THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

Transferable Neural Networks for Partial Differential Equations

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Abstract

Transfer learning for partial differential equations (PDEs) is to develop a pre-trained neural network that can be used to solve a wide class of PDEs. Existing transfer learning approaches require much information about the target PDEs such as its formulation and/or data of its solution for pre-training. In this work, we propose to design transferable neural feature spaces for the shallow neural networks from purely function approximation perspectives without using PDE information. The construction of the feature space involves the re-parameterization of the hidden neurons and uses auxiliary functions to tune the resulting feature space. Theoretical analysis shows the high quality of the produced feature space, i.e., uniformly distributed neurons. We use the proposed feature space as the predetermined feature space of a random feature model, and use existing least squares solvers to obtain the weights of the output layer. Extensive numerical experiments verify the outstanding performance of our method, including significantly improved transferability, e.g., using the same feature space for various PDEs with different domains and boundary conditions, and the superior accuracy, e.g., several orders of magnitude smaller mean squared error than the state of the art methods.

Date:	July 19, 2024 (Friday)
Time:	2:00pm – 3:00pm
Venue:	Room 210, Run Run Shaw Building HKU

All are welcome