國立中山大學應用數學系
學術演講

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講　題：Neural Network Applications to Scientific Computations: Caveats in Dynamical Systems Learning.

時　間：2025/2/5（Wednesday）10:30 ~ 11:30

地　點：理 SC 4009-1 教室

茶　會：10:10

Abstract

Dynamic systems are fundamental to understanding many physical phenomena and the motion of mechanisms. For years, researchers have explored how to identify unknown dynamical systems based on available observations. In the past decade, the use of Neural Networks has enabled researchers to develop innovative techniques for this purpose.

In this presentation, I will introduce a well-known neural network architecture released in 2019, the ODEnet, which has received over 5,000 citations for its application in learning about autonomous dynamic systems. This method approximates unknown but trainable functions using neural networks, integrates conventional numerical techniques to generate predictions, and aims to minimize the difference between predictions from actual observations by fine-tuning the parameters of the trainable functions.

In the first part of my presentation, I will focus on learning linear dynamical systems using noise-free data. This part will cover the results of employing both one-step and multi-step methods for learning a dynamical system. I will also provide criteria for selecting numerical methods appropriately, ensuring that the learned dynamic retains the same structure as the unknown system.

In the second part of my talk, I will introduce the Richardson extrapolation method, which improves the accuracy of learning results without requiring additional data. In a later section, I will discuss how noisy data causes the learned dynamics to deviate from those obtained from noise-free data. Finally, I will provide a brief overview of our findings on nonlinear dynamics, which build on the insights gained from the linear case.

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