THE UNIVERSITY OF CHICAGO | THE COMMITTEE ON COMPUTATIONAL AND APPLIED MATHEMATICS

COLLOQUIUM

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Physics-uninformed machine learning

THURSDAY, January 29th at 4:00 PM

Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637

ABSTRACT

How much can we learn about a complex system when governing equations are unknown and data are scarce? This talk explores how modern machine-learning models can extrapolate beyond limited training data without physics priors. First, I will show that simple recurrent neural networks with no built-in physics can unexpectedly reconstruct basins of attraction in multistable systems, even for basins not seen during training. This unexpected generalization capability raises questions about what hidden inductive biases are implicitly regularizing the model. Second, I will examine time-series foundation models and their ability to forecast entirely new dynamical systems from a short context trajectory. These models often achieve strong zero-shot performance in forecasting chaotic systems by exploiting a strategy we term context parroting. Analyzing the parroting strategy provides insights into the capabilities of current foundation models and explains observed neural scaling laws. Exploring strategies beyond parroting may further reveal how both artificial and natural intelligence extract information from limited data.

Organizers:
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