ADVANCEMENTS IN MACHINE LEARNING FOR RISK ASSESSMENT, MITIGATION, AND MANAGEMENT OF STRUCTURES AND INFRASTRUCTURES

Mirko Calò[(1)], Giuseppina Uva[(1)], Ilaria Venanzi[(2)]

[(1)] Politecnico di Bari Dipartimento DICATECH

[(2)] Università di Perugia, Dipartimento di Ingegneria Civile e Ambientale

ABSTRACT

Artificial intelligence (AI), and particularly machine learning (ML), is revolutionizing the approaches to risk assessment, mitigation, and management of structures and infrastructures. By processing large datasets, ML algorithms can detect patterns, predict failures, and evaluate the structural integrity of buildings, bridges, and other critical assets. This predictive capability enables early risk identification, facilitating timely interventions and reducing maintenance costs. Furthermore, ML enables the development of advanced vulnerability and fragility models, which help assessing how structures respond to natural hazards, aging, and environmental factors. By improving decision-making processes, these models enhance the understanding of structural behavior, supporting more resilient and sustainable infrastructure design.

This special session explores the latest applications of artificial intelligence for predictive analysis, structural monitoring, and risk mitigation strategies. Through ML-based methodologies and real-world case studies, contributions will showcase how these technologies can enhance infrastructure reliability, resilience, and safety, with focus on developing fragility models, optimizing preventive maintenance, and enabling proactive responses to critical events.