

*Title:* Empowering Natural Intelligence with Artificial Intelligence: a Mathematician's Perspective

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*Abstract:* Over the past decades, computational models grounded in physical laws have profoundly transformed our ability to understand and predict complex phenomena in the natural world. These models, by providing a rigorous framework in which scientific insight and technological innovation can flourish, embody what may be called *natural intelligence*: the cumulative result of centuries of scientific reasoning, mathematical structure, and physical understanding.

This lecture begins by illustrating how this paradigm has shaped modern computational science through selected examples. We will discuss large-scale simulations in earthquake engineering, the use of mathematical modeling to enhance sports performances; and, in particular, *iHEART*, a mathematical model of the complete cardiac function. The iHEART simulator will serve as a central case study, showing how multiphysics and multiscale models of the heart—combining electrophysiology, mechanics, and blood flow—can support both scientific discovery and clinical decision-making.

The second part of the lecture turns to artificial intelligence and machine learning, which represent a fundamentally different paradigm: one driven primarily by data rather than by physical principles. We will review the strengths of purely data-driven approaches, highlighting some of their remarkable success, while also discussing their limitations.

These considerations naturally lead to the emerging field of *Scientific Machine Learning*, where physics-based modeling and data-driven methods are no longer seen as competing philosophies, but as complementary sources of intelligence. Scientific Machine Learning offers a new generation of computational models that are more accurate and trustworthy.

In this perspective, the fusion of “natural intelligence” and artificial intelligence is not merely a technical development, but a conceptual shift: a unique opportunity to combine the explanatory power of science with the adaptive strength of data-driven learning. The lecture will argue that this synthesis represents one of the most promising directions for the future of computational science, opening new avenues for understanding complex systems and for translating mathematics into tangible benefits for society.