Turbulence state modelling using Machine Learning for fusion plasmas

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Controlled nuclear fusion presents a promising path toward a carbon-free and virtually limitless energy source. In fusion reactors, the fuel exists as a high-temperature gas in a plasma state. In tokamak plasmas, turbulence emerges due to the steep temperature gradient between the plasma core and its edge. This system can be modeled as an extension of a predator-prey model [1].

This work represents an initial step toward data-driven modeling of dynamical systems [2]. Specifically, we explore the application of Recurrent Neural Networks (Encoder-Decoder architecture [4]) and NeuralODEs [3] to simulated data derived from a prey-predator-type system.

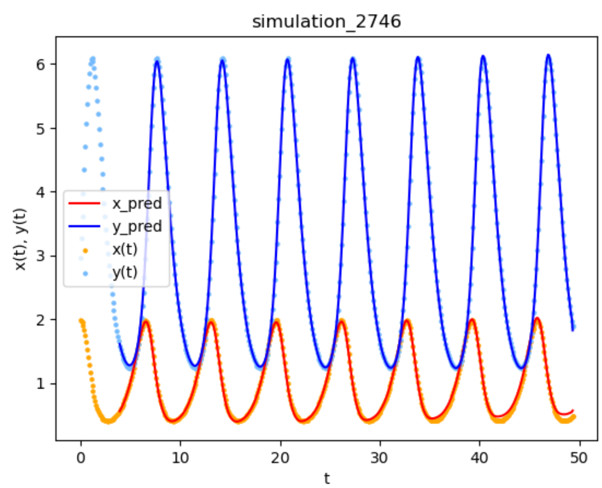

Figure 1. Recurrent Neural Network trained on 2-D Lokta-Volterra simulations

Références

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