Preface to the Proceedings of Green-Aware AI 2025

Riccardo Cantini[1], Luca Ferragina[1], Davide Mario Longo[1,*], Anastasija Nikiforova[2], Simona Nisticò[1], Francesco Scarcello[1], Reza Shahbazian[3], Dipanwita Thakur[1], Irina Trubitsyna[1] and Giovanna Varricchio[1]

[1]*University of Calabria, Rende, Italy*
[2]*University of Tartu, Estonia*
[3]*University of Palermo, Italy*

1. Introduction

The rapid advancement and widespread adoption of Artificial Intelligence has brought transformative opportunities across scientific, industrial, and societal domains. At the same time, the growing scale and complexity of AI systems raise critical concerns related to energy consumption, environmental impact, resource usage, and broader societal implications. As modern AI increasingly relies on data-intensive and computation-heavy models, addressing these challenges has become a pressing priority, requiring a shift from purely performance-driven development toward approaches that explicitly account for sustainability, responsibility, and long-term impact.

In response to this need, the *2nd Workshop on Green-Aware Artificial Intelligence* provides a dedicated forum for researchers and practitioners interested in developing, evaluating, and deploying AI systems that are environmentally conscious and socially responsible. Building on the success of the previous edition, the workshop fosters interdisciplinary dialogue across theoretical foundations, algorithmic design, system architectures, and real-world applications. The contributions presented in this volume reflect the growing maturity of the field, highlighting concrete advances that balance effectiveness with sustainability considerations throughout the AI lifecycle.

The program is further enriched by an invited talk by *Prof. Thomas Eiter (TU Wien)*, titled *"The Bilateral AI approach for Green and Sustainable AI"*. The talk addresses the environmental challenges posed by the rapid growth of AI technologies, particularly those driven by deep learning, large language models, and foundation models, whose computational demands raise serious concerns about energy consumption and ecological impact. Prof. Eiter introduces the concept of *Bilateral AI*, an approach that combines symbolic AI techniques—such as logic-based reasoning and search—with subsymbolic methods based on neural networks and machine learning. By leveraging the complementary strengths of these paradigms, Bilateral AI aims to enable more efficient and sustainable computation. The talk presents ongoing large-scale research activities in Austria on this topic, with a particular focus on green AI and sustainability, and outlines promising directions for future research.

Overall, the workshop aims to advance the understanding of how sustainability considerations can be systematically embedded into AI research and practice, encouraging the development of next-generation AI systems that are not only powerful, but also environmentally responsible and socially aware.

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*Corresponding author.
riccardo.cantini@unical.it (R. Cantini); luca.ferragina@unical.it (L. Ferragina); davidemario.longo@unical.it (D. M. Longo); anastasija.nikiforova@ut.ee (A. Nikiforova); simona.nistico@unical.it (S. Nisticò); francesco.scarcello@unical.it (F. Scarcello); reza.shahbazian@unipa.it (R. Shahbazian); dipanwita.thakur@unical.it (D. Thakur); irina.trubitsyna@unical.it (I. Trubitsyna); giovana.varricchio@unical.it (G. Varricchio)
0000-0003-3053-6132 (R. Cantini); 0000-0003-3184-4639 (L. Ferragina); 0000-0003-4018-4994 (D. M. Longo); 0000-0002-0532-3488 (A. Nikiforova); 0000-0002-7386-2512 (S. Nisticò); 0000-0001-7765-1563 (F. Scarcello); 0000-0002-2313-6002 (R. Shahbazian); 0000-0003-2895-1425 (D. Thakur); 0000-0002-9031-0672 (I. Trubitsyna); 0000-0001-6839-8551 (G. Varricchio)

2. Workshop Scope and Themes

The workshop continues to serve as a multidisciplinary venue for discussing recent advances in green-aware and sustainability-oriented Artificial Intelligence. This year's edition further consolidates this vision by structuring the program around three complementary and interconnected thematic sessions, each addressing a key dimension of sustainable AI research and practice.

The first session focuses on *Sustainability*, broadly understood as the integration of environmental, social, and governance principles into AI system design and analysis. The second session is devoted to *Green AI*, emphasizing methods, metrics, and tools aimed at reducing the computational, energetic, and environmental costs of AI technologies. Finally, the *Applications* session highlights concrete deployments of green-aware AI solutions across diverse domains, illustrating how sustainability principles can be effectively translated into practice.

Together, these sessions reflect the workshop's overarching goal of promoting holistic approaches to AI sustainability, encouraging cross-community dialogue, and advancing solutions that balance performance, responsibility, and long-term impact.

2.1. Sustainability

The Sustainability session brings together contributions that frame sustainability in AI as a multifaceted concept encompassing resource efficiency, transparency, governance, and social responsibility. Rather than focusing on isolated metrics, the papers collectively illustrate how sustainability emerges from informed theoretical foundations, practical methodologies, and principled system design.

A first group of contributions addresses *resource-aware and efficiency-driven perspectives*. The paper [1] studies sustainability at a foundational level by analyzing temporal connectivity under strict resource constraints, offering theoretical insights with direct implications for energy-aware scheduling in dynamic networks. Complementing this perspective, [2] introduces Sustainability Model Cards, extending existing documentation practices with structured information on energy consumption, carbon emissions, and water usage, thereby supporting responsible decision-making across the AI lifecycle.

A second thematic cluster focuses on *transparency, governance, and institutional sustainability*. The paper [3] proposes an NLP-based pipeline for automatically identifying sustainability criteria in public procurement documents. Through lightweight embeddings and similarity-based matching, the approach enables scalable monitoring of sustainability adoption while remaining aligned with Green AI principles. Together with [2], this work highlights AI's dual role as both a subject and an enabler of sustainable governance.

Finally, sustainability is explored from the perspective of *responsible and socially grounded AI behavior*. The paper [4] presents a hybrid agent architecture combining symbolic reasoning, fuzzy logic, and LLM-assisted planning to support green-aware decision-making in uncertain environments. Complementarily, [5] addresses social sustainability by studying fairness-aware clustering, demonstrating that equity constraints can be satisfied without compromising solution quality.

Overall, the Sustainability session underscores the importance of integrated approaches that combine efficiency, transparency, and social responsibility, advancing sustainability as a foundational principle for future AI research.

2.2. Green AI

The Green AI session focuses on methodological, algorithmic, and system-level approaches aimed at reducing the environmental footprint of AI systems while preserving effectiveness and reliability. The contributions span model design, learning paradigms, evaluation practices, and incentive mechanisms, offering a comprehensive view of Green AI across the AI lifecycle.

A first group of papers addresses *energy-aware model design and deployment*. The paper [6] investigates layer-wise quantization strategies, showing how non-uniform precision allocation can significantly reduce energy consumption with limited accuracy loss. Complementarily, [7] explores dynamic model

selection through energy-aware cascading and routing strategies, enabling adaptive and sustainable inference-time decisions.

Another key theme concerns *data-centric and distributed Green AI*. The paper [8] proposes a data-centric framework for environmentally sustainable Federated Learning, leveraging intelligent node selection and data reduction strategies guided by data quality and carbon footprint estimates.

Several contributions emphasize *evaluation, accountability, and benchmarking*. The paper [9] introduces a systematic framework for measuring energy consumption in AI planning, moving beyond runtime as the sole efficiency proxy. In a complementary direction, [10] proposes a methodology for reducing the cost and environmental impact of large language model benchmarking while maintaining reliable performance estimates.

Finally, Green AI is explored through *optimization and incentive-aware mechanisms*. The paper [11] studies renewable energy auctions using obviously strategy-proof mechanisms, while [12] addresses green-aware decision processes that align algorithmic incentives with energy-efficient behavior.

Collectively, the Green AI session highlights the maturity of the field, demonstrating that meaningful sustainability gains arise from the integration of algorithmic innovation, system design, evaluation methodology, and incentive structures.

2.3. Applications

The Applications session showcases how green-aware and sustainability-oriented AI techniques can be effectively deployed across diverse real-world domains, demonstrating tangible environmental and societal benefits.

In the context of *sustainable manufacturing*, [13] presents a deep reinforcement learning approach for optimizing milling processes, explicitly balancing production efficiency and tool lifespan through adaptive decision-making.

In *precision agriculture*, [14] proposes calibrated semantic segmentation models for drone-based weed mapping. By combining lightweight architectures with post-hoc calibration techniques, the approach enables reliable confidence estimates and more resource-efficient interventions.

The paper [15] addresses *wildfire monitoring and management*, presenting the PRIMA platform for real-time analysis that integrates heterogeneous data sources with AI-based predictive models and LLM-supported decision interfaces.

Human-centered and socially aware AI systems are explored in [16], which combines symbolic representations with data-driven components to support interpretable and context-aware decision-making. Finally, [17] focuses on *environmental monitoring*, proposing machine learning techniques for extracting actionable insights from environmental data under constrained computational resources.

Overall, the Applications session illustrates the breadth of domains in which green-aware AI can be concretely applied, highlighting how tailored methodologies can effectively address domain-specific sustainability challenges.

3. Contributions and Paper Selection

The *2nd Workshop on Green-Aware Artificial Intelligence* received a total of **23 submissions**, nearly tripling the number from the previous edition. Following a rigorous single-blind peer-review process, **17 papers were accepted**, corresponding to an acceptance rate of approximately **74%**. The final program includes **8 regular papers** and **9 short papers**.

The accepted contributions reflect the growing convergence between AI research and environmental awareness, addressing ecological, social, and ethical challenges through innovative methods, frameworks, and applications.

Each submission was reviewed by two independent reviewers. Final decisions were made by the workshop chairs based on reviewer feedback and standard academic criteria, including *originality*, *technical quality*, *relevance* to the workshop themes, *potential impact* on sustainable AI, and *clarity of presentation*.

3.1. Program Committee

We sincerely thank the members of the Program Committee for their dedication and careful evaluations, which were essential in ensuring the quality and rigor of the selected papers. In recognition of their valuable contributions, we gratefully acknowledge the following Program Committee members:

- *Julien Aligon*, Université de Toulouse, France
- *Vittorio Bilò*, University of Salento, Italy
- *Gianlorenzo D'Angelo*, Gran Sasso Science Institute, Italy
- *Davide Di Stefano*, TU Wien, Austria
- *Diodato Ferraioli*, Università di Salerno, Italy
- *Hong Jia*, University of Melbourne, Australia
- *Martin Lněnička*, Univerzita Pardubice, Czech Republic
- *Cristian Molinaro*, University of Calabria, Italy
- *Gianpiero Monaco*, University of Chieti-Pescara, Italy
- *Luca Moscardelli*, University of Chieti-Pescara, Italy
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