Luigi Bonassi
Nicola Gigante
(eds.)



8th International Workshop on Artificial Intelligence and Formal Verification, Logic, Automata and Synthesis

Lisbon (Portugal), July 18–19, 2026

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8th International Workshop on
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Preface

Artificial Intelligence (AI) is becoming increasingly relevant to safety-critical systems, and the research community is working to integrate symbolic and neural approaches to support their use in these contexts. Such applications require *Formal Methods* (FM) techniques for the design, verification, and synthesis of reliable and robust systems. Close collaboration between the AI and FM communities is therefore essential.

OVERLAY 2026 is the 8th edition of the *International Workshop on Artificial Intelligence and fOrmal VERification, Logic, Automata, and sYnthesis*. The workshop is the main official initiative supported by the OVERLAY group. Its aim is to establish a stable, long-term scientific forum on the relationships between AI and FM, providing a stimulating environment in which researchers can discuss opportunities and challenges at the intersection of the two areas.

The 2026 edition was held as part of the 2026 Federated Logic Conference (FLoC 2026), and has taken place on July 18–19, 2026, in Lisbon, Portugal. Its principal goals are to encourage ongoing interaction between the FM and AI communities, to identify innovative tools and methodologies, and to promote discussion of open issues and new challenges. The review process involved 27 PC members whose affiliations span 10 countries: Australia (1), Austria (1), France (2), Germany (2), Italy (14), Japan (1), the Netherlands (1), Portugal (1), Spain (1), and the United Kingdom (3). Eventually, 17 papers were accepted for presentation and involved a total of 45 distinct authors whose affiliations came from 10 different countries: Canada, France, Germany, Greece, Israel, Italy, Japan, Portugal, Sweden, United Kingdom. Out of the accepted papers, 13 were included in these proceedings.

Seven sessions organized the presentations of the accepted papers:

- Session 1: Planning, chaired by Periklis Mantenoglou (Örebro University, Sweden);
- Session 2: Multi-agent systems, chaired by Aniello Murano (University of Naples Federico II, Italy);
- Session 3: Temporal, Modal and Logical Foundations (part 1), chaired by Fabio Aurelio D'Asaro (University of Verona, Italy, and University College London, United Kingdom);
- Session 4: Temporal, Modal and Logical Foundations (part 2), chaired by Angelo Matteo (University of Udine, Italy);
- Session 5: Learning, chaired by Kittiphon Phalakarn (National Institute of Informatics, Japan);
- Session 6: Verification and Model Checking, chaired by Andrea Mazzullo (Free University of Bozen-Bolzano, Italy);
- Session 7: Explainability, chaired by Noa Izsak (CISPA Helmholtz Center for Information Security, Germany).

In addition, the workshop included an invited talk by Przemysław Wałega (Queen Mary University, London, United Kingdom) titled *Preservation Theorems: From Tarski to Graph Neural Networks*.

We extend our sincere gratitude to all authors and participants and look forward to meeting everybody again at next year's OVERLAY.

The chairs,

Luigi Bonassi, University of Oxford, United Kingdom
Nicola Gigante, Free University of Bozen-Bolzano, Italy

Invited Talk

Preservation Theorems: From Tarski to Graph Neural Networks

Przemysław Wałęga, Queen Mary University, London, UK

Preservation theorems are classical results in model theory that connect semantic properties of structures with logical definability. For example, the seminal Łoś-Tarski theorem states that a first-order logic sentence is preserved under embeddings if and only if it is expressible in the existential fragment.

In the talk, I will revisit some of the main preservation theorems in logic and discuss how the ideas underlying these results can be applied to modern AI models. In particular I will present recent results on preservation theorems for expressive power of graph learning architectures. Graph Neural Networks, and explain their consequences for understanding the

More broadly, the talk will illustrate how preservation theorems can provide a principled framework for studying the expressiveness of graph-based machine learning models.

The new results presented in this talk are based on recent work.[1]

[1]Przemysław Andrzej Wałega, Bernardo Cuenca Grau. *Structural Preservation and the Logical Expressiveness of Graph Neural Networks.* https://arxiv.org/abs/2606.17882
Przemysław Andrzej Wałega, Bernardo Cuenca Grau. *Preservation Theorems for Unravelling-Invariant Classes: A Uniform Approach for Modal Logics and Graph Neural Networks.* https://arxiv.org/abs/2602.01856