Investigating Complex Systems with Pattern Causality

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Abstract

Throughout time, operational laws and concepts from complex systems have been employed to quantitatively model important aspects and interactions in nature and society. Nevertheless, it remains enigmatic and challenging, yet inspiring, to predict the actual interdependencies that comprise the structure of such systems, particularly when the causal interactions observed in real-world phenomena might be persistently hidden.

In this presentation, we propose a robust methodology for detecting the latent and elusive structure of dynamic complex systems. Our treatment utilizes short-term predictions from information embedded in reconstructed state space. In this regard, using a broad class of real-world applications from ecology, neurology, and finance, we explore and are able to demonstrate our method's power and accuracy to reconstruct the fundamental structure of these complex systems, and simultaneously highlight their most fundamental operations.