THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

Neural Networks in Scientific Computing

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Abstract

Neural networks (NNs) have achieved astonishing performance in computer vision, natural language processing, and many other artificial intelligence (AI) tasks. This success encourages wide applications to other fields, such as scientific computing.

In this talk, I will first give a brief introduction of NNs from numerical analysis perspective and use a simple example to show why NNs are superior to piecewise polynomials on fixed meshes when approximating discontinuous functions with unknown interface.

I will then describe two NN-based methods for solving nonlinear scalar hyperbolic conservation laws. One is a space-time approach (least-squares neural network (LSNN) method), and the other is an explicit approach (evolving neural network (ENN) method) that emulates the underlying physics. Both the methods show a great potential to sharply capture shock without oscillation, overshooting, or smearing. The ENN method in one dimension is super accurate and efficient comparing with existing, well-developed mesh-based numerical methods.

The exceptional approximation powers of NN come with a price: the procedure for determining the values of the nonlinear parameters of NN entails solving a high-dimensional non-convex optimization problem. If time permits, I will describe our newly developed training algorithm for shallow ReLU NN.

Date:	May 22, 2024 (Wednesday)
Time:	4:00pm – 5:00pm
Venue:	Room 210, Run Run Shaw Building HKU

All are welcome