17th World Congress on Computational Mechanics
10th European Congress on Computational Methods in Applied Sciences and Engineering
WCCM-ECCOMAS2026
July 19-24, 2026, Munich, Germany

BRIDGING SCIENTIFIC MACHINE LEARNING AND SCIENTIFIC DISCOVERY: NOVEL DEVELOPMENTS

TRACK NUMBER 600

ROMIT MAULIK[*], GIANMARCO MENGALDO[‡] AND RICARDO VINUESA[†]

[*] Pennsylvania State University
E327 Westgate Building, University Park, PA-16802, USA
rmaulik@psu.edu

[‡] National University of Singapore
9 Engineering Drive 1, #07-08 Block EA, Singapore 117575
mpegim@nus.edu.sg

[†] University of Michigan, Ann-Arbor
Francois-Xavier Bagnoud Building, 1320 Beal Ave, Ann Arbor, MI 48109
rvinuesa@umich.edu

Keywords: Scientific Machine Learning, Explainable AI, Data-driven scientific discovery

ABSTRACT

In recent literature, machine learning (ML) algorithms have made tremendous advances in accelerating computer simulations across various applications. Scientific ML (SciML) is a branch of ML that devises algorithms that are customized for scientific applications, for e.g., by imposing constraints and preserving symmetries. These are designed to bridge the gap between rigorous scientific computing, built on first-principles-based numerical modeling of various governing laws, and purely data-driven methods. In this minisymposium, we will showcase recent developments in an emergent but important application of SciML – where algorithms are designed not only to accelerate scientific computing, but also to discover some previously unknown underlying property of physical systems such as an invariant measure, a governing law, or a reward that engenders the observed behavior. Specifically, we wish to discuss how SciML algorithms can be devised to mature beyond simply reproducing observed data and simple extrapolation tasks.