Department of Mathematics and Statistics

Special Colloquium

Numerical and Optimization Methods for Balance Laws & Fidelity Weighted Transfer Learning

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Abstract:

Part 1: Many physical systems can be represented by conservation laws with source terms, or balance laws. First, we present efficient well-balanced discontinuous Galerkin methods for one-dimensional systems of balance laws, which preserve the general non-zero velocity equilibria of the forward problem. Second, we examine the inverse problem in which the states of the balance law are known and measured, but the variable in the source term is unknown. We present an iterative method using an adjoint approach for recovering a time-dependent topographical source term from balance laws.

Part 2: Neural networks have recently been used as surrogate models for mapping inputs of an engineering system to outputs of interest. Once trained, neural networks are computationally inexpensive and remove the need for repeated evaluations of computationally expensive models. However, accurate training often requires large amounts of simulation data that may not be available in the case of computationally expensive systems. We explore the application of bi-fidelity weighted transfer learning techniques using training data generated from both high- and low-fidelity models. We illustrate the utility of the bi-fidelity transfer learning method where we focus on accuracy improvement achieved compared to standard training approaches.

Keywords: Numerical analysis, Neural networks, Discontinuous Galerkin methods

Tuesday, March 3, 12:05-12:50pm in 8-249