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# Proceedings of the 16th International Workshop on Neural-Symbolic Learning and Reasoning (NeSy)

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## Preface

NeSy is the annual meeting of the Neural-Symbolic Learning and Reasoning Association<sup>1</sup> and the premier venue for the presentation and discussion of the theory and practice of neural-symbolic computing systems.<sup>2</sup> Since 2005, NeSy has provided an atmosphere for the free exchange of ideas bringing together the community of scientists and practitioners that straddle the line between deep learning and symbolic AI.

Neural networks and statistical Machine Learning have obtained industrial relevance in a number of areas from retail to healthcare, achieving state-of-the-art performance at language modelling, speech recognition, graph analytics, image, video and sensor data analysis. Symbolic AI, on the other hand, is challenged by such unstructured data, but is recognised as being in principle transparent, in that reasoned facts from knowledge-bases can be inspected to interpret how decisions follow from input. Neural and symbolic methods also contrast in the problems that they excel at: scene recognition from images appears to be a problem still outside the capabilities of symbolic systems, for example, while neural networks are not yet sufficient for industrial-strength complex planning scenarios and deductive reasoning tasks.

Neurosymbolic AI aims to build rich computational models and systems by combining neural and symbolic learning and reasoning paradigms. This combination hopes to form synergies among their strengths while overcoming their complementary weaknesses.

NeSy 2022 was part of the Second International Joint Conference on Learning and Reasoning (IJCLR 2022) held in Cumberland Lodge, Windsor Great Park, United Kingdom, 28-30 September 2022.<sup>3</sup> NeSy welcomed submissions of the latest and ongoing research work on neurosymbolic AI for presentation at the workshop. Topics of interest included, but were not limited to:

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NeSy 2022 as part of the 2nd International Joint Conference on Learning & Reasoning (IJCLR)

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 CEUR Workshop Proceedings (CEUR-WS.org)

<sup>1</sup><https://www.city-data-science-institute.com/nesy>

<sup>2</sup><http://www.neural-symbolic.org/>

<sup>3</sup><https://sites.google.com/view/nesy-2022/>

- Knowledge representation and reasoning using deep neural networks;
- Symbolic knowledge extraction from neural and statistical learning systems;
- Explainable AI methods, systems and techniques integrating connectionist and symbolic AI;
- Neural-symbolic cognitive agents;
- Biologically-inspired neuro-symbolic integration;
- Integration of logics and probabilities in neural networks;
- Neural-symbolic methods for structure learning, transfer learning, meta, multi-task and continual learning, relational learning;
- Novel connectionist systems able to perform traditionally symbolic AI tasks (e.g. abduction, deduction, out-of-distribution learning);
- Novel symbolic systems able to perform traditionally connectionist tasks (e.g. learning from unstructured data, distributed learning);
- Applications of neural-symbolic and hybrid systems, including in simulation, finance, healthcare, robotics, Semantic Web, software engineering, systems engineering, bioinformatics and visual intelligence.

NeSy received 21 submissions for peer-review; out of these, 15 papers were accepted for presentation in the workshop and inclusion within these proceedings. NeSy also featured 3 invited talks:

Forough Arabshahi  
 Hannes Leitgeb  
 William Cohen

Facebook  
 Ludwig-Maximilians-University Munich  
 Google AI

## Organisation

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