Translational AI Center (TrAC) Seminar Spring 2024

Jinlong Wu

May 1st at 1:00 PM (US Central Time)

More information and zoom link: https://trac-ai.iastate.edu/event/trac-seminar-jinlong-wu/

Operator learning for data-driven closure models of complex dynamical systems

Abstract

Closure models are widely used in simulating complex multiscale dynamical systems such as turbulence and Earth's climate, for which direct numerical simulation that resolves all scales is often too expensive. For those systems without a clear scale separation, deterministic and local closure models often lack enough generalization capability, which limits their performance in many real-world applications. In this talk, I will present some recent efforts for constructing closure models that go beyond deterministic and local assumptions, based on (i) abundant direct data such as short temporal trajectories and (ii) a limited amount of indirect data (e.g., time-averaged statistics, physics constraints). Specifically, operator learning with direct and indirect data will be demonstrated in the context of both deterministic and stochastic closure modeling problems. The results show that the proposed methodology can leverage different types of data to construct advanced data-driven closure models, which potentially lead to better generalization capabilities than deterministic and local closures for modeling and simulation of complex dynamical systems.

Short Bio

Dr. Wu is an assistant professor in the Department of Mechanical Engineering at the University of Wisconsin-Madison. The current research of his group mainly focuses on developing data-driven methods to learn closure models for complex dynamical systems (e.g., multi-scale, multi-physics, chaotic) from direct and indirect data. Before joining UW-Madison, he was a research scientist at Caltech, working on a data-driven climate modeling project. He got his Ph.D. degree in Aerospace Engineering at Virginia Tech in 2018, and his dissertation is about using Bayesian inference and physics-informed machine learning in turbulence modeling.

https://trac-ai.iastate.edu/