

RECENT ADVANCES ON SCIENTIFIC MACHINE LEARNING AND DATA-DRIVEN APPROACHES IN SUSTAINABILITY

ALESSIO GIUSEPPE D'INVERNO¹, CARMEN SCALONE², GIACOMO SPERONI³,
ERICA TEMELLINI³, AND CARMINE VALENTINO⁴

¹ SISSA, International School for Advanced Studies
via Bonomea, 265, 34136, Trieste, Italy
gdinvern@sisssa.it

² Department of Engineering, Computer Science and Mathematics, University of L'Aquila
via Vetoio, 67100, L'Aquila, Italy
carmela.scalone@univaq.it

³ MOX, Department of Mathematics, Politecnico di Milano
Piazza L. da Vinci, 32, Milano, Italy, I-20133
giacomo.speroni@polimi.it, erika.temellini@polimi.it

⁴ Department of Industrial Engineering, University of Salerno
Via Giovanni Paolo II, 132, 84084 Fisciano (SA), Italy
cvalentino@unisa.it

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ABSTRACT

In the era when technological innovation has sustainable development from a human and environmental perspective as its main mission, mathematics can play a leading role. Addressing complex challenges such as climate change, natural resource management, and the transition to low-emission energy systems requires advanced tools and methodologies. In this context, the integration of mathematical modeling, reliable numerical simulations, and predictive machine learning techniques has become fundamental to understand and predict the evolution of environmental, economic, and social systems. This mini-symposium focuses on recent advances in scientific machine learning and data-driven approaches, emphasizing the synergy between physics-based models and data obtained from experimental observations and sensor networks within the Internet of Things paradigm. By exploiting reliable simulations and predictive algorithms, these approaches enable the design of innovative strategies for sustainable development, optimize resource utilization, and facilitate informed decision-making in ecological and industrial processes.

Specifically, the current Session aims to discuss recent advances and emerging methodologies in the context of sustainability. It presents a wide range of applications, including, but not limited to, product life cycle optimization, emission reduction, intelligent energy storage and management, advanced recycling and recovery technologies, and reduction of dependence on critical materials while exploiting renewable energies.