Colloquium
Dr. Yingjie Liu

Professor of Mathematics

Georgia Institute of Technology

**Virtual,
October 28th, 2022
at 2:00pm**

EMS Building, E495

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Neural Networks with Local Converging Inputs (NNLCI) for Solving Conservation Laws and Other Differential Equations with Greatly Reduced Complexity

This talk is based on a series of joint works (arXiv:2109.09316 and 2204.10424) with Haoxiang Huang and Vigor Yang. We are able to predict discontinuities and smooth parts of solutions of the Euler equations in 1D and 2D by a neural network accurately. For example, in order to predict the solution of the 1D Euler equations at a space-time location, one can design the output of a neural network to be the solution value at the location. If one tries to design the input as the low-cost numerical solution patch in a local domain of dependence of the location (where the information comes from), can the neural network tell if the input is across a shock or in a smooth region ? The answer is no ! Our approach uses two numerical solutions of a conservation law from a converging sequence, computed from low-cost numerical schemes, and in a local domain of dependence of a space-time location as the input for a neural network to predict its high-fidelity solution at the location. Despite smeared input solutions, the output provides sharp approximations to solutions containing shocks. The method reduces the complexity by one or two magnitudes compared to a fine grid numerical simulation, and has relatively low cost to train because it's a local method. And it can be applied to other differential equations.

**Link to Online Event:
https://wisconsin-edu.zoom.us/j/96609553505**

The Colloquium will be streamed in E495. Refreshments will follow.

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