, and Gopal Gupta;
- *An ASP Framework for the Refinement of Authorization and Obligation Policies,* by Daniela Inclezan;
- *Logic-Based Benders Decomposition in Answer Set Programming for Chronic Outpatients Scheduling,* by Paola Cappanera, Marco Gavanelli, Maddalena Nonato, and Marco Roma;
- *Toward A Logical Theory Of Fairness and Bias: A Situation Calculus Formalisation,* by Vaishak Belle;
- *"What if?" in Probabilistic Logic Programming,* by Rafael Kiesel, Kilian Rueckschloss, and Felix Weitkämper;
- *Automatic Differentiation in Prolog,* by Tom Schrijvers, Birthe van den Berg, and Fabrizio Riguzzi;
- *Implementing Backjumping by Means of Exception Handling,* by Wlodzimierz Drabent;
- *External Behavior of a Logic Program and Verification of Refactoring,* by Jorge Fandinno, Zachary Hansen, Yuliya Lierler, Vladimir Lifschitz, and Nathan Temple;
- *An Efficient Solver for ASP(Q),* by Wolfgang Faber, Giuseppe Mazzotta, and Francesco Ricca.

6 Sponsors

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- Platinum Sponsors:
  - Artificial Intelligence Journal;
  - The National Science Foundation, USA.
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— Imperial College London and Imperial-X;
— LPA;
— New Mexico State University;
— Potassco Solutions.

7 Conference organization

The organizers of ICLP 2023 are listed below.

General chairs

- Alessandra Russo, Imperial College London, UK;
- Francesca Toni, Imperial College London, UK.

Program Chairs

- Stefania Costantini, Universitá degli Studi dell'Aquila, Italy;
- Enrico Pontelli, New Mexico State University, USA.

Organizing and Publicity Chairs

- Guilherme Paulino-Passos, Imperial College London, UK;
- Alex Spies, Imperial College London, UK.

Workshop chair

- Wolfgang Faber, University of Klagenfurt, Austria.

Thematic tracks chairs

- *LP and Explainability, Ethics and Trustworthiness:* Roberta Calegari, Universitá di Bologna, Italy;
- *LP and Machine Learning:* Artur Garcez, City University of London, UK.

Applications, systems, and demos chair

- Carmine Dodaro, Universitá della Calabria, Italy.

Recently published research chair

- Sarah Gaggl, TU Dresden, Germany.

Tutorials chairs

- Agostino Dovier, Universitá degli Studi di Udine, Italy;
- Esra Erdem, Sabanci University, Turkey.

Doctoral consortium chairs

- Francesco Fabiano, Universitá degli Studi di Udine, Italy;
- Alessandra Mileo, DCU, Ireland.

Programming contest chairs

- Martin Gebser, Graz University of Technology, Austria;
- Mario Alviano, Universitá della Calabria, Italy.

Summer school chairs

- Simona Perri, Universitá della Calabria, Italy;
- Bart Bogaerts, Vrije Universiteit Brussel, Belgium.

Birds of a feather chair

- Luciano Serafini, Fondazione Bruno Kessler, Trento, Italy.

Women@ICLP chair

- Daniele Nantes Sobrinho, Universidade de Brasília, Brazil, and Imperial College London, UK.

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The ICLP Program Committee included the following members:

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