



INVITED SESSION SUMMARY

Title of Session:

Sustainable Adaptive Artificial Intelligence

Name, Title and Affiliation of Chair:

Alessia Amelio, associate professor, University of Chieti-Pescara, Italy
Radu Tudor Ionescu, professor, University of Bucharest, Romania
Francesco Carlo Morabito, professor, University Mediterranea of Reggio Calabria, Italy
Domenico Ursino, professor, Polytechnic University of Marche, Italy

Details of Session (including aim and scope):

A huge amount of data originates from heterogeneous sources, such as IoT sensor networks, social media platforms, transactional databases, mobile devices, and large-scale digital infrastructures, and is embedded in evolving contexts including social networks, financial markets, healthcare ecosystems, and smart cities. Within this scenario, adaptive artificial intelligence (adaptive AI) systems have been introduced to enable continuous knowledge extraction while dynamically adjusting their models to environmental changes to ensure resilience and scalability in real-time scenarios. Recent years have witnessed a significant increase in research contributions focused on adaptive AI, with particular emphasis on streaming data mining, reinforcement learning in dynamic environments, and self-adaptive software architectures. Additionally, Large Language Models (LLMs) can be embedded within adaptive frameworks when combined with mechanisms for contextual updating or feedback-driven adjustment, thereby contributing to system-level adaptability. Nevertheless, the deployment of adaptive AI systems raises open challenges related to environmental and social sustainability. From an environmental perspective, the computational overhead associated with continuous model retraining and large-scale distributed processing results in substantial energy consumption, raising concerns about the carbon footprint of AI infrastructures. From a social perspective, issues of algorithmic transparency, fairness, and accountability remain critical, as adaptive systems may propagate biases or generate opaque decision-making processes. Open problems therefore include the design of energy-efficient adaptive learning algorithms, the integration of explainability frameworks into adaptive pipelines, and the establishment of governance models that ensure ethical compliance and societal trust in adaptive AI technologies.

This Special Session builds on the established paradigms of Green AI and Responsible AI, extending them into the emerging field of Sustainable Adaptive AI. The aim is to explore how adaptivity can be reframed as a driver of sustainability, combining environmental efficiency with social responsibility. Novel research and survey contributions are invited to investigate techniques, frameworks, and applications for designing adaptive AI systems that are not only efficient and resilient, but also environmentally responsible and socially equitable.

The topics include but are not limited to:

- Online and incremental learning algorithms
- Lightweight adaptive architectures (compression, pruning, quantization, distillation)
- Explainability in adaptive AI pipelines
- Energy-aware adaptive learning algorithms
- Bias mitigation in adaptive systems
- Adaptive AI for smart cities
- Adaptive AI in healthcare data streams
- Governance and ethical frameworks for adaptive AI
- Green data stream processing architectures
- Sustainable edge-AI for adaptive systems
- Adaptive AI for climate and environmental monitoring
- Eco-efficient reinforcement learning in dynamic environments
- Adaptive AI for inclusivity across cultural and linguistic contexts

- Lifecycle approaches for sustainable training, deployment, and maintenance

Main Contributing Researchers / Research Centres (tentative, if known at this stage):

High Performance Computing Laboratory, Department InGeo, University of Chieti-Pescara, Italy
Department DII, Polytechnic University of Marche, Italy
Department DICEAM, University Mediterranea of Reggio Calabria, Italy
University of Bucharest, Romania

Website URL of Call for Papers (if any):

Email & Contact Details:

Assoc. Prof. Alessia Amelio, Department InGeo, University of Chieti-Pescara, Italy
E-mail: alessia.amelio@unich.it
Prof. Radu Tudor Ionescu, University of Bucharest, Romania
E-mail: raducu.ionescu@gmail.com
Prof. Francesco Carlo Morabito, Department DICEAM, University Mediterranea of Reggio Calabria,
Italy
E-mail: morabito@unirc.it
Prof. Domenico Ursino, Department DII, Polytechnic University of Marche, Italy
E-mail: d.ursino@staff.univpm.it