



复旦大学数学科学学院 数学综合报告会

报告题目: Neural Networks in Scientific Computing (SciML):
Basics and Challenging Questions

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报告摘要:

Neural networks (NNs) have demonstrated remarkable performance in computer vision, natural language processing, and many other tasks of artificial intelligence. Recently, there has been a growing interest in leveraging NNs to solve partial differential equations (PDEs). Despite the rapid proliferation of articles in recent years, research on NN-based numerical methods for solving PDEs in the context of science and engineering is still in its early stages. Numerous critical open problems remain to be addressed before these methods can be broadly applied to solve computationally challenging problems.

In this talk, I will first give a brief introduction of ReLU NNs from numerical analysis perspective. I will then discuss our works on addressing some of critical questions such as

- why use NNs instead of finite elements in scientific computing? Or for what applications, are NNs better than finite elements in approximation?
- how to develop NN discretization methods that are not only physics-informed but more importantly physics-preserved?
- how to develop reliable and efficient "training" algorithms for NN discretization (non-convex optimization)?
- for a given task, how to design a nearly optimal NN architecture within a prescribed accuracy?

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