MODEL-CONSTRAINED DEEP LEARNING METHODS FOR FORWARD AND INVERSE PROBLEMS

Tan Bui-Thanh[1], Hai V. Nguyễn[1] and C. G. Krishanunni[1]

[1]The University of Texas at Austin

ABSTRACT

The fast growth in practical applications of machine learning in a range of contexts has fueled a renewed interest in machine learning methods over recent years. Subsequently, scientific machine learning is an emerging discipline which merges scientific computing and machine learning. Whilst scientific computing focuses on large-scale models that are derived from scientific laws describing physical phenomena, machine learning focuses on developing data-driven models which require minimal knowledge and prior assumptions. With the contrast between these two approaches follows different advantages: scientific models are effective at extrapolation and can be fit with small data and few parameters whereas machine learning models require "big data" and a large number of parameters but are not biased by the validity of prior assumptions. Scientific machine learning endeavors to combine the two disciplines in order to develop models that retain the advantages from their respective disciplines. In this talk, we discuss the following:

a) the potential of neural networks for computational engineering and sciences?
b) a model-constrained neural network framework for forward/inverse problems.